It's your turn: The dynamics of conversational turn-taking in father-child and mother-child interaction

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Abstract: The aim of this study was to elucidate the interactive and temporal features of conversational turn-taking during father-child and mother-child play and investigate associations with children's cognitive and language abilities. Eighty typically developing two-year-olds (M = 24.06 months, SD = 1.39) and their biological mothers and fathers took part in the current study which consisted of a single visit to an Infant and Child Lab. Parent-child conversational turn-taking was measured from dyadic structured play interactions (160 dyads in total), as well as parents' verbal turn-taking behaviours including length of turn, questions, and contingent responsiveness. Child language and cognitive skills were directly assessed using standardised measures. Results indicated that there was greater balance in conversational turn-taking during father-child play. However, mothers were more responsive to their child's vocalisations during interaction. Mothers' and fathers' use of questions effectively scaffolded children's participation in conversation. Finally, controlling for mother-child conversational turn-taking, father-child conversational turn-taking did not account for any unique variance in child cognitive skills. Regression analyses failed to demonstrate associations between parent-child conversational turn-taking and child language skills. These findings present new insights into the dynamics of mother-child and father-child conversational turn-taking during play as well as the nature of the contribution of father-child linguistic exchanges to child development.

Keywords: fathers; child-directed speech; conversational turn-taking; language development; cognitive development.

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Introduction

Socio-cultural and social-interactionist theories of development emphasise how variation in the quality of social-communicative interactions between parents and their children contribute meaningfully to child development (Bruner, 1981; Snow, 1977; Vygotsky, 1978). Child-directed speech (CDS) is an important communicative tool which parents use, seemingly intuitively, that serves a variety of important functions for the developing child (Fernald, 1989; Rowe, 2012; Werker & McLeod, 1989). Traditionally, research on children's early linguistic environment has focussed on the mother-child dyad, but we know that fathers contribute in important and unique ways to child development (Cabrera et al., 2014; Lamb & Lewis, 2010). Including both mothers and fathers in research is valuable in providing a closer approximation of the ecology of the developing child and the range of factors which shape their development.

Apart from the lexical and syntactic features of CDS, studies have demonstrated the importance of pragmatic dimensions of parental input during toddlerhood (Rowe & Snow, 2020). According to Bruner (1983), children's development relies on more than exposure to language input, and it is important to emphasise the interactive component of parent-child communication. In particular, recent literature has turned its focus to the importance of conversational turn-taking in parent-child interaction for child development (e.g., Donnelly & Kidd, 2021; Gilkerson et al., 2017; Gómez & Strasser, 2021; Romeo et al., 2018). However, little research thus far has specifically examined conversational turn-taking in father-child interaction. The aim of the current study was therefore to examine conversational exchanges in mother-child and father-child interaction. Furthermore, in order to better understand the dynamics of these communicative exchanges, the present study sought to decompose the construct of conversational turn-taking and examine how mother-child and father-child interactive verbal behaviours support young children's engagement in back-and-forth exchanges. Lastly, this study investigated concurrent associations between father-child conversational turn-taking and children's language and cognitive abilities.

Conversational Turn-Taking and Child Development

Newborn infants show an early propensity for social interaction and the behaviours of both infants and their parents are intent on promoting and maintaining proximity with one another (Bowlby, 1969). Before they learn to speak, infants engage in episodes of joint attention with their parents and communicate using behaviours such as vocalisations and facial expressions. These behaviours are highly contingent upon and synchronised with those of their parents (Trevarthen & Aitken, 2001). Bateson (1979) termed these pre-linguistic interactions between infant and parents "proto-conversations" and described these exchanges as the early precursors of conversation and turn-taking. The "conversational duet" in which parent and child are jointly engaged in interaction is also considered an important foundation for child language

and socio-cognitive development (Bruner, 1983; Hirsh-Pasek et al., 2015). This aligns with transactional models which frame the development of the individual as arising from dynamic bidirectional interactions between the child and their environment (Sameroff, 2009).

The literature proposes several pathways by which parent-child conversational turn-taking may support children's development. Back-and-forth verbal exchanges between parents and children may help caregivers gauge the developmental capacities of their child and pitch the complexity of their language input within the bounds of the child's zone of proximal development, maximising their learning potential (Vygotsky, 1978). Greater conversational turn-taking may be indicative of high levels of caregivers' responsiveness, which may explain how greater involvement in conversation drives child language learning (Zimmerman et al., 2009). Involvement in conversation also provides children the opportunity to practice their emerging language and cognitive skills and may support deeper engagement by the child with the linguistic structure of speech input (Romeo et al., 2018). Beyond exposure to language input, studying children's involvement in conversation provides an insight into the child's active role in their own development.

Research to date has demonstrated that during early childhood, conversational turn-taking in parent-child interaction may be a stronger predictor of child language and brain development than quantity of parental speech input (e.g., Gilkerson et al., 2017; Romeo et al., 2018; Zimmerman et al., 2009). Romeo and colleagues (2018) demonstrated that, controlling for quantity of speech input, conversational turn-taking between children aged 4–6 years and their parents was associated with children's brain activity and their verbal abilities. Longitudinal research has also demonstrated that controlling for quantity of input, more conversational turn-taking between parents and preschool aged children was associated with greater language abilities 18 months later (Zimmerman et al., 2009). In another longitudinal study, Gilkerson and colleagues (2017) examined conversational turn-taking between children aged 2–48 months of age and their caregivers at monthly intervals and observed associations with child language ability.

Gilkerson and colleagues (2018) also demonstrated that early conversational turn-taking predicted child IQ and verbal abilities 10 years later. The authors observed that conversational turn-taking between caregivers and their children which took place during the window of 18–24 months of age was particularly important for later child outcomes. Recently, Donnelly and Kidd (2021) demonstrated bidirectional associations between adult-child conversational turn-taking and children's vocabulary development between 9–24 months of age. Children become more proficient turn-takers as their language skills advanced, and at the same time conversation with caregivers emerged as an important context for children's language development (Donnelly & Kidd, 2021). Overall, the findings of these studies emphasise the importance of

studying the interactive components of children's early communicative environments.

Previous studies of conversational turn-taking are however subject to several limitations. Research to date has relied on data produced by The Language Environment Analysis (LENA) system, a widely used tool for measuring day-long recordings. Recent studies evaluating LENA suggest that, compared to human coders, this system may miss more instances of speech and is less effective in tagging speakers correctly (Cristia et al., 2020). A longitudinal study which compared LENA's adult-child conversational turn count to manually coded turn counts at five time points between 6–24 months of age also demonstrated that LENA overestimated turn counts across all age groups (Ferjan Ramírez et al., 2021). In addition, it can be unclear when using this tool as to whether the speech in the child's environment was directed towards the child or was merely overheard (Zimmerman et al., 2009).

Furthermore, LENA relies on counts of conversational turns in the child's interactive environment. This approach, however, fails to account for the distribution of conversational load across the interaction. A conversational turn begins when one interlocutor starts speaking and ends when the next speaker commences. One conversational turn can therefore consist of several utterances. Comparing both parent's and child's mean length of turn provides insight into how interlocutors share the burden of conversation within turn-taking episodes. Greater balance in turn-taking occurs when parent and child take turns of similar length and no one interlocutor is dominating the conversation. Equilibrium in turn-taking suggests that both interlocutors are actively verbally participating in conversation across the interaction and may be more effective in capturing children's engagement in conversation compared with conversational turn counts. Conversational balance is calculated by computing the ratio of each interlocutor's mean length of turn within a conversation (see Lloyd et al., 2001; McDonnell et al., 2003; Vaughan et al., 2015 for examples of other studies using this approach).

Examination of conversational balance provides insight into children's involvement in conversation but reveals little information with regards to the qualitative content of the conversations between parent and child and the turn-taking behaviours exhibited by parents which support children's participation in language interactions. If conversational turn-taking is an important aspect of the early interactive environment, as emerging research suggests, it is of interest to understand more clearly the dynamics of conversational turn-taking and the mechanisms through which it may support child language and cognitive development.

Finally, a key limitation of previous research is the lack of focus on father-child conversational turn-taking. Early father-child language exchanges have important implications for children's language and cognitive development (Rowe et al., 2017; Schwab,

et al., 2018), often beyond the influence of maternal CDS (Baker & Vernon-Feagans, 2015; Conica et al., 2020; Malin et al., 2014; Pancsofar & Vernon-Feagans, 2006; Pancsofar & Vernon-Feagans, 2010). Studies comparing mothers' and fathers' CDS during toddlerhood have, however, primarily focussed on the lexical and syntactic features of speech rather than the interactive elements of parent-child communication. This study therefore sought to profile both mother-child and father-child conversational turn-taking during play and examine how parents' interactive verbal behaviours support children's verbal participation in conversation as well as their language and cognitive development.

Dynamics of Turn-Taking during Parent-Child Conversation

Certain features of parents' speech and communication may serve to scaffold children's participation in conversation. The present study was concerned with elucidating whether certain interactive verbal behaviours produced by mothers and fathers were associated with greater balance in turn-taking in parent-child conversation. The units of turn-taking explored in the current study included parents' length of turn, questions posed by mothers and fathers, and parental contingent responsiveness.

Length of Turn

The first interactive verbal behaviour examined by the present study was parents' length of turn. As previously mentioned, one conversational turn can comprise multiple utterances. Longer turns may indicate that one interlocutor is dominating the language interaction. Parents who take longer turns may be providing fewer opportunities for their child to participate in conversation. Previous research has demonstrated that when parents decreased the length of turns they took, children's verbal participation in conversation increased (Brassart & Schelstraete, 2015; Girolametto, 1988). The literature suggests the CDS that mothers and fathers produce during interaction with their toddlers is comparable (Pancsofar & Vernon-Feagans, 2006; Rowe et al., 2004), therefore it was hypothesised that no significant differences between mothers' and fathers' length of turn would be observed. If greater conversational turn-taking is associated with better child language and cognitive scores, it was expected that parents' length of turn would be inversely related to child developmental abilities.

Parental Contingent Responsiveness

Another important aspect of back-and-forth exchanges is responsiveness. As young children develop greater competency as communicators, parents hold much of the responsibility for coordinating smooth verbal exchanges, and this is facilitated by responding contingently to the child's vocalisations (Rutter & Durkin, 1987). Conversational turn-taking may therefore be enhanced by sensitive and contingent responding to the child (Brassart & Schelstraete, 2015). Well-timed responses are typically

considered to occur within 2–5 seconds of a child's utterance (McGillion et al., 2013). Semantically contingent responding is also a prerequisite of successful verbal interaction (Bornstein et al., 2015) whereas parental utterances which fail to follow the child's focus of attention may be less useful in supporting children's engagement in conversation (Brassart & Schelstraete, 2015).

Research with mothers has consistently shown that responses which are well-timed and semantically related to the child's present focus of attention facilitate child language and cognitive development (Bornstein et al., 1999; Landry et al., 2000; Masur et al., 2005; Tamis- LeMonda et al., 2001; Tamis-LeMonda et al., 2014). Parental responsiveness in early infancy may serve to convey the role of language as a social-communicative device (Tamis-LeMonda et al., 2001). It may also help children to match labels to objects in the environment thereby supporting vocabulary development (Tamis-LeMonda & Bornstein, 2002). Furthermore, responsive caregiving may contribute to the child's emerging sense of their own impact on the world around them (Bornstein et al., 2015), perhaps furnishing them with an awareness of their own behaviour and capacity for regulation (Kopp, 1982). Compared to mothers, much less is known about fathers' responsiveness during parent-child interaction although research suggest that fathers' sensitivity to their children's cues is important for cognitive and language development (Tamis-LeMonda et al., 2004).

Questions

Another turn-taking behaviour studied in the literature is questions produced by mothers and fathers during interaction with their child. Locke (1996) suggested that while turn-taking with younger children is primarily supported by parents' contingent responsiveness, by age 24 months caregivers place more responsibility upon children to participate in conversation by asking questions. Previous studies suggest that fathers produce more conversation-eliciting speech such as *wh*-questions during interaction with their young children compared to mothers (Malin et al., 2014; Rowe et al., 2004) although others (e.g., Pancsofar & Vernon-Feagans, 2006) observed no difference. Conversation-eliciting speech is hypothesized to be a challenging feature of the child's communicative environment and has previously been demonstrated to support child verbal reasoning (Rowe et al., 2017) and language development (Leech et al., 2013). *Wh*-questions may require complex responses compared to yes/no questions and may therefore support children's development of language and reasoning skills (Rowe et al., 2017). It was also expected that a higher proportion of CDS in the form of questions posed by parents would encourage greater verbal participation of the child during interaction.

The Current Study

Research focussing solely on the role of mothers overlooks the rich ecology of the

developing child. This study sought to more comprehensively characterise the child's early linguistic environment by examining conversational turn-taking in father-child and mother-child interaction. The first aim of the current study was to present a profile of parents' interactive verbal behaviours produced during parent-child interaction and compare these between mothers and fathers. Given the absence of previous research comparing mother-child and father-child conversational turn-taking, no specific hypothesis was made in this regard. In relation to parents' interactive verbal behaviours, and in light of previous research, it may be expected that fathers would produce more *wh*-questions compared to mothers. On the other hand, previous research suggests that mothers may display more contingent responsiveness in interaction compared to fathers (e.g., Hallers-Haalboom et al., 2017).

The second aim of the present study was to elucidate the interactive verbal behaviours of parents which may promote greater balance in turn-taking in conversation. It was expected that parents' use of questions and contingent responsiveness would be positively associated with greater balance in parent-child conversational turn-taking.

Finally, the current study aimed to examine associations between parent-child conversational turn-taking and child language and cognitive abilities. In light of previous research, it was expected that greater balance in parent-child conversational turn-taking would be associated with higher child scores on standardised assessments of cognitive and language abilities. This study also sought to unpack how the components of parent-child conversation may relate to child cognitive and language skills. Again, based on previous research it was expected that parents taking longer turns would be negatively associated with child outcome measures whilst parents' use of *wh*-questions and contingent responsiveness was expected to demonstrate positive associations with child language and cognitive skills.

Children's turn-taking proficiency increases with age (Rutter & Durkin, 1987; Casillas et al., 2016) and by age two years turn-taking between parent and child is carried out with relative fluidity even in the presence of delays, irrelevant responses, and non-responding (Cekaite, 2013; Casillas et al., 2016). As mentioned previously, conversational turn-taking between parent and child within this time period may be particularly salient for later development (Gilkerson et al., 2018). This study therefore proposed to investigate the dynamics of parent-child conversational turn-taking at child age two years. Furthermore, this study observed conversational turn-taking between parent and child during structured play. Research suggests that parents are spending increasing amounts of time in structured play with their young children with a view to preparing children for school (Hirsh-Pasek et al., 2009), yet there is little research examining parental-child interaction in this context. By decomposing the construct of conversational turn-taking and investigating how specific features of both the mother-child and the father-child communicative environment at age two years are associated with turn-taking as well as child cognitive and language abilities, the

findings may provide important insights which can inform future interventions.

Method

Participants

Eighty children aged between 21–27 months (41 females; *M* = 24.06 months, *SD* = 1.39) and their biological mothers and fathers were recruited to take part in the current study. Participants were recruited through social media, flyers distributed to crèches and supermarkets, and snowballing. All participating families were White and predominantly classified as middle-class. All children included in the current study were born full-term and were typically developing. Parents were monolingual, Irish-English speaking, and residing in the family home. Mothers were aged between 25 and 46 years (*M* = 35.03, *SD* = 4.14). Fathers were aged between 23 and 55 years (*M* = 36.5, *SD* = 5.06). All mothers had completed second-level education, 77.5% had a bachelor's degree, and 35% had a postgraduate qualification. 93.8% of fathers had completed second-level education, 63.8% had a bachelor's degree, and 22.5% had a postgraduate qualification.

Procedure

The study was conducted at an Infant and Child Research Lab based in a university setting with the approval of the relevant Research Ethics Committee. Informed consent was obtained from participants prior to commencement of testing. The lab visit consisted of a developmental assessment with the child and video-recorded observations of mother-child and father-child interaction during structured play. Each child was recorded at play with their mother and father separately, thus 160 observations were recorded in total.

In the structured play condition, dyads were presented with a magnetic puzzle board (of either fish or car design) which differed between the mother-child and father-child interactions. The task firstly required the child to use a magnetic stick attached to a string (similar to a fishing-rod) to pull out ten puzzle pieces, and secondly to replace these pieces back into the correct slots once all had been removed. The task was challenging for two-year-olds and required parental input to be completed. The duration of the structured play condition was five minutes and parents were instructed to play with their children as they would at home. The order of mother-child and father-child play interactions was counterbalanced.

Interactions were video recorded using Mangold VideoSync Pro 1.5 and transcribed offline by trained research assistants using the Computerised Language Analysis (CLAN) software according to the Codes for Human Analysis of Transcripts (CHAT) conventions (MacWhinney, 2000). All speech was transcribed verbatim. These transcripts were each reviewed by a senior transcriber. Parent-child conversation

variables were extracted from the transcripts using CLAN (MacWhinney, 2000). These variables included adult and child word counts, balance in conversational turn-taking (MLT ratio), mean length of turn (MLT), and proportion of questions. Alongside video footage of the interactions, parental contingent responsiveness was also coded using these transcripts.

Information on family sociodemographic factors (*what is the highest level of education (full- or part-time) which you have completed to date?*) and child developmental status (*has your child had any longstanding illness, condition or disability or were there any complications with their birth or pregnancy?*) was collected via questionnaire. Parents and child were offered breaks during the session as needed. Participants were not given monetary compensation for taking part in the study. At the end of the visit, participants were debriefed and thanked for their time.

Measures

Conversational Turn-Taking

The index of parent-child conversational turn-taking employed by the current study was mean length of turn (MLT) ratio. The MLT ratio calculation is a measure of conversational load (MacWhinney, 2000) and is calculated as a ratio of each speakers' mean length of turn. MLT was calculated by dividing the speakers' total number of utterances by their total number of turns. An utterance was defined as a unit of speech delineated by a change in intonation, pause, or change in conversational turn (MacWhinney, 2000). A turn referred to a sequence of utterances spoken by one interlocutor. CLAN calculates turns by identifying sequences of repeated speaker ID codes at the beginning of the main line in a transcript. The end of one turn is therefore delineated by the next interlocutor commencing to speak. The ratio of child-father MLT was then calculated as an index of conversational balance such that a ratio closer to one indicated greater balance. A father and child taking equally long turns of 6 utterances each, for example, would have an MLT ratio of 1. Mother-child MLT ratio was calculated in the same manner.

A measure of adult turn counts was also included in the present analyses and was produced using the MLT command in CLAN. This quantitative measure captures the total number of turns speakers took during the five-minute interaction.

Interactive Verbal Behaviours

Mothers' and fathers' turn-taking behaviours were coded from the transcripts of the structured play interactions in CLAN and from the video recordings.

Length of Turn. Parents' length of turn was measured using the MLT command

in CLAN (MacWhinney, 2000) as described above. It is important to note that although MLT is a direct component of parent-child conversational turn-taking, it gives no indication of the child's role in the language exchange. A high MLT calculated for a father, for instance, provides no information on his child's involvement in that interaction or on that child's own MLT. Table 1 provides a sample of turn-taking from one dyad in the current study. In this example, the father produced a total of three utterances over two turns and the child produced two utterances over two turns.

Table 1. ***Example of turn-taking in father-child interaction***

Speaker	Utterance
FAT	that (i)s right.
CHI	there?
FAT	yeah.
FAT	that is a red car.
CHI	red.

Note. FAT = father; CHI = child.

Questions. Frequency lists of all parental utterances containing a question mark were calculated in CLAN using the combo +s"*?*" +t*FAT command for fathers and combo +s"*?*" +t*MOT for mothers. Consistent with CHAT transcription conventions (MacWhinney, 2000), during the transcription process, attention was paid to speaker intonation and the content and context of utterances. Questions were typically characterised by a terminal rising intonation. The number of open-ended questions (i.e., questions requiring more than yes/no response) was computed (see Table 2 for an example from the current sample) and finally proportions of total questions and open-ended questions were calculated from each parent's total number of utterances.

Table 2. ***Example of open-ended questions in father-child interaction***

Speaker	Utterance
FAT	who is that?
CHI	horse.
FAT	seahorse.
FAT	where does the seahorse go?
CHI	there.

Note. FAT = father; CHI = child.

Contingent Responsiveness. Taking each child utterance as the target utterance, parents' verbal response to the child's utterance was coded for temporal and semantic contingency.

Parents' verbal response following their child's vocalisation was first coded for its temporal contiguity. If a parental response occurred within 2 seconds of the offset of the child's vocalisation it was coded as temporally contingent (TC). Parental responses which occurred outside of the 2-second timeframe following the child's vocalisation were coded as not temporally contingent (NTC). This time frame is frequently reported in the literature on maternal verbal responsiveness (e.g., Bornstein et al., 2015; Goldstein & Schwade, 2008; McGillon et al., 2013). Parental responses that began while the child was still vocalising were considered temporally contingent. In cases where a child produced more than one utterance in succession, the timing between each child utterance was checked – if there was a gap of more than 2 seconds between two successive child utterances this was coded as NTC (i.e., no temporally contingent response from parent); if the gap between successive child utterances was less than 2 seconds no code was required. In cases where parents produced more than one utterance within the 2-second timeframe following a child vocalisation, the temporal and semantic contingency of the first utterance only was considered.

Parent responses that were coded as temporally contingent to the child's preceding vocalisation were further coded for their semantic contingency to the child's utterance using the transcripts alongside video footage in order to examine the child's current focus of attention. Parent responses that were conceptually related to their child's preceding vocalisation/focus of attention were coded as semantically contingent (SC). Parent responses that were not conceptually related to the child's vocalisation and/or served to redirect the child's focus of attention were coded as not semantically contingent (NSC).

SC parental responses were those which related to the child's current focus of attention (Roth, 1987). SC responses included parental utterances which repeated a child's vocalisation; which answered a question the child had posed; which expanded upon the child's vocalisation or activity the child was engaged in; which named the object a child was attending to or one of its components; which praised or referenced the child's current activity; and clarification requests (e.g., asking the child to repeat what they had said). In Table 1, for example, taking the child utterance "there?" the father followed the child's focus of attention and provided a semantically contingent response to the child's vocalisation, "yeah". Similarly, in Table 2, the father expanded upon the child's vocalisation "horse", saying "seahorse".

NSC responses were parental utterances which occurred within 2 seconds of the child's vocalisation which was not conceptually related to the child's utterance and

referred to something outside of the child's current focus of attention (Akhtar et al., 1991). NSC utterances included those which directed the child towards a different activity and away from their current focus of attention; where parent and child were engaged in parallel toy play; where the parent commented on their own activity or object which the parent is engaged with. The majority of NSC utterances arose when parents attempted to refocus the child's attention towards the task. In one example, a child is focussed on a particular puzzle piece, however, the father responds directing the child's attention towards the magnet in order to continue with the task:

CHI: this is my truck .
FAT: see this red bit Evan?

Temporal and semantically contingent responses to child utterances were calculated as proportions of total number of child vocalisations in mother-child and father-child interaction, respectively.

All videos were coded by the first author. Two research assistants who were blind to the study hypotheses double coded 25% of the interactions chosen at random. Cohen's Kappa statistic was used to test inter-rater reliability of the temporal contingency codes (kappa = .87), and the semantic contingency codes (kappa = .83).

Child Language and Cognitive Abilities

Child language and cognitive abilities were directly assessed by a trained research assistant using the Bayley Scales of Infant and Toddler Development-Third Edition (BSID-III). The BSID-III are widely used to assess child development and have demonstrated acceptable levels of internal consistency, test-retest reliability, and concurrent validity (Bayley, 2006). The cognitive scale assesses the child's memory, ability to manipulate objects, and knowledge of concepts such as big and small. The receptive language scale assesses child vocabulary, understanding of grammar and tenses and knowledge of prepositions. The expressive scale assesses child ability to label objects, use different tenses of verbs and use prepositions. Child scaled scores on the cognitive, receptive and expressive scales were used in the present analyses. Bayley cognitive scores were missing for one child and Bayley language scores were missing for two children. These cases were not included in the final analyses.

Results

Analytic Strategy

Data analysed in the current study were drawn from a demographic questionnaire, video-recorded mother-child and father-child play interactions, and a cognitive and language developmental assessment administered to the child during a single visit to

the lab at child age two years. Data were analysed using SPSS version 26. To address the first research question, mean-level differences in mother-child and father-child conversational balance as well as differences between mothers' and fathers' interactive verbal behaviours were analysed. Second, bivariate correlations were conducted in order to examine associations between parents' interactive verbal behaviours and parent-child conversational balance. Lastly, multiple regression analyses were conducted to investigate associations between mother-child and father-child conversational turn-taking and child cognitive and language abilities.

Comparing Father-Child and Mother-Child Conversational Turn-Taking

Descriptive statistics for parent-child turn counts, conversational balance, parents' interactive verbal behaviours, as well as quantities of parent-child speech are presented in Table 3. As parental semantic contingency was only coded from temporally contiguous responses, one measure of contingent responsiveness was used in the present analyses (i.e., the proportion of parental responses which were temporally *and* semantically contingent upon the child's vocalisations). Preliminary analyses identified a number of outliers and analyses were conducted with and without these cases. Overall, the results were not affected by the presence of these outliers and therefore these cases were retained in the final dataset.

Paired *t*-tests were conducted to compare parent-child speech variables in father-child and mother-child interaction. There was no significant difference with regards to the quantity of child speech across mother-child and father-child play interactions and no difference in the quantity of mothers' and fathers' speech, as indexed by total word counts. There was greater balance in conversational turn-taking (i.e., MLT ratio was higher) during father-child interaction compared to mother-child interaction, $t(79) = 2.12$, $p = .04$, $d = 0.24$.[1] However, mothers produced more contingently responsive utterances in response to their child's vocalisations compared to fathers, $t(79) = -2.67$, $p = .01$, $d = 0.30$, whilst fathers produced more responses which were not contingent upon the child's vocalisation, $t(79) = 2.73$, $p = .01$, $d = 0.31$. Mothers in the present sample responded to child vocalisations in both a semantically and temporally contingent manner approximately 78% of the time, whilst fathers did so on average 73% of the time. There were no significant differences between mothers and fathers in relation to mean length of turn, proportion of questions, or *wh*-questions produced during interaction. Paired *t*-tests were also run to examine any differences in mothers' and fathers' turn-taking behaviours according to child gender. No differences in parent-child turn-taking were found between boys and girls.

[1] Cohen's *d* is a measure of effect size (i.e., the size of the difference between two groups). Cohen (1988) proposed that $d = 0.2$ should be considered a small effect size, $d = 0.5$ a moderate effect size, and $d = 0.8$ a large effect size.

Table 3. ***Descriptive statistics and t-tests for parent-child conversational turn-taking behaviours during father-child and mother-child interaction***

	Father-child		Mother-child			
Measure	Mean (*SD*)	Range	Mean (*SD*)	Range	Paired Differences Skewness	*t*
PAR word tokens	411.54 (117.72)	175–698	429.33 (126.37)	192–843	.12	-.96
CHI word tokens	54.85 (37.88)	2–150	49.85 (37.92)	3–191	.15	1.42
Turn count	32.32 (14.40)	4–68	28.74 (15.61)	3–74	-.67	2.00
MLT ratio	0.38 (0.21)	0.04–.94	0.33 (0.19)	0.03–0.86	-.29	2.12*
Mean length of turn	4.32 (3.58)	1.36–25.25	5.34 (5.30)	1.68–38.67	2.42	-1.51
Questions	27.33 (11.56)	0–65.93	29.21 (11.16)	4.63–61.39	.14	-1.31
Wh-questions	7.90 (5.50)	0–25.77	7.96 (5.53)	0–30.34	-.10	-.08
Contingent responsiveness	72.78 (13.71)	33.33–96.88	78.21 (13.69)	23.08–100	-.26	-2.67**
Non-semantically contingent responses	18.02 (11.68)	0–54.55	13.41 (11.72)	0–76.92	-.01	2.73**

Note. PAR = parent; CHI = child; MLT = Mean Length of Turn.

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

Parental Interactive Verbal Behaviour and Conversational Balance

The second aim of the present study was to investigate the features of parent-child communicative exchanges which were associated with children's engagement in conversation. Tables 4 and 5 present data pertaining to the associations between parents' interactive verbal behaviours and parent-child conversational balance. These data are presented separately for mothers and fathers. As several variables were not normally distributed Spearman's correlations were conducted. Fathers' use of questions was positively associated with father-child conversational balance whilst mothers' production of *wh*-questions was positively associated with mother-child conversational balance. There were no associations between parents' contingent responsiveness and parent-child conversational balance.

Conversational Balance and Child Cognitive and Language Abilities

Tables 4 and 5 also present bivariate correlations between parent-child conversational balance and child cognitive and language abilities. The role of possible covariates including child age, parental education and parents' quantity of speech input (number of word tokens) was also considered. Mothers' level of education was slightly higher than fathers' and this difference was statistically significant, $t(73) = 4.15$, $p < .001$. Child age demonstrated a significant association with child expressive language ability as well as several features of parents' turn-taking behaviour and was therefore included as a control variable in subsequent analyses. Father-child conversational balance was positively associated with child cognitive ability and mother-child conversational balance was associated with child cognitive and expressive language abilities. Mothers' and fathers' production of *wh*-questions was positively associated with child cognitive ability and mothers' *wh*-questions were also associated with child language abilities. Mothers' MLT was negatively associated with child cognitive and expressive language abilities. Finally, mothers' non-semantically contingent responding was negatively associated with child cognitive and receptive language scores. The strength of these associations ranged from weak to medium.

To examine the contribution of parent-child conversational balance to children's cognitive and language skills, multiple regression analyses were conducted. Normal probability plots of residuals alongside scatter plots of residuals were examined prior to conducting these analyses which indicated that the assumptions of multiple regression had been satisfied. Due to its associations with multiple main variables, child age was retained as a covariate. Table 6 displays the results examining associations between parent-child conversational balance and child cognitive ability, controlling for child age.

In the first model, child cognitive ability was associated with child age. In the second model, child cognitive ability was associated with mother-child MLT ratio only, $F(3,75) = 5.39$, $p = .002$. Greater balance in mother-child conversational-turn taking was associated with greater child cognitive ability. This model explained 18% of the variance in child cognitive ability. Parents' *wh*-questions and non-semantically contingent responding were added to the third model to ascertain whether these variables contributed any additional variance to child cognitive scores. MLT could not be added to the model due to issues with multicollinearity. The addition of these variables did not significantly improve the model, (significance of F change >. 05). Examining associations between parent-child conversational balance and child receptive language, controlling for child age, produced a non-significant F-test, suggesting the model did not fit the data well. Examining associations between parent-child conversational balance and child expressive language, controlling for child age, produced a significant F-test, $F(3, 74) = 4.34$, $p = .007$, $R^2 = .15$, however none of the predictors included in the model were significant.

Table 4. ***Bivariate correlations between father-child turn-taking variables and child language and cognitive abilities***

Factor	1	2	3	4	5	6	7	8	9	10	11	12
1 CHI age	1											
2 FAT education	-.05	1										
3 FAT word tokens	.13	.16	1									
4 MLT ratio	.21	-.26*	-.38**	1								
5 FAT MLT	-.18	.29*	.36**	-.97**	1							
6 FAT questions	.21	.07	.24*	.27*	-.28*	1						
7 FAT *wh*-ques-	.22	-.09	.05	.21	-.24*	.51**	1					
8 FAT SC	.16	-.00	.27*	-.22	.15	.09	.23*	1				
9 FAT NSC	-.30**	.01	.02	.03	.01	-.07	-.20	-.79**	1			
10 Bayley Cog	.19	.06	-.01	.23*	-.21	.04	.24*	.19	-.22	1		
11 Bayley Rec	.21	.04	.13	-.02	.00	-.03	.11	.16	-.12	.56**	1	
12 Bayley Exp	.32**	.09	.15	.20	-.21	.07	.22	.11	-.18	.47**	.50**	1

Note. CHI = Child; FAT = Father; MLT = Mean length of turn; SC = Semantic contingency; NSC = Non-semantic responding; Cog = Cognitive; Rec = Receptive; Exp = Expressive.

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

Table 5. ***Bivariate correlations between mother-child turn-taking variables and child language and cognitive abilities***

Factor	1	2	3	4	5	6	7	8	9	10	11	12
1 CHI age	1											
2 MOT education	-.02	1										
3 MOT word tokens	.10	-.07	1									
4 MLT ratio	.34**	-.21	-.18	1								
5 MOT MLT	-.34**	.22	.10	-.96**	1							
6 MOT questions	.21	.02	.17	.16	-.21	1						
7 MOT *wh*-questions	.35**	.08	.32**	.29**	-.33**	.57**	1					
8 MOT SC	.20	-.10	.05	-.08	.06	-.01	.14	1				
9 MOT NSC	-.08	.02	-.06	-.03	.02	.01	-.10	-.70**	1			
10 Bayley Cog	.19	.10	-.13	.44**	-.40**	.17	.33**	.08	-.23*	1		
11 Bayley Rec	.21	.05	.10	.22	-.22	.15	.37**	.13	-.28*	56**	1	
12 Bayley Exp	.32**	.08	.16	.32**	-.28*	.14	.34**	.16	-.21	.47**	.50**	1

Note. CHI = Child; MOT = Mother; MLT = Mean length of turn; SC = Semantic contingency; NSC = Non-semantic responding; Cog = Cognitive; Rec = Receptive; Exp = Expressive.

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

Table 6. ***Multiple regression model predicting child cognitive ability (n=79)***

	Model 1			Model 2			Model 3		
Predictors	B	SE B	β	B	SE B	β	B	SE B	β
CHI age (in	.43	.21	.23*	.19	.21	.10	-.05	.23	-.03
MOT-CHI MLT ra-				3.71	1.72	.27*	3.73	1.72	.27*
FAT-CHI MLT ra-				2.23	1.50	.17	1.84	1.49	.14
MOT *wh*-questions							.06	.05	.13
FAT *wh*-questions							.05	.05	.10
MOT NSC							-.03	.02	-.14
FAT NSC							-.03	.02	-.17

Note. CHI = Child; MOT = Mother; FAT = Father; MLT = Mean length of turn; NSC = Non-semantic responding.

*$p < .05$.

Discussion

The current study sought to provide a detailed insight into mothers' and fathers' conversational turn-taking in interaction with their two-year-old children and investigate how interactive features of parental CDS support children's engagement in conversation. This study also aimed to elucidate any associations between father-child conversational turn-taking and child cognitive and language abilities. Fathers remain underrepresented in developmental research and the inclusion of both mothers and fathers in this study is important, as it provides a closer approximation of the early interactive environment of the developing child. To our knowledge, this is the first study to provide an in-depth examination of conversational turn-taking during father-child interaction. Overall, the results indicated that there was greater balance in conversational turn-taking in father-child interaction compared to mother-child exchanges. However, father-child turn-taking did not account for any additional variance in child cognitive ability once mother-child conversational balance was controlled for. Finally, regression analyses failed to demonstrate associations between parent-child conversational turn-taking and child receptive and expressive language skills.

The first aim of the present study was to compare father-child and mother-child conversational turn-taking as well as the interactive verbal behaviours of mothers and fathers. Although there was greater balance in father-child interaction, within turns mothers were more contingently responsive to their child's vocalisations compared to fathers. There is little research examining fathers' contingent responsiveness during toddlerhood and previous research has produced inconsistent findings. Several

studies suggest that mothers and fathers are similarly sensitive to their young child's cues (e.g., Tamis-LeMonda et al., 2004; Towe-Goodman et al., 2014) whilst others indicate that mothers' display greater contingent responsiveness compared to fathers (e.g., Flippin & Watson, 2015; Schueler & Prinz, 2013).

Hallers-Haalboom and colleagues (2017) suggested that fathers' tendency to be less contingently responsive may align with their propensity to produce more questions and directive speech during parent-child interaction compared to mothers. It is frequently cited in the literature that fathers use more questions during parent-child play compared to mothers, and in particular produce more challenging *wh*-questions (Malin et al., 2014; Rowe, Coker, & Pan, 2004). However, the present study observed no significant differences in mothers' and fathers' production of questions overall, or *wh*-questions.

This study did however find that fathers produced more responses that were not semantically contingent to their child's speech compared to mothers, although the difference was small. Directive speech was a key component of non-semantically contingent talk. It may be, as Hallers-Haalboom and colleagues (2017) proposed, that fathers were more goal-oriented than mothers and therefore were more focussed on completing the task at hand than responding contingently to their child's behaviour. Future studies examining fathers' responsiveness during free play and structured play conditions may provide further insight. Whilst it has long been contended that fathers may be more challenging communicative partners to their children compared to mothers (Gleason, 1975), the present study suggests this may be borne out in their propensity to respond non-contingently to their children's vocalisations rather than their production of *wh*-questions.

The second aim of the present study was to gain insight into the ways in which these interactive verbal behaviours support children's verbal engagement in conversation. It was expected that by posing more questions and responding contingently to children's speech initiations parents would scaffold their participation in conversation. Parents' use of questions emerged as an important feature of mothers' and fathers' CDS for engaging children in conversation. *Wh*-questions in particular may encourage children to provide longer responses. Previous research has demonstrated that two-year-olds produce more syntactically complex responses to this type of question (Rowe et al., 2017). It may be of interest, in future research, to examine in more depth the complexity and length of children's responses to different types of parental *wh*-question and yes/no questions and whether this translates to children taking longer turns. Parents' contingent responsiveness was not associated with conversational balance. Perhaps, as Locke (1996) suggested, this feature of caregiver-child communication may be less important for engaging children of the current age group in back-and-forth exchanges compared to asking questions. This may also explain the lack of associations between parental responsiveness and child language and cognitive

abilities.

It is unclear from the present results how differences in mothers' and fathers' interactive behaviours were associated with differences in mother-child and father-child conversational balance. There was greater conversational balance in father-child play but there were no differences in mothers' and fathers' use of questions. Although the difference was not statistically significant, fathers' mean length of turn was shorter than mothers' mean length of turn. As previously mentioned, when caregivers decrease the length of turns they take, children's verbal participation in communicative exchanges tends to increase (Brassart & Schelstraete, 2015; Girolametto, 1988). It is also possible that a feature of turn-taking not considered in this study may account for the present findings.

Pausing, for instance, is an important unit of turn-taking which serves as a cue for speaker transitions (Schlangen, 2006). Sufficient pausing following a parental utterance ensures the child has enough time to plan and initiate their response and facilitates children's participation in conversation. More in-depth analysis of pauses between consecutive parental utterances within turns may elucidate whether parents were providing temporal space for their children to respond and whether or not children were availing of these opportunities to participate in conversation. Perhaps fathers in the current sample provided more cues regarding speaker transition through pausing which encouraged child engagement in conversation. Furthermore, the timing of parents' responses to their child's vocalisation in the current study were coded as either occurring within two seconds or not. If more detailed examination regarding the timing of these responses in milliseconds was carried out, perhaps it would emerge that fathers' timing provided more temporal space for the child to take multiple utterances per turn, thus facilitating greater balance in conversation. Future research may also benefit from examining the role of prosody, gesture and gaze as important elements of conversational turn-taking (e.g., Kuchirko et al., 2017; Rohlfing et al., 2020; Rutter & Durkin, 1987). Instances where parents may have provided prosodic or visual cues to mark turn boundaries and children did not take a subsequent turn may not be captured by the present coding scheme.

The final aim of this study was to examine concurrent associations between child language and cognitive abilities and parent-child conversational turn-taking. Whilst mother-child and father-child balance were separately correlated with child cognitive scores, regression analyses indicated that considered jointly, mother-child conversational balance was the only variable significantly associated with child cognitive ability. In other words, father-child conversational balance did not explain any unique variance in child cognitive abilities above and beyond mother-child conversational balance. Similarly, although mothers' and fathers' *wh*-questions were positively correlated with child language and cognitive competencies, these variables did not contribute any additional variance in child cognitive ability.

In the present study, the only difference observed between mothers' and fathers' interactive behaviours was that mothers were more contingent. As contingency was not associated with cognitive abilities, it may be that it interacts with a linguistic feature of mothers', and not fathers', CDS to support children's cognitive development. It may be of interest to future research to examine linguistic features of mothers' and fathers' CDS such as vocabulary diversity and language complexity and how these interact with the interactive features of parents' CDS to influence child development. It may also be important to consider whether the MLT ratio measure employed in the current study favours parents' use of shorter utterances which could lead to simpler speech on the part of the parent. Future studies may address this concern by examining associations between parents' language complexity and balance in parent-child conversational turn-taking.

It is also possible that longitudinal associations may emerge between father-child turn-taking and child cognitive and language development. Previous research has suggested that certain aspects of fathers' parenting may exert specific influences on child development at certain points in time (Towe-Goodman et al., 2014). It is conceivable that over a longer period of time, the effects of father-child conversational turn-taking on child cognitive and language abilities would be elucidated. It is also possible that the current study was underpowered to demonstrate associations between father-child conversational turn-taking and child abilities after controlling for mother-child turn taking. Nonetheless, participation in conversation likely relies on several cognitive skills such as attention and executive function (Casillas et al., 2016) and the present results indicate that the contribution of mother-child conversational turn-taking to child cognitive development is important, despite being less balanced compared to father-child turn-taking.

Strengths and Limitations

This study adds to our knowledge on the dynamics of parent-child conversation and is one of few studies to examine turn-taking within the father-child dyad. The inclusion of both mothers and fathers in the current study permitted a closer approximation of the children's early interactive environment compared to previous research, which has primarily focussed on mother-child exchanges. The use of observational methods to capture naturalistic interactions between parents and children is considered gold standard in the field of fathering research (Cabrera & Volling, 2019). The lab setting also allowed for stimuli and environmental factors to be controlled for across all participants, facilitating comparability across the present sample (De Barbaro et al., 2013). Direct assessment of child cognitive and language skills was another strength of the research as this provided an objective measure of child abilities. Parent-report measures of child capabilities or behaviour may be subject to social desirability and recall bias (Baumeister et al., 2009; Chorney et al., 2014). Finally, the

present design mitigated several limitations of the LENA device mentioned previously.

The cross-sectional design of the current study, however, makes it difficult to tease apart the direction of influences between parent and child factors under consideration. Longitudinal analyses which control for children's baseline abilities may elucidate the direction of the associations between conversational turn-taking and child development over time. For instance, parents may take longer turns when children have lower language abilities. Longitudinal analyses would also allow us to examine the bidirectional associations between turn-taking and child developmental capacities. It is also important to consider how the brief play interactions measured in the lab environment represent the daily experiences of parents and children. Despite advantages of studying behaviour in a laboratory setting, as discussed above, behaviours measured in this setting may have lower ecological validity than observations taken in the home.

The variables included in the present analyses accounted for a small percentage of the variance in child cognitive ability and, as previously mentioned, factors which were not included in the present study likely have important implications for children's development. Data on child birth order, for example, were not compiled. Whilst some research suggests that parent-child dynamics and development may be impacted by child birth order (e.g., Bornstein et al., 2019; Lehmann et al., 2016), other research has not observed an effect of birth order on mothers' and fathers' behaviours during parent-child interaction (e.g., Hallers-Haalboom et al., 2017).

The homogeneity of the sample, which comprised White, highly educated, married parents, may limit the generalisability of the current findings. There may have been limited variability in mothers' and fathers' conversational turn-taking and interactive verbal behaviours in the present sample compared to more diverse populations. This is important to acknowledge given established associations between socioeconomic status and CDS (Schwab & Lew-Williams, 2016). Whilst maternal education is perhaps the strongest predictor of child language development (McNally et al., 2019), there was little variation in this domain among the current sample in order to control for such effects.

Whilst mothers in the current sample were slightly more educated than fathers, fathers' education, and not mothers', was significantly associated with fathers' conversational balance and mean length of turn. On the other hand, mothers' mean length of turn was negatively associated with child age. It is possible that mothers are taking shorter turns with slightly older children to signal greater responsibility for them to engage in the back-and-forth exchange. Future research with a more diverse sample may allow for the associations between sociodemographic factors and parent-child conversational behaviours to be teased apart more clearly.

Finally, it is important to acknowledge cultural assumptions regarding developmental milestones and processes of development (Kuchirko & Nayfeld, 2020). For instance, there are communities outside of the Western world where CDS is relatively rare (e.g., Casillas et al., 2020) and different cultures may have distinct expectations for children's verbal participation in interaction (Girolametto et al., 2002). Participants in the present collection of studies were also homogeneous in relation to family composition. Families comprised two-parent households consisting of a biological resident father and mother. It may therefore be important to consider family structure when generalising the present findings and when making comparisons across future replications.

Conclusion

In order to attain a more comprehensive account of the developing child's early environment it is crucial to consider the multiple contexts within which a child develops. Research on both mother-child and father-child interaction provides an important insight into the early interactive experiences of children and how this shapes their development. Results from this study provide a deeper understanding of the processes by which fathers and mothers interact with their children during conversation and indicate that taking shorter turns and using questions is associated with greater balance in conversational turn-taking between parent and child. The results also added to the small body of research on the role of pragmatics in child cognitive development. Promoting "serve and return" interactions between parents and children may have significant implications for children's development and equip children with the skills needed for future success. Future research with a larger, more socioeconomically diverse sample is however needed to test longitudinal associations between father-child conversational turn-taking and child development.

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Data, Code and Materials Availability Statement

The raw data, analysis syntax, and transcripts used in the current study are available on the Open Science Framework at https://osf.io/h8czg/.

Ethics Statement

Ethical approval for the present study was obtained from the ethics committee of Trinity College Dublin. All participants gave informed written consent before taking part in the study.

Authorship and Contributorship Statement

LK was involved in the conceptualisation of the research, data collection, data curation, coding and analysis, and wrote the first draft of the manuscript. LN was involved in the conceptualisation of the research, methodology, provision of resources, data curation and analysis, review and editing of the manuscript, and supervision. JQ was involved in the conceptualisation of the research, methodology, provision of resources, data curation and analysis, review and editing of the manuscript, and supervision. All authors gave final approval of the version of the manuscript to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

The authors declare no conflict of interest.

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