Published in final edited form as:
Res Dev Disabil. 2012 ; 33(2): 506–517. doi:10.1016/j.ridd.2011.10.018.

Maternal Functional Speech to Children: A Comparison of Autism Spectrum Disorder, Down Syndrome, and Typical Development

P. Venuti[a], **S. de Falco**[a], **G. Esposito**[a,b], **M. Zaninelli**[a], and **Marc H. Bornstein**[c]
[a]Department of Cognitive Science and Education, University of Trento, Italy

[b]Kuroda Research Unit for Affiliative Social Behavior, RIKEN Brain Science Institute, Japan

[c]Child and Family Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services, U.S.A

Abstract

Children with developmental disabilities benefit from their language environment as much as, or even more than, typically developing (TD) children, but maternal language directed to developmentally delayed children is an under investigated topic. The purposes of the present study were to compare maternal functional language directed to children with two developmental disabilities – Autism Spectrum Disorder (ASD) and Down Syndrome (DS) –with TD children and to investigate relations of maternal functional language with child language skills. Participants were 60 mothers and their children with TD (n =20), DS (n =20), or ASD (n =20). Children's mean developmental age was 24.77 months (SD = 8.47) and did not differ across the groups. Mother and child speech were studied during naturalistic play. We found (a) similarities in maternal functional language directed to the two groups of children with developmental disabilities compared to that directed to TD children and (b) a positive association between subcategories of information-salient speech and child mean length of utterance in TD dyads only. The clinical and developmental implications of these findings are discussed.

1. Introduction

Maternal language represents a key determinant in children's language acquisition and is crucial for the development of other cognitive and socioemotional skills in children (Garton, 1992; Hampson & Nelson,1993; Longobardi, 1992; Stern, 1985; Thiessen, Hill, & Saffran, 2005; Tamis-LeMonda, Bornstein, & Baumwell, 2001). For these reasons, parental language directed to typically developing (TD) children has long been a subject of close scrutiny (Cameron-Faulkner, Lieven, & Tomasello, 2006; Eigsti & Cicchetti, 2004; McDonald & Pien, 1982; Olsen-Fulero, 1982; Snow, 1984, 1995). Children with developmental disabilities likely benefit from their language environment as much as, or even more than, TD children, but maternal language directed to developmentally delayed children has been the subject of far less attention (cf. Longobardi, Caselli, & Colombini, 1998; Spiker, Boyce, & Boyce, 2002). The purposes of the present study were, first, to compare maternal functional language directed to typically developing children with language directed to children with two developmental disabilities - Autism Spectrum Disorder (ASD) and Down

Correspondence should be addressed to Paola Venuti, Department of Cognitive Science and Education, Via Matteo Del Ben 5, 38068 Rovereto (TN), Italy; TEL: +39 0464 808117/15, FAX: +39 0464 808102; paola.venuti@unitn.it.

Syndrome (DS) – and, second, to investigate relations between maternal functional language and child language skills.

The functional or pragmatic aspects of maternal speech – those that encompass the intent of mothers' language directed to their children – are considered central from a developmental perspective (Hoff-Ginsberg, 1986; Camaioni, Longobardi, Venuti, & Bornstein, 1998; Herrera, Reissland, & Sheperd, 2004). Maternal language is used as a prominent and consistent means to convey both affect and information to children. Accordingly, many developmental and linguistic scientists have commonly distinguished between speech whose principal goal is to express affective content and maintain social interaction between child and parent and speech that conveys information to the child (Bloom, Margulis, Tinker, & Fujita, 1996; Bretherton, McNew, Snyder, & Bates,1983; Camaioni et al., 1998; Fernald; 1992; Locke, 1996; Penman, Cross, Milgrom-Friedman, & Meares, 1983). Affect-salient speech is used to foster child motivation to communicate and interact; it includes expressive, generally nonpropositional, idiomatic, or meaningless statements such us encouragement, onomatopoeia, singing, greetings, and the like (Camaioni et al., 1998; Locke, 1996; Penman et al., 1983). Information-salient speech is used to share information about the dyad and the environment and to encourage exploration through fully propositional speech that includes questions, descriptions, and directives (Bornstein et al., 1992; Fernald, 1992; Penman et al., 1983). Specific subcategories of information-salient speech include types (e.g., direct statements, questions, or descriptions) and referents (to the environment, the child's actions or internal states, or the parent him/herself) (see Hampson & Nelson, 1993; McDonald & Pien, 1982; Olsen-Fulero, 1982; Penman et al., 1983; Yoder, 1989). In mothers, these two functional categories of speech follow opposite developmental trajectories from early infancy into toddlerhood (Bornstein et al., 1992); specifically, information-salient speech increases, whereas affect-salient speech decreases.

Mothers' use of different language functions is associated with children's development. For example, question use is positively associated with rate of child language acquisition (e.g., Yoder, 1989), whereas the use of directives appears to be negatively associated with language development and other cognitive skills (e.g., Gilmore, Cuskelly, Jobling, & Hayes, 2009). Rather consistently, prominent use of child-centred communicative acts with respect to directive communicative acts during the second year of child life predicts child grammatical development in the third year (Rollins & Snow, 1998). Moreover, maternal language centred on child attention focus (Harris, Kasari, & Sigman, 1996; Tomasello & Farrar, 1986) as well as maternal responsiveness to child language (Yoder & Warren, 1998) have positive predictive associations with child language development.

Maternal language is affected by sociodemographic characteristics. Family socioeconomic status (Hoff, 2003) and more importantly maternal educational level (Vernon-Feagans, Pancsofar, Willoughby, Odom, Quade, & Cox,. 2008) have positive associations with the structural complexity of maternal child-directed speech, which in turn predicts child language development (Hoff, 2003). However, to our knowledge, the relation between sociodemographic characterisitics and functional maternal language have been far less investigated.

The majority of studies on maternal language directed to children with developmental disabilities has focused on DS, the most common genetic cause of intellectual delay. However, this literature has concentrated on the structural features of maternal language, for example mean length of utterance (MLU), number of different words, and other measures of syntactic complexity (see D'Odorico, 2005, and Hodapp, 2002). Studies of mothers of children with DS compared to mothers of chronological age-matched TD children reported less complex and sophisticated conversational patterns (Buium, Rynders, & Turnure, 1974;

Mahoney, 1975; Marshall, Hegrenes, & Goldstein, 1973), but no differences in structural aspects of language between mothers of children with DS and mothers of TD children in samples matched for developmental age or MLU suggesting that mothers adapt the structural complexity of their language according to the developmental level of their children (Mundy, Sigman, Kasari, & Yirmiya, 1988; Rondal, 1988). Few investigations have focused on functional aspects of maternal speech (Longobardi et al., 1998; Legerstee, Vagherse, & Van Beek, 2002; Roach, Barratt, & Miller, 1998), and those that have concentrated on directives and restrictions (Legerstee et al., 2002; Roach et al., 1998) with some exceptions (Gilmore et al., 2009) report that mothers of children with DS tend to be more verbally directive than mothers of TD children. Pino (2000) reported that mothers of children with DS used more information-salient speech with the purpose of teaching than mothers of TD children. Also the functional aspects of maternal speech appear to be influenced by child MLU in the few studies investigating this relation (Rondal, 1978, 2006) in maternal language directed to children with DS.

ASD are neurodevelopment disorders characterised by impairment in reciprocal socialisation, qualitative deficit in communication, and repetitive or unusual behavior (DSM-IV- TR, APA, 2000; ICD-10, WHO, 1993). Despite their core deficit in interaction and communication, children with ASD still profit from harmonious interactive exchanges to develop their potential (Baker, Haltigan, Brewster, Jaccard & Messinger, 2010; Baker, Messinger, Lyons, Grantz, 2010; Chow, Haltigan, & Messinger, 2010; Venuti, 2007) especially for language development (Goodwin, Piotroski, Jaffery, Fein & Naigles, 2010; Meyer, Edelson & Tager-Flusberg, 2010). To date, however, features of mother-child interaction in ASD dyads have not been adequately explored. This lacuna in the literature can be explained, in part, by past inappropriate inferences that inadequate parenting causes ASD. Early formulations depicted mothers of children with ASD as more controlling compared to mothers of TD children and children with other developmental disabilities (Doussard-Roosevelt, Joe, Bazhenova, & Porges, 2003; Kasari, Sigman, Mundy, & Yirmiya, 1988; Lemanek, Stone, & Fishel, 1993; Siller & Sigman, 2002, 2008). Concerning maternal language directed to children with ASD, specifically, the few existing studies have reached inconsistent conclusions. The majority reported few differences in functional (or structural) features in child-directed language of parents of children with ASD compared to those of TD children matched for child language status (Konstantareas, Zajdeman, Homatidis, & MacCabe, 1988; Wolchik, 1983; Wolchik & Harris, 1982; Watson, 1998). However, other studies aimed at identifying early diagnostic markers of ASD reported that parents of children with ASD engaged in compensatory strategies (Adrien, Faure, Perrot, Hameury, Garreau, Barthelemy, & Sauvage, 1991), such as calling their child's name more often than parents of TD children or children with other developmental disabilities (Baraneck, 1999). This was likely a result of the deficit in children with ASD responding to parental bids. Recent studies investigated the effects of structural features of maternal language input identifying clear positive influence on the language development of children with ASD. Specifically, mothers' complexity of noun phrases relates positively to children's concurrent linguistic abilities (Meyer, Edelson, & Tager-Flusberg, 2010). Children's learning Wh-questions also appears to be positively influenced by the complexity of language input provided by mothers (Goodwin, Piotroski, Jaffery, Fein, & Naigles, 2010).

In light of the general significance of parental speech for child psychological development and the need for proper comparative studies that consider the function of maternal language directed to children with developmental disabilities, the present investigation aimed to compare functional characteristics of maternal language directed to toddlers with ASD, DS, and TD. ASD and DS are among the most common developmental disabilities with defined clinical features: a deficit in social and communicative skills and either preserved or compromised intellectual functioning in ASD; a deficit in intellectual and communicative

functioning with mostly preserved social skills in DS. Recently, we reported that both mothers and fathers of children with DS showed a more directive style asking fewer questions and making more direct statements as well as making fewer references to the environment and more to child actions (Authors, 2011). By comparing mothers of these two clinical samples to mothers of a TD group, in the present study we aimed to discern if a common maternal style of functional language is associated with different types of developmental disabilities. In addition, we investigate relations between maternal functional speech and child language (MLU and number of utterances) in the three groups. To achieve these aims we analyzed spontaneous functional language of mothers at play with their children.

We had specific expectations about maternal language directed to children with DS based on the existing literature and on our previous study (Longobardi et al., 1998; Legerstee, Vagherse, & Van Beek, 2002; Roach, Barratt, & Miller, 1998; Authors; 2011). Maternal speech directed to children with ASD has been the subject of much less investigation, and so most of our predictions reflect our consideration of ASD as a developmental disability that is partially comparable with DS. Based on general knowledge about DS and ASD and on the limited literature on maternal language, we hypothesized as follows about the language specific to mothers of children with TD, DS, and ASD.

A. We hypothesized that mothers of children with DS would use more affective-salient speech compared to those of children with TD and ASD, as it has been found that parents often behave as if their children with DS were at a younger developmental age, perhaps due to child *baby face* morphology and preserved sociability (Fidler, 2003; Snow, 1977). As for information-salient speech, we expected similar frequencies of use in the three groups of mothers as this category appears to relate to child developmental age which was the same in our samples. With respect to calling the child's name, we expected mothers of children with ASD to do so more often compared to mothers of children with ASD and DS, as reported in previous studies on the early markers of ASD (Baraneck, 1999).

B. Concerning the subcategories of information-salient speech, we expected that both mothers of children with DS and ASD would use more direct statements, fewer questions, and the same amounts of description compared to mothers of TD children. Our hypotheses are based on the few studies of mother-child interaction in ASD that have reported mothers' tendency to be controlling (Doussard-Roosevelt, Joe, Bazhenova, & Porges, 2003; Kasari, Sigman, Mundy, & Yirmiya, 1988; Lemanek, Stone, & Fishel, 1993).

C. We also expected mothers of children with both developmental disabilities to refer more often to child action and less often to the environment compared to those of TD children, whereas we expected similarities in references to child state and to the mother.

D. We expected to find associations between maternal pragmatic language and child language in all groups. Specifically, we hypothesized that greater complexity in maternal language (more information-salient speech, more questions, more reference to the environment) would be associated with greater complexity of child language (longer MLU and larger number of utterances; Rondal et al., 1978, 2006).

2. Methods

2.1 Participants

Participants were 60 mothers and their children with TD (n =20), DS (n =20), or ASD (n =20). Table 1 shows sample demographics by group. Children's mean developmental age

was 24.60 months (*SD* = 8.31) and did not differ across the 3 groups, whereas mean chronological ages of groups differed. Mean maternal age was 35.95 years (*SD* = 4.93) and did not differ across the 3 groups. Mothers in all groups were ethnically homogeneous of European (Italian) heritage and married. Mothers of children diagnosed with DS and ASD were referred to the project by clinicians at two intervention centers, and mothers of TD children were recruited from public daycare centers. Based on clinical judgment, the presence of autistic traits in children with DS was excluded. The diagnosis of participants with ASD was confirmed through clinical judgment by an independent clinician based on the DSM-IV criteria for Pervasive Developmental Disorders (PDD) as well as through the Autism Diagnostic Observation Schedule (ADOS - Lord, Rutter, DiLavore, & Risi, 2003). Specifically, 13 children had a diagnosis of Autistic Disorder and 7 of PDD-NOS. Children in the clinical groups did not show co-morbidity with other disorders, although two children in the ASD group had an unidentifiable genetic anomaly. The Bayley Scales of Infant and Toddler Development (2nd ed., Bayley, 1993) was used to determine the developmental ages of children with ASD and DS. No Bayley data were available for TD children, but interviews with parents, examination of health records, and observations during the study all indicated that they were developing typically. We also had two other converging kinds of data on children in the TD sample: (a) We had data on the Vineland Assessment of Behavioral Adaptation, and children in this group fell within the nom al range (*M* = 102.7, *SD* = 11.66), and (b) children in the TD sample were part of a longitudinal study, and IQ measures at 48 months obtained using the WPPSI showed that TD children had IQs in the normal range (*M* = 103.5, *SD* = 7.07). The Four-Factor Index of Social Status (Hollingshead, 1975) was used to calculate the socioeconomic status (SES) of the families, which differed across groups (Table 1); mothers of children in the three samples also had different levels of education. therefore, these variables were controlled in the statistical analyses. Part of the dataset presented in this study for TD and DS groups has appeared in a previous study (Authors, 2011).

2.2 Procedures

Mothers' child-directed speech was studied during an observation of naturalistic joint play interaction. Data were collected during 10-min sessions video recorded continuously by a female filmer. Observations took place in a quiet room, which was familiar to the participants. A standard set of toys was provided. The mother was asked to play individually with her child in ways she typically would and to disregard the filmer's presence as much as possible. Mothers and children could use any or all of the toys provided.

From the 60 videos of mother-child interaction, verbatim transcripts were made of maternal and child language. We used the CHAT system to provide a standardized format for producing computerized transcripts of face-to-face conversational interactions (MacWhinney, 2000). Transcripts were then compared with the video records by a second transcriber, and any necessary corrections were made (see Johnson-Glenberg & Chapman, 2004).

Maternal speech was categorized from the transcripts in terms of the primary function of each speech unit, using a coding scheme validated in previous studies of maternal speech that confirm its appropriateness across cultures (Bornstein, Tal, Rahn, Galperin, Pecheux, Lamour, Toda, Azuma, Ogino, & Tamis-LeMonda, 1992; Rossi, Venuti, & Bornstein, 1998; Venuti, Bornstein, Toniatty, & Rossi, 1997). Several functional taxonomies of maternal speech have been developed (Delia Corte, Benedict, & Klein, 1983; Folger & Chapman, 1978; Morikawa, Shand, & Kosawa, 1988; Penman et al., 1983; Rondal, 1985; Sherrod et al., 1978; Toda et al., 1990), and our coding system followed them closely.

Main categories—(a) affect-salient speech—expressive generally nonpropositional language that included encouragement [e.g., "Well done"!], discouragement [e.g., "Not that way"!], Nonsense [Vocal sounds without meaning: e.g., "na na"], greetings [e.g., "Hello"!], mimic [e.g., The child says "ba" and the parent repeats "ba"], singing and reciting [e.g., "Here we go round the Mulberry Bush…"], onomatopoeia [e.g., "Choo-choo"], and conventions [e,g., "Yahoo"!];(b) information-salient speech—normally fully propositional statements that give or ask information about the child, the parent him/herself, or the environment.

Subcategories—Information-salient speech was also coded for type and referent. Specifically, 3 subcategories differentiated the type of information-salient speech (direct statements, questions, or descriptions) and, where applicable, 4 subcategories distinguished the speech referent (child's action, child's internal state, parent, and environment). We also separately considered (c) child name—use of child's name or nickname normally to attract his/her attention. (d) A fourth category of "other" maternal speech was also identified. Other included unintelligible speech but also nonaffect, noninformation speech, such as incompletely pronounced words for the purpose of stimulating child speech ["teleph…"] or mother speaking on behalf of a toy. Including this category in analyzing the three categories of interest also eliminated statistical limitations of linear dependence. Together, these four categories are mutually exclusive and exhaustive of parental child-directed speech.

For maternal language, the coding unit consisted of each speech unit for which a single functional category could be reliably identified, and the unit changed when there was a change in coded unit type or when an utterance terminated and a silence of at least 2 s ensued. Thus, the minimum unit size could be a single word [e.g., "Look"! (information-salient speech, direct statement). However, the same utterance could contain multiple coding [e.g., "take the cup [information-salient speech, type: direct statement, referent: environment] and drink" [information-salient speech, direct statement]. On the basis of these parameters, we determined the frequency of each category and subcategory of maternal speech.

This functional analysis was applied to the transcripts by two independent coders. Although coding was applied to the transcripts, viewing the video was essential to accurately code maternal language. Therefore, coders could not be completely blind to child group as children with DS are recognizable and those with ASD could sometimes be identified. Coders were trained on the functional analyses of parental speech by an independent reliable coder. Interrater reliability on 25% of the transcripts was carried out, and Cohen's kappas ranged from .79 to .96.

Verbatim transcriptions of child language were used to obtain the number of words, the number of utterances, and the MLU on words. In Italian MLU words and MLU morphemes are highly correlated (up to $r(134) = .88$; Venuti, de Falco, Esposito, Zannella, Villotti, & Bornstein, 2011); MLU words was used in this study. Following standard procedures, utterance segmentation was based on prosodic features and pauses. In addition, a set of rules was applied to facilitate agreement between transcribers. Concerning child speech anomalies (e.g., echolalia), when words (or speech units) pronounced by the child were repeated within 2 s, they were excluded from the total number of words; when more the 2 s occurred between repetitions, the repeated words were counted in the total number of words and constituted separate utterances. However, when the child repeated words (or speech units) uttered by the mother, they were counted in the total number of words even when occurring within 2 s from maternal speech.

3. Results

3.1 Preliminary Analyses

Preliminary correlations between mother and child ages, maternal level of education, and main categories of maternal speech were conducted to screen for possible covariates. Child developmental age was–negatively associated with the frequency of maternal affective-salient speech. No associations emerged between mother language and child chronological age, maternal level of education, or SES. (Table 2 shows bivariate correlations; results of partial correlations controlling for developmental age were similar and non significant.) In consequence, child developmental age was controlled as appropriate in the analyses of maternal speech. As described below further analyses showed that child MLU was associated with maternal language (Table 4); moreover, child MLU and number of utterances were associated, $r(59) = .48$, $p < .001$, and, therefore, MLU was also controlled as appropriate in analyses of maternal speech. Although no significant correlations emerged between maternal level of education and maternal language (Table 2), maternal level of education was controlled in subsequent analysis because it has been shown to be strongly associated with maternal child-directed speech (Vernon-Feagans et Al., 2008). No child gender differences were found in maternal speech; therefore, we pooled the data for maternal speech to girls and boys.

Categories of maternal speech were analyzed as frequencies and as proportions. With few exceptions, fundamentally similar patterns emerged from the two analytic approaches. Consequently, we report results for frequencies—the more directly measured variable. Moreover, to control for differences in maternal "talkativeness" we carried out a 3-way analysis of covariance on the total frequency of speech units, with group (TD, DS, ASD) as between-subjects factor and child developmental age and MLU and maternal level of education as a covariates. No main effect of group emerged (Table 3).

3.2 Main Maternal Speech Categories

Table 3 shows descriptive and inferential statistics for main categories and subcategories of maternal speech in the three groups. A multivariate analysis of covariance (MANCOVA) was carried out, with group (TD, DS, ASD) as a between-subjects factor, specifying the frequencies of affect-salient speech, information-salient speech, child name, and other as dependent variables; child developmental age and MLU and maternal education served as covariates. Results showed a main effect of group. Univariate analyses on each category showed (Fig. 1):

Affect-salient speech—A main effect of group was found for affect-salient speech. Specifically, mothers of children with DS used more affect-salient speech than mothers of TD children (DS-TD M difference = 12.56, SE = 3.48, $p < .01$). Mothers of children with ASD did not significantly differ from the other two groups.

Information-salient speech—No difference among the groups was found for the frequency of information-salient speech.

Child name—A main effect of group emerged for the frequency of using the child's name. Post hoc tests showed that mothers of children with ASD named their children more often compared to mothers of TD children (ASD-TD M difference = 14.01, SE = 4.77, $p < .02$) but did not differ from mothers of children with DS. Also, the latter were not different from mothers of TD children.

Other—No difference among the groups was found.

3.3 Subcategories of Maternal Information-Salient Speech

A MANCOVA was carried out, with group (TD, DS, ASD) as a between-subjects factor, specifying the frequency of the 3 types of information-salient units as dependent variables; child developmental age and MLU and maternal education level served as covariates. Results showed a main effect of group (Fig. 2).

Direct statements—Univariate analyses revealed a group main effect for frequency of direct statements; direct statements were used more often by mothers of children with ASD and children with DS compared to mothers of TD children (ASD-TD *M* difference = 21.39, SE = 7.04, $p = .01$; DS-TD *M* difference = 22.51, SE = 7.04, $p < .01$). No differences emerged between mothers of the two groups of children with atypical development.

Questions—A group main effect emerged and post-hoc analyses revealed that mothers of children with ASD and children with DS used fewer questions than mothers of TD children (TD-ASD *M* difference = 20.68, SE = 5.95, $p < .01$; TD-DS M difference = 16.44, SE = 5.95, $p < .05$). No differences were found between mothers of the two groups of atypically developing children.

Descriptions—No difference among the groups was found.

3.4 Referents of Maternal Information-Salient Speech

A MANCOVA was carried out with group (TD, DS, ASD) as a between-subjects factor, specifying the frequencies of the 4 referents of information-salient speech as dependent variables; child developmental age and MLU and maternal education served as covariates. Results showed a main effect of group (Fig. 3).

Reference to child action—Univariate analyses yielded a significant group main effect for child action; post-hoc results revealed that mothers of children with ASD and DS referred to their children's actions more often compared to mothers of TD children (ASD-TD *M* difference = 24.40, SE = 8.01, $p = .01$; DS-TD *M* difference = 22.08, SE = 8.01, $p < .05$), but did not differ from one another.

Reference to child internal state—No main or interaction effects were found.

Reference to the mother—The univariate analyses showed a group effect for mother's reference to herself. Specifically, the mothers of children with ASD referred to themselves more often (ASD-TD *M* difference = 4.01, SE = 1.47, $p < .05$; ASD-DS M difference = 3.88, SE = 1.41, $p < .05$) compared to the other two groups of mothers who did not differ from one another.

Reference to the environment—A main effect of group emerged for mothers' reference to the environment. Post hoc analyses revealed that mothers of children with ASD and DS were similar to one another but both referred less often to the environment than mothers of TD children (TD-ASD *M* difference = 34.14, SE = 7.33, $p < .001$; TD-DS *M* difference = 22.95, SE = 7.33, $p < .01$).

3.5 Child Language

Table 1 shows descriptive statistics for child MLU and number of utterances in the three groups. Univariate ANCOVAs with group (TD, DS, ASD) as a between-subjects factor and child developmental age as a covariate revealed main effects for group on both child MLU and number of utterances (Table 1). Specifically, children with ASD spoke in shorter MLU

compared to the TD group and used fewer utterances compared to both other groups (ASD-TD *M* difference = 4.01, SE = 1.47, $p < .05$; ASD-DS M difference = 3.88, SE = 1.41, $p < .05$).

3.6 Associations between Mother and Child Language

Correlational analyses were carried out to investigate associations of the categories of maternal functional language with child MLU and number of utterances within each group (Table 4). No significant associations emerged between the categories of maternal functional language and children's number of utterances in any group. Positive correlations between maternal functional language and child MLU emerged in the TD group. Specifically, in the dyads with TD children positive associations were found between the frequency of maternal Descriptions and child MLU and between reference to the Environment and child MLU. In dyads with children with DS and ASD, no associations were found between maternal language and child MLU. We compared groups correlation coefficients using Fischer's Z and found no significant differences between dyads with TD and ASD children for Descriptions/MLU (z = .71, *ns*) and references to the Environment/MLU correlations (z = .48, *ns*), whereas we found that in dyads with DS children correlations between Descriptions and MLU (z = 2.68, $p < .001$) and reference to the Environment and MLU (z = 2.61, $p < .001$) differed significantly from those in dyads with TD children.

4. Discussion

The main purposes of this study were to compare the functional features of maternal speech directed to three groups of children of the same developmental age, children with Autism Spectrum Disorder, children with Down syndrome, and typically developing children, and to investigate associations between maternal functional speech and child language in each group. To reach these aims mothers' language during naturalistic dyadic play interactions with their children were categorized in terms of primary functions and referents of each speech unit. From the same play interaction, child MLU and number of utterances were acquired.

Considering the main categories of maternal speech, we found that information-salient speech in all groups exceeded affective-salient speech, as expected for mothers of children with 2 years of developmental age (Bornstein et al., 1992; D'Odorico, Salerni, Cassibba, & Jacob, 1999; Longobardi, 1995; Penman et al., 1983). At this stage, mother-child verbal exchanges focus more on sharing meanings about the internal and external world than on expressing affect (Venuti et al., 1997). Mothers in all groups used the same amounts of information-salient speech. Affect-salient speech, which tends to decline over the first 2 years of life, was used more often by mothers of children with DS compared to mothers of TD children, and this might be due to their children's baby face-like dysmorphy, that makes them perceived as more immature (Fidler, 2003; Fidler & Hodapp, 1999). The greater use of affect-salient speech may also reflect the different parenting agenda of mothers of children with developmental disabilities, which might include, especially for parents of children with DS, an immaturity-dependent parenting style and stronger protective instinct (Hodapp 2000; Fidler, 2003). This style might result in emphasizing an affect-salient way of speaking that is usually directed to younger infants. Moreover, the use of the child's name, usually to attract the children's attention, was more frequent in mothers of children with ASD compared to TD children, likely a result of children with ASD's deficit in engaging in social interactions (Adrien et al., 1991; Hobson, 1993)

With respect to the different types of information-salient speech, our results showed that direct statements were used less often by mothers of TD children compared to mothers of children with either DS or ASD, whereas questions were asked more frequently by mothers

of TD children than by mothers of children with either developmental disability We found that descriptions were used equally by all mothers, suggesting that they offered similar verbal scaffolding to their children's exploration through descriptions of their external and internal world (Longobardi & Caselli, 2007). These differences in maternal functional language seem to partly follow the distinction between two maternal language styles -- interactive and controlling -- previously identified with typical development (Camaioni et al. 1998; McDonald & Pien, 1982; Olsen-Fulero, 1982). According to this distinction, some mothers show an interactive style by using language to engage in reciprocal verbal exchanges with their children, similar to conversations, asking them questions and avoiding directives. Other mothers tend to show a controlling style characterized by more directives and fewer questions. Notably, these two styles have been linked to positive or negative child outcomes, respectively, in typically developing children (McDonald & Pien, 1982; Olsen-Fulero, 1982). Based on this distinction in maternal language styles, in our study mothers of children with either DS or ASD developmental disabilities, appeared more "controlling" than mothers of TD children. A possible explanation of this finding lies in the difficulty these mothers have in engaging their children in adequate reciprocal interactions; such mothers may try to control the situation by over structuring children's actions and giving simple and repetitive prompts (Hoddap, 2002). However, in mothers of children with developmental disabilities a directive style could have a different meaning and a positive significance. The dual interpretation of directiveness in parents of children with developmental disabilities has constituted an animated, intense, and still open debate in the scientific literature (Cielinski et al., 1995; de Falco, Venuti, Esposito, & Bornstein, 2009; Marfo, 1990; Marfo, Cynthia, Dedrick, & Barbour, 1998; McCathren, Yoder, & Warren, 1995). In this study, the category of maternal direct statements included both appropriate structuring directions (e.g., *"Throw the ball like this."*) and restrictions (e.g., *"Stop moving!"*), and the positive or detrimental effects of this language style were not assessed longitudinally, although at a concurrent level no association with child MLU was found.

With respect to the referents of information-salient speech, all mothers made reference to child actions and to the environment more often compared to reference to the child's internal state and to themselves. Given the developmental age of their children, mothers oriented their language more to the behaviors of their actively exploring children and to the surrounding environment as the appropriate object of child exploration (Trevarthen & Aitken, 2001). Mervis underscored the importance of maternal descriptions of the features of objects for children's category learning (Mervis & Mervis, 1988; Banigan & Mervis, 1988). However, references to the environment were made more often by mothers of TD children when compared to mothers in the other groups. Reciprocally, references to child action were made more often by mothers of children with ASD and DS compared to mothers of TD children. The language styles displayed by mothers of children with ASD and DS appear more focused on orienting children's actions than on stimulating their attention to the surrounding environment in attempts to support exploration, perhaps because mothers of children with developmental disabilities need first to support their children in behavioral planning and they focus less, or wait, to convey information about the surrounding world. References to the child's internal state, such as simple feelings (e.g., *"Are you sad?"*) or physiological states (e.g., *"You must be hungry"*), were made with the same frequency by mothers in all three groups, whereas references to themselves were made more frequently by mothers of children with ASD than by those of children with TD and DS, suggesting that the mothers of children with an important social-communication deficit, such as ASD, tend to talk more about themselves possibly in consequence of the limited social responsiveness of their children.

Altogether, the results of this study highlight similarities in maternal functional language directed to 2 groups of children with contrasting developmental disabilities compared to that

directed to TD children. Specifically, mothers of children with developmental disabilities, compared to mothers of normally developing children, showed a specific style in their verbal interaction, asking fewer questions and making fewer references to the environment but using more direct statements and references to their children's actions (McDonald & Pien, 1982; Olsen-Fulero, 1982). Moreover, few characteristics emerged that specifically differentiated maternal speech in the two atypical conditions compared to TD: the tendency to use more affect-salient speech by mothers of children with DS, and the enhanced use of child name and of reference to themselves by mothers of children with ASD.

Besides differences, we found several general similarities among mothers in the 3 groups (they were the total amount of maternal speech and of information-salient speech, the frequency of descriptions and of references to the children's state) suggesting that, even when interacting with children with developmental disabilities, mothers activate a functional speech register that is appropriate to child developmental level and may favor scaffolding of interaction and language growth.

Concerning child language, children with ASD, although matched for developmental age to children with TD and DS, spoke in shorter MLU and fewer utterances during mother-child interaction. This finding is consistent with the socio-communicative impairment that represents the core deficit in ASD (DSM-IV, APA, 1994; ICD-10, WHO, 1993). In consequence, we statistically controlled MLU in our investigation of the functional features of maternal speech directed to children with ASD, DS, and TD. Thus, the differences we found between mothers of TD children and children with developmental disabilities can be attributed to child diagnostic status rather than to child language level.

In line with previous studies, we found a significant association between maternal language and child MLU (Rondal et al., 1978, 2006), but only for TD mother-child dyads. Specifically, in dyads with TD children frequencies of maternal descriptions and maternal referents to the environment were positively associated with child MLU. Relations between these features of maternal language and child MLU appeared weaker in dyads with ASD children and absent in dyads with DS children. However, it is also important to note that the small inter-subject variability in MLU shown by children with DS may have affected the correlations, and in general the small *n*s of the subgroups of participants may have reduced the power of our analyses. One possible interpretation of differences in the groups is that mothers of TD children adapt their verbal stimulation to the language level expressed by their children, whereas mothers of children with developmental disabilities, and especially those of children with DS, do not adapt their functional language to the language complexity expressed by their children in the interaction session (and may calibrate their verbal scaffolding on other aspects of the child). However, our study was cross-sectional, and the direction of the associations must be interpreted with caution. It could be that TD children express more language complexity in response to greater maternal verbal stimulation, whereas the expressive language of children with DS and ASD is less influenced by the amount of maternal stimulation.

Several limitations of this study should be mentioned. Most notably, having larger samples would allow a grater generalization of the data. Second, as mentioned, data in this study are cross-sectional, and direction of the effects is undetermined. Adding longitudinal measurements of children's language development would permit us to predict associations between the different categories (and subcategories) of maternal speech and children's subsequent language. Third, we did not measure developmental age of typically developing children and assumed it was equivalent to their chronological age; although we deduced from clinical reports, interviews from the parents, and our own observations that these children were not delayed or atypical in their general development, controlling for their

actual developmental age would have augmented the validity of our findings. Additionally, even though groups were matched on developmental age, it seems possible that the greater set of life experiences of the two groups of children with developmental disabilities might lead their mothers to speak to them differently. The free-play session lasted only 10 min; therefore, the data sample might have low reliability, especially for child language. Finally, future work should also consider associations between maternal language and the level of specific child skills that might influence mother-child interaction. As an example, in our study maternal language could reflect difficulties in symbolic play (Jarrold, Boucher, & Smith, 1993) and joint attention (Meindl & Cannella-Malone, 2011) of children with ASD and difficulties in exploratory play and sustained attention of children with DS (Venuti, de Falco, Esposito, & Bornstein, 2010). For instance, the literature suggests that children in these groups differ in the ability to initiate and respond to joint attention bids, to sustain focus of attention, to talk about internal states of self and other, and to engage in different types of play activities

This study has some developmental and clinical implications. Consistent with a view of mother-child interaction as a bidirectional transaction (Bornstein, 2002; Sander, 2000; Stern, 1985; Trevarthen & Aitken, 2001; Van Egeren, Barratt, & Roach, 2001; Venuti, de Falco, Giusti, & Bornstein, 2008), our results show how the child's condition is clearly associated with a crucial aspect of maternal interactive style, namely the language functions mothers use during dyadic interactions. These findings also point to mothers' aptitude to tailor language to the special needs of their children (Longobardi & Caselli, 2007). However, the diagnoses of the two subsamples of children with developmental disabilities targeted in this study implied salient differences in their socio-communication skills that constitute a core deficit in ASD and a relatively preserved area for children with DS. It appears that mothers of children with developmental disabilities, in attempt to tailor their language to the special needs and behaviors of their children, may display some non-optimal features (being more controlling and less oriented toward the environment) which could be profitably targeted for early intervention with foci not only on specific child skills but also on mother-child interaction. Such programs may help mothers enhance other effective ways of speaking with their children, such us using more questions, fewer direct statements, and more reference to the environment, which in turn might facilitate child language and social development. The specific differences we observed between mothers of children with developmental disabilities compared to those of TD children apparently only concern mothers' attempts to reiterate behaviors that are likely to be successful when directed to TD children but are instead unsuccessful when directed to children with developmental disabilities. As an example, mothers of children with ASD may call their name to get their attention without getting a response and might therefore perseverate in calling them, sometimes unsuccessfully. The same may happen for directive speech. A specific intervention with parent-child dyads should help parents understand which behaviors and language are most likely to be successful in regulating interaction with their children and which, by contrast, do not achieve useful results. Such awareness may help parents to persevere in cases of interaction failures and lead to changes in their "intuitive parenting", hopefully toward strategies more suitable for the special needs of their children.

Acknowledgments

This research was supported by the Intramural Research Program of the NIH, NICHD.

References

Adrien JL, Faure M, Perrot A, Hameury L, Garreau B, Barthelemy C, Sauvage D. Autism and family home movies: Preliminary findings. Journal of Autism and Developmental Disorders. 1991; 21:43–49. [PubMed: 2037548]

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4. Washington, DC: 1994. (DSM-IV)

Banigan RL, Mervis CB. Role of adult input in young children's category evolution: II an experimental study. Journal of Child Language. 1988; 15:493–504. [PubMed: 3198718]

Baker JK, Messinger DS, Lyons KK, Grantz CJ. A pilot study of maternal sensitivity in the context of emergent autism. Journal of Autism and Developmental Disorders. 2010; 40:988–999. [PubMed: 20130975]

Baker J, Haltigan JD, Brewster R, Jaccard J, Messinger DS. Non-Expert Ratings of Infant and Parent Emotion: Concordance with Expert Coding and Relevance to Early Autism Risk. International Journal of Behavioral Development. 2010; 34:88–95. [PubMed: 20436947]

Baranek GT. Autism during infancy: A retrospective video analysis of sensory- motor and social behaviors at 9–12 months of age. Journal of Autism and Developmental Disorders. 1999; 29:213–224. [PubMed: 10425584]

Bayley, N. Bayley Scales of Infant and Toddler Development. 2. San Antonio, TX: Psychological Cor; 1993. Manual

Bloom L, Margulis C, Tinker E, Fujita N. Early Conversations and Word Learning: Contributions from Child and Adult. Child Development. 1996; 67:3154–3175. [PubMed: 9071775]

Bornstein, MH. Parenting infants. In: Bornstein, MH., editor. Handbook of parenting. 2. Vol. 1. Mahwah, NJ: Erlbaum; 2002. p. 3-93.

Bornstein MH, Tamis-LeMonda CS. Activities and interactions of mother and their firstborn infants in the first six months of lives: covariation, stability, continuity, correspondence, and prediction. Child development. 1990; 61:1206–17. [PubMed: 2209190]

Bornstein MH, Tal J, Rahn C, Galperín CZ, Pêcheux MG, Lamour M, Toda S, Azuma H, Ogino M, Tamis-LeMonda CS. Functional analysis of the contents of maternal speech to infants of 5 and 13 months in four cultures: Argentina, France, Japan, and the United States. Developmental Psychology. 1992; 28:593–603.

Bretherton I, McNew S, Snyder L, Bates E. Individual differences at 20 months: analytic and holistic strategies in language acquisition. Journal of Child Language. 1983; 10:293–320. [PubMed: 6874769]

Buium N, Rynders J, Turnure J. Early maternal linguistic environment of normal and non-normal language-learning children. American Journal of Mental Deficiency. 1974; 79:52–58. [PubMed: 4279552]

Camaioni L, Longobardi E, Venuti P, Bornstein M. Maternal speech to 1-year-old children in two Italian cultural contexts. Early Development and Parenting. 1998; 7:9–17.

Cameron-Faulkner, Lieven EV, Tomasello. A Construction Based Analysis of Child Directed Speech. Cognitive Science. 2003; 27:843–873.

Chow SM, Haltigan JD, Messinger DS. Dynamic infant-parent affect coupling during the face-to-face/still-face. Emotion. 2010; 10:101–114. [PubMed: 20141307]

Cielinski KL, Vaughn BE, Seifer R, Contreras J. Relations Among Sustained Engagement During Play, Quality of Play, and Mother-Child Interaction in Samples of Children With DS and Normally Developing Toddlers. Infant Behaviour and Development. 1995; 18:163–176.

D'Odorico, L. Lo sviluppo linguistico. Roma-Bari: Laterza; 2005.

D'Odorico L, Salerni N, Cassibba R, Jacob V. Stability and change of maternal speech in italian infants from 7 to 21 months of age: a longitudinal study of its influence on early stages of language acquisition. First language. 1999; 57:313–346.

de Falco S, Venuti P, Esposito G, Bornstein MH. Mother-child and father- child emotional availability in down syndrome families. Parenting: science and practice. 2009; 9:198–215.

Delia Corte M, Benedict H, Klein D. The relationship of pragmatic dimensions of mother's speech to the referential-expressive distinction. Journal of Child Language. 1983; 10:35–43. [PubMed: 6841499]

Doussard-Roosevelt JA, Joe CM, Bazhenova OV, Porges SW. Mother- child interaction in autistic and non-autistic children: Characteristics of maternal approach behaviors and child social responses. Development and Psychopathology. 2003; 15:277–295. [PubMed: 12931828]

Eigsti IM, Cicchetti D. The impact of child maltreatment on expressive syntax at 60 months. Developmental Science. 2004; 7:88–102. [PubMed: 15323121]

Fernald, A. Human maternal vocalizations to infants as biologically relevant signals: An evolutionary perspective. 1992. p. 391-428.

Fidler DJ. Parental vocalizations and perceived immaturity in Down syndrome. American Journal on Mental Retardation. 2003; 108:425–434. [PubMed: 14561106]

Fidler DJ, Hodapp RM. Craniofacial maturity and perceived personality in children with Down syndrome. American journal of mental retardation. 1999; 104:410–421. [PubMed: 10541412]

Folger JP, Chapman RS. A pragmatic analysis of spontaneous imitation. Journal of Child Language. 1978; 5:25–35.

Garton, AF. Social Interaction and development of language and cognition. Hove: LEA; 1992.

Gilmore L, Cuskelly M, Jobling A, Hayes A. Maternal support for autonomy: Relationships with persistence for children with Down syndrome and typically developing children. Research in Developmental Disabilities. 2009; 30:1023–1033. [PubMed: 19304452]

Goodwin, A.; Piotroski, J.; Jaffery, G.; Fein, DA.; Naigles, L. Maternal Input Correlates with Wh-Question Comprehension in Young Children with Autism. International Meeting for Autism Research; Philadelphia: PA. 2010.

Hampson J, Nelson K. The relation of maternal language to variation in rate and style of language acquisition. Journal of Child Language. 1993; 2:313–342. [PubMed: 8376472]

Harris S, Kasari C, Sigman MD. Joint attention and language gains in children with Down syndrome. American Journal on Mental Retardation. 1996; 100:608–619. [PubMed: 8735574]

Herrera E, Reissland N, Shepherd J. Maternal touch and maternal child directed speech: effects of depressed mood in the postnatal period. Journal of Affective Disorders. 2004; 81:29–39. [PubMed: 15183597]

Hobson, P. Autism and the development of mind. Hillsdale. NJ: Erlbaum; 1993.

Hodapp, RM. Parenting children with mental retardation. In: Bornstein, MH., editor. Handbook of parenting. Hillsdale, NJ: Erlbaum; 2002. p. 355-381.

Hoff-Ginsberg E. Function and structure in maternal speech: Their relation to the child's development of syntax. Developmental Psychology. 1986; 22:155–163.

Hoff E. The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. Child Development. 2003; 74:1368–1378. [PubMed: 14552403]

Hollingshead, AA. Unpublished manuscript. Yale University; New Haven, CT: 1975. Four-factor index of social status.

Hutman T, Siller M, Sigman M. Mothers' narratives regarding their child with autism predict maternal synchronous behavior during play. Journal of Child Psychology and Psychiatry. 2009; 50:1255–1263. [PubMed: 19519754]

Jarrold C, Boucher J, Smith P. Symbolic play in autism: A review. Journal of Autism and Developmental Disorders. 1993; 23:281–307. [PubMed: 7687245]

Jonson-Glenberg MC, Chapman RS. Predictors of Parent-Child Language During Novel Task Play: A Comparison Between Typically Developing Children and Individuals with Down Syndrome. Journal of Intellectual Disability Research. 2004; 48:225–238. [PubMed: 15025665]

Kasari C, Sigman M, Mundy P, Yirmiya N. Caregiver interactions with autistic children. Journal of Abnormal Child Psychology. 1988; 16:45–56. [PubMed: 2966189]

Konstantareas MM, Zajdeman H, Homatidis S, McCabe A. Maternal speech to verbal and higher functioning versus nonverbal and lower functioning autistic children. Journal of Autism and Developmental Disorders. 1988; 18:647–656. [PubMed: 3215890]

Legerstee M, Van Beek Y, Varghese J. Effects of Maintaining and Redirecting infant attention on the production of referential communication in infants with and without Down syndrome. Journal of Child Language. 2002; 29:23–48. [PubMed: 11968884]

Lemanek KL, Stone WL, Fishel PT. Parent-child interactions in handicapped preschoolers: The relationship between parent behaviors and compliance. Journal of Clinical Child Psychology. 1993; 22:68–77.

Locke JL. Why do infants begin to talk? Language a san unitended consequence. Journal of Child Language. 1996; 23:251–268. [PubMed: 8936686]

Longobardi E. Funzione comunicativa del comportamento materno e sviluppo comunicativo e linguistico del bambino nel secondo anno di vita. Giornale Italiano di Psicologia. 1992; 3:425–440.

Longobardi E. Funzioni comunicative materne nel secondo anno di vita del bambino: come varia il supporto materno in relazione allo sviluppo linguistico. Rassegna di Psicologia. 1995; 1:67–83.

Longobardi E, Caselli MC. Interazioni comunicative nello sviluppo tipico e atipico: implicazioni per la ricerca e per il trattamento. Psicologia Clinica dello Sviluppo. 2007; 11:385–389.

Longobardi E, Caselli MC, Colombini MG. Stile comunicativo materno nell'interazione con il bambino con sindrome di Down. Psichiatria dell'infanzia e dell'adolescenza. 1998; 65:407–418.

Lord, C.; Rutter, M.; DiLavore, PC., et al. Autism Diagnostic Observation Schedule - Generic (ADOSG). 2003.

MacWhinney, B. The childes Project: Tools for Analyzing Talk. Lawrence Erlbaum Associates; Mahwah, NJ: 2000.

Mahoney GJ. An ethological approach to delayed language acquisition. American Journal of Mental Deficiency. 1975; 80:139–148. [PubMed: 1163559]

Marfo K. Maternal directiveness in interactions with mentally handicapped children. Journal of Child Psychology and Psychiatry. 1990; 31:531–549. [PubMed: 2195053]

Marfo, K.; Cynthia, FD.; Dedrick, F.; Barbour, N. Mother-child interactions and the development of children with mental retardation. In: Burack, AB.; Hodapp, RM.; Zigler, EF., editors. Handbook of Mental Retardation and Development. Cambridge: Cambridge University Press; 1998. p. 637-668.

Marshall N, Hegrenes J, Goldstein S. Verbal interactions: Mothers and their retarded children versus mothers and their nonretarded children. American Journal of Mental Deficiency. 1973; 77:415–419. [PubMed: 4706401]

McCathren RB, Yoder PJ, Warren SF. The role of directives in early language intervention. Journal of Early Intervention. 1995; 19:74–85.

McDonald L, Pien D. Mother conversational behaviour as a function of interactional intent. Journal of Child Language. 1982; 9:337–358. [PubMed: 7119039]

Meindl, JN.; Cannella-Malone, HI. Research in Developmental Disabilities. 2011. Initiating and responding to joint attention bids in children with autism: A review of the literature.

Mervis CB, Mervis CA. Role of adult input in young children's category evolution: I an observational study. Journal of Child Language. 1988; 15:257–272. [PubMed: 3209643]

Meyer, AT.; Edelson, LR.; Tager-Flusberg, H. Maternal Noun Phrase Complexity and Child Language in Autism. International Meeting for Autism Research; Philadelphia: PA. 2010.

Morikawa H, Shand N, Kosawa Y. Maternal speech to prelingual infants in Japan and the United States: relationships among functions, forms and referents. Journal of Child Language. 1988; 15:237–256. [PubMed: 3209642]

Mundy P, Sigman M, Kasari C, Yirmiya N. Nonverbal communication skills in Down syndrome children. Child Development. 1988; 59:235–249. [PubMed: 2963734]

Olsen-Fulero L. Style and stability in mother conversational behaviour: a study of individual differences. Journal of Child Language. 1982; 9:543–564. [PubMed: 7174756]

Penman R, Cross T, Milgrom-Friedman J, Meares R. Mothers' speech to prelingual infants: A pragmatic analysis. Journal of Child Language. 1983; 10:17–34. [PubMed: 6841489]

Pino O. The effect of context on mother's interaction style with Down's Syndrome and typically developing children. Research in Developmental Disabilities. 2000; 21:329–346. [PubMed: 11100797]

Roach MA, Barratt MS, Miller JF, Leavitt JA. The structure of mother-child play: young children with Down syndrome and tipically developing children. Developmental Psychology. 1998; 34:77–87. [PubMed: 9471006]

Rollins P, Snow C. Shared attention and grammatical development in typical children and children with autism. Journal of Child Language. 1998; 25:653–673. [PubMed: 10095329]

Rondal JA, Docquier L. Maternal speech to children with Down Syndrome: an update. Journal of Speech-Language Pathology and Applied Behavior Analysis. 2006; 1:218–227.

Rondal JA. Patterns of correlations for various language measures in mother-child interactions for normal and Down's syndrome children. Language and Speech. 1978; 21:142–252. [PubMed: 692247]

Rondal, JA. Adult-child interaction and the process of language acquisition. New York: Praeger; 1985.

Rondal JA. Language development in Down's syndrome: a life-span perspective. International Journal of Behavioral Development. 1988; 11:21–36.

Rossi G, Venuti P, Bornstein MH. Sequential analysis of maternal language in two italian sample. Di PAV. 2001; 2:33–48.

Sander L. Where are we going in the field of infant mental health? Infant Mental Health Journal. 2000; 21:1–18.

Schieve LA, Blumberg SJ, Rice C, Visser SN, Boyle C. The relationship between autism and parenting stress. Pediatrics. 2007; 119:S114–S121. [PubMed: 17272578]

Sherrod K, Crawley S, Petersen G, Bennett P. Maternal language to prelinguistic infants: Semantic aspects. Infant Behavior and Development. 1978; 1:335–345.

Siller M, Sigman M. The behaviors of parents of children with autism predict the subsequent development of their children's communication. Journal of Autism and Developmental Disorders. 2002; 32:77–89. [PubMed: 12058846]

Siller M, Sigman M. Modeling longitudinal change in the language abilities of children with autism: Investigating the role of parent behaviors and child characteristics as predictors of change. Developmental Psychology. 2008; 44:1691–1704. [PubMed: 18999331]

Snow, CE. Mothers' speech research: From input to interaction. In: Snow, CE.; Ferguson, CA., editors. Talking to children: Language input and acquisition. Cambridge: Cambridge University Press; 1977.

Snow, CE. Parent-child interaction and the development of comunicative ability. In: Schiefelbusch, RL.; Pickar, J., editors. The acquisition of communicative competence. Baltimore: University Park Press; 1984. p. 69-107.

Snow, CE. Issues in the study of input: Finetuning, universality, individual and developmental differences, and necessary causes. In: Fletcher, P.; MacWhinney, B., editors. The handbook of child language. Oxford: Blackwell; 1995. p. 180-193.

Spiker D, Boyce GC, Boyce LK. Parental-child Interactions When Young Children Have Disabilities. International Review of Research in Mental Retardation. 2002; 25:35–70.

Stern, D. The Interpersonal World of the Infant. New York: Basic Books; 1985.

Tamis-LeMonda CS, Bornstein MH, Baumwell L. Maternal responsiveness and children's achievement of language milestones. Child development. 2001; 72:748–767. [PubMed: 11405580]

Thiessen ED, Hill EA, Saffran JR. Infant-directed speech facilitates word segmentation. Infancy. 2005; 7:53–71.

Toda S, Fogel A, Kawai M. Maternal speech to three-month-old infants in the United States and Japan. Journal of Child Language. 1990; 17:279–294. [PubMed: 2380270]

Tomasello M, Farrar MJ. Joint attention and early language. Child Development. 1986; 57:1454–1463. [PubMed: 3802971]

Trevarthen C, Aitken KJ. Infant intersubjectivity: research, theory and clinical applications. Journal of Child Psychology and Psychiatry. 2001; 42:3–48. [PubMed: 11205623]

Van Egeren LA, Barratt MS, Roach MA. Mother–infant responsiveness: Timing, mutual regulation, and interactional context. Developmental Psychology. 2001; 37:684–697. [PubMed: 11552763]

Venuti, P. Percorsi Evolutivi. Carocci: Milano; 2007.

Venuti P, Bornstein MH, Toniatti C, Rossi G. Analisi funzionale del linguaggio materno rivolto a bambini di 13 mesi. Giornale Italiano di Psicologia. 1997; 24:335–350.

Venuti P, de Falco S, Giusti Z, Bornstein MH. Play and Emotional Availability in Young Children with Down Syndrome. Infant Mental Health Journal. 2008; 29:133–152.

Venuti P, de Falco S, Giusti Z, Bornstein MH. Mother-child Play: Children with Down Syndrome and Typical Development. American Journal on Intellectual and Developmental Disabilities. 2009; 114:274–288. [PubMed: 19642713]

Vernon-Feagans L, Pancsofar N, Willoughby M, Odom E, Quade A, Cox M. Family Life Project Key Investigators. Predictors of maternal language to infants during a picture book task in the home: Family SES, child characteristics and the parenting environment. Journal of Applied Developmental Psychology. 2008; 29:213–226. [PubMed: 18618023]

Watson, A. Measuring Perceived Quality of Speech and Video in Multimedia Conferencing Applications. MULTIMEDIA '98 Proceedings of the sixth ACM international conference on Multimedia; 1998. p. 55-60.

Weiss MJ. Hardiness and social support as predictors of stress in mothers of typical children, children with autism, and children with mental retardation. Autism. 2002; 6:115–130. [PubMed: 11918107]

World Health Organization. The ICD-10 classification of mental and behavioral disorders: diagnostic criteria for research. Geneva: World Health Organization; 1993.

Wolchik SA. Language patterns of parents of young autistic and normal children. Journal of Autism and Developmental Disorders. 1983; 13:167–180. [PubMed: 6863211]

Wolchik SA, Harris SL. Language environments of autistic children and normal children matched for language age: A preliminary investigation. Journal of Autism and Developmental Disorders. 1982; 12:43–55. [PubMed: 7096260]

Yoder PJ. Maternal Question Use Predicts Later Language Development in Specific-Language-Disordered Children. Journal of Speech and Hearing Disorders. 1989; 54:347–355. [PubMed: 2755097]

Yoder PJ, Warren SF. Maternal Responsivity Predicts the Prelinguistic Communication Intervention That Facilitates Generalized Intentional Communication. Journal of Speech, Language, and Hearing Research. 1998; 41:1207–1219.

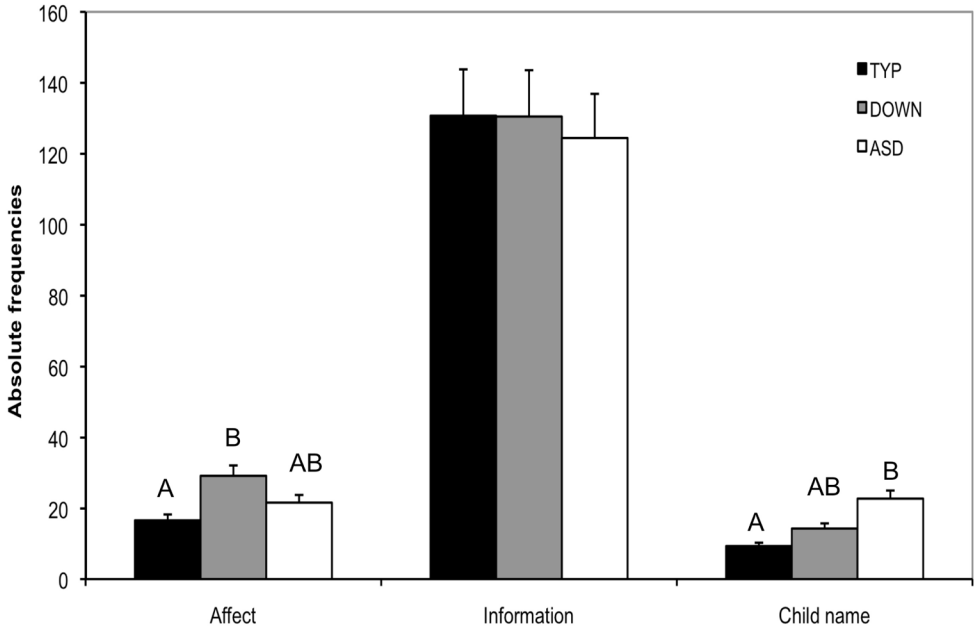

Figure 1. Main categories of maternal speech by group

Note. Bars with different superscripts represent significant mean differences (Tukey HSD post-hoc tests for $p < .05$.)

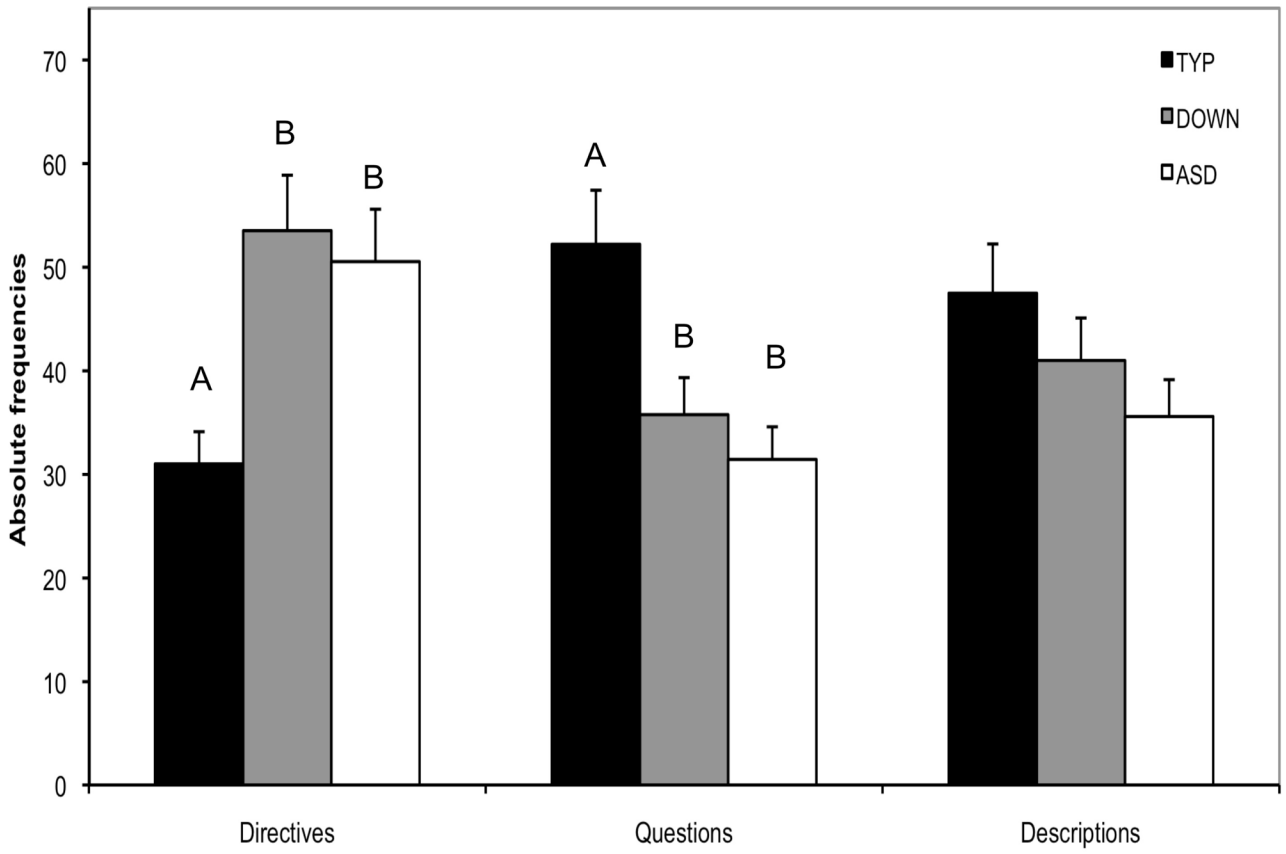

Figure 2. Type of maternal information-salient speech by group

Note. Bars with different superscripts represent significant mean differences (Tukey HSD post-hoc tests for $p < .05$).

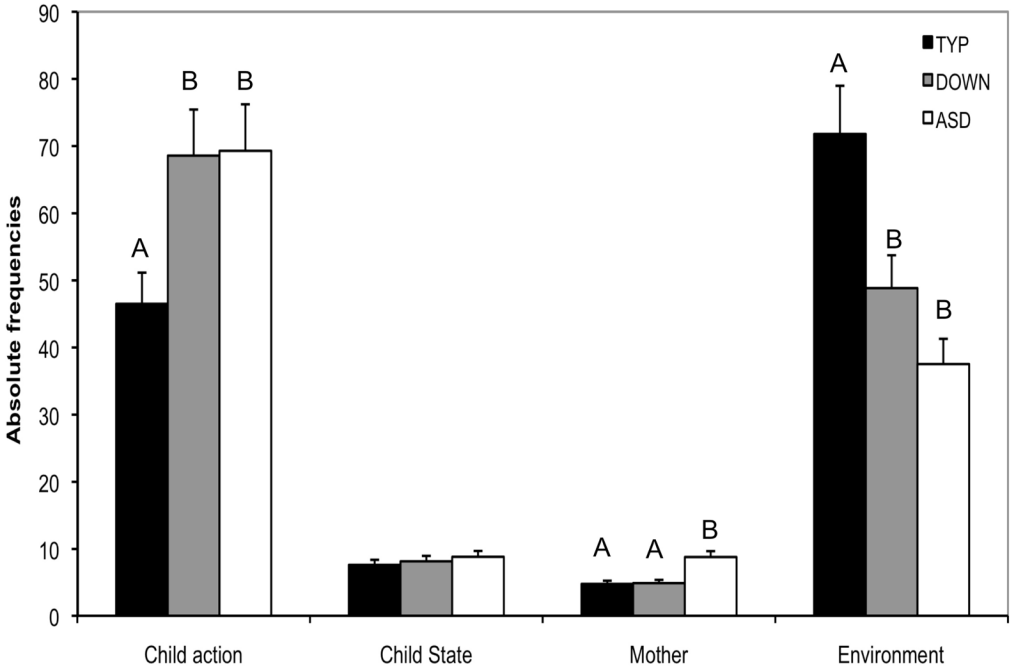

Figure 3. Referent of information-salient speech by group

Note. Bars with different superscripts represent significant mean differences (Tukey HSD post-hoc tests for $p < .05$).

Table 1

Descriptive and inferential statistics of child and family characteristics by group

	Typical Development (*N* = 20; F = 10)			Down syndrome (*N* = 20; F = 7)			Autism Spectrum Disorders (*N* = 20; F = 4)					
	M	***SD***	***range***	***M***	***SD***	***range***	***M***	***SD***	***range***	$F_{(2, 58)}$	***p***	η^2_p
Child												
Chronological age	24.70_a	*3.91*	19.00–31.00	41.15_b	*6.71*	28.00–48.00	52.95_c	*16.83*	30.00–88.00	35.18	*.01*	.55
Developmental age	24.70	*3.91*	19.00–31.00	22.55	*3.24*	16.00–26.00	26.55	*13.42*	13.00–28.00	1.17	*.32*	.04
MLU	1.33_a	*.22*	1.00–1.69	1.09_{ab}	*.13*	1.00–1.47	$.93_b$	*.75*	.00–2.43	3.08	*.03*	.12
n of utterances	32.00_a	*20.92*	3.00–82.00	21.45_a	*17.90*	1.00–64.00	6.95_b	*9.78*	.00–35.00	11.11	*.01*	.28
Mother/family												
Ge	35.05	*4.70*	27.00–45.00	36.85	*6.28*	27.00–50.00	35.95	*3.39*	30.00–43.00	.66	*.52*	.02
education level	4.65_a	*1.87*	1.00–7.00	2.85_b	*1.39*	1.00–6.00	4.35_a	*1.32*	2.00–6.00	7.57	*.01*	.22
SES	42.05_a	*14.37*	22.00–66.00	27.10_b	*12.91*	.00–47.00	38.00_{ab}	*14.52*	19.00–63.50	6.10	*.01*	.20

Notes: Means with different subscripts represent significant mean differences at Tukey HSD post-hoc tests for $p < .05$. TD children's developmental age was assumed to correspond to their chronological *age.*

Table 2

Preliminary correlations analyses between participants demographics and main categories of maternal speech.

Maternal Speech Categories	Child chronological age		Child developmental age		Mother Age		Maternal education level		Family SES	
	r(58)	p	r(58)	p	r(58)	p	r(58)	p	r(58)	p
Affect	−.27	*.04*	−.01	*.98*	.07	*.61*	−.16	*.25*	−.19	*.17*
Information	−.06	*.62*	−.17	*.21*	−.10	*.47*	.06	*.64*	.04	*.78*
Child Name	−.01	*.99*	.04	*.78*	.13	*.32*	.07	*.59*	.15	*.27*
Other	−.09	*.48*	−.09	*.49*	.15	*.26*	−.05	*.69*	−.11	*.41*
Total	−.14	*.29*	−14	*.29*	.06	*.65*	−.04	*.79*	−.04	*.78*

Table 3

Descriptive and inferential statistics of maternal functional language by group.

	Typical Development (*N* = 20)		Down Syndrome (*N* = 20)		Autism Spectrum Disorders (*N* = 20)		Multivariate analysis			Univariate analysis		
	M	***SD***	***M***	***SD***	***M***	***SD***	$F_{(2, 57)}$	***p***	***eta***	$F_{(2, 58)}$	***p***	***eta***
Main Speech Categories												
Affect	16.67_a	7.38	29.23_b	13.88	23.11_{ab}	10.91	3.38	.002	.22	6.06	.004	.19
Information	130.72	38.24	130.50	34.32	126.33	40.74				.19	.82	.01
Child Name	9.42_a	7.15	14.37_{ab}	17.31	23.43b	18.18				3.88	.027	.13
Other	23.47	11.45	25.10	13.17	39.15	49.68				3.07	.055	.10
Tot	180.29	46.53	199.20	50.52	212.61	75.37				1.99	.15	.07
Type of Information-salient sp.												
Direct statements	31.02_a	16.84	53.53_b	25.44	52.41_b	23.62	2.91	.012	.15	4.55	.015	.15
Questions	52.21_a	22.25	35.77_b	14.92	31.53_b	18.56				3.63	.034	.13
Descriptions	47.49	18.30	41.00	16.21	35.05	16.70				1.09	.345	.04
Referent of Information-salient sp.												
Child action	46.50_a	18.46	68.58_b	29.71	70.90_b	26.51	3.72	.001	.23	4.15	.021	.14
Child state	7.63	5.71	8.16	5.27	8.95	9.51				.02	.978	.00
Mother	4.79a	3.58	4.91a	3.76	7.82b	5.98				3.27	.046	.11
Environment	71.80_a	31.81	48.85_b	18.32	37.66_b	16.19				6.72	.003	.21

Note:: Means with different subscripts represent significant mean differences at Tukey HSD post-hoc tests for $p < .05$.

Table 4

Correlations between maternal and child speech by group.

	Child N of utterances						Child MLU					
	TD		*DS*		*ASD*		*TD*		*DS*		*ASD*	
	r(58)	*p*	*r(58)*	*p*	*r(58)*	*p*	*r(58)*	*p*	*r(58)*	*p*	*r(58)*	*p*
Main speech categories												
Affect	.02	*.95*	−.27	*.25*	−.12	*.62*	−.30	*.20*	−.19	*.42*	.02	*.96*
Information	.22	*.35*	.08	*.75*	.27	*.26*	.21	*.37*	−.23	*.34*	.21	*.38*
Child Names	.12	*.62*	−.11	*.66*	.35	*.13*	−.37	*.11*	−.16	*.49*	.34	*.15*
Other	−.12	*.63*	.12	*.60*	.10	*.69*	−.16	*.51*	.01	*.97*	.24	*.30*
Total	.17	*.46*	−.03	*.92*	.21	*.38*	.03	*.90*	−.26	*.27*	.34	*.15*
Type												
Direct statements	−.27	*.25*	−.03	*.91*	.14	*.57*	−.28	*.23*	−.11	*.65*	.21	.37
Questions	.35	*.13*	.21	*.37*	.36	*.12*	.10	*.66*	−.22	*.35*	.29	.22
Descriptions	.24	*.30*	−.01	*.99*	.13	*.60*	.54	*.01*	−.10	*.68*	.23	.34
Referent												
Child action	−.17	*.49*	.01	*.98*	.08	*.76*	−.31	*.19*	−.20	*.39*	.13	.59
Child state	.34	*.14*	−.05	*.83*	−.09	*.72*	−.13	*.57*	−.08	*.74*	−.18	.45
Mother	.30	*.29*	−.13	*.59*	.09	*.70*	−.33	*.15*	−.06	*.80*	.07	.78
Environment	.27	*.26*	.18	*.46*	.18	*.44*	.50	*.03*	−.06	*.79*	.15	.53