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Does input influence uptake? Links between maternal talk, processing speed and vocabulary size in Spanish-learning children

Nereyda Hurtado, **Virginia A. Marchman**, and **Anne Fernald**
Department of Psychology, Stanford University, USA

Abstract

It is well established that variation in caregivers' speech is associated with language outcomes, yet little is known about the learning principles that mediate these effects. This longitudinal study (n = 27) explores whether Spanish-learning children's early experiences with language predict efficiency in real-time comprehension and vocabulary learning. Measures of mothers' speech at 18 months were examined in relation to children's speech processing efficiency and reported vocabulary at 18 and 24 months. Children of mothers who provided more input at 18 months knew more words and were faster in word recognition at 24 months. Moreover, multiple regression analyses indicated that the influences of caregiver speech on speed of word recognition and vocabulary were largely overlapping. This study provides the first evidence that input shapes children's lexical processing efficiency and that vocabulary growth and increasing facility in spoken word comprehension work together to support the uptake of the information that rich input affords the young language learner.

Introduction

Infants begin to understand and produce words and sentences through interaction with experienced speakers of the language they are learning. While most children become increasingly proficient over the first few years, they also vary considerably at every age in the numbers of words they can produce (Fenson, Marchman, Thal, Dale, Reznick & Bates, 2006). One robust correlate of individual differences in early lexical development is variation in the quantity and quality of the language children hear from caregivers. Several studies show that English-learning children who hear more speech and more diverse vocabulary in daily interactions learn new words more quickly than do those who hear less child-directed speech (Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991). Our first goal is to extend this research to Latina mothers speaking Spanish to their children, asking whether the amount and nature of their child-directed speech are predictive of differences in children's lexical development.

Although studies exploring sources of variability in lexical development have focused on environmental factors related to early language experience, a few have asked how infants' skill in processing speech sounds might also account for differences in language learning. A recent longitudinal study using real-time measures of comprehension found that infants who were faster to identify familiar words had larger vocabularies than those who were slower (Fernald, Perfors & Marchman, 2006). Moreover, faster processing speed, reflecting more efficient ‘uptake’ of lexical information, was associated with more accelerated vocabulary growth

Address for correspondence: Nereyda Hurtado, Department of Psychology, Jordan Hall, Stanford University, Stanford, CA 94305, USA; nhurtado@stanford.edu.

across the second year. Our second goal is to examine longitudinally the relation between speech processing efficiency and vocabulary development in Spanish-learning infants, asking whether those who are faster to identify familiar words are also lexically more advanced.

These previous findings show that variation in early vocabulary growth is associated not only with features of the language children hear from caregivers, but also with their ability to interpret language in real time. However, little is known about how caregiver talk relates to children's skill in comprehension. Our third goal is to determine whether the quantity and quality of language input are associated with children's speech processing efficiency, asking whether caregiver talk not only guides the end-products of vocabulary learning, but also sharpens the processing skills used during real-time language comprehension. Finally, the overarching goal of this study is to explore the extent of overlap among these relations, asking whether processing speed and vocabulary knowledge work together to enable more efficient uptake of the information that rich input affords the young language learner.

Caregiver talk and language outcomes

Early studies examining consequences of caregiver talk asked whether the incidence of particular syntactic constructions predicted children's learning of those constructions (Newport, Gleitman & Gleitman, 1977). Specific links were difficult to identify, but further research using more global measures converged on a surprising finding – that the sheer quantity of talk to the child influences language learning. Huttenlocher *et al.* (1991) found that the amount of speech middle-class mothers addressed to their children was robustly related to rate of vocabulary growth from 14 to 26 months. Hart and Risley (1995) examined child-directed speech in a broader demographic range, discovering even greater variability in the quantity and nature of caregiver talk. By their estimate, parents from professional families directed thousands more words to their children each day than did parents from working-class and welfare families, and these ‘meaningful differences’ in early language experience predicted long-term language outcomes. While this association could be an artifact of inherited verbal ability shared among family members, similar links are seen among unrelated individuals (Huttenlocher, Vasilyeva, Cymerman & Levine, 2002). Moreover, caregiver talk predicts outcomes even after controlling for children's earlier vocabulary, ruling out the reverse explanation based on the possibility that more talkative children tend to elicit more speech from caregivers. Finally, in studies of English-learning children from different socioeconomic backgrounds, Hoff (2003) showed that variation in language outcomes is directly attributable to characteristics of caregiver talk. Although mothers' speech in Latino populations has been described in several studies (Laosa, 1981; Eisenberg, 2002; Moreno, 2000; Pérez-Granados & Callanan, 1997), none has explored relations between language input and vocabulary development in Spanish-learning children.

Speech processing efficiency and vocabulary development

Clarifying the role of the environment in language development also requires understanding the learning principles that guide young children's use of information available in the input. Several studies have explored how variation in vocabulary development is predicted by infants' efficiency in processing speech sounds. Recent results show how auditory processing (Benasich & Tallal, 2002), phonological discrimination (Tsao, Liu & Kuhl, 2004), and segmentation (Newman, Bernstein Ratner, Jusczyk, Jusczyk & Dow, 2006) in the first year relate to early lexical development, based on procedures assessing perception of speech sounds not yet meaningful to preverbal infants. Using an eye-tracking procedure that requires infants to listen for meaning in speech, Fernald *et al.* (2006) found that faster processing speed at 25 months was associated with more rapid vocabulary learning across the second year. Moreover, processing speed and vocabulary knowledge at 25 months strongly predicted performance on standardized tests of language and cognition at 8 years, showing that infants' early efficiency

in interpreting language and building a working lexicon has long-term predictive validity (Marchman & Fernald, 2008). While cross-sectional studies have also found associations between faster word recognition and more advanced linguistic development in both English (Fernald, Swingley & Pinto, 2001; Zangl & Fernald, 2007) and Spanish (Hurtado, Marchman & Fernald, 2007; Lew-Williams & Fernald, 2007), this is the first longitudinal study of processing efficiency by Spanish-learning children in relation to lexical development.

Linking caregivers' speech to children's processing speed and vocabulary growth

These findings suggest that children who are faster to recognize words are also children who are better word learners. The most general explanation of these links is that caregiver talk influences both language processing and vocabulary knowledge, but these relations are independent and non-overlapping. In contrast, it could be that vocabulary knowledge and speed of spoken language understanding are interrelated, working together to take advantage of the multiple cues to meaning that are available in the input. For example, children exposed to richer caregiver input may be more practiced at interpreting words in continuous speech, and this increased practice could enable them to learn more words. In this case, correlations between caregiver talk and vocabulary size would be attributable to early experiences that facilitate children's skill in processing language in real time. It is also possible that relations between processing and vocabulary work in the other direction: Children who hear more talk may develop more robust phonological and lexical representations that are more easily accessed in real time. In this case, it could be vocabulary knowledge itself that leads to the development of greater efficiency in speech processing.

In sum, this study explores longitudinally how caregiver talk relates both to children's vocabulary knowledge and to their skill in lexical processing. First, we examine links between Latina mothers' child-directed speech at 18 months and children's vocabulary at 18 and 24 months, an association documented previously in English- but not in Spanish-learners. Next, we ask whether children's vocabulary size also relates to their efficiency in identifying familiar nouns in fluent speech, and whether individual differences in speech processing, like vocabulary knowledge, are grounded in children's early language experience. Finally, in a series of multiple regression models we assess the proposal that children's processing speed and vocabulary knowledge work together to allow more efficient uptake of the information that is available in caregiver talk.

Method

Participants

This research was conducted in a community-based laboratory staffed by bicultural/bilingual Spanish-speaking researchers, located in a low-income neighborhood near San Francisco, CA. Twenty-seven mother–child dyads participated when children (12 females, 15 males) were 18 (M = 18.1; range = 17–20) and 24 (M = 24.2; range = 23–27) months. About half (14 of 27) of the children were first-born; 30% were second-born (8 of 27). Most parents were recent immigrants from Mexico with low English proficiency; all reported Spanish as the only language spoken at home. Table 1 presents descriptive statistics for parental education, family income, and SES, as reported in interviews with parents. Most parents had less than a high-school education. Nearly 90% reported income levels less than required to cover basic expenses according to the California Self-Sufficiency Standard for San Mateo County (Pierce, 2003), a poverty benchmark reflecting regional differences in cost-of-living. Estimates of family SES were based on the Hollingshead Four Factor Index of Social Status (HI; Hollingshead, 1975), revealing a mean HI of 24.3, with 70% of the families in the lowest two social strata. While each demographic measure spanned a broad range, this sample is best characterized as primarily low SES.

Measures

Mothers' speech—At the 18-month visit, mothers were asked to play with the child as at home for about 20 minutes, using age-appropriate toys provided. Sessions were video- and audio-recorded. All maternal and child utterances were transcribed by trained native Spanish-speakers following CHILDES protocols (MacWhinney, 2007). An utterance was defined as one grammatical sentence, or a shorter phrase prosodically marked as a separate utterance. Each maternal word was coded for word root, part of speech, tense, number and person, using the Spanish-language *mor* utility in CHILDES. Based on the shortest play session, all transcripts were reduced to 12 min., beginning 2 min. after participants were comfortably engaged in play. All transcripts and codings were double-checked for accuracy by the original transcriber and first author.

Following previous studies (Huttenlocher *et al.*, 1991; Hoff-Ginsberg, 1991), four measures of maternal speech were assessed: (1) number of utterances, (2) number of word tokens, (3) number of word types, (4) mean length of utterance (MLU). The first two measures provide estimates of the amount of maternal talk during a fixed-length play session. Number of word types provides an index of lexical diversity in maternal talk. While token-counts include every instance of a word, type-counts include only the number of unique word roots; e.g. como '*I eat*', come '*he/she eats*', and comemos '*we eat*' comprise three tokens of one word type, comer '*to eat*'. As is the convention for romance languages, MLU is defined as the mean number of words per utterance, an index of grammatical complexity.

Vocabulary size—At 18 and 24 months, parents completed the MacArthur-Bates Inventario del Desarrollo de Habilidades Comunicativas: Inventario II. Vocabulary size was the number of reported words produced; percentile ranks were based on norms for Mexican Spanish (Jackson-Maldonado, Thal, Marchman, Newton, Fenson & Conboy, 2003). The difference in words produced at 24 versus 18 months provided a measure of vocabulary gains across the period.

Speech processing—Efficiency in online comprehension was assessed at 18 and 24 months using the looking-while-listening procedure (Fernald *et al.*, 2006; Fernald, Zangl, Portillo & Marchman, 2008). On each trial, children saw pictures of two familiar objects and heard speech naming one of them. Gaze patterns were videotaped and coded frame-by-frame, yielding a high-resolution record of eye movements aligned with target noun onset. Inter-observer agreement within a single frame averaged 97% on reliability assessments.

Speech stimuli, recorded by a native Spanish-speaker, consisted of simple sentences ending with a target noun (¿Dónde está el/la [target]? '*Where's the [target]?*'). At 18 months, the eight target nouns (el perro '*doggie*', el libro '*book*', el jugo '*juice*', el globo '*balloon*', el zapato '*shoe*', el plátano '*banana*', la pelota '*ball*', la galleta '*cookie*') were familiar to most children learning Mexican Spanish at this age. Four more familiar words were added at 24 months. Target nouns were each presented four times at 18 months (32 test trials) and three times at 24 months (36 test trials). Stimuli were acoustically analyzed and edited using Peak 4.0 LE software to control for prosodic comparability. Visual stimuli were digitized pictures presented in fixed pairs, matched for visual salience and grammatical gender of object name, with 3–4 tokens of each object type. Side of target picture was counterbalanced across trials.

Mean reaction time (RT) for each child was based on trials when the child started on the distracter and shifted to the target picture within 300–1800 ms from target-word onset.[1]

[1]Shifts in gaze earlier than 300 ms from noun onset were excluded because they occurred before the child had time to process sufficient acoustic input to mobilize an eye movement. Shifts longer than 1800 ms from noun onset were excluded since these delayed looks are less likely to reflect a response to the target word (Fernald *et al.*, 2008).

Because children vary in the likelihood they will by chance start out on the distracter on a given trial, mean RTs are based on different numbers of trials across participants (18 mos: *M* = 8 trials, range = 2–18; 24 mos: *M* = 13, 7–21).

Results

Table 2 summarizes measures of maternal speech during play at 18 months. Although there was considerable variation in the quantity, diversity, and complexity of mothers' speech, these measures were highly intercorrelated. Mothers who produced more utterances also used more word tokens, $r(27) = .86$, $p < .001$, and types, $r(27) = .56$, $p < .01$, than those who said fewer utterances, and mothers who spoke more also used more different words, $r(27) = .80$, $p < .001$, and longer utterances, $r(27) = .68$, $p < .001$. No significant differences in maternal talk were observed in boys vs. girls or first- vs. later-borns (all *p*s > .30). Moreover, maternal talk was uncorrelated with HI, indicating that variability in caregiver speech was not attributable to variation in SES in this primarily low-SES sample. Note that the estimates of MLU are lower than would be expected if morphemes were the units of analysis, but are comparable to those reported in an earlier study of maternal speech in Latina mothers that uses similar measures (Martinez, 1987).

Children's vocabulary showed significant gains from 18 (*M* = 50 words, *SD* = 50) to 24 months (*M* = 203, *SD* = 142), $t(26) = 6.5$, $p < .001$. The mean percentile was significantly below the 50th at 18 months (*M* = 33rd, *SD* = 21), but higher by 24 months (*M* = 44th, *SD* = 26). In the looking-while-listening task, children's mean RT decreased significantly between 18 (*M* = 1034 ms; *SD* = 163) and 24 months (*M* = 892 ms; *SD* = 153), $t(24) = 3.3$, $p < .003$, consistent with earlier research showing gains in processing speed across this period (Fernald, Pinto, Swingley, Weinberg & McRoberts, 1998; Fernald *et al.*, 2006). Vocabulary and RT at 18 and 24 months were uncorrelated with SES and did not reliably differ as a function of sex or birth order of child.

Maternal talk and children's vocabulary

As shown in Table 3, mothers' speech and children's vocabulary at 18 months were uncorrelated, most likely due to the fact that these children were just beginning growth in their productive vocabularies. In contrast, numbers of utterances and word tokens in mothers' speech at 18 months were significantly correlated with children's vocabulary at 24 months. These relations remained significant after controlling for child vocabulary at 18 months. Thus, variability in children's vocabulary was linked to the amount of language input experienced, over and above variance attributable to the child's vocabulary 6 months earlier. Spanish-learning children whose mothers used more words and utterances at 18 months also had larger increases in vocabulary from 18 to 24 months, consistent with studies of English-speaking mothers and infants (Hoff & Naigles, 2002).

Children's processing efficiency and vocabulary

While mean RT and vocabulary size were uncorrelated at 18 months, this correlation was significant at 24 months, $r(27) = -.55$, $p < .01$. Mean RT at 24 months was also associated with greater gains in vocabulary from 18 to 24 months, $r(27) = -.55$, $p < .01$. Grouping children by median mean RT, those with faster RTs knew more words at 24 months (*M* = 270, *SD* = 153) than did those with slower RTs (*M* = 141, *SD* = 100), $t(25) = 2.6$, $p < .01$. Faster children also showed significantly larger vocabulary gains from 18 to 24 months (*M* = 204 word change, *SD* = 124) than slower children (*M* = 106, *SD* = 101), $t(25) = 2.3$, $p < .05$. These findings are consistent with reports that efficiency in spoken word understanding and vocabulary growth are linked across the second year (Fernald *et al.*, 2006).

Maternal talk as predictor of processing efficiency

Maternal talk and child RT were uncorrelated at 18 months; however, measures of maternal talk were significantly correlated with children's RT at 24 months, accounting for 18–26% of the variance (Table 3). Relations remained in the same range after partialling out RT at 18 months, indicating that the influence of input on processing speed was over and above variance attributable to the child's own processing efficiency 6 months earlier. Thus, children whose mothers used more and more complex talk at 18 months were faster to process spoken language 6 months later. To illustrate, mothers were divided by median split into two groups, based on the number of word tokens in their child-directed speech at 18 months. As shown in Figures 1 and 2, those children whose mothers produced more words shifted from the distracter to the target picture sooner, resulting in significantly faster mean RTs, than did children with less talkative mothers, $t(25) = 3.5$, $p < .01$.

Overlapping vs. independent influences

In Figure 3, panel A shows the strength of the direct vs. indirect effects of maternal talk on vocabulary, with processing speed serving as a potential mediator. The total effect of maternal talk is .24, accounting for 14% of the variance ($p < .03$). However, the path coefficient is reduced substantially after controlling for processing speed (unique $r^2 = 4\%$, *ns*), suggesting that caregiver talk exerts an influence on vocabulary via processing speed. Panel B tests another scenario in which maternal talk influences processing speed with vocabulary as the mediating variable. The total effect of maternal talk is −.33 ($p < .01$), yet that relation is no longer significant after further controlling for vocabulary (unique $r^2 = 7\%$, *ns*). In both cases, the effects of maternal talk are significantly diminished with a mediator included in the model. These findings argue against a general explanation that links between processing speed and lexical development are reducible to their independent relations to caregiver talk, suggesting instead that language processing and vocabulary knowledge are synergistically related in the context of a unified learning system.

Discussion

This longitudinal study of the impact of Latina mothers' talk to Spanish-learning children revealed four major findings. First, there was substantial variability in maternal talk within this primarily low-SES sample, and these differences in language input were associated with children's vocabulary outcomes. The children of mothers who talked relatively more heard on average seven times more words, five times more utterances, three times more different words, and sentences that were twice as long as those heard by children of less talkative mothers. Those children who experienced more caregiver speech had larger vocabularies at 24 months and made greater gains in vocabulary compared to children whose mothers talked less. Because these links remained strong even after controlling for child variables at 18 months, these effects cannot be attributable to the child's own level of talkativeness. Second, children with larger vocabularies at 24 months were also faster to identify familiar words in fluent speech at that age. As in the Fernald *et al.* (2006) longitudinal study of English-learning infants in middle-class families, Spanish-learning children who had faster RTs at 2 years also had greater gains in vocabulary from 18 to 24 months, compared to children with slower RTs.

The third result was the discovery of a link between early language input and the development of speech processing efficiency by the child. The quantity and quality of caregivers' speech at 18 months, defined here in terms of four features of talk, predicted children's efficiency in spoken language understanding. Controlling for child RT at 18 months, those children whose mothers produced more words and more complex utterances during the play session at 18 months were significantly faster in an online comprehension task 6 months later than those children who had experienced less maternal talk. This finding provides the first evidence that

individual differences in the early efficiency of spoken word understanding are related to the language input children experience during day-to-day interactions.

These results show that the influence of children's early experiences with language goes beyond traditional measures of language competence: maternal talk is associated not only with children's vocabulary learning but also with the development of efficiency in real-time lexical processing. However, the most exciting result was that these relations represent primarily overlapping influences between maternal talk and child outcomes. While independent effects were not completely absent, we found that vocabulary knowledge and processing efficiency are interdependent, operating within a synergistic system of language learning (Fernald *et al.*, 2006).

We modeled this coupling in two ways. In the first model, processing speed mediates the relation between language input and children's vocabulary knowledge (Figure 3A). Maternal speech could facilitate vocabulary development because children who hear more caregiver talk are more practiced in skills directly implicated in word learning, such as parsing speech (Brent & Siskind, 2001), accessing semantic representations (Gershkoff-Stowe, 2002), or monitoring distributional cues to meanings or grammatical categories of words (Cameron-Faulkner, Lieven & Tomasello, 2003). Children with more experience in lexical access may require fewer exposures to a word to achieve the same level of lexical detail as children with less practice, and thus may have more resources available to interpret unfamiliar words later in the sentence. In these ways, efficiency in speech processing is shaped by children's early experiences with caregiver speech, accounting for the relation between input and vocabulary knowledge reported here and elsewhere.

The second model emphasizes a path of influence in the reverse direction: vocabulary knowledge mediates the relation between language input and processing speed (Figure 3B). More caregiver talk exposes children to more varied exemplars of words in context, yielding a richer database of lexical and morphosyntactic cues to meaning. Hearing more words enables children to encode increasingly subtle distinctions among lexical forms (Storkel, 2002), and to abstract higher-order lexical-semantic and morphosyntactic regularities that obtain within and across words (Marchman & Bates, 1994). As the lexicon grows, more refined processing skills are required to discriminate among words with phonetic overlap and other potentially confusable representations (Metsala & Walley, 1998). Increases in vocabulary size have also been linked to greater facility in word retrieval (Gershkoff-Stowe & Smith, 1997; Dapretto & Bjork, 2000), and to learning new words in a single exposure (Gershkoff-Stowe & Hahn, 2007). Thus, changes in the size and density of the lexicon could help to fine-tune speech processing skills.

These models are both consistent with the findings reported here. Together they suggest that early language input affects both processing efficiency and vocabulary knowledge, which are mutually influential in a bidirectional fashion. An increase in processing efficiency could enable faster word learning, while an increase in lexical knowledge could further sharpen the processing skills required to interpret increasingly complex and diverse strings of words. Thus vocabulary learning and fluency in lexical access act in interdependent ways within a unified system of language knowledge and real-time use. Earlier evidence of associations between these different aspects of linguistic ability left open the possibility that language processing skill and vocabulary knowledge emerge independently across this period (Fernald *et al.*, 2006). However, the common links to early language input demonstrated here suggest that lexical growth and increasing facility in online lexical comprehension work together to support language learning.

It is important to note that these effects were observed in a sample of primarily low-SES Spanish-speaking families. Within this restricted sample, we observed variation in maternal talk that was significantly predictive of child outcomes. However, it is not known whether caregiver talk would also relate to children's lexical processing efficiency in middle- or higher-SES families. Although previous work has found that variation in language input is associated with children's vocabulary development across a range of SES levels, this is the first study to explore associations between input and processing efficiency, and we focused on low-SES families. It could be that for children with fewer environmental opportunities, the influence of amount and diversity of caregiver speech on children's lexical processing is relatively greater than for children with more opportunities. This result would be analogous to the non-linear relations seen in studies investigating genetic and environmental contributions to IQ in which the effects of environmental factors are moderated by SES (e.g. Turkheimer, Haley, Waldron, D'Onofrio & Gottesman, 2003).

In sum, this study provides the first evidence that input from caregivers influences both vocabulary knowledge and lexical processing skills in ways that enable more efficient uptake of relevant information in the speech signal. While these findings focus on 18 to 24 months, richer early language experiences can provide cascading advantages to the young language learner, enhancing the efficiency with which children apprehend the fine-grained regularities that underlie the structure of their native language and form the foundation for continued lexical and grammatical growth. Indeed, a recent longitudinal study found that speed of spoken word recognition and vocabulary knowledge at 25 months are related to cognitive and language outcomes at 8 years of age (Marchman & Fernald, 2008), showing that early processing efficiency has long-term predictive validity. Of course, there are many other dimensions of early interactions with caregivers beyond features of their child-directed speech that also influence language learning, such as perspective-taking ability and emotional support (Hart & Risley, 1995; Hoff, 2006). And there are many other skills important to language learning beyond speech processing efficiency that are presumably also strengthened through interactions with attentive caregivers, such as the ability to attend to and encode relevant aspects of visual scenes in relation to spoken language. Nevertheless, the current findings highlight the role of caregiver talk in shaping children's access to and efficient processing of information in the service of learning language.

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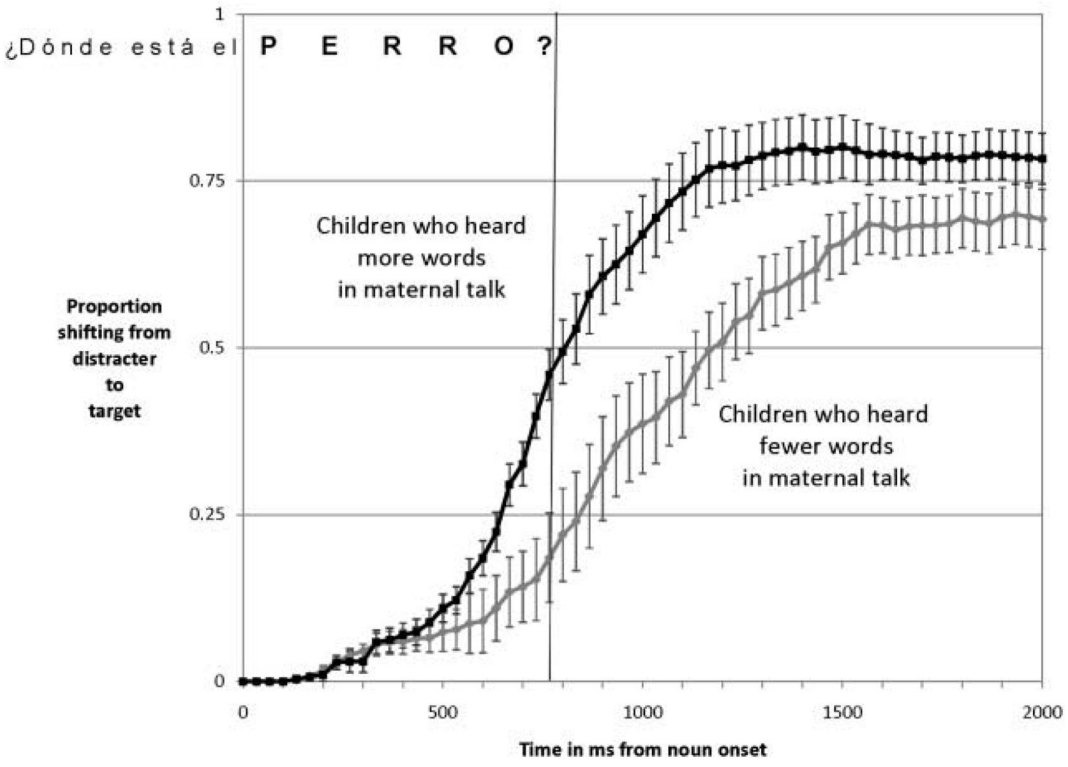

Figure 1.

Mean proportion of trials on which children shift their gaze from the distracter to the target picture at 24 months as a function of time (in ms) from the onset of the target noun. Based on a median split of word tokens produced by the mother during the play session at 18 months, the top line represents the time course of shifting for those children who heard more words at 18 months; the lower line shows proportion shifting for those children who heard fewer words at 18 months. Solid vertical line represents target noun offset; error bars represent *SE*s over participants.

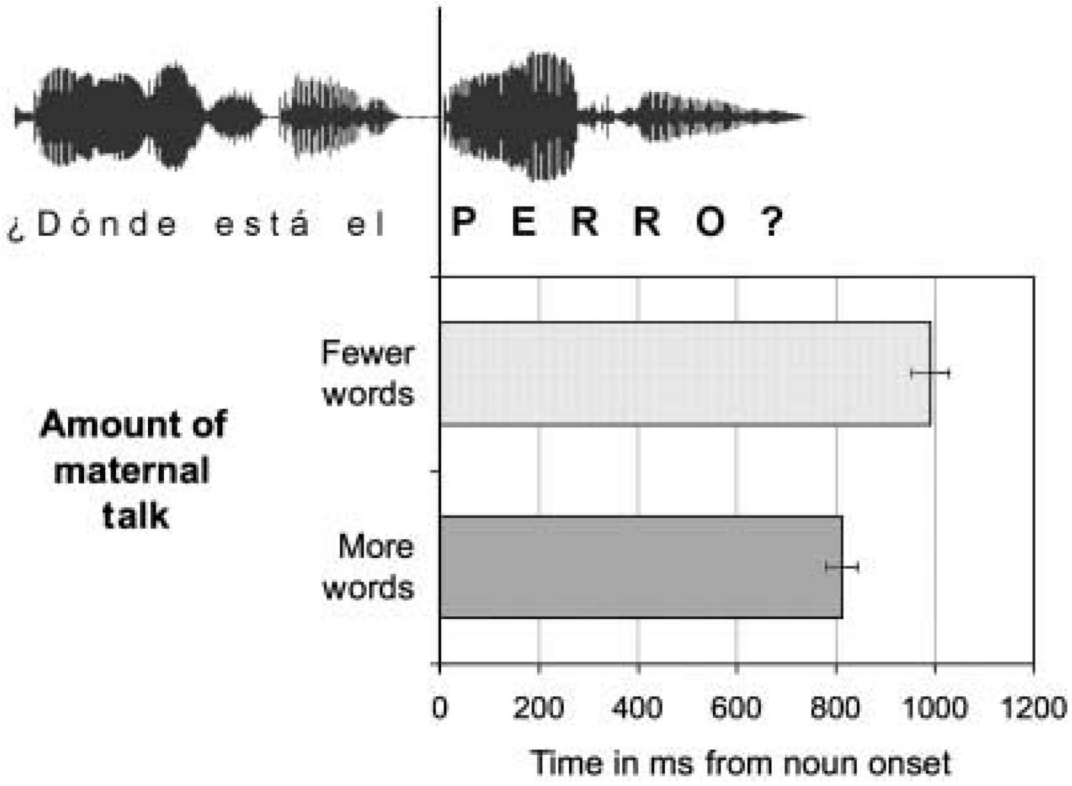

Figure 2.

Children's mean reaction time (in ms) to initiate a shift in gaze from the distracter to the named target picture at 24 months as a function of amount of maternal talk. Mothers were divided by median split based on number of word tokens produced during the play session at 18 months. Children of mothers who used more words were significantly faster to identify familiar words in online comprehension task at 24 months. The graph is aligned with an amplitude waveform of one of the stimulus sentences; error bars represent *SE*s over participants.

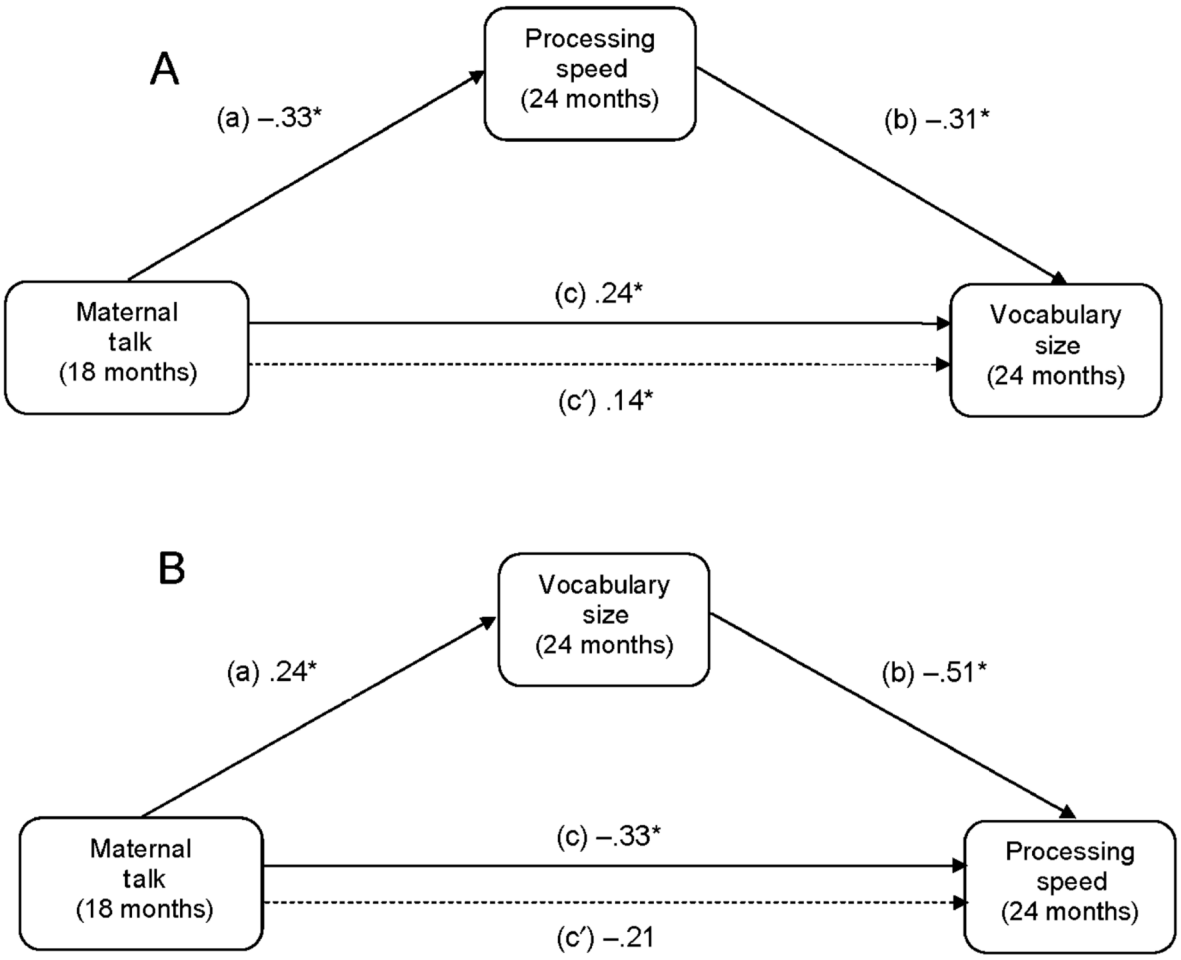

Figure 3.

Summary of regression analyses of links between maternal word tokens at 18 months and child vocabulary and processing speed at 24 months, controlling for child vocabulary at 18 months. Unstandardized coefficients are reported for direct and indirect relations between maternal talk and vocabulary (Panel A) and processing speed (Panel B). In both models, (a) presents the path coefficients for maternal talk and the potential mediator, (b) shows the unique relation between the mediator and the dependent variable, (c) gives the total effect of maternal talk on the dependent variable, and finally, (c′) presents the direct effect of maternal talk after the mediator has been included in the model. Dashed lines represent non-significant effects. In both cases, non-parametric bootstrapping estimation with bias corrected confidence intervals (BC CIs; Preacher & Hayes, in press) indicated that the indirect effects (i.e. c – c′) were significantly greater than zero ($p < .05$), supporting the interpretation of mediation (Panel A: point estimate = .13, CI: .01 to .38; Panel B: point estimate = −.12, CI: −.01 to −.37).

Table 1

Demographic characteristics of sample: n *(%)*

	Mother *n* (%)	Father *n* (%)
Education[a]		
Less than elementary school	0 (0)	2 (7)
Completed elementary school	5 (19)	4 (15)
Less than high school	9 (33)	8 (30)
Completed high school	5 (19)	5 (18)
Some college	4 (15)	4 (15)
College degree	4 (15)	3 (11)
Not available	0 (0)	1 (4)
Occupation		
Not employed outside the home	21 (78)	0 (0)
Non-skilled	4 (15)	14 (52)
Semi-skilled	2 (7)	8 (30)
Semi-professional	0 (0)	2 (7)
Professional	0 (0)	2 (7)
Not available	0 (0)	1 (4)

	Family *n* (%)
Annual Income	
≤ $25,000	16 (60)
≤ $50,000	9 (33)
> $50,000	2 (7)
SES: Social Stratum (HI)[b]	
Unskilled laborers, HI = 8–19	13 (48)
Semi-skilled workers, HI = 20–29	6 (22)
Skilled/clerical workers, HI = 30–39	5 (19)
Minor professionals, HI = 40–54	1 (4)
Major professionals, HI = 55+	2 (7)

Notes:

[a] Maternal and paternal education: primaria '*primary*' = 0–6 years; secundaria '*secondary*' = 7–9 years; preparatoria '*preparatory*' = 10–12 years; universidad '*university*' = 13–18 years.

[b] Hollingshead Four-Factor Index of Social Status (range = 8–66).

Table 2

Measures of maternal talk during play session at 18 months

Maternal talk	*M*	*SD*	Range
Number of utterances	210.6	58.0	67–350
Word tokens	609.1	219.8	168–1204
Word types	110.5	26.6	54–191
MLU[a]	2.9	0.5	2.2–4.4

Note:

[a]Mean length of utterance (in words).

Table 3

First-order and partial correlations between maternal talk at 18 months and child outcomes at 18 and 24 months

	Vocabulary[a]			RT[b]	
Maternal talk	**18 mos**	**24 mos**	**Δ from 18–24 mos[c]**	**18 mos**	**24 mos**
# Utterances	.11	.37[#]/.38*	.39*	−.24	−.36[#]/−.32
# of Words	.08	.42*/.45*	.45*	−.19	−.48*/−.47*
Word types	.25	.36[#]/.28	.32	−.10	−.46*/−.51*
MLU[d]	.07	.24/.24	.25	.04	−.40*/−.43*

Notes:

[#] $p < .07$;

* $p < .05$;

** $p < .01$.

[a] Reported words produced on the MacArthur-Bates *Inventario del Desarrollo de Habilidades Comunicativas: Inventario II* (Jackson-Maldonado *et al*., 2003). Second number in each pair is partial correlation controlling for child vocabulary at 18 months.

[b] Mean latency to shift to target picture. Second number in pair is partial correlation controlling for child RT at 18 months.

[c] Mean change in vocabulary from 18 to 24 months.

[d] Mean length of utterance (words).