Published in final edited form as:

J Autism Dev Disord. 2019 April ; 49(4): 1366–1377. doi:10.1007/s10803-018-3839-8.

Parents' Use of Internal State Language with Toddlers at High and Low Genetic Risk for Autism Spectrum Disorder

Susan B. Campbell, Amanda S. Mahoney, Celia A. Brownell, Elizabeth L. Moore, and Amy B. Tavares

Department of Psychology, University of Pittsburgh

Abstract

Parents of toddlers with an older sibling with autism spectrum disorder (ASD; high risk, HR) and parents of low risk (LR) toddlers with typically-developing older siblings read a wordless picture book to their child at 22 and 28 months. Parents' and toddlers' internal state language (ISL) was coded; parents reported on toddlers' use of ISL. Diagnostic assessments conducted at 36 months identified three groups: ASD, HR-noASD, LR. Parents did not differ in overall ISL, but parents of toddlers with later ASD attempted to elicit ISL from their children less than parents of LR toddlers. Toddlers increased their use of ISL with age, but those with ASD had lower scores and less age-related improvement than children in the other two groups.

Keywords

High risk siblings; parents' internal state language; children's state words; autism spectrum disorder

Emotion and mental state understanding are core aspects of social competence and undergird a wide array of developmental achievements, including empathy and prosocial responding, conversational competence, positive peer relationships, emotion regulation, and morality (Hughes & Leekam 2004). It is well documented that typically-developing (TD) toddlers and preschoolers learn about internal states, that is thoughts, emotions, perceptions, and bodily sensations, in themselves and others largely through spontaneous social interactions with parents and other social partners. Research indicates that young TD children whose parents talk to them more frequently about their own and others' desires, thoughts, and feelings are more likely to use internal state language themselves. They are also more likely than children whose parents rarely engage in such conversations to understand that other people can have thoughts or feelings different from their own (Dunn et al. 1991; Slaughter et al. 2006; Taumoepeau & Ruffman 2006). Moreover, beginning in toddlerhood, parents' conversations with their children about emotional and mental states predict young children's later use of internal state language and their understanding of emotions, prosocial behavior,

Corresponding author: Susan B. Campbell, Ph.D., Department of Psychology, University of Pittsburgh, 210 South Bouquet Street, Pittsburgh, PA 15260, sbcamp@pitt.edu, 412-624-8792, 412-624-5407 (fax).

Conflict of Interest: The authors have no conflicts of interest.

Ethical Approval: This study was approved by the University Internal Review Board. Informed consent was obtained from all parents who participated in this study at each visit.

and theory of mind (Brownell et al. 2013; Dunn et al. 1991; Symons et al. 2006; Taumoepeau & Ruffman 2006).

Although TD children benefit from adults' conversations about internal states (Ruffman et al. 2002; Ornaghi et al. 2017), less is known about how parents of young children with ASD incorporate talk about internal states in conversations with their children or how young children with ASD process and internalize internal state language during daily interactions with parents. Several studies have compared parents of older children with ASD to parents of TD children during structured narrative tasks meant to elicit talk about emotions and other mental states. Slaughter et al. (2006) asked mothers to read wordless picture books to their preschool and school-age children. The children with ASD ranged in age from 4 to 9 years and the TD children ranged in age from 3 to 6; the ASD and TD groups were matched on verbal mental age. The two groups of mothers did not differ in the overall number of words or in the frequency with which they mentioned thoughts or emotions, but the mothers of TD children were more likely than the mothers of children with ASD to explain the story characters' cognitions and affect. Within the ASD group, performance on tasks assessing theory of mind were associated with mothers' explanations of affect during the story-reading, demonstrating links between language input and social cognition, although the direction of effects cannot be disentangled. Mothers may provide more explanations to children with ASD who are already more advanced on theory of mind tasks; or, consistent with experimental work with TD children (Ornaghi, et al. 2011, 2017), mothers' explanations may provide scaffolding for perspective-taking and awareness of others' viewpoints that then enhance social understanding.

Hutchins et al. (2017) also compared the story narratives of mothers of TD children and children with ASD who ranged in age from 4 to 11 years. Consistent with the findings of Slaughter et al. (2006), mothers did not differ in the overall amount of talk or the frequency of references to emotions, desires, or thoughts, but mothers of TD children more often made causal statements, explaining why something might have occurred in the story. Hutchins et al. point out that such clarifying statements may be especially important for children with ASD who appear to be less able to make such links on their own. Within the ASD group, neither symptom severity nor vocabulary scores were related to maternal use of internal state language. However, mothers who used cognitive terms more frequently rated their children higher on theory of mind skills. This may suggest that mothers of children with ASD adjust their language about mental states either to follow their child's focus of attention or to scaffold their child's level of social understanding (Hutchins et al. 2017).

The studies cited above suggest only subtle differences between parents of school-age children with ASD and parents of TD children in their use of internal state language during structured narrative tasks. Despite this, however, recent studies also indicate that school-age children with ASD are less likely to reference their own emotions and thoughts (Brown et al. 2012) or those of story characters (Siller et al. 2014) during narrative tasks than TD children matched for language ability. Brown et al. argue that children with ASD show less awareness and understanding of emotional states in themselves and others than do TD children. In support of this argument, Siller et al. found that children with ASD who used less internal state language when asked to narrate a wordless picture book also performed

more poorly on theory of mind tasks. Understanding feelings and thoughts in self and others, a deficit that Siller et al. suggest may be specific to ASD, may explain these associations. This suggests that children with ASD do not acquire emotional understanding through day-to-day conversations with parents and other social partners as readily as TD children do and, thus, they may require more intensive and focused language around internal states (Hutchins et al. 2017).

In view of the importance of parents' conversations about internal states for the early social and cognitive development of TD children beginning in toddlerhood (Brownell et al. 2013; Dunn et al. 1991), and the limited use of internal state language by school-age children with ASD, even when prompted (Brown et al., 2012), it is important to examine parents' use of internal state language early in development when emotion understanding and language are emerging and still relatively primitive. Prospective studies that examine the development of infants who are at high genetic risk (HR) to develop ASD because they have an older sibling with an ASD diagnosis (Szatmari et al. 2016) provide one window into early parent and child internal state language in children who later are diagnosed with ASD. Evidence indicates that approximately 20% of HR infants will receive a diagnosis of ASD by 36 months (Ozonoff et al. 2011). As part of a prospective study focused on the early social development of HR toddlers recruited in infancy and followed through 36 months we examined parents' use of internal state language with children at risk for ASD and compared them to parents of low risk (LR) children with typically-developing older siblings.

Although numerous studies of spontaneous parent-child conversations and structured narrative assessments indicate that parents use internal state language early in development, both by labeling their children's emotional and other internal states and discussing the emotions and internal states of others (e.g., Brownell et al., 2013; Dunn et al., 1987; Dunn et al., 1991; Ruffman et al., 2002; Taumoepeau & Ruffman, 2006), to our knowledge no work has yet examined parents' internal state language with toddlers who later receive a diagnosis of ASD or who are at risk for such a diagnosis. Given the known deficits in emotion and mental-state understanding among children with autism spectrum disorder (Brown et al. 2012; Frith et al. 1994; Siller et al. 2014) it is critical to consider the social context within which this understanding develops beginning in the toddler years when children's language, social understanding, and parent socialization are all undergoing rapid developmental change. In the current study we examined parents' internal state talk with their toddlers at 22 and 28 months in TD children and in children at heightened risk for ASD, some of whom received a later diagnosis of ASD. We also examined how toddlers' internal state language develops, how it differs as a function of diagnosis, and relations between parent talk about internal states and children's ability to use internal state language.

Parents read a wordless picture book to their child at 22 and 28 months, and children were assessed for ASD at 36 months. Follow-up through 36 months allowed us to compare parents of HR children who did not receive an ASD diagnosis (HR-noASD) to parents of HR children with a diagnosis (ASD) and to parents of LR control children. The small body of research with older children cited above suggests that we would find subtle differences in the types of internal state language used by parents of TD children and parents of children with ASD. In particular, based on the work of Hutchins et al. (2017) and Slaughter et al.

(2006), we expected that parents of children who received a diagnosis of ASD would provide fewer elaborations of story characters' internal states and would attempt to elicit fewer internal state words from their children than parents of LR children, possibly reflecting parental sensitivity to the language and cognitive level of their children. Based on the limited work on the social and language development of HR-noASD toddlers (Campbell et al., 2017; 2018; Iverson et al., 2018), we also expected the HR-noASD children and their parents to differ from the ASD children and their parents. However, these expectations about the HR-noASD group are admittedly more speculative, given the limited research on HR toddlers without a later diagnosis. Because of their experience raising a child with ASD, parents of both ASD and HR-noASD children may use simpler and more concrete language, thereby resulting in fewer prompts for internal state language and fewer explanations relative to the parents in the LR group.

We tested the following hypotheses: 1) parents of children with a diagnosis of ASD by 36 months will use less overall internal state language with their toddlers at both 22 and 28 months than parents of HR-noASD and LR toddlers; will attempt to elicit internal state language less frequently; and will elaborate less on the story character's thoughts and feelings; 2) parents across groups will use more internal state language, including elicitations and elaborations, at 28 months than at 22 months, since children are expected to have more understanding of internal states at 28 months than at 22 months; 3) toddlers later diagnosed with ASD will use less internal state language than LR and HR-noASD children during book reading and according to parent report; 4) children across groups will show increases in their use of internal state language during book reading between 22 and 28 months and their parents will report increases in their use of internal state language between 22 and 34 months; 5) there will be positive associations between parents' use of internal state language and children's observed and reported use of internal state language both concurrently and over time.

Method

Participants

Toddlers with an older sibling with ASD and comparison toddlers with a typically-developing older sibling were seen at 22, 28, and 34 months for a play-based assessment of social behavior as part of a larger prospective study of children at risk for ASD. The sample of 168 toddlers has been described in several prior publications (references removed for blind review). The current report focuses only on the 155 parent-child dyads who participated in the book reading protocol at 22 and/or 28 months, as described below. Most children were seen at 36 months for a follow-up diagnostic assessment (details below). Toddlers did not differ in mean age at either the 22 month or 28 month assessments. Parents signed informed consents prior to participation at each visit; the research protocol was approved by the University Institutional Review Board.

HR toddlers were recruited through the Autism Center for a study of cognitive and social development. To be eligible for inclusion in the HR group, children had to be born full-term after an uncomplicated pregnancy and delivery, and have an older sibling diagnosed with ASD according to research criteria. The older sibling's diagnosis was confirmed by research

reliable staff at the Autism Center who administered the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000) under the supervision of a licensed psychologist, prior to the younger sibling's enrollment in the study. Infants whose older siblings had known genetic or other anomalies, such as Fragile X, were excluded. LR control participants were recruited from the local obstetrics hospital, community groups, pediatric offices, and word of mouth. Full-term healthy children with a typically developing older sibling and negative family history of ASD in first and second-degree relatives comprised the LR group, most of whom were recruited in infancy. Parents of LR children completed the Social Communication Questionnaire (Rutter et al. 2003) on the older sibling prior to study enrollment and all scored well below the ASD cut-off of 15.

Data on parent-child book-reading were available for 155 parent-child dyads who participated in the book reading protocol at 22 and/or 28 months. At 22 months, 143 toddlers (86 boys) and parents completed the book-reading (79 LR, 48 HR-noASD, 16 ASD) and at 28 months, 147 parent-toddler dyads (84 boys) completed the book-reading (81 LR, 47 HR-noASD, 19 ASD). Data were available at both time points for 135 dyads (75 LR, 44 HR-noASD, 16 ASD). The proportion of boys and girls did not vary systematically by group, $\chi^2(2) = 1.12, p = .572$.

Participating families were predominantly Caucasian and non-Hispanic (86%); all but five were two-parent families. Parent education was scored according to the Hollingshead Scale (Hollingshead 1975) and averaged when data for both parents were available. Although the majority of parents in both groups had at least a college degree, there was a main effect of parent education, $F_{(2, 152)} = 5.55, p = .005$; follow-up tests indicated that the LR parents were more educated than the parents of the toddlers with ASD ($p = .004$). Descriptive statistics are summarized in Table 1.

Procedure

Parent-Child Book Reading—About half-way through a longer parent-child play visit, parents were presented with an age-appropriate wordless picture book and asked to use the pictures to tell a story to their child. The book, adapted from the cover of *Feelings* (Ailiki, Greenwillow Books, 1986), includes 16 pictures that tell the story of a young boy/girl who is happy to have an ice cream cone. The child then trips and cries upon dropping the ice cream cone. The story concludes with the child smiling after receiving a new ice cream cone. The pictures convey changing basic emotions in facial expressions (e.g., happy, sad, crying), while also depicting action scenes (e.g., licking the cone, tripping, dropping the cone) and easily labeled objects (e.g., ice cream cone, steps). The story is easily grasped by toddlers at various developmental levels. The variety in the pictures allowed us to capture differences in parents' use of emotion words, internal state language, and descriptions and explanations of objects and events. Most children participated in the visit with their mothers, but 13 fathers took part at 22 months (7 LR, 4 HR-noASD, 2 ASD) and 12 fathers at 28 months (6 LR, 5 HR-noASD, 1 ASD). Because the proportion of fathers did not differ significantly by group at either age, participating parent is not considered further.

Coding.: Parents' and children's language during storytelling was transcribed verbatim from video recordings. Transcripts were checked for accuracy by two researchers prior to coding. Utterances that were inaudible were not included in the transcript. Coders were blind to diagnosis. All internal state language referring to emotions (e.g. happy, sad), mental states (e.g. think, know), internal physiological states (e.g. hungry, tired), and desires (e.g. want, wish) were coded, based on prior research (Brownell et al. 2013; Ruffman et al. 2006b; Symons et al. 2006). Parents' sounds or words used to convey empathy were also coded (e.g. "Aww, his ice cream fell down!") (Garner et al. 1997). Following Brownell et al. (2013), an overall composite score reflecting the total number of internal state utterances was computed. Utterances were double-coded if more than one internal state word was used. For example, if the mother asked the child "do you think he is sad?", both "think" and "sad" were coded. The child's internal state words were coded using the same criteria.

To capture how much parents elaborated upon the story character's internal states, or attempted to elicit internal state language from the child, coders noted when elaboration or elicitation were part of the internal state utterance. An elaboration provided additional information about emotions or events (e.g., "she is sad because she lost her ice cream"). Elicitation was an open-ended request to the child to label or explain an internal state (e.g., "How does she feel now?"), and provided the child with an opportunity to express internal state understanding in the context of the story. These two sub-categories of internal state language were examined in separate analyses.

Two coders independently coded 20% of the transcripts at each age to determine interrater reliability. Intraclass correlation coefficients (ICC) ranged from 0.77 to 0.96 for included variables across the two assessment points (22 and 28 months).

Parent Reports of Children's Use of Internal State Language.—Parents completed the State Words Checklist (Brownell et al. 2006) at 22, 28, and 34 months. The checklist is an inventory of 76 internal state words and phrases that generally begin to appear in children's vocabularies between 16 months and 4 years of age. Parents indicated how often their children used words referring to emotions (e.g., sad, happy), perceptions (e.g., see, hear, taste), and other internal and mental states (e.g., sleepy, hungry, remember, think) from never (0) to often (3). Total scores could range from 0 to 228.

Developmental and Autism Assessments

Mullen Scales of Early Learning.: The Mullen Scales of Early Learning (MSEL; Mullen 1995), a standardized measure of cognitive development, was administered at 24 and 36 months. Scores on the Receptive Language and Expressive Language Scales formed the Verbal Quotient and scores on Visual Reception and Fine Motor skills were combined to form the Non-Verbal Quotient (both $M = 50$, $SD = 10$). All four scales were combined to form the Early Learning Composite Score (ELC; $M = 100$, $SD = 15$). Six children were missing Mullen scores at 24 months, so their 36-month Mullen score was substituted in the analysis which was based on 24-month scores when available. Another four children (2 HR-noASD, 2 ASD) were missing Mullen scores at both ages because of missed appointments or lack of cooperation. One child with ASD has only a verbal score. Groups differed

significantly on Mullen Verbal, $F(2, 7) = 31.81, p < .001$, Non-Verbal, $F(2, 7) = 13.97, p < .001$, and ELC scores, $F(2, 7) = 27.39, p < .001$, as can be seen in Table 1. Follow-up tests indicated that the children with ASD scored significantly lower than the HR-no ASD children and the LR children on all three measures. HR- noASD children also scored lower than LR children on the Non-Verbal Quotient and the ELC, but not on the Verbal Quotient.

Evaluations for Autism.: HR and LR toddlers were evaluated at follow-up at 36 months using the Autism Diagnostic Observation Schedule (ADOS, Lord et al. 2000) which provides scoring rules for a diagnosis of ASD. The ADOS is a semi-structured observational assessment that includes play-based activities meant to elicit reciprocal social interaction, communication, and stereotyped behaviors. Children received either Module 1 or 2. A research-reliable tester, under the supervision of a licensed clinical psychologist from the Autism Center with extensive experience assessing children with ASD, conducted the evaluations; no one involved in the diagnostic assessments conducted the laboratory visits. Diagnostic decisions for all HR-noASD children were based on the 36-month assessment or later. Two children with ASD were seen at 24, but not 36 months, so their 24-month ADOS scores were used. Finally, one child with ASD was assessed and diagnosed at a local developmental clinic specializing in autism, but the ADOS score was not available. Most LR children were assessed at 36 months, but three missed the 36-month visit and their 24-month ADOS scores were substituted.

Children were classified as ASD if they met cut-off scores on the ADOS (Lord et al. 2000) and also met DSM-IV criteria for an autism spectrum disorder (American Psychiatric Association 2000), as determined by clinician interview and observation. Parents of children with elevated ADOS scores and/or serious clinical concerns were interviewed using the Autism Diagnostic Interview-Revised (ADI-R, Lord et al. 1994) to provide further information. Final diagnoses were based on a combination of structured diagnostic measures, DSM-IV criteria, and the clinical judgment of the licensed clinical psychologist from the Autism Center; 19 HR toddlers (13 boys) received a diagnosis of ASD. One LR boy with an early language delay and social concerns received a diagnosis of ASD, but his data are not included, given the emphasis on parent language as a function of risk status.

ADOS scores were converted to severity scores using the algorithm provided by Gotham et al. (2009) to allow for comparability across ages; scores are summarized in Table 1. As expected, there was a main effect of group status, $F(2, 15) = 153.70, p < .001$. The children with a diagnosis (ASD) had substantially higher severity scores than the LR children ($p < .001$) and the HR-noASD children ($p < .001$), who did not differ from one another.

Results

Data Analysis Plan

Cross-sectional analyses were conducted to compare the three groups of children (ASD; HR-noASD; LR) using one-way analysis of variance (ANOVA). When a significant group main effect was obtained, follow-up tests with a Bonferroni correction were used to make paired comparisons. This permitted us to retain data from participants who missed visits at either 22 or 28 months. Significant differences were checked with non-parametric analyses

for measures with low frequencies and skewed data. Longitudinal analyses were conducted for the 135 participants with complete data at both time points to examine developmental change from 22 to 28 months, and possible age by group interactions, using repeated measures ANOVAs. Finally, correlations were calculated between parents' and children's use of internal state language and children's scores on the State Words Checklist.

Preliminary Analyses

Preliminary analyses were conducted prior to the main analyses. Because the three groups of parents differed in educational level, correlations were calculated between parent education and the measures of internal state language at each age. At 22 months, parent education was modestly correlated with their use of both total inner state language ($r_{(143)} = .226, p = .007$) and inner state elicit ($r_{(143)} = .221, p = .008$). At 28 months, parent education was modestly correlated with inner state elicit ($r_{(147)} = .226, p = .006$). To control for this potentially confounding variable, parent education was covaried in the analyses of total inner state language at 22 months and inner state elicit at both ages. Correlations between parents' inner state elaborate, children's use of inner state language, and parent reports of children's language on the State Words Checklist were not significant; therefore parent education was not considered further in the analyses of these variables.

T-tests were calculated to determine whether there were sex differences evident in either parent or child measures, given that girls often demonstrate superior language skills in early childhood. Only one comparison reached statistical significance; girls received higher scores than boys on the State Words Checklist at 22 months, $t_{(142)} = 2.10, p = .038$, so child sex was not considered further.

Correlations across time were computed to examine the stability of individual differences in the sample as a whole. Parents who used more internal state language at 22 months were also likely to do so at 28 months, indicating moderate stability on these measures: total internal state, $r_{(135)} = .60, p < .001$; internal state elicit, $r_{(135)} = .498, p < .001$; internal state elaborate, $r_{(135)} = .306, p < .001$. Children's use of internal state language was modestly stable over time, $r_{(135)} = .192, p = .026$. State Word Checklist Scores were quite stable: 22 and 28 months, $r_{(140)} = .677, p < .001$; 28 and 34 months, $r_{(145)} = .781, p < .001$. Concurrent correlations between children's use of internal state language and their scores on the State Word Checklist were also significant: 22 months, $r_{(143)} = .361, p < .001$; 28 months, $r_{(144)} = .327, p < .001$.

Age and Group Differences in Internal State Language.

Time on Task.—On average, parents spent about three minutes telling the story ($M = 184.08$ seconds at 22 months and $M = 169.27$ seconds at 28 months). One-way ANOVAs at both 22 and 28 months indicated that the three groups of parents did not differ in the amount of time they devoted to this task ($F_{(2,140)} = 1.46, p = .24$ at 22 months; $F_{(2, 144)} = 0.14, p = .87$ at 28 months).

Parents' Language during Book Reading.—Descriptive statistics by age and group are summarized in Table 2. The composite measure including all internal state utterances did

not show a significant group difference at 22 months, $F(2, 139) = 1.81, p = .31$ or 28 months, $F(2, 144) = 0.25, p = .78$. Thus, overall parent talk about internal states did not differ among the three groups of children. Moreover, a repeated measures ANOVA indicated that parents' overall use of internal state language did not increase significantly between 22 months ($M = 19.01, SD = 8.68$) and 28 months ($M = 19.41, SD = 9.38$), $F(1, 132) = 1.95, p = .16$.

In addition to overall composite scores, we examined parents' elaboration of story characters' feelings and internal states, and parents' attempts to elicit internal state language from their child. There were no group differences in parents' use of elaborated internal state language at either age (22 months: $F(2, 140) = 1.74, p = .18$; 28 months: $F(2, 144) = 0.49, p = .61$). Group differences in parents' attempts to elicit internal state language from their child were analyzed with parent education as a covariate at both ages. The main effect was significant at 22 months, $F(2, 139) = 4.46, p = .013$, partial $\eta^2 = .06$; follow-up tests indicated that parents of LR toddlers made significantly more attempts to elicit language about internal states than did parents of ASD toddlers ($p = .045$) and marginally more than parents of HR-noASD toddlers ($p = .069$). However, the group main effect was not significant at 28 months, $F(2, 143) = 1.82, p = .167$, partial $\eta^2 = .025$.

Because data for internal state elicit were low frequency and highly skewed at both age points, the results were checked using the Kruskal-Wallis non-parametric test, but without controls for parent education. At both ages the main effect of group was significant ($H = 10.41, p = .006$ at 22 months; $H = 9.18, p = .01$ at 28 months). A follow-up Mann-Whitney U test confirmed that parents of children later diagnosed with ASD were less likely to attempt to elicit state words from their toddlers at both 22 and 28 months than parents of LR toddlers ($p < .01$ at both ages). Parents of HR-noASD toddlers were also less likely than parents of LR toddlers to attempt to elicit internal state language from their children at 22 months, ($p = .034$), but not at 28 months ($p = .273$). Differences between the parents of HR-noASD and ASD groups were not significant at either age ($p = .141$ at 22 months; $p = .062$ at 28 months).

A repeated measures analysis on the sample with data at both time points indicated that parents did not provide more elaboration at 28 months ($M = 4.37, SD = 2.75$) than they had at 22 months ($M = 4.07, SD = 2.53$), $F(1, 132) = 3.43, p = .066$, partial $\eta^2 = .03$, nor were there group differences for internal state elaborate, $F(2, 132) = .680, p = .508$. Parent education was controlled in the analysis of internal state elicit; parents in all three groups were more likely to attempt to elicit internal state language from their child at 28 months ($M = 3.01, SD = 3.72$) than at 22 months ($M = 1.76, SD = 2.40$), $F(1, 131) = 12.11, p = .001$, partial $\eta^2 = .085$. The group main effect for internal state elicit approached significance, $F(2, 131) = 2.78, p = .065$, partial $\eta^2 = .04$. The group by age interaction was not significant in either analysis (elaborate, $F(2, 132) = 2.16, p = .12$; elicit, $F_{a m} = 1.43, p = .24$).

Children's Language during Book Reading.—Children's internal state language was coded during the parents' book reading (see Table 2). There was minimal codable child speech at 22 months, and the group difference was not significant, $F(2, 140) = 2.87, p = .08$, partial $\eta^2 = .035$. However, by 28 months children were talking more and the group main effect was significant, $F(2, 144) = 3.16, p = .045$, partial $\eta^2 = .04$. Follow-up paired

comparisons indicated that the difference between the LR and ASD children was significant, $p = .039$. The HR-noASD toddlers fell between the other two groups but did not differ significantly from either. The repeated measures analysis indicated a significant increase across groups in children's use of internal state words between 22 months ($M = 0.47$, $SD = 1.00$) and 28 months ($M = 1.55$, $SD = 2.43$), $F(1, 132) = 11.83$, $p = .001$, partial $\eta^2 = .08$, and also confirmed the group main effect, $F(2, 132) = 3.58$, $p = .03$, partial $\eta^2 = .05$, which was accounted for by the difference between the LR and ASD groups ($p = .01$). The group by age interaction was not significant, $F(2, 132) = 1.05$, $p = .35$.

Non-parametric tests indicated a significant group difference in children's use of internal state language at both 22 months, $H = 6.10$, $p = .047$, and 28 months, $H = 12.87$, $p = .002$. Follow-up Mann-Whitney U tests revealed marginal differences between the LR and ASD groups at 22 months ($p = .053$) and significant differences at 28 months ($p < .001$). The differences between the LR and HR-noASD were not significant ($p = .064$ at 22 months; $p = .946$ at 28 months). The differences between the HR-noASD and ASD toddlers, though not significant at 22 months ($p = .479$), were significant at 28 months ($p = .002$).

Parent Reports of Children's Internal State Language.

Parents reported on their children's use of internal state language at 22, 28, and 34 months (see Table 3). In the cross-sectional analyses, the main effect of group was not significant at 22 months, $F(2, 141) = 1.48$, $p = .23$, partial $\eta^2 = .02$, but group differences were evident at both 28 months, $F(2, 148) = 13.62$, $p < .001$, partial $\eta^2 = .156$, and 34 months, $F(2, 144) = 21.29$, $p < .001$, partial $\eta^2 = .228$. Follow-up tests at 28 and 34 months indicated that the LR and HR-noASD toddlers did not differ from each other, but both groups used significantly more internal state language than the children with ASD, all p 's $< .001$.

A repeated measures ANOVA revealed a significant change with age, $F(2, 130) = 187.12$, $p < .001$, partial $\eta^2 = .625$, which was qualified by a group by age interaction, $F(4, 262) = 10.10$, $p < .001$, partial $\eta^2 = .134$. As can be seen in Table 3 and Figure 1, all children, regardless of group, increased their use of internal state language between 22 and 34 months. However, the group by age interaction demonstrates that this increase was substantially larger for the LR and HR-noASD children than for the children with an ASD diagnosis.

Associations between Parents' and Children's Use of Internal State Language.

It was expected that there would be significant correlations between parents' use of internal state language and children's observed internal state language during book reading, especially at 28 months. Since children used only minimal internal state language at 22 months, concurrent correlations with parents' internal state and internal state elicit were generally low, with most non-significant. Therefore, we focus on correlations between parent internal state language at 22 and 28 months and children's use of internal state language at 28 months when children were using internal state words more frequently. Parents' total internal state language and attempts to elicit internal state language at 22 months were modestly associated with children's internal state talk at 28 months (total internal state, $r(143) = .254$, $p = .003$; internal state elicit, $r(143) = .300$, $p < .001$), suggesting a possible facilitative effect of earlier parent internal state language on children's later

internal state talk. Concurrent correlations at 28 months between parent and child talk were somewhat stronger, (total internal state, $r(147) = .512, p < .001$; internal state elicit, $r(147) = .534, p < .001$), indicating that parents used more internal state language with toddlers who talked more about internal states during book reading.

Simple correlations were also calculated to determine whether scores on the State Words Checklist at each age were associated with parents' total internal state language and internal state elicitation during book reading. We expected that parents who used and attempted to elicit internal state language more often would report higher use and understanding of internal state language by their toddlers. For the full sample, correlations ranged from $r(136) = .043, p = .622$ to $r(139) = .214, p = .011$. Because correlations were generally low for the sample as a whole, we also examined them separately by group. For both the LR and HR-noASD groups, correlations were consistently low and non-significant, ranging from $r(76) = .034, p = .772$ to $r(79) = .183, p = .11$ for the LR group and from $r(48) = -.159, p = .279$ to $r(48) = .183, p = .213$ for the HR-noASD group. However, for the ASD group, correlations between parents' language and children's scores on the State Words Checklist were consistently moderate, with many significant (see Table 4). These correlations must be interpreted with caution given the small sample size and bimodal distribution of the State Words Checklist scores. Overall, parents of children with a later diagnosis of ASD were likely to use and attempt to elicit internal state words when they also perceived their toddlers as able to use and understand them at some basic level.

Discussion

This is the first study of which we are aware to explore parents' use of internal state language during a structured narrative task with toddlers at heightened genetic risk for ASD. We compared the use of internal state language at 22 and 28 months by parents of HR toddlers with a diagnosis of ASD by 36 months, HR toddlers without ASD, and LR toddlers. We also assessed changes in parents' language usage between 22 and 28 months, a period of rapid language development and awareness of internal states in typically developing toddlers. In addition, we examined children's use of internal state language and whether parents' use of internal state language was associated with children's use of internal state language.

Parents' Use of Internal State Language.

Although children varied widely in cognitive functioning and use of internal state language, there were few group differences in parents' language when reading a wordless picture book to their toddler. Parents across groups spent about three minutes reading to their child. Consistent with the findings of Brownell et al. (2013) in their study of typically-developing toddlers, parents in all three groups used similar frequencies of overall internal state language at both ages. This finding is also consistent with studies that have compared parents of somewhat older children with ASD to parents of control children matched for mental age and language (Hutchins et al. 2017; Slaughter et al. 2006). In addition, parents in our study, regardless of group, elaborated on the thoughts and feelings of the story character at similar rates. These results demonstrate that parents of children at genetic risk of

developing ASD, both those who do and do not receive a diagnosis by 36 months, attempt to expose their children to language about mental and emotional states starting at a young age, much like parents of typically-developing low risk children.

In contrast, age and group differences were evident for parents' attempts to elicit internal state language from their children. Across the three groups, parents tried to elicit internal state language from their children more frequently at 28 months than at 22 months. However, parents of children with ASD did so less often than parents of LR children at both ages, and parents of HR-noASD children fell in between, with scores more similar to those of the LR parents by 28 months. Importantly, previous research with TD children has shown that parents' attempts to elicit toddlers' talk about others' internal states, rather than parents' overall internal state talk, relates to aspects of early social functioning, especially those that depend on emotion understanding (Brownell et al. 2013; Grazzani et al. 2016).

Such differences may be especially important in the toddler years when children's emotion understanding is emerging and may be associated with parents' efforts to involve children in attending to, labeling, and thinking about others' emotions. Because children with ASD do not appear to acquire emotion understanding through day-to-day conversations with parents and other social partners as readily as TD children, they may require more intensive and focused language around internal states as part of early intervention efforts. Several recent studies of the Early Start Denver Model highlight the effectiveness of interventions for young children with ASD that begin during toddlerhood, emphasize typical child-caregiver routines, and encourage language and social engagement (Dawson et al. 2010; Rogers et al. 2012; Vivanti et al. 2016). The findings from the current study suggest that early interventions for children showing early signs of ASD or at risk for ASD should also encourage young children's active reflection on and discussion of others' thoughts and emotions.

Toddlers' Use of Internal State Language

Group differences on the State Words Checklist showed diverging trajectories between 22 and 34 months in children's use of internal state language, with no differences evident at 22 months when children's language was quite limited, but with marked differences at 28 months that increased by 34 months. Despite parents' repeated use of internal state language during the book reading task, parents of children with an ASD diagnosis reported that their toddlers were using many fewer internal state words at 28 or 34 months than HR-noASD and LR toddlers. Importantly, although children with ASD did show a steady increase in their use of internal state words between 22 and 34 months, indicating modest developmental change, the HR-noASD and LR children showed a much steeper increase in their use of internal state words and phrases between 22 and 34 months.

This pattern was also evident in the children's use of internal state language observed during book reading, with increased use between 22 and 28 months of age across groups. However, by 28 months, children who were later diagnosed with ASD had fallen behind children in the other two groups on both observed and parent-reported use of internal state words. These results are consistent with the well-documented finding that school-age children with a diagnosis of ASD use less internal state language than TD children (Siller et al. 2014), even

when specifically asked about their own feelings (Brown et al. 2012). Given group differences in cognitive functioning, these results are not surprising, but they highlight a specific gap in social development in young children with ASD when followed longitudinally.

Despite the possibility that toddlers with a later ASD diagnosis did not respond as often, or at all, to their parents' efforts to engage them in emotion and mental state talk, parents of toddlers in all groups used similar amounts of internal state language during book reading. This finding may reflect parents' experience raising their older child with ASD and skills learned from interventions with that child. In prior papers from this study (references removed for blind review), we found that children with emerging ASD showed less social engagement with parents during free play and a lower level of self-understanding at 22 months than HR-noASD and LR toddlers. The group differences on production of internal state words reported from this research follow a similar pattern. Although children with ASD showed some increase over time on these measures, they remained different from the other two groups. On the other hand, HR-noASD toddlers and LR toddlers showed greater gains with age and did not differ from each other by 28 months. In other analyses of parent behavior from this data set, we reported that parents across groups received high ratings on scales of warmth, sensitivity, and cognitive stimulation during observations of free play with their child at 22, 28, and 34 months. All of the parents were generally tuned in to their child's level of engagement with the tasks and made appropriate efforts to encourage their interest and social engagement.

Relations between Parents' and Children's Internal State Language.

We expected to obtain significant correlations between parents' and children's use of internal state language. Correlations between observed parent and child internal state language were modest at 22 months, when children were using only a few internal state words, but became stronger by 28 months. However, contrary to expectations, correlations between parent language and children's scores on the State Words Checklist were generally low and non-significant within both the LR and HR-noASD groups, but more consistently moderate within the ASD group. By 28 months, it is possible that parents of children with ASD were likely to use more internal state language and attempt to elicit internal state words when they perceived their toddlers as more likely to use and understand this type of language. Significant correlations in the ASD group from children's internal state word use at 22 months to parents' internal state language use at 28 months, and from parents' elicitation of internal state language at 22 months to children's internal state word use at 28 and 34 months may reflect a bidirectional feedback loop. This may be especially evident in the dyads of parents and toddlers with ASD because parents of children with ASD may be more tuned in to small advances in their children's understanding of words about feelings and other internal states. Such advances may appear less dramatic to the parents of typically-developing toddlers and to parents of HR toddlers who appear to be developing typically.

Although the skewed data and the small sample size do not permit more fine-grained analyses of these data, this intriguing suggestion of bidirectional effects between parents and children with ASD over time demonstrates two important points. First, development of

mental state understanding in children with ASD starts early, just as it does in TD children; it both depends on and contributes to parents' efforts to help children attend to, label, and understand others' subjective states during everyday conversations. Second, similar developmental processes are at work in children with ASD and TD children. Growth is a joint function of children's changing skills and abilities and parents' active accommodations as they continuously scaffold children's development. Both points have important implications for intervention, as illustrated by the early successes of the Early Start Denver Model noted above. The current study highlights the importance of focusing on conversations about internal states, both the internal states of the children and of their social partners, simple labeling and explanation of internal state words, and attempting to elicit internal state language during interventions.

Limitations and Future Directions.

Despite these intriguing findings, there are a number of limitations that must be considered in interpreting the results. First, as noted above, the small sample of children with ASD, the skewed data, and the lack of complete data at each point are limitations. In addition, given the prospective study design, it was not possible to match groups on mental or language age. Thus, group differences are to some degree confounded with the lower cognitive and language levels of the children with ASD, as reflected in their Mullen scores. Although parents across groups spent the same amount of time reading the book to their toddlers and differences were not obtained in the frequency of overall internal state language, we do not have measure of the overall total amount of talk (see Hutchins et al., 2005), an additional limitation of this study. The inclusion of such a measure along with a more fine-grained analysis of parent language and parent-child language reciprocity at 28 months, with a larger sample of later-diagnosed children with ASD, would add clarity to these findings.

Some other limitations of the current study also provide fruitful avenues for future research. For example, although the book-reading task provided topics besides emotion (e.g., food, events, physical surroundings), children with ASD may have been more engaged with a book about their specific interests. The structured story-book reading task provided the necessary control and standardization to permit group comparisons among children in the three groups, and has been routinely used by previous researchers. However, it is unknown whether children's exposure to internal state language in this task reflects their exposure to such language in less structured situations, including their home environment. It would be worthwhile to study aspects of parent-child internal state talk in naturalistic settings, including parents' ability to engage their children in discussions about others' emotions in the child's immediate environment. This may be especially important to examine in families with an older sibling with ASD. As Dunn has repeatedly shown, young TD children's conversations with mothers about their emotions and their TD siblings' emotions, and young TD children's conversations with their siblings about feelings, relate to developing social and emotional understanding both concurrently and longitudinally (e.g., Dunn et al. 1987; Dunn et al. 1991).

Conclusions

In summary, parents of HR toddlers who received a diagnosis of ASD by 36 months did not differ from parents of LR or HR-noASD toddlers in their overall amount of internal state language when asked to read a wordless picture book to their child at 22 and 28 months; nor did they differ on how often they elaborated the thoughts and feelings of the story character. However, group differences did emerge in how often parents attempted to elicit internal state language from their toddlers at 22 and 28 months. Children also differed in their use of internal state language, both observed and parent reported. Across groups, parent reports of children's use of internal state language increased with age. Although all groups showed some growth, group differences were increasingly strong at 28 and 34 months, with the ASD group falling further behind the LR and HR-noASD groups. The results of this study underscore the promise of early interventions that capitalize on day-to-day parent-child interactions in naturalistic settings, while targeting specific developmental delays in social engagement and understanding of internal states.

Acknowledgments

This study was supported by the National Institute of Mental Health R01 MH091036 to Dr. Campbell. We thank Dr. Nancy Minshew, Dr. Mark Strauss, Dr. Carla Mazefsky, Dr. Holly Gastgeb, Ms. Stacey Becker, and the staff at Autism Center of Excellence, University of Pittsburgh for overseeing initial recruitment and assessment of participating families. The Autism Center of Excellence was supported by award number HD055748 (PI Minshew) from the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Recruitment was also facilitated by the Clinical and Translational Science Institute, supported by the National Institutes of Health through Grant Numbers UL1 RR024153 and UL1TR000005. Thanks are due to Taylor Day, Kristen Decker, Stephanie Fox, Phebe Lockyer, and Emily Schmidt for overseeing data collection, and to Rachel Fleming, Kendra Guinness, and Mariel McMarlin for assistance with data collection and coding. Special thanks go to the parents and children who participated in this study.

References

- American Psychiatric Association (2000) Diagnostic and statistical manual of mental disorders: DSM-IV-TR (text revision). Washington, DC: Author.
- Brown BB, Morris G, Nida RE, & Baker-Ward L (2012). Making experience personal: Internal states language in memory narratives of children with and without Asperger's disorder. *Journal of Autism and Developmental Disorders*, 42, 441–446. [PubMed: 21503798]
- Brownell CA, Svetlova M, Anderson A, Nichols SR, & Drummond J (2013). Socialization of early prosocial behavior: Parents' talk about emotions is associated with helping and sharing in toddlers. *Infancy*, 18, 91–119. [PubMed: 23264753]
- Brownell CA, Ramani GB, & Zerwas S (2006). Becoming a social partner with peers: Cooperation and social understanding in one- and two-year-olds. *Child Development*, 77, 803–821. [PubMed: 16942491]
- Campbell SB, Mahoney AS, Northrup J, Moore EL, Leezenbaum NB, & Brownell CA (2018). Developmental changes in pretend play from 22- to 34-months in younger siblings of children with autism spectrum disorder. *Journal of Abnormal Child Psychology*, 46, 639–654. [PubMed: 28685398]
- Campbell SB, Moore EL, Northrup J, & Brownell CA (2017). Developmental changes in empathic concern and self-understanding in toddlers at genetic risk for autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 47, 2690–2702. [PubMed: 28593600]
- Dawson G, Rogers S, Munson J, Smith M, Winter J et al. (2010). Randomized controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics*, 125, e17–e23. [PubMed: 19948568]

- Dunn J, Bretherton I, & Munn P (1987). Conversations about feeling states between mothers and their young children. *Developmental Psychology*, 23, 132–139..
- Dunn J, Brown J, & Beardsall L (1991). Family talk about feeling states and children's later understanding of others' emotions. *Developmental Psychology*, 27, 448–455.
- Frith U, Happé F, & Siddon F (1994). Autism and theory of mind in everyday life. *Social Development*, 3, 108–124.
- Garner PW, Jones DC, Gaddy G, & Rennie KM (1997). Low-income mother's conversations about emotions and their children's emotional competence. *Social Development*, 8, 37–52.
- Gotham K, Pickles A, & Lord C (2009). Standardizing ADOS scores for a measure of severity in Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 39, 693–705. [PubMed: 19082876]
- Grazzani I, Ornaghi V, Agliati A, & Brazzeli E (2016). How to foster toddlers' mental state talk, emotion understanding, and prosocial behavior: A conversation-based intervention at nursery school. *Infancy*, 21, 199–227.
- Hollingshead AA (1975). Four-factor index of social status Unpublished manuscript, Yale University, New Haven, CT.
- Hughes C & Leekam S (2004). What are the links between theory of mind and social relations? Review, reflections, and new directions for studies of typical and atypical development. *Social Development*, 13, 590–619.
- Hutchins TL, Brannick M, Bryant JB, & Sillimman ER (2005). Methods for controlling amount of talk: Difficulties, considerations, and recommendations. *First Language*, 25, 347–363.
- Hutchins TL, Deraway C, Prelock P, & O'Neill A (2017). Mothers' and children's story telling: A study of dyads with typically developing children and children with ASD. *Journal of Autism and Developmental Disorders*, 47, 1288–1304. [PubMed: 28220359]
- Iverson JM, Northrup JB, Leezenbaum NB, Parlade MV, Koterba EA, & West KL (2018). Early gesture and vocabulary development in infant siblings of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 48, 55–71. [PubMed: 28900778]
- Lord C, Risi S, Lambrecht L, Cook E, Leventhal B, DiLavore P, et al. (2000) Autism diagnostic observation schedule-generic: A standard measure of social and communicative deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders*, 30, 205–223. [PubMed: 11055457]
- Lord C, Rutter M, & Le Couteur A (1994) Autism Diagnostic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, 24, 659–695. [PubMed: 7814313]
- Mullen E (1995). *The Mullen Scales of Early Learning*. Circle Pines, MN: American Guidance Service.
- Ornaghi V, Brazzelli E, Grazzani I, Agliati A, & Lucarelli M (2017). Does training toddlers in emotion knowledge lead to changes in their prosocial and aggressive behavior? *Early Education and Development*, 28, 396–414.
- Ornaghi V, Brockmeier J, & Grazzani Gavizzi I (2011). The role of language games in children's understanding of mental states: A training study. *Journal of Cognition and Development*, 12, 239–259.
- Ozonoff S, Young GS, Carter A, Messinger D, Yirmiya N et al. (2011). Recurrence risk for autism spectrum disorders: A baby siblings research consortium study. *Pediatrics*, 128, e488–e495. [PubMed: 21844053]
- Rogers SJ, Estes A, Lord C, Vismara L, Winter J, Fitzpatrick A, Guo M, & Dawson G (2012). Effects of a brief Early Denver Start Model (ESDM)-based parent intervention on toddlers at risk for autism spectrum disorders: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry*, 51, 1052–1065. [PubMed: 23021480]
- Ruffman T, Slade L & Crowe E (2002). The relation between children's and mothers' mental state language and theory-of-mind understanding. *Child Development*, 73, 743–751.
- Ruffman T, Slade L, Devitt K, & Crowe E (2006). What mothers say and what they do: The relation between parenting, theory of mind, language, and conflict/cooperation. *British Journal of Developmental Psychology*, 24, 105–124.

- Rutter M, Bailey A, & Lord C (2003). Social Communication Questionnaire. Los Angeles:Western Psychological Services.
- Siller M, Swanson MR, Serlin G, & Teachworth AG (2014). Internal state language in the storybook narratives of children with and without autism spectrum disorder: Investigating relations to theory of mind abilities. *Research in Autism Spectrum Disorders*, 8, 589–596. [PubMed: 24748899]
- Slaughter V, Peterson CC, & Mackintosh E (2006). Mind what mother says: Narrative input and theory of mind in typical children and those on the autism spectrum. *Child Development*, 78, 839–858.
- Symons DK, Fossum KM, & Collins TBK (2006). A longitudinal study of belief and desire state discourse during mother-child play and later false belief understanding. *Social Development*, 15, 676–691.
- Szatmari P, Chawarska K, Dawson G, Georgiades S, Landa R et al. (2016). Prospective longitudinal studies of infant siblings of children with autism: Lessons learned and future directions. *Journal of the American Academy of Child and Adolescent Psychiatry*, 55, 179–187. [PubMed: 26903251]
- Taumoepeau M & Ruffman T (2006). Mother and infant talk about mental states relates to desire language and emotion understanding. *Child Development*, 77, 465–481. [PubMed: 16611184]
- Vivanti G, Dissanayake C, & the Victorian ASELCC Team (2016). Outcome for children receiving Early Start Denver Model before and after 48 months. *Journal of Autism and Developmental Disorders*, 46, 2441–2449. [PubMed: 27020055]

Figure 1.

Group by Age Interaction on the State Words Checklist: Parent reports of children's use of internal state words at 22, 28, and 34 months for the ASD, HR-noASD, and LR groups for children with data at all three age points.

Table 1.

Demographic Characteristics: Book Reading Task

	ASD (n=19)	HR-noASD (n=51)	LR (n=85)
Gender, male	68%	59%	55%
Ethnicity, Caucasian	80%	86.4%	88.8%
	M (SD)	M (SD)	M (SD)
Parent Education	5.55 (0.92) _a	5.98 (0.77)	6.18 (0.71) _b
Age at 22-month assessment	22.78 (0.67)	22.70 (0.73)	22.77 (0.71)
Age at 28-month assessment	28.69 (0.65)	28.69 (0.51)	28.50 (0.40)
Mullen Early Learning Composite	77.69 (17.36) _a	100.60(13.71) _b	107.41(14.97) _c
Mullen Verbal Quotient	34.56 (12.23) _a	50.85 (8.44) _b	53.62 (8.58) _b
Mullen Non-Verbal Quotient	42.50 (7.93) _a	49.16 (7.45) _b	53.79 (9.03) _c
ADOS severity score at outcome	5.83 (1.58) _a	1.57 (0.92) _b	1.44 (0.87) _b

Note: Means with different subscripts differ significantly at $p < .02$ or higher. See text.

Table 2.
Means and Standard Deviations of Parent and Child Language during Book Reading

	ASD (16, 19) ¹	HR-noASD (48, 47)	LR (79, 81)	F	P	partial η^2
<i>Parent Language</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>			
Total Internal State						
22 months ²	15.75 (7.18)	18.35 (7.59)	20.29 (9.50)	1.81	.31	.017
28 months	18.32 (10.54)	18.89 (8.82)	19.80 (10.01)	0.25	.78	.003
Internal State Elaborate						
22 months	3.06 (3.15)	3.98 (2.03)	4.35 (2.73)	1.74	.18	.024
28 months	4.16 (2.54)	4.66 (2.63)	4.19 (2.85)	0.49	.61	.007
Internal State Elicit						
22 months ²	0.50 (0.73) _a	1.27 (1.67)	2.37 (2.85) _b	4.46	.013	.06
28 months ²	1.00 (1.73)	3.11 (4.17)	4.19 (2.85)	1.62	.167	.025
<i>Child Language</i>						
Total Internal State						
22 months	0.13 (0.71)	0.42 (0.99)	0.71 (1.19)	2.55	.08	.035
28 months	0.32 (1.16) _a	1.53 (1.78)	1.84 (2.84) _b	3.16	.045	.04

¹ *n*'s by group at 22 and 28 months.

² Parent education was controlled in these analyses.

Note: Means with different subscripts differ significantly at $p < .05$.

Table 3.

Means and Standard Deviations of Children's Scores on the State Words Checklist

	ASD	HR-noASD	LR	F	P	partial η^2
	M (SD)	M (SD)	M (SD)			
<i>State Words Total Score</i>						
22 months	24.37 (35.86)	34.63 (30.44)	38.88 (30.92)	1.48	.23	.02
28 months	35.22 (42.35) _a	81.55 (40.70) _b	91.40 (41.38) _b	13.68	<.001	.156
34 months	57.81(64.14) _a	126.82 (43.07) _b	136.81 (40.37) _b	21.29	<.001	.228

Note: *n*'s for the State Word Checklist: 16, 48, and 80 at 22 months; 18, 51, and 82 at 28 months; 16, 50, 81 at 34 months for ASD, HR-noASD, and LR respectively. Means with different subscripts differ at $p < .001$.

Table 4.

Correlations between Parent Language and Children's Scores on the State Words Checklist within the ASD Group

State Words Checklist Score	22 Months	28 Months	34 Months
<u>Parent Language</u>			
Internal State at 22 mos.	.416	.556 *	.450
Internal State Elicit at 22 mos.	.306	.473	.557 *
Internal State at 28 mos.	.523 *	.523 *	.487
Internal State Elicit at 28 mos.	.528 *	.631 **	.637 **

* Note: $p < .05$,

** $p < .01$