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Fathers' repetition of words is coupled with children's vocabularies

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ABSTRACT

Differences in vocabulary size among children can be explained in part by differences in parents' language input, but features of caregivers' input can be more or less beneficial depending on children's language abilities. The current study focused on a specific feature of infant-directed speech: parents' repetition of words across utterances. Although previous work with infants showed a positive relation between repetition and children's vocabulary, we predicted that this would not be the case later in development. Instead, parents may use less repetition as their children become increasingly proficient language learners. In the current study, we examined the extent to which low-income fathers of 24-month-olds ($N = 41$) repeat words to their children using three indices: type–token ratio, automated repetition index, and partial repetition of open-class words. The same finding emerged across all measures of repetition: Fathers whose children had larger vocabularies at 24 months repeated words *less* often, suggesting a developmental coupling of fathers' input and children's language proficiency.

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Introduction

Individual differences in young children's vocabulary sizes can be explained in part by differences in parents' language input, yet the extent to which various features of input promote vocabulary growth also depends on children's language abilities. The current study focused on one particular feature of caregivers' speech shown to relate to children's word-learning abilities: the repetition of words across utterances. Repetition in caregivers' speech has been shown to be beneficial for vocabulary growth in young children (Newman, Rowe, & Ratner, 2016), yet the amount of repetition in caregivers' speech declines over the course of early development (e.g., Kaye, 1980; McRoberts, McDonough, & Lakusta, 2009). Moreover, older infants pay less attention to speech characterized by repetition (Segal & Newman, 2015), so it is likely that repetition becomes an incrementally less helpful or necessary cue over the course of children's language development. That is, parents may repeat words less frequently as their children's knowledge of language increases. Conversely, if children have less developed language skills, then parents may continue to repeat words frequently.

Here, we addressed the hypothesis that parents' use of repetition is associated with their children's language skills. Whereas research adopting a social interactionist perspective on language learning highlights the important role of parents' input in children's language development (e.g., Vygotsky, 1978), transactional developmental models emphasize the role of children in shaping their own input (e.g., Sameroff & Chandler, 1975). We examined both of these perspectives to investigate the coupling of parents' language input and children's language skills at 24 months of age. Specifically, we examined whether low-income fathers use less repetition when their children have larger vocabularies compared with fathers whose children have smaller vocabularies.

Repetition in infant-directed speech

Repetitions and partial repetitions of words and phrases are commonly occurring features of caregivers' input to children[1] (e.g., Newport, Gleitman, & Gleitman, 1977; Snow, 1972), and they relate to young children's vocabulary growth. The ratio of word types to word tokens (type–token ratio or TTR) in mothers' speech to their 7-month-olds has been found to predict children's later vocabulary knowledge at 24 months (Newman et al., 2016). Recent research has suggested that the time course of repetition may also be important and, in particular, that repetition of words across successive sentences promotes young children's learning. Analyses of language corpora have shown that up to 58% of caregivers' utterances share at least one word with a neighboring utterance (Onnis, Waterfall, & Edelman, 2008). Below is an example of this type of partial repetition across child-directed utterances (where a mother is speaking to her 1-year-old daughter) retrieved from the Providence corpus of the Child Language Data Exchange System (CHILDES) database (MacWhinney, 2000):

Mother: Bear needs a hat, will daddy's yellow hat fit?
Mother: No, the yellow hat is too big.
Mother: See the hat?

This type of partial repetition has been shown to directly promote adults' word segmentation in an artificial language task (Onnis et al., 2008), and caregivers' partial repetition of multiword constituents across utterances predicts children's later production of those constituents (as cited in Brodsky, Waterfall, & Edelman, 2007). Moreover, the repetition of object labels in successive sentences (vs. distribution of object labels over time) facilitates 2-year-olds' novel word learning in a laboratory context (Schwab & Lew-Williams, 2016).

[1] Whereas repetition is a common feature of caregivers' input in American English, notably, parents' speech to their children differs across cultures (e.g., Shneidman & Goldin-Meadow, 2012). However, note that repetition also seems to be an important feature in speech to children in other languages, such as Tzeltal and Japanese (Brown, 1998; Fernald & Morikawa, 1993).

Interactionist perspectives on language input and language learning

Importantly, the influence of particular features of language input on children's language outcomes depends on the language level of the child. One study showed that among 18-month-olds, parents' input quantity, as compared to diversity in vocabulary within the input, was more strongly associated with children's vocabulary skill one year later. However, by 30 months, parents' use of diverse vocabulary and rare words, as compared to input quantity, was more strongly related to children's vocabulary growth (Rowe, 2012). In addition to the role of caregivers' speech, children's own productions matter. Research has shown that earlier child speech predicts the quality of caregivers' speech later in development, suggesting mutual influence (Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). These findings are consistent with Vygotsky's (1978) interactionist perspective on language learning, which suggests that parents can promote children's vocabulary growth at different time points in development by using features of language input that are best matched to children's level of understanding.

The idea of a "social feedback loop" between infants and parents (usually mothers) has been studied in many realms of child development research (see Warlaumont, Richards, Gilkerson, & Oller, 2014). Researchers have measured mothers' responsiveness to their infants, where a "response" is a time-locked change in mothers' behavior or speech that is contiguous with and contingent on children's actions or speech (see Tamis-LeMonda, Kuchirko, & Song, 2014, for a review). This type of responsiveness predicts the timing of children's language milestones, such as first words and combinatorial speech (Nicely, Tamis-LeMonda, & Bornstein, 1999; Tamis-Lemonda, Bornstein, Kahana-Kalman, Baumwell, & Cyphers, 1998), as well as the size of infants' receptive and expressive vocabularies (Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004; Tamis-Lemonda et al., 1998). Other studies have found that mothers dynamically change the prosodic features of their speech in response to infant feedback (Braarud & Stormark, 2008; Ko, Seidl, Cristia, Reimchen, & Soderstrom, 2016; Smith & Trainor, 2008). These results are consistent with various models of human development that emphasize the influence of reciprocal adult–child interactions. According to Shonkoff (2010), these models (e.g., the transactional model, the bioecological model) suggest that children play an active role in influencing their caregivers' interactions, and, thus, their own development. Not only does parents' language input likely influence children's language development, but also, differences in children's own language abilities and behaviors likely influence parents' speech to their children.

Repetition offers an ideal test case for interactionist models, as the amount of repetitiveness in parents' input has been shown to change over the course of children's development. Specifically, parents' repetition has been shown to peak when infants are 4 to 6 months of age and then to decline at approximately 24 months (e.g., Kaye, 1980; Stern, Spieker, Barnett, & MacKain, 1983). This pattern of change over time is also evident in studies of infants' attention to speech. For instance, McRoberts et al. (2009) played 6-month-olds several natural recordings of either mothers interacting with their 4- to 6-month-olds ("younger IDS [infant-directed speech]") or mothers interacting with their 12- to 14-month-olds ("older IDS"). The 6-month-olds showed a preference only for younger IDS and not for older IDS (relative to adult-directed speech). However, 6-month-olds did show a preference for older IDS if the stimuli contained more repetition, suggesting that repetition might be a particularly important component of speech for young infants. In contrast, a study with older infants showed that 12- and 16-month-olds continue to prefer speech with the prosodic features of infant-directed speech compared to adult-directed speech, but they do not prefer speech with the structural features of infant-directed speech, e.g., lexical repetition and short utterance length (Segal & Newman, 2015). Thus, it is possible that although repetition supports learning during early infancy (Newman et al., 2016) and in difficult lab tasks involving new words (Schwab & Lew-Williams, 2016), it may generally become less important for children's language learning over time, particularly as children gain familiarity with the words used most commonly in their environments. Based on this collection of findings, we hypothesize that parents tailor their use of repetition to the language level of their children, using less repetition as children make gains in language proficiency.

The role of fathers in promoting children's language development

Fathers' interactions with their children have been shown to contribute to children's outcomes (e.g., Cabrera, Shannon, & Tamis-LeMonda, 2007; Shannon, Tamis-LeMonda, London, & Cabrera, 2002). For example, fathers' quality of caregiving accounts for unique variance in toddlers' scores on language and cognitive development assessments, over and above the influence of mothers' caregiving (Pancsofar, Vernon-Feagans, & The Family Life Project Investigators, 2010; Ryan, Martin, & Brooks-Gunn, 2006). Moreover, fathers' responsiveness in parent–child interactions predicts children's language development (e.g., Shannon et al., 2002; Tamis-LeMonda et al., 2004).

Interestingly, mothers and fathers display similarities, differences, and complementary behaviors when interacting with their children (Berko-Gleason, 1975; Cabrera, Fitzgerald, Bradley, & Roggman, 2014; Shute & Wheldall, 1999). Similarities in their infant-directed speech include the use of repetition (Kruper & Užgiris, 1987), high pitch (Shute & Wheldall, 1999; Warren-Leubecker & Bohannon, 1984), and shorter utterances (Golinkoff & Ames, 1979). Differences in their infant-directed speech include fathers' use of more *wh*- questions (as opposed to yes/no questions) and elicitation of more speech from children via clarification requests (e.g., Rowe, Coker, & Pan, 2004). Importantly, prior research has shown that fathers have an independent effect on children's language development (e.g., Cabrera et al., 2014), so the lack of data on the influence of specific features of fathers' infant-directed speech on children's language learning has likely underestimated the overall effect of parents' language input on language development. In addition, although several studies have examined fathers' contributions to children's developmental outcomes in low-income families (e.g., Black, Dubowitz, & Starr, 1999; Duursma, Pan, & Raikes, 2008; Malin, Cabrera, Karberg, Aldoney, & Rowe, 2014a; Pancsofar et al., 2010; Rowe, Leech, & Cabrera, 2017), few studies have examined the ways in which low-income fathers might adapt their speech to their children's level of understanding (Malin, Cabrera, & Rowe, 2014b).

The current study contributes to research on fathers' speech to their children—and its relation to children's language knowledge—by determining whether variation in low-income fathers' use of repetition aligns with their children's language abilities. Interestingly, fathers have been shown to be more challenging communication partners in some instances (e.g., in using more *wh*- questions and eliciting more speech) relative to mothers, and this seems to benefit children's language development. Children are able to rise to the challenge of communicating with fathers in these slightly more demanding interactions, as shown by the fact that their utterances are often longer when communicating with fathers than with mothers (Rowe et al., 2004), and that fathers' use of *wh*- questions with toddlers is positively related to children's language outcomes (e.g., Rowe et al., 2017). Therefore, fathers are likely to tailor their use of repetition to their children's language level, which for older infants and toddlers may mean using *less* repetition when their children have *larger* vocabularies (and instead providing more challenging language input).

The current study

In this study, we examined low-income fathers' repetition of words in the context of play interactions with their 2-year-old children. Given that children from low-SES (socioeconomic status) families have been shown to be at risk for language delays (e.g., Fernald, Marchman, & Weisleder, 2013; Nelson, Welsh, Trup, & Greenberg, 2011), we wanted to examine the extent to which fathers adapt this feature of language input to their children's language level. Three different measures of repetition were used—type–token ratio, automated repetition index, and partial repetition coding (see Method for details)—to address whether variability in children's vocabulary size at 24 months is meaningfully related to repetition in fathers' input. Because prior literature has revealed wide variability in caregivers' speech even within SES groups (e.g., Weisleder & Fernald, 2013), we first aimed to quantify the amount of variability in the use of repetition and partial repetition of words across utterances in low-income fathers' speech to their 2-year-old children. Given that repetition may become a less helpful cue over time, we predicted that fathers would use less repetition if their children have larger vocabularies. Specifically, we predicted that the amount of repetition used by fathers would be

negatively correlated with children's concurrent vocabulary knowledge. Alternatively, however, the amount of repetition used by fathers could be positively correlated with children's concurrent vocabulary knowledge, given previous findings showing that repetitiveness in parents' speech to young infants predicts children's later vocabulary (Newman et al., 2016) and given the fact that researchers have not identified a threshold of language ability at which repetitiveness becomes less necessary for word learning in naturalistic interactions. Ultimately, in order to determine how we can best promote language learning in low-SES populations, it is important for researchers to examine variability in specific, naturally-occurring features of infant-directed speech within low-SES homes, and whether or not differences in these features are related to children's language outcomes.

Method

Participants

The current study used data from naturalistic interactions between low-income fathers and their 24-month-old children ($N = 41$). The data originally came from the Early Head Start Research and Evaluation Project (EHSREP), a randomized controlled evaluation of Early Head Start (EHS), which is a government-funded program in the United States designed to enhance children's health and development in families at or below the poverty level (Vogel, Xue, Moiduddin, Carlson, & Kisker, 2010). The sample used here came specifically from the Father Involvement with Toddlers Substudy (FITS; see Boller et al., 2006, for additional information on FITS) and includes English-speaking African American fathers and their 24-month-old children (22 girls and 19 boys). Fathers in this sample ranged from 18 to 52 years of age ($M = 29$ years, $SD = 8.96$). Fathers also varied in their years of educational attainment, but on average they earned a high school degree ($M = 12.5$ years of education, $SD = 1.47$, range = 10–16). As in Rowe et al. (2017), we included years of education as a control variable in our analyses because other studies within low-SES samples find that variation in parents' education level relates to differences in parents' speech and children's vocabulary development (e.g., Pan, Rowe, Singer, & Snow, 2005; Rowe, Pan, & Ayoub, 2005; for an exception, see Weisleder & Fernald, 2013). See Rowe et al. (2017) for additional characteristics of the father–child pairs in our sample.

Procedure

Father–child pairs were videotaped at home for 10 minutes of semistructured reading and play when children were 24 months of age. Each father was asked to play with his child using the contents of three bags that contained (a) a book (*The Very Busy Spider*), (b) a toy pizza and telephone, and (c) a toy barnyard with animals. The fathers were asked to play with the bags in this order, but they could divide the 10 minutes in any way they wanted. The experimenter also interviewed fathers and mothers to collect demographic information. Mothers completed the Words and Sentences short form of the MacArthur Communicative Development Inventory (MCDI), a checklist of 100 lexical items where parents indicate whether their children have produced each word (see Fenson et al., 2000). According to maternal report, children's productive vocabularies within this sample ranged from 14 to 93 of the 100 words ($M = 61.00$ words, $SD = 18.22$). One year later, when children were 36 months old, researchers visited the families in their homes and assessed children's receptive vocabulary using the Peabody Picture Vocabulary Test–Fourth Edition (PPVT; Dunn & Dunn, 2007) and assessed their verbal reasoning using the Mental Development Index (MDI) from the Bayley Scales of Infant Development–Second Edition (Bayley, 1993). Note that analyses involving the PPVT and MDI used reduced samples ($N = 36$ and $N = 34$, respectively) due to missing data from the latter visit. See Rowe et al. (2017) for more details on assessment methods.

Measures of input quantity and quality

Fathers' 10-minute interactions with their 24-month-old children were transcribed by trained research assistants using the CHAT conventions of the CHILDES (Child Language Data Exchange

System) database (MacWhinney, 2000). To ensure accuracy, each transcript was verified by a separate research assistant. Each line code for a different utterance, defined as a sequence of words that was preceded or followed by a change in conversational turn, intonation, or pause. Using the CLAN (Computerized Language Analysis) program (MacWhinney, 2000), we retrieved automated analyses of the total number of words (word tokens) spoken by fathers, our measure of overall quantity of speech. Our measure of input "quality"—repetition across utterances—was calculated in three distinct ways as follows:

1. *Type–token ratio:* Using CLAN, we automatically calculated TTR, defined as the number of different word types in fathers' input divided by the total number of word tokens. Lower TTR signaled a greater amount of overall repetitiveness.
2. *Repetition index:* Using the CHIP framework (Sokolov & MacWhinney, 1990) within CLAN, we automatically calculated an average repetition index for each father, looking exclusively at fathers' self-repetition, not repetition across fathers' and children's utterances. CHIP computes a repetition index for the amount of overlap between one utterance (the "source" utterance) and the utterance that follows (the "response" utterance). For example, if there are five total words in an utterance and two of those words overlap with the previous utterance, the repetition index would be 2 divided by 5, or 0.40. Although CHIP's repetition index can be used to examine utterances across speakers, the father was always both the "source" and "response" in our analyses. Two contiguous father utterances still count as "source" and "response" utterances even if a child utterance occurred between the two.
3. *Partial repetition:* From the transcripts, trained research assistants identified and marked every instance of partial repetition of nouns, verbs, and adjectives. We defined partial repetition as instances where fathers repeated one or more nouns, verbs, and/or adjectives in three or fewer lines following the first instance of the word (children's own utterances were included in this line count). Note that the repetition of inflected forms was also counted (e.g., "cow" in one sentence and "cows" in another). Similar to other corpus analyses that have excluded words that do not fit into clean open-class categories (e.g., Brent & Siskind, 2001), we were interested specifically in partial repetition of open-class words. We also excluded repetitions of identical utterances (i.e., fathers repeating an entire sentence within three lines following the first instance of that sentence) to try to avoid instances where fathers simply thought their children failed to hear an utterance. In addition, our coding excluded proper nouns, pronouns, auxiliary verbs, and "to be" verbs. See Kaye (1980) for a similar method of coding parents' partial repetition in which the researcher identified words that reoccurred within three utterances and excluded exact immediate repetitions of identical utterances. Below is an example of one instance of partial repetition—taken from one of the 41 father–child transcripts—where a father repeats the noun "sheep" and the verb "go" within three lines following the first instance of those words (note that the child's utterance of "sheep" is counted in the line count but would not be counted as an instance of partial repetition):

   Father: How do sheep go?
   Child: Sheep.
   Father: No.
   Father: Sheep go baah.

   To ensure reliability, 20% of transcripts were coded by two research assistants. Percent agreement, defined as the number of agreed-upon partial repetition markings divided by the total number of markings per participant, averaged 95.6%.

Other measures

In all analyses, we controlled for fathers' years of education because prior work has shown that variation in parents' years of education relates to differences in the quantity and quality of parents' speech, even within low-SES samples (e.g., Hoff, 2006; Malin et al., 2014b; Rowe et al., 2005). As described above, children's vocabulary was measured at 24 months using the MCDI (Fenson et al., 2000) and at 36 months using the PPVT (Dunn & Dunn, 2007). Children's verbal reasoning was also

assessed at 36 months using the MDI from the Bayley Scales of Infant Development–Second Edition (Bayley, 1993). Using CLAN, we also obtained a measure of the total number of child word types used during the parent–child interaction at 24 months (i.e., the number of different word roots produced by children) as a secondary measure of children's vocabulary knowledge.

Results

Variability in fathers' language input

There was substantial variability in our measures of fathers' input, in line with previous research showing variability in quantity and quality of speech within low-SES samples (e.g., Pan et al., 2005; Weisleder & Fernald, 2013). Total number of words in fathers' speech (our measure of input quantity) ranged from 163 to 1202 words per 10 minutes (M = 710.61 words, SE = 37.20), revealing a 7-fold difference in input between the least and most talkative fathers in our low-SES sample. In terms of repetition (our measures of input quality), fathers' TTR ranged from .18 to .42 (M = .26, SE = .01), fathers' average repetition index ranged from .43 to .74 (M = .58, SE = .02), and fathers' instances of partial repetition ranged from 8 to 85 (M = 40.51, SE = 2.84). Note that the highest TTR value (.42) was more than 2.5 standard deviations above the mean, so we excluded it as an outlier in all subsequent analyses, and the adjusted range of fathers' TTR was .18 to .37 (M = .25, SE = .01). Correlations among these measures suggest that they captured overlapping but distinct aspects of fathers' language input. Whereas TTR and partial repetition were significantly correlated (r = −.61, p < .001), there was no significant correlation between TTR and repetition index (r = −.03, p = .87) or between partial repetition and repetition index (r = .16, p = .30).

Fathers' repetition and children's language knowledge

To determine whether there were relations between children's MCDI scores and fathers' use of repetition, we first ran simple correlations between children's MCDI scores (i.e., their 24-month productive vocabulary) and our measures of repetition in fathers' input. Interestingly, in our sample, children's vocabulary at 24 months was not significantly related to fathers' total number of words (r = −.17, p = .29). However, children's vocabulary at 24 months was significantly related to all three measures of fathers' repetition (see Fig. 1). Fathers' TTR was positively correlated with children's MCDI scores (r = .33, p = .04), suggesting that greater repetitiveness was negatively associated with children's vocabulary; fathers' repetition index was negatively correlated with children's MCDI scores (r = −.32, p = .04); and fathers' partial repetition was negatively correlated with children's MCDI scores (r = −.35, p = .03). Thus, across all three measures, children with larger vocabularies at 24 months (as reported by mothers on the MCDI) had fathers who used less repetition when speaking to them, suggesting the possibility that fathers were adjusting their speech to the language level of their children.

To further investigate potential relations between children's vocabulary and fathers' input, we fit regression models to determine whether children's vocabulary at 24 months was associated with each measure of repetition at 24 months, controlling for fathers' education and fathers' total number of word tokens at 24 months. Results displayed in Table 1 show that children's 24-month vocabulary on the MCDI was a marginally significant predictor of fathers' TTR (p = .052), controlling for fathers' education (*ns*) (Model 1; note that here we did not control for fathers' total number of word tokens, given that type–token ratio already includes this variable). Similarly, children's 24-month vocabulary was a significant predictor of fathers' repetition index (p < .05), controlling for fathers' education (*ns*) and fathers' total number of word tokens (*ns*) (Model 2). Finally, children's 24-month vocabulary was a marginally significant predictor of fathers' partial repetition (p = .051), controlling for fathers' education (*ns*) and fathers' total number of word tokens (p < .001) (Model 3). Importantly, across all three measures of repetition, children's vocabulary at 24 months was significantly associated with fathers' repetition at 24 months, such that children with larger (vs. smaller) vocabularies had fathers who used less repetition, controlling for fathers' level of education and the total number of words spoken.

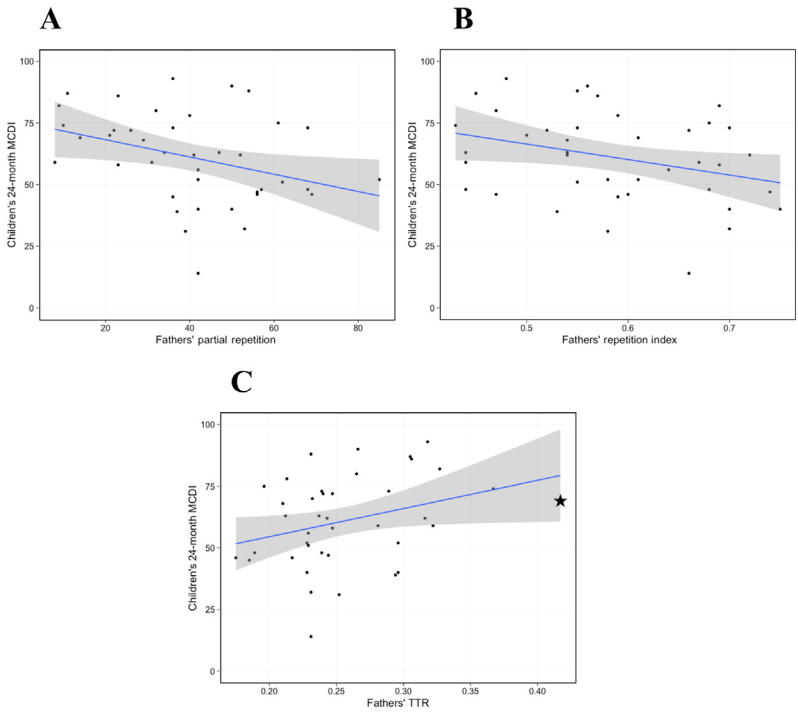

Fig. 1. Correlations between children's 24-month MCDI and each measure of fathers' repetition: (A) partial repetition, (B) repetition index, and (C) type–token ratio (TTR). Note that the star point in Panel C indicates the outlier that was excluded from all TTR analyses. Blue lines show smoothed conditional means (linear), and error bands show confidence intervals around the mean. (For interpretation of the reference to color in this figure legend, the reader is referred to the Web version of this article.)

Table 1
Regression models predicting fathers' TTR (where lower TTR suggests more repetition) (Model 1), fathers' repetition index (Model 2), and fathers' partial repetition (Model 3) from fathers' education, fathers' total number of words (for Models 2 and 3), and children's MCDI vocabulary scores at 24 months.

	Model 1: TTR	Model 2: repetition index	Model 3: partial repetition
Intercept	.04 (.15)	.04 (.15)	.01 (.11)
Father education	.18 (.15)	.19 (.15)	−.17 (.12)
Fathers'# word tokens	–	.07 (.16)	.64*** (.12)
24-month MCDI	.30† (.15)	−.32* (.16)	−.24† (.12)
F statistic	2.98†	2.01	13.51***
R^2 (%)	14.20†	14.34	52.95***

Note. The table displays β-coefficients for each predictor (with significance symbols where applicable). Standard errors are in parentheses. The final line displays R^2 values for each model (with significance symbols for overall model significance).
† $p < .10$.
* $p < .05$.
*** $p < .001$.

Next, we examined whether children's total number of word *types* (i.e., number of different word roots they produced) during the play interaction was related to fathers' repetition. That is, it is possible that, to the extent they differ, both children's general vocabulary knowledge (MCDI) and their vocabulary use in the specific interaction (word types) may be associated with fathers' input. Although

Table 2
Regression models predicting fathers' TTR (where lower TTR suggests more repetition) (Model 1), fathers' repetition index (Model 2), and fathers' partial repetition (Model 3) from fathers' education, fathers' total number of words (for Models 2 and 3), children's MCDI vocabulary scores at 24 months, and children's total number of word types spoken.

	Model 1: TTR	Model 2: repetition index	Model 3: partial repetition
Intercept	.04 (.15)	.04 (.15)	.01 (.11)
Father education	.18 (.16)	.19 (.15)	−.17 (.12)
Fathers' # word tokens		.07 (.16)	.64*** (.12)
24-month MCDI	.31† (.16)	−.30† (.16)	−.14† (.10)
# child word types	−.04 (.16)	−.08 (.16)	−.40*** (.10)
F statistic	1.95	1.54	18.55***
R^2 (%)	14.35	14.96	67.95***

Note. The table displays β-coefficients for each predictor (with significance symbols where applicable). Standard errors are in parentheses. The final line displays R^2 values for each model (with significance symbols for overall model significance).
*** $p < .001$.
† $p < .10$.

number of child word types was not significantly related to fathers' TTR ($r = .04$, $p = .81$) or fathers' repetition index ($r = -.14$, $p = .39$), there was a significant negative relation between number of child word types and fathers' partial repetition ($r = -.38$, $p = .01$). To further explore this relation, we added child word types to our regression models to determine whether child word types at 24 months predicted repetition in fathers' input, controlling for total quantity of input, fathers' years of education, and children's 24-month MCDI vocabulary scores. Children's MCDI scores and their number of word types used during the interaction were positively, but not significantly, correlated ($r = .23$, $p = .16$). Results displayed in Table 2 show that children's 24-month word types were significantly associated with fathers' partial repetition ($p < .001$), controlling for fathers' education (*ns*), total quantity of fathers' speech ($p < .001$), and children's 24-month vocabulary scores ($p < .10$) (Model 3). Children's word types at 24 months were not significantly associated with fathers' TTR (Model 1) or repetition index (Model 2), controlling for the same variables (although note that again we did not control for fathers' total number of word tokens in predicting TTR). These results suggest that children's language knowledge—as displayed by the number of different word types children used within a conversational episode—was negatively related to fathers' use of partial repetition within that same conversational episode, controlling for fathers' education, children's MCDI scores, and fathers' total number of words spoken. That is, children who used *more* different word types had fathers who used *less* partial repetition across neighboring utterances.

Because we found negative relations between children's vocabulary knowledge and fathers' use of repetition in general, we wanted to address the possibility that fathers' repetition at this age might be negatively associated with children's later language outcomes. To do so, we examined whether repetition in fathers' speech to their 24-month-old children related to language outcomes at 36 months, as measured by PPVT vocabulary scores and MDI verbal reasoning scores. Although we cannot definitively determine who is influencing whom from our correlational study, there are two competing possible outcomes of this analysis that can enable us to make cautious inferences about directionality. First, if fathers' repetition at 24 months is driving variation in children's vocabulary levels at 24 months (i.e., if more repetition "causes" children to have smaller vocabularies), then fathers' repetition at 24 months may also be negatively related to children's language outcomes at 36 months. In contrast, if children's vocabulary levels at 24 months contributed to variation in fathers' repetition at 24 months (i.e., if fathers tailored their input to the language levels of their children), then it is unclear whether fathers' repetition at 24 months would be associated with children's 36-month vocabulary scores. Fathers with low-vocabulary children at 24 months might be helping those children "catch up" to their high-vocabulary counterparts by using more repetition, and fathers with high-vocabulary children might not need to use as much repetition to promote their children's vocabulary growth.

To examine these two possible alternatives, we ran partial correlations between each measure of fathers' repetition at 24 months (TTR, repetition index, and partial repetition) and children's language

Table 3
Partial correlations between children's language outcomes at 36 months (PPVT vocabulary scores and MDI verbal reasoning scores) and each measure of fathers' repetition at 24 months (TTR, repetition index, and partial repetition), controlling for fathers' education, fathers' total number of word tokens at 24 months (for repetition index and partial repetition), and children's MCDI vocabulary scores at 24 months.

	36-month PPVT	36-month MDI
TTR	.06	−.01
Repetition index	−.28	−.19
Partial repetition	.20	−.27

outcomes at 36 months (PPVT vocabulary scores and MDI verbal reasoning scores), controlling for fathers' education, children's MCDI vocabulary scores at 24 months, and fathers' total number of word tokens at 24 months (for repetition index and partial repetition). None of the relations was statistically significant (see Table 3).

Overall, our results suggest that children with larger vocabularies at 24 months had fathers who used less repetition of words during 24-month interactions. Our finding that children's production of different word types was negatively related to fathers' partial repetition provides further evidence that children's own language use influenced fathers' input and suggests that the time course of repetition might be a particularly important feature of caregivers' speech (see Schwab & Lew-Williams, 2016). Finally, repetition in fathers' speech did not predict children's 36-month vocabulary or their verbal reasoning scores over and above children's 24-month vocabulary, total input quantity, and fathers' years of education. Thus, repetition in speech to 24-month-olds did not negatively predict their language development thereafter.

Discussion

The current study examined variability in low-SES fathers' repetition and partial repetition in speech to their 2-year-old children. In particular, we asked whether differences in fathers' repetition were related to children's vocabulary knowledge. Our results expand on existing literature in several ways. First, to our knowledge, this is the first study to examine repetition in low-SES families, and our results show wide variability in the extent to which fathers repeat words to their toddlers. Second, whereas repetition in parents' language input to 7-month-old infants has been shown to positively predict children's vocabulary size during toddlerhood (Newman et al., 2016), our results reveal that at 24 months, repetition in fathers' language input was negatively related to children's concurrent vocabulary size. That is, fathers of children with larger vocabularies used less repetition. Moreover, repetition in fathers' input at 24 months was not predictive of children's subsequent receptive vocabulary or verbal reasoning abilities at 36 months, suggesting that—controlling for concurrent vocabulary—more repetitiveness in fathers' speech to toddlers is not directly implicated in children's later learning outcomes. Together, these findings add support to research showing that specific features of input are more or less helpful in promoting vocabulary at different stages in early language development (Rowe, 2012; Rowe & Zuckerman, 2016) while extending research on repetition and accommodation to a sample of low-income fathers. Importantly, future longitudinal research is needed to further explore changes in fathers' use of repetition in child-directed speech over time. Moreover, to better understand the unique role played by fathers in children's language learning, future research should compare the current findings directly with mothers' speech, as well as with parents' speech across the SES spectrum.

Interestingly, whereas children's 24-month vocabulary predicted all three indices of fathers' repetition, the strongest relation was between children's vocabulary and fathers' partial repetition in particular. Although we cannot conclusively determine the causal nature of these variables, the fact that child word types at 24 months only predicted fathers' partial repetition suggests that this variable might best capture relevant individual differences in fathers' repetition. This finding—that partial repetition seems to be a particularly promising construct for investigating the relation between fathers' repetition and children's vocabulary development—suggests that the partial repetition of open-class

words in particular may be important for promoting children's learning of those words (Schwab & Lew-Williams, 2016).

One possible interpretation of our finding that 24-month-olds with larger vocabularies had fathers who used less repetition—and that children who produced more word types had fathers who used less partial repetition in particular—is that parents are sensitive to children's language knowledge and tailor their language input to their own children's developmental level. This interpretation is supported by previous research (Huttenlocher et al., 2010; Rowe et al., 2005; Snow & Ferguson, 1977; Vygotsky, 1978). In a study examining caregivers' speech over time with 14- to 36-month-old children, mothers from low-income families increased both their number of word tokens and types as their children became more proficient (Pan et al., 2005). But young children are not just passive listeners. Their social feedback to caregivers—such as moment-to-moment attentiveness and vocalizations—shapes caregivers' future language input (e.g., Ko et al., 2016; Nicely et al., 1999), and in turn, parental responsiveness promotes children's language development (e.g., Tamis-LeMonda et al., 2014). This active responsiveness to caregivers facilitates increasingly useful and informative interactions with caregivers.

Another possible interpretation of our findings is that fathers' use of more repetition at 24 months "caused" their children to have smaller vocabularies. If this was the case, it is likely that fathers' repetition at 24 months would also negatively relate to children's later vocabulary at 36 months. Yet our research revealed that repetitiveness in fathers' input to children at 24 months was not associated with either of our measures of language knowledge at 36 months (children's PPVT scores or MDI scores), controlling for concurrent vocabulary, suggesting that fathers' use of repetition did not seem to hinder children's language development. This finding also converges with research showing that although infant-directed speech seems to promote word learning early on in development (e.g., Ramírez-Esparza, García-Sierra, & Kuhl, 2014), this might not be the case for older toddlers (Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011). Similarly, young children's ability to capitalize on parents' repetition of words over time might decline during the third year of life, as observed here. Importantly, however, it does not seem to be the case that hearing more repetition at 24 months is negatively related to children's vocabulary growth; rather, it may simply no longer be beneficial.

Although repetitiveness in fathers' speech to their 24-month-old children was not related to children's 36-month vocabulary or verbal reasoning in our sample, repetition could still be beneficial for this age group under certain circumstances. In particular, experimental evidence has shown that partial repetition of words in successive sentences is important for 2-year-olds' initial encoding of new words (Schwab & Lew-Williams, 2016). Thus, it is possible that when 24-month-olds are learning new object labels, hearing a word in immediate succession is initially beneficial, but it might not be as necessary with subsequent exposures to words over protracted time scales. Moreover, the recordings of fathers took place in a constrained setting; all children participated in a 10-minute play session with familiar objects, such as a toy pizza, toy telephone, and toy animals. Increased repetition might not be helpful in this laboratory context, but in natural settings where 2-year-olds are engaging with many new words, parents' repetition over time may in fact positively predict language outcomes.

Our findings also contribute to a growing field of research examining the relations between fathers' interactions with their children and children's developmental outcomes. While most prior research showing the influence of parents' speech on children's language outcomes has focused on mothers' speech and mother–infant interactions, particularly in middle-income households (e.g., Hoff, 2003; Newport et al., 1977), more recent research has shown that high-quality interactions with fathers also promote children's language and cognitive development (e.g., Cabrera et al., 2007; Shannon et al., 2002). In particular, fathers' responsiveness to their young children predicts language development in a similar way to mothers' responsiveness (e.g., Tamis-LeMonda et al., 2004). Our findings go further to suggest that fathers in a low-SES sample vary the amount of repetition in their speech based on their children's vocabulary knowledge. Thus, similar to mothers (e.g., Rowe et al., 2005), fathers seem to engage in a highly sensitive form of audience design, tailoring their speech to the language level of their children.

To help alleviate the "vocabulary gap" between low- and high-SES toddlers, as well as to better serve children with language delays or disorders, researchers need to determine the particular ways in which caregivers can promote children's language learning. Future work is needed to compare the use of specific features of language input (such as repetition) in the speech of mothers and fathers

from both high- and low-SES families. This would facilitate a more complete understanding of how variation in these features interacts with different children's learning trajectories. However, our results are suggestive of two possible steps for parent-aimed interventions and early childhood programs. First, suggestions for enhancing parent–child interactions should be targeted to children's specific age and level of language knowledge. A "one size fits all" strategy for supporting language learning is not likely to be beneficial for all young children, and we currently know little about when and why certain types of input are more or less helpful for different children's language development. This is a prime opportunity for collaboration between basic cognitive scientists and, for example, speech–language pathologists. Notably, several speech therapy techniques already incorporate the use of repetition, including auditory bombardment, in which specific sounds are repeated (Bowen & Cupples, 1998), and focused stimulation, in which a child is exposed to multiple exemplars of a specific linguistic target (Ellis Weismer & Robertson, 2006). Second, the current study extends previous research showing the importance of fathers for promoting children's language development. Specifically, we show for the first time that repetition in low-income fathers' speech is related to children's language knowledge, providing further support for the idea that policies and programs should aim to include fathers as an important centerpiece of parenting.

Conclusions

Although repetition of words over time may be beneficial for children's language learning at early developmental time points, as well as for the initial encoding of new words slightly later in development, the current study suggests that repetition in fathers' language to their children does not broadly promote children's language learning during the third year of life. Instead, within our low-SES sample, fathers seem to tailor their speech—and in particular their use of repetition—to the language level of their children. This research highlights a key idea for future research on the influence of language input on children's learning: that specific features of language input are beneficial to children at different time points of development and across different contexts. In designing interventions that target early language learning, simple messages to parents such as "more repetition is good" or "more repetition is bad" are not accurate or beneficial. Instead, it is important for caregivers to cater their language to children's maturing vocabulary knowledge. In support of efforts to improve the effectiveness of policies, interventions, and early childhood programs, our findings indicate that fathers provide responsive and valuable support for children's language growth over time.

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