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Cross-Sectional and Longitudinal Associations Between Quality of Parent–Child Interaction and Language Ability in Preschool-Age Children With Developmental Language Disorder

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4 **Cross-sectional and longitudinal associations between quality of parent-child**
5 **interaction and language ability in pre-school-aged children with developmental**
6 **language disorder**
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Abstract

Purpose: This study explores whether the quality of parent-child interaction is associated with language abilities cross-sectionally and longitudinally up to preschool-age among children with developmental language disorder (DLD).

Method: Participants were 97 monolingual children with DLD and their parents from the Helsinki Longitudinal SLI study, HelSLI (baseline, age in years; months, mean (M) = 4;3, standard deviation (SD) = 0;10), of which 71 pairs were followed longitudinally (age in years; months M = 6;6, SD = 0;5). Video recordings from three play sessions were scored for child, parent, and dyadic behavior using Erickson's sensitivity scale protocol and mutually responsive orientation at baseline. Children's expressive and receptive language and language reasoning ability were assessed at baseline, and expressive and receptive language were assessed at follow-up.

Results: At baseline, engaged child behavior, parent's supportive guidance, and fluent and attuned dyadic behavior were associated with better receptive language ability, and engaged child behavior and dyadic synchrony were positively associated with language reasoning ability in 3-6-year-olds. The child's positive engagement, and fluent and attuned dyadic behavior at baseline, were associated with better expressive and receptive language abilities at follow-up, in 6-7-year-olds, respectively.

Conclusions: Fluent and attuned dyadic behavior is associated with better receptive language ability in preschool-aged children. Parent behavior alone was not associated with language ability. A connected and mutually attuned parent-child relationship could be a protective factor for language development for children with DLD.

Keywords: parent-child interaction, engagement, supportive guidance, dyadic behavior, developmental language disorder, specific language impairment, pre-school age

59 A wealth of research on typically-developing children illustrates that interactions
60 between caregiver and child shape language development in a fundamental manner (Blinkoff
61 et al., 2016). Much of the available research on parent-child interaction and language
62 development has focused on parent-child language use (Rowe & Snow, 2020), and less on
63 the emotional quality of interaction. Moreover, little research exists on the role of the
64 emotional quality of caregiver-child interaction on language development in populations with
65 developmental challenges in language acquisition. Considering the importance of parent-
66 child interaction to language development, research with these children could open new
67 avenues of intervention, and provide further support for existing ones (e.g., parent-child
68 interaction therapy, Falkus et al., 2016). The current study will focus on the association
69 between parent-child interaction and language development in children with developmental
70 language disorder (DLD).

71 **Parent-child interaction and language development**

72 Language development is influenced by a complex combination of biological and
73 environmental factors (Dale et al., 2015; Hayiou-Thomas, 2008; Spinath et al., 2004). Central
74 among the environmental factors on language development is parent-child interaction (Rowe
75 & Weisleder, 2020). An important feature of caregiver input for a child's language
76 development, in addition to linguistic and conceptual input, is interactive input. (Rowe &
77 Snow, 2020). Interactive input refers to the back-and-forth nature of parent-child interaction
78 and is founded on features such as parent responsiveness and sensitivity (Rowe & Snow, 2020).
79 Parents build on early episodes of caregiver-infant joint attention, by offering sensitive, timely
80 and contingent responses (Blinkoff et al., 2016). As the child grows parent and child eventually
81 cocreate connected, fluent interactional exchanges (Rowe & Snow, 2020). Sensitive, fluent,
82 and connected parent-child interaction has been associated with several positive language
83 outcomes, like larger vocabulary in toddlerhood larger vocabulary in toddlerhood (Brooks &

84 Meltzoff, 2008; Farrant & Zubrick, 2012; Todd, 1983), and greater communicative competence
85 (Rocissano & Yatchmink, 1983; Tomasello & Farrar, 1986).

86 Research on parent-child interaction and language development particularly with
87 children aged 3-5 years old has focused mostly on language use (Rowe & Snow, 2020), and
88 less on the role of emotional expressiveness and matching (Harrist & Waugh, 2002). Some
89 studies have extended the above findings to examine how the quality of parent-child interaction
90 can encourage or impede language development. The quality of parent-child interaction is
91 quantified through rating scales designed to measure different features of interaction, which
92 are thought to contribute to the emotional quality of parent-child interaction. For the purposes
93 of this study, parent-child interaction is operationalized using Erickson's sensitivity scales
94 (Egeland et al., 1990; Erickson et al., 1985), an observational schedule which includes
95 measures of child (e.g., enthusiasm, persistence), parent (e.g., supportiveness, sensitivity and
96 timing and clarity of instruction) and dyadic behaviors (e.g., quality of the relationship,
97 diffusion of boundaries).

98 Parent sensitivity is a key feature of parent-child interaction often examined in the
99 context parent-child interaction. Sensitivity refers to the extent to which a parent is attentive to
100 their child's needs, affect, arousal, and capability. A considerable amount of evidence suggests
101 that parenting sensitivity is associated with better expressive and receptive language ability in
102 toddlers (Barnett et al., 2012; Loi et al., 2017; Pungello et al., 2009; Stanton-Chapman et al.,
103 2002), even when controlling for earlier language ability (Loi et al., 2017).

104 Another feature of parent-child interaction that has been examined in relation to
105 language development is dyadic synchrony, which is defined as a pattern of interaction that is
106 regulated by both parent and child in cooperation, that is reciprocal in orientation and
107 responsiveness, and where communication is harmonious and smooth-flowing (Harrist &
108 Waugh, 2002). Dyadic synchrony has also been associated with greater communicative

109 competence in toddlers (Rocissano & Yatchmink, 1983; Tomasello & Farrar, 1986).
110 Specifically, shared affect during parent-child interaction has been associated with the earlier
111 achievement of expressive language milestones, such as vocabulary size and the use of
112 combinatorial speech, in toddler-aged children (Nicely et al., 1999) and greater expressive
113 language skills at 3 years (Lindsey et al., 2009). Nicely et al. (1999) hypothesize, that shared
114 affect may serve to make parent utterances more salient to toddlers or serve to motivate longer
115 episodes of joint attention.

116 **Parent-child interaction and children with DLD**

117 Interaction in dyads with children who have language impairment is characterized by
118 several features, which may pose additional challenges to creating the kind of smooth-
119 flowing and connected episodes of interaction that are associated with greater language
120 competence. Children with language impairment may be less compliant and persistent during
121 interaction with parents than typically-developing (TD) children (Skibbe et al., 2010).
122 Moreover, Skibbe et al. (2010) found that children with language impairment participate
123 more actively in storybook reading, when their mothers showed a high level of sensitivity.
124 Thus, children with language impairment may be more dependent on the emotional support
125 provided by their caregiver (Skibbe et al., 2010). Research suggests that linguistic and
126 pragmatic difficulties of children with developmental language disorder (DLD) may result in
127 more frequent breakdowns of communication (Bishop et al., 2000; Rescorla et al., 2001;
128 Rescorla & Fechnay, 1996). Furthermore, children with DLD may give less input for parents
129 to respond or attune their communication to than typically-developing children, thus resulting
130 in an impoverished conversational context, which could negatively impact language
131 development (Bishop et al., 2000; Paul & Shiffer, 1991; Rescorla et al., 2001; Rescorla &
132 Fechnay, 1996; van Balkom et al., 2010).

133 Findings on the behavior of parent with children who have language impairment are
134 somewhat contradictory. Research has shown on one hand, that parents of children with DLD
135 may be less responsive (Hoffer & Bliss, 1990; Schodorf & Edwards, 1983), and use shorter
136 utterances and provide less input (Schodorf & Edwards, 1983). On the other hand, parents of
137 children with language impairment may also appear more controlling and directive
138 (Blackwell et al., 2015; Conti-Ramsden et al., 1995; Hammer et al., 2001; Hoffer Corbett &
139 Bliss, 1990; Kloth et al., 1998). Parents of language-impaired children may also be less
140 emotionally supportive during interactions than parents of typically-developing children
141 (Skibbe et al., 2010). There is agreement among researchers examining parent-child
142 interaction from a linguistic perspective, that parents are likely attuning their language use
143 and level of responsiveness to the child's language ability and output (Blackwell et al., 2015;
144 Conti-Ramsden et al., 1995; Majorano & Lavelli, 2014; Paul & Elwood, 1991). Given that
145 DLD has a clear genetic component (Bishop, 2006) parents of children with DLD may have
146 language difficulties themselves (Hammer et al., 2001), which may limit their ability to
147 manage the child's non-compliance and lack of persistence during interactions.

148 Only one study was identified examining parent-child dyadic synchrony with children
149 who have impaired language development. In a study with late-talkers, Rescorla and Fechnay
150 (1996) found that dyads with late-talkers did not differ in dyadic synchrony from dyads with
151 TD children. However, results also indicated that controlling mothers had lower levels of
152 synchrony. Taken together, parents of children with DLD who have more directive and
153 controlling parenting styles might have lower levels of dyadic synchrony and in turn, less of
154 the kind of smooth-flowing and connected interaction, which has been shown to play a
155 significant role in language development. Notably, the participants for this study were
156 identified as late-talkers, and thus generalizations to children with DLD should be viewed
157 with caution. Thus, no research was identified examining dyadic synchrony in children with

158 DLD. Moreover, a paucity of information exists on how dyadic synchrony might be
159 associated with language development in children with developmental challenges in language
160 ability, and thus more research is needed to clarify the associations between dyadic
161 synchrony and language impairment.

162 In summary, existing research has examined how children with DLD and their parents
163 may differ individually and in terms of their dyadic functioning from children with typically-
164 developing language. However, no research was identified examining the associations
165 between different facets of parent-child interaction (child, parent, and dyadic behaviors) and
166 language development in children with DLD. This is a significant gap in the existing
167 literature. Moreover, few studies have examined receptive language comprehensively with
168 relation to parent-child interaction, as the majority of the research has focused on expressive
169 language impairment (Blackwell et al., 2015; Conti-Ramsden & Friel-Patti, 1984; Rescorla &
170 Fechnay, 1996). Considering that children with receptive language impairment are at greater
171 risk for negative outcomes than children with expressive language impairment, and that less
172 is known about treating receptive language impairment, more information on potential
173 protective and risk factors for receptive language development is needed (Boyle et al., 2010).

174 **Current study**

175 The evidence on the emotional features of parent-child interaction with children who
176 have DLD is scarce. Furthermore, no studies were found examining how the quality of
177 parent-child interaction is longitudinally associated with language development in children
178 with DLD. Moreover, few studies have examined the association between receptive and
179 parent-child interaction in children with language impairment (Blackwell et al., 2015; Conti-
180 Ramsden & Friel-Patti, 1984; Rescorla & Fechnay, 1996). This study will focus on children
181 with DLD, which is the current label used to categorize children who have lasting language
182 difficulties, which are not caused by any known biomedical issue or intellectual disability

183 (Bishop, 2017). This study aims to address the gaps within the existing literature by exploring
184 first how the quality of parent-child interaction might be associated with language ability in
185 3-6-year-old children with DLD. This study will examine child, parent, and dyadic behaviors
186 to gain a multidimensional understanding of the emotional quality of parent-child interaction
187 in children with DLD. Measures of expressive and receptive language and language
188 reasoning ability will be included to enable a comprehensive examination of the associations
189 between the quality of parent-child interaction and different facets of language ability. This
190 study will then use a longitudinal approach to examine whether these features of parent-child
191 interaction in 3–6-year-old children are longitudinally associated to the language
192 development of pre-school-aged children with DLD.

193 **Method**

194 **Participants**

195 Participants were Finnish monolingual children from the Helsinki Longitudinal SLI study
196 (HelSLI, see Laasonen et al., 2018, for a protocol and comprehensive description of
197 participants). Participants were recruited from the initial clinical assessment at the children's
198 audiophoniatic ward at the Helsinki University Hospital (HUH) during 2013-2015. Inclusion
199 criteria for the HelSLI study were a referral to the audiophoniatic ward for an enduring
200 concern in language development, without any known biomedical etiology. Children had
201 been assessed by speech-language therapists and had received speech-language therapy prior
202 to referral to the audiophoniatic ward. All children in the sample had been diagnosed with a
203 language disorder as per the criteria set out in the Finnish ICD-10 (WHO, 2010). Out of the
204 monolingual children with language impairment participating in the HelSLI study (n = 136),
205 written informed consent was obtained from parents, and video recording and cognitive
206 testing were conducted, for 120 children. Exclusion criteria were hearing defects, intellectual
207 disability, autism spectrum disorders, diagnosed neurological defects or disorders (e.g.,

208 epilepsy, XYY syndrome), oral anomalies, and performance intelligence quotient below 70
209 (n = 98). Further, one child was excluded because they participated in the video recording
210 with a grandparent. The final sample at baseline after exclusions consisted of 97 parent-child
211 pairs (children's age in years; months, mean (M) = 4;3, standard deviation (SD) = 0;10),
212 range = 2;10 – 6;10), and 71 pairs at follow-up (children's age in years; months M = 6;6, SD
213 = 0;5, range = 5;6 – 7;5) (Table 1). Parents participating included both mothers and fathers,
214 and the ratio of mothers to fathers was approximately 3:1 at both baseline and follow-up. The
215 median maternal level of education was primary or secondary-level education. The sample in
216 this study consisted of monolingual, mother-tongue Finnish speakers. The follow-up was
217 conducted during the academic year when the children were due to begin pre-school or had
218 begun preschool (from August to June the following year). The study was approved by the
219 HUH Ethics committee (§ 248/2012).

220

221 **Measures**

222 *Child, parent, and dyadic behaviors*

223 Video recording of interactional sequences was conducted in an examination room on
224 the ward. Parent-child interaction was examined in three different situations - drawing, free-
225 play, and assembling a puzzle, with a target timing of 5-minutes per task. Both the drawing
226 and puzzle tasks were goal-oriented, while the free play task was less structured. The videos
227 were scored using the Erickson scales (Egeland et al., 1990; Erickson et al., 1985) and the
228 scale for mutually responsive orientation (Aksan et al., 2006). The Erickson scales are a
229 commonly used measure for sensitivity (Mesman & Emmen, 2013), and are grounded in
230 attachment theory (Mesman & Emmen, 2013). The scales are used to code interactions
231 during teaching tasks with toddlers and preschoolers and include measures for child, parent,
232 and dyadic behavior (Mesman & Emmen, 2013). The sensitivity construct measured by the

233 Erickson scales is sensitive to changes in maternal sensitivity following intervention (Stams
234 et al., 2001). The Erickson scales were selected as they allowed for the examination of
235 interactional sequences from child, parent, and dyadic perspectives, and were suitable for use
236 with children up to preschool age (Mesman & Emmen, 2013). The scale for mutually
237 responsive orientation (MRO) is also founded in attachment theory and is based on four
238 theoretical components (coordinated routines, mutual cooperation, harmonious
239 communication, emotional ambiance) (Aksan et al., 2006). Aksan et al. (2006) have explored
240 the psychometric properties of MRO and conclude that their findings suggest that the MRO is
241 sensitive to changes in the dyadic relationship, has good discriminant validity when
242 compared to individual measures, and shows structural stability over time and across mother-
243 child and father-child relationships (please see Aksan et al., 2006, for a detailed description
244 of the psychometric properties of this scale). MRO was included as it allows for the
245 assessment different aspects of the dyad specifically, and not individual features of parent
246 and child.

247 Two research assistants with training in the use of the Erickson scales coded the
248 videotaped interactional sequences for child, parent, and dyadic behavior (Egeland et al.,
249 1990; Erickson et al., 1985) drawing and puzzle completion tasks on seven-point scales.
250 Children were evaluated on enthusiasm, persistence, negativity, compliance, experience of
251 the session, avoidance, and affection towards the parent. Parents were evaluated on
252 supportive presence, hostility, intrusiveness, clarity of instruction, sensitivity, timing of
253 instruction, and confidence. Dyads were assessed on the quality of the relationship and
254 dissolution of physical/psychological parent-child boundaries. During drawing, puzzle-
255 making, and free play dyads were also assessed on mutually responsive orientation (MRO)
256 (Aksan, Kochanska, & Ortmann, 2006), on five dimensions: harmonious communication,

257 coordinated routines, mutual cooperation, and emotional ambiance. (Please see Supplemental
258 tables 2 and 3 for short descriptions of the variables described above).

259 Inter-rater reliability was evaluated using a two-way mixed model, consistency,
260 average-measures intra-class correlation (ICC) for child, parent, and dyadic factors in the
261 drawing and puzzle-completion tasks. ICCs indicated good (0.74 – 0.90) to excellent (above
262 0.90) reliability for all factors (Koo & Li, 2016).

263 *Language ability (baseline and follow-up)*

264 Cognitive and language performance was assessed at visits to the audiophoniatic ward
265 by neuropsychologists and speech and language therapists. Measures used to assess cognitive
266 and language performance were limited to those available in Finnish. The following subtests
267 were used from Wechsler Preschool and Primary Scale of Intelligence - Third Edition (WPPSI-
268 III) (Wechsler, 2009): Picture Naming, Receptive Vocabulary, Information, Vocabulary, Word
269 Reasoning. From Nepsy-II (Korkman et al., 2008), Comprehension of Instructions was used.
270 The Expressive and Comprehension scales from Reynell Developmental Language Scales III
271 (Edwards et al., 1997) were also used, as well as the Expressive (EOWPVT) and Receptive
272 (ROWPVT) One-Word Picture Vocabulary Tests (Martin & Brownell, 2010, 2011) and the
273 Boston Naming Test (BNT) (Kaplan et al., 1983). At baseline, all 11 measures of language
274 were used. At follow-up, only measures used by clinical speech and language therapists were
275 evaluated, and thus measures from WPPSI-III and Nepsy-II were not available at follow-up.
276 (Table 1)

277 **Confounding variables**

278 Child's age, as well as mother's age and education, were selected as covariates (Table
279 1). Age influences the child's language skills, with higher skill-level associated with more
280 advanced development. Mother's age (years) was controlled for to account for biological risk
281 factors to child development associated with giving birth at a later age on the one hand

282 (Frederiksen et al., 2018), and the protective effect of advanced maternal age on
283 development, including language development, on the other (Sutcliffe et al., 2012). Maternal
284 educational attainment ((1) secondary-level education or less, (2) bachelor's degree or above)
285 was also controlled for, as maternal educational attainment is associated with (1) children's
286 language development (Pungello et al., 2009; Zambrana et al., 2012) and is also (2) indicative
287 of maternal socioeconomic status, which also has strong associations to children's language
288 development (Jalovaara & Andersson, 2018; Pungello et al., 2009). (Table 1).

289 **Analysis**

290 Data was analyzed using IBM SPSS Statistics v27. Missing values were identified in
291 maternal education, maternal age at childbirth, and language outcome variables (Table 1). Of
292 the confounding variables, 19.7% of cases were missing either maternal age at childbirth or
293 maternal education level. At baseline 17.5% and at follow-up 29.6% of cases had missing
294 values in at least one language outcome variable. The missing values were analyzed using
295 Little's test and determined as missing completely at random at baseline ($\chi^2 = 63.40$, $df = 60$,
296 $p = .358$) and follow-up ($\chi^2 = 19.31$, $df = 17$, $p = .278$) as the probability values for both
297 exceeded 0.05 (Little, 1988). The missing data were then imputed using the expectation-
298 maximization algorithm (Dempster et al., 1977).

299 Factor analysis was conducted to identify underlying factors among the behavioral
300 variables to reduce the number of subsequent analyses, in order to avoid increased likelihood
301 of type I error associated with conducting a large number of statistical tests. Although larger
302 sample sizes are generally preferred for factor analysis, a smaller sample as in this study
303 ($n=97$) can be considered sufficient (Bryant & Yarnold, 1995; Hair et al., 1998; Osborne,
304 2014). Examination of distributions behavioral variables showed four variables with highly
305 skewed distributions (child's avoidance, child's negativity, parent's hostility, and parent's
306 intrusiveness); these variables were removed as containing little information, and as

307 problematic in terms of the assumptions of exploratory factor analysis. The child's affection
308 towards their parent was also removed, as the content of the variable was more dyadic in
309 nature (see the description of Erickson scales in Supplemental table 1), and thus had low
310 factor loadings on the child behavior factor. Following this, an exploratory factor analysis
311 with the remaining interactional variables in one model was conducted. Parallel analysis,
312 (O'Connor, 2000), where eigenvalues from the real data set were compared with eigenvalues
313 from a randomly generated dataset with the same number of cases and variables (Tabachnik
314 et al., 2007), was used to determine the number of factors to be retained and suggested a
315 three-factor solution (Supplemental table 3 and Supplemental Figure 2). The three factors
316 identified encapsulated child, parent, and dyadic behaviors (Supplemental table 3). The factor
317 structure was parallel to the structure of the Erickson scales and theoretically justified
318 (Erickson et al., 1985). Mutually responsive orientation also fit in well with this factor
319 solution (Aksan et al., 2006). Confirmatory factor analyses were conducted, inputting child,
320 parent, and dyadic variables in to separate factor analyses, to confirm the factor solution
321 (Supplemental table 4). The series of factor analyses described above was conducted for
322 interaction variables in both drawing and puzzle completion tasks. As the results were
323 similar, results are presented for the drawing task only

324 The child factor encapsulated the child's enthusiasm, persistence, experience of the
325 session, and compliance, and can be described as *the child's positive engagement*. The parent
326 factor comprised the parent's sensitivity, supportiveness, clarity, and confidence, and can be
327 described as *the parent's supportive guidance*. The dyadic factor comprised the quality of
328 the relationship, mutually responsive orientation, and diffusion of psychological/physical
329 boundaries and refers to the level of *fluent and attuned dyadic behavior*. This three-factor
330 solution was used to calculate composite scores of child, parent, and dyadic behavior using
331 sample-standardized z-scores from the ratings derived from the video-recorded play sessions.

332 For language variables, sample standardized z-scores were calculated from raw scores
333 of the 11 language measures used. Expressive, receptive, and complex language reasoning
334 composites were formed as averages of these z-scores, as per the hierarchical three-factor
335 model outlined in a previous publication (Lahti-Nuutila et al., 2021) (Supplemental figure 1).
336 A complex language reasoning composite was only formed for children above 4 years old
337 (n=54) as two of the subtests required for calculating the complex language reasoning
338 composite (WPPSI-III Vocabulary, Word Reasoning), were not available for younger
339 children. At follow-up, expressive and receptive language composites were formed from the
340 five available measures (RDLS Expressive and Comprehension scales, EOWPVT,
341 ROWVPT, BNT) (see Table 1).

342 Hierarchical linear regression models were used to test (1) the cross-sectional
343 associations between child, parent, and dyadic behavioral factors and child's expressive and
344 receptive language, and language reasoning ability in 3-6-year-olds, at the baseline, and (2)
345 the longitudinal associations between child, parent, and dyadic behavioral factors measured
346 in 3-6-year-olds at the baseline, and the child's expressive and receptive language ability
347 measured in 6-7-year-olds at follow-up, after controlling for corresponding language ability
348 composites measured at baseline. The child's age, maternal education level, and maternal age
349 at childbirth were controlled for in all models.

350 **Results**

351 Correlations between main research variables and covariates showed that child's age
352 was positively and significantly associated with language composite scores at baseline and
353 follow-up. Maternal education level and age at childbirth were significantly and positively
354 associated with parent and dyad behaviors in both tasks. Child, parent, and dyad behaviors in
355 the two different tasks were strongly intercorrelated. (Table 2)

356 Parent-child interaction and language ability at baseline

357 In the drawing task, the child's positive engagement was positively associated with
358 better receptive language and complex language reasoning at baseline. The parent's
359 supportive guidance was also positively associated with better receptive language ability.
360 Fluent and attuned dyadic behavior was positively associated with receptive language and
361 complex language reasoning ability. In the puzzle-completion task, fluent and attuned dyadic
362 behavior was positively associated with receptive language and complex language reasoning
363 ability. In the free play task, mutually responsive orientation was positively associated with
364 receptive language ability. (Table 3).

365 Parent-child interaction at baseline and language ability at pre-school follow-up

366 The child's positive engagement in the puzzle task at baseline was positively
367 associated with better expressive language ability at pre-school follow-up. Fluent and attuned
368 dyadic behavior in the puzzle task was positively associated with better receptive language
369 ability at pre-school follow-up. Notably significant associations were not found between
370 behavioral variables measured during the drawing task and language ability in pre-school
371 aged children with DLD. (Table 4).

372 Discussion

373 This study examined (1) how the quality of parent-child interaction, i.e., the child's
374 positive engagement, the parent's supportive guidance, and fluent and attuned dyadic behavior,
375 is associated with expressive and receptive language, and complex language reasoning ability
376 for 3–6-year-old children with DLD, and (2) whether the quality of parent-child interaction in
377 3–6-year-old children with DLD is associated with the child's expressive and receptive
378 language ability at pre-school follow-up. In 3–6-year-old children, parent-child interaction
379 characterized by the child's positive engagement, supportive parental guidance, and attuned
380 dyadic behavior were cross-sectionally associated with better receptive language ability. The

381 child's positive engagement, as well as fluent and attuned dyadic behavior, were also associated
382 with better complex language reasoning ability. The child's positive engagement during play
383 sessions with their parent in 3–6-year-old children, was longitudinally associated with better
384 expressive language ability at pre-school age. Moreover, fluent, and attuned dyadic behavior
385 during parent-child play sessions in 3–6-year-old children, was longitudinally associated with
386 better receptive language ability at pre-school age.

387 The findings of the current study suggest that parent-child interaction is associated with
388 language ability in children who have DLD, as several significant associations were identified
389 at the cross-sectional phase of the study. Moreover, they suggest that the quality of parent-child
390 interaction is longitudinally associated with language outcomes in pre-school-aged children.
391 These findings are in accordance with the wealth of research highlighting the importance of
392 smooth-flowing, connected, and engaged parent-child interaction to language development
393 (McGillion et al., 2013; Romeo et al., 2018; Rowe & Snow, 2020; Tamis-Lemonda et al., 1998,
394 2001). Earlier research has illustrated the importance of parent responsiveness, and
395 connectedness between parent and infant, to early features of linguistic ability, such as first
396 words, and vocabulary growth in typically-developing children (Donnellan et al., 2020; Hirsh-
397 Pasek et al., 2015). The findings of the current study extend those results, showing that the
398 quality of the parent-child relationship is important to language development beyond infancy
399 and toddlerhood (Rocissano & Yatchmink, 1983; Rowe & Snow, 2020) for children with DLD.
400 These findings support earlier research highlighting the role of engaged, connected episodes of
401 interaction, as opposed to a focus on parent or child behaviors separately (Ford et al., 2020;
402 Rowe & Snow, 2020). Furthermore, they highlight the potential importance that the emotional
403 quality of parent-child interaction might have for language development. These findings echo
404 earlier findings and suggest that over and above individual parent behaviors like sensitivity and
405 responsiveness, which are often the focus of research, it may be the general patterns of

406 interaction and the emotional atmosphere that forms between parent and child that could be
407 salient for language development (Lindsey et al., 2009; Nicely et al., 1999).

408 The reason for the significance of dyadic synchrony may be that it supports the kind
409 of atmosphere that is conducive to long bouts of engaged interaction between parent and
410 child, which in turn are beneficial for language development (Romeo et al., 2018). A high
411 level of dyadic synchrony also means fewer breakdowns and faster repair of breakdowns
412 when they do occur. This could simply free up cognitive resources to language development,
413 which in the context of a more precarious and less predictable parent-child relationship might
414 be dedicated to attempts at re-establishing connection, acceptance, and affection after a
415 breakdown. The findings of the current study could suggest that an emotional atmosphere
416 characterized by shared positive affect, connectedness, mutual attunement, and fluent,
417 harmonic interaction where parent and child boundaries are maintained, facilitates a higher
418 level of shared attention and prolonged episodes of shared attention, which in turn might
419 facilitate orientation toward salient objects in the environment (Lindsey et al., 2009;
420 Rocissano & Yatchmink, 1983; Romeo et al., 2018; Tomasello & Farrar, 1986) allowing for
421 more efficient accumulation of receptive language ability.

422 Notably, the only significant association for expressive language ability was that
423 between the child's positive engagement and expressive language in 6-7-year-old children.
424 As there is less research on the association between parent-child interaction and receptive
425 language ability, as measures for expressive language development are included more often
426 than receptive measures (Blackwell et al., 2015), there is little to compare this result to in the
427 literature on parent-child interaction and language development. The association between
428 positive child engagement and better expressive language ability in 6-7-year-olds is,
429 however, in line with findings from research on language development and temperament,
430 which show that more outgoing children have better expressive language ability (Paul &

431 Kellogg, 1997; Pérez-Pereira et al., 2016; Prior et al., 2008). This association between higher
432 surgency and expressive language ability has been found in TD children and children with
433 language impairment. This study adds to the existing knowledge base providing support for
434 the notion, that children who are more engaged in interaction actively and in a positive
435 manner, may develop better expressive language ability.

436 **Limitations**

437 The lack of a typically-developing control group is a limitation of the current study
438 and prevents conclusions from being drawn concerning the role of parent-child interaction in
439 language development overall. The lack of balancing in the order of interactional tasks
440 provides uniformity in the administration of these tasks but could also bias results. It should
441 also be noted that the sample size of the current study was, though sufficient, on the modest
442 side for the use of factor analysis as a statistical technique. Moreover, though the Erickson
443 scales are widely used to assess parenting sensitivity (Mesman & Emmen, 2013), there is no
444 comprehensive resource widely available addressing the psychometric properties of this
445 instrument, and therefore results and generalizations are preliminary.

446 **Conclusions**

447 The results of this study add to the current literature on language development in
448 children with DLD by illustrating that the emotional quality of the parent-child interaction is
449 significantly associated to language development for preschool-aged children with DLD.
450 These findings point towards important protective factors for language development for
451 children with DLD. Particularly, a parent-child relationship characterized by connectedness,
452 belonging, and shared positive affect, despite significant language impairment can serve to
453 encourage receptive language development. Moreover, parent behavior alone was not
454 longitudinally associated with a child's language development, but rather the quality of the

455 interactive relationship, to which their child's temperament and cognitive abilities also have
456 bearing.

457 The findings of this study provide potential directions for treatment. In addition to
458 speech and language therapy and interventions focused on parent behaviors like
459 responsiveness, treatment could also consider the level of connectedness between parent and
460 child during interaction. Treatment for children with DLD could perhaps include the option
461 of interventions to foster more attuned, cohesive and positive interactions between parents
462 and children.

463

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719 **Tables**720 **Table 1**

721 *Descriptive statistics for unimputed gender, age, maternal education level, maternal age at*
722 *childbirth, and language variables at baseline and follow-up*

723 **Table 2**

724 *Correlations (Pearson's r , two-tailed) between child's age, maternal education, maternal*
725 *age, child, parent and dyad behaviors and language composites*

726 **Table 3**

727 *Results from hierarchical regression analyses testing the relationship between parent-child*
728 *interaction during drawing and puzzle-completion and language ability at baseline*

729 **Table 4**

730 *Results from hierarchical regression analyses testing the relationship between parent-child*
731 *interaction during drawing and puzzle-completion at baseline, and language ability at*
732 *preschool follow-up*

733 **Supplemental Material**

734 **Supplemental table 1**

735 *Descriptions of Erickson's sensitivity scales (Egeland et al., 1990; Erickson et al., 1985)*
736 *and mutually responsive orientation (Aksan, Kochanska, & Ortmann, 2006).*

737 **Supplemental table 2**

738 *Descriptions of the aspects assessed when scoring mutually responsive orientation (MRO)*
739 *(Aksan, Kochanska & Ortmann, 2006).*

740 **Supplemental table 3**

741 *Factor loadings from an exploratory factor analysis of parent, child, and dyadic variables*
742 *measured during the drawing task.*

743 **Supplemental table 4**

744 *Factor loadings from three separate one-factor factor analyses of child, parent, and dyadic*
745 *behavioral variables measured during the drawing task.*

746 **Supplemental Figure 1**

747 *Hierarchical three-factor model of language, originally published in Lahti-Nuutila et al.,*
748 *(2021), reproduced with the author's permission.*

749 **Supplemental Figure 2**

750 *Parallel analysis for the exploratory factor analysis of parent, child and dyadic variables*
751 *measured during the drawing task (see Supplemental table 3 for loadings).*