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(Baby)Talk to Me: The Social Context of Infant-Directed Speech and Its Effects on Early Language Acquisition

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Abstract

Since the mid-20th century, scientists have observed unique features in speech, facial expression, and content directed to infants and toddlers in comparison to speech directed to adults. Whereas much research has studied the characteristics of so-called infant-directed speech and speculated about its significance for language learning, research directly testing these ideas has been more limited until recently. Studies now suggest that infant-directed speech (a) promotes infant attention to language, (b) fosters social interaction between infants and caregivers, and (c) informs infants about various aspects of their native language by heightening distinctions relative to the speech addressed to adults. New developments focusing on the social role of infant-directed conversational interactions highlight the importance of caregiver responsiveness to the infant. Building a communicative foundation even prior to the time language emerges is crucial for fostering language development.

Keywords

language development, infancy, mother-infant interaction, infant-directed speech

It has long been recognized that caregivers speak differently to children than to other adults, and this has important implications for infant development (Saint-Georges et al., 2013; Soderstrom, 2007). This specialized speech register (henceforth infant-directed speech, or IDS) is contrasted with adult-directed speech (ADS) by a variety of properties including higher and more variable pitch, limited vocabulary, shorter utterances, and vowel alterations (e.g., Fernald et al., 1989). Recently, there has been a growing focus on the other behaviors that accompany IDS, such as caregiver responsiveness (Goldstein & Schwade, 2008; Kuhl, 2007). IDS is found across many cultures (e.g., Fernald et al., 1989; Soderstrom, 2007), though not all (e.g., Schieffelin & Ochs, 1983), and in sign languages (Reilly & Bellugi, 1996). It is used by both women and men (Golinkoff & Ames, 1979) and even young children when addressing infants (Soderstrom, 2007).

Its widespread use has led researchers to postulate that IDS plays a critical role in the process of language development. Fernald (1992) argued that this register has biological roots in the desire of a parent to comfort a child from a distance. This is supported by emotional characteristics of IDS that are also found in speech to others to whom we show affection, such as the elderly or even household pets (Soderstrom, 2007).

Most of the evidence for the causal role that IDS might play in language learning has been indirect and correlational. However, there is now enough research to support infants' use of IDS as a language-learning tool.

Quantity Versus Quality: Why Does Infant-Directed Speech Matter?

A body of research has shown that the total amount of speech heard by an infant is highly correlated with

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language outcomes. Children whose parents talk less to them—and there is wide variability—tend to have smaller vocabularies by age 3. This difference is highly correlated with socioeconomic status and academic achievement (e.g., Hart & Risley, 1995; Rowe, 2012). Known as the "30 million word gap," it has been the impetus behind social programming initiatives (e.g., Providence Talks; http://www.providencetalks.org) and even a new technology (the LENA system; Greenwood, Thiemeann-Bourque, Walker, Buzhardt, & Gilkerson, 2011) focused on measuring the quantity of language input. Yet if hearing language was all that mattered, children could be set in front of a television or radio to learn their native tongue. Equally at odds with the quantitative focus is the finding that bilingual children hear about half the input in each of their languages compared to monolinguals and become fluent speakers nonetheless (Gauthier & Genesee, 2011). We argue instead that quality of language input is of primary importance. By quality, we refer not only to the structural characteristics of the IDS register, but also the accompanying manner in which the adult and child engage in "conversational duets" (Hirsh-Pasek et al., 2015) that build upon the child's interests. We first discuss the perceptual-attentional and linguistic effects of IDS and then the social context in which it often occurs.

Perceptual-Attentional Effects of IDS

Before infants can learn language, they must attend to it and discriminate it from other environmental sounds. From birth, babies prefer to listen to IDS over ADS (Soderstrom, 2007). IDS increases the salience of language input, probably because of its variability relative to adult-directed speech and because it reflects positive emotions ("happy talk" and exaggerated facial expressions; Singh, Morgan, & Best, 2002; Tamis-LeMonda, Kuchirko, & Song, 2014). When IDS does not reflect positive emotions—as in depressed mothers' speech—infants are less likely to engage in the associative learning necessary for language development (Kaplan, Bachorowski, Smoski, & Hudenko, 2002). The positive emotion conveyed by IDS is also reflected in the avoidance of negative facial expressions in infant-directed sign language (Reilly & Bellugi, 1996) and the avoidance of negative-sounding tonal changes in Chinese IDS (Grieser & Kuhl, 1988), at the risk of altering the meaning of utterances.

These attentional findings are supported by research using neurological and brain imaging methods showing that IDS results in more brain activation than ADS—for example, in infants' left and right temporal areas (Naoi et al., 2012) and frontal lobes (Saito et al., 2007). IDS elicits increased neural activity (i.e., larger event-related potential responses) from both 6- and 13-month-olds between 600 and 800 milliseconds (N600–800), which is related to attentional processing (Zangl & Mills, 2007). For the 6-month-olds, this occurred mainly for familiar words, whereas for the older group, familiar or unfamiliar words triggered increased activity. In addition, event-related potential responses to IDS from 200 to 400 milliseconds (N200–400)—linked to word meaning—were larger than they were to ADS only for the familiar words in the left temporal and parietal regions of 13-month-old infants. This suggests that the effect of IDS on cerebral function may change with age and experience.

Linguistic Effects of IDS

IDS also impacts language learning in structural ways. One of the most widely cited characteristics of IDS speech is the expanded "vowel triangle" (see Fig. 1). When plotted in perceptual space, vowels in IDS are farther apart than the same vowels in ADS. This larger acoustic difference has been argued to simplify infants' task of constructing vowel categories (Kuhl et al., 1997; although cf. McMurray, Kovack-Lesh, Goodwin, & McEchron, 2013). Recent work has suggested that IDS may help with clarity of consonants as well. Five and 13-month-old children whose caregivers produced clear, hyperarticulated /s/ sounds better discriminated /s/ from another sound (Cristia, 2011).

IDS's exaggerated intonational characteristics highlight the structural properties of utterances and provide information about how speech "chunks" together. These properties affect infants' organization of, and memory for, speech. For example, 9-month-olds prefer to hear artificial pauses at grammatical boundaries over pause insertions at non-boundaries, but only for IDS and not ADS speech stimuli (Kemler Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989). Similarly, infants can segment artificial speech with IDS characteristics, but not when the stimuli are produced in ADS (Thiessen, Hill, & Saffran, 2005). Other linguistic properties of IDS, such as the preponderance of questions, may also serve to highlight these chunks and syntactic regularities in the language (Soderstrom, Blossom, Foygel, & Morgan, 2008). Finally, the amount of IDS, but not ADS, predicted vocabulary growth in a population of Spanish-speaking American immigrants (Weisleder & Fernald, 2013).

IDS also enables 21-month-old children (and adults; Golinkoff & Alioto, 1995) to learn new words that they could not learn in ADS (Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011), and younger infants better remember words they have heard spoken in IDS (Singh, Nestor, Parikh, & Yull, 2009). When manipulated separately, these effects appear to be driven by slower speaking rate and vowel characteristics but not melodic properties of intonation (Song, Demuth, & Morgan, 2010).

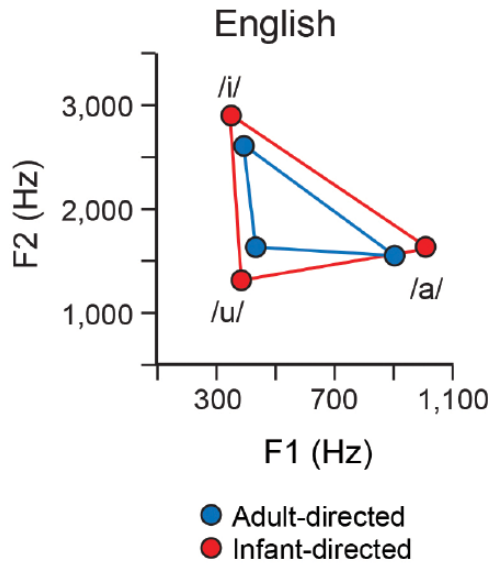

Fig. 1. An example "vowel triangle" in which the vowel sounds (the /i/ in *see*, the /a/ in *saw*, and the /u/ in *Sue*) are articulated more distinctly via infant-directed speech. The "acoustic stretching" of the F1 and F2 formants (bands of acoustic frequencies of high energy) creates a larger vowel triangle for infant-directed speech than adult-directed speech, and infants might benefit from this exaggeration.

IDS Is Not Used in Isolation but in a Social Context

Infants experience language in a social context. Middle-class mothers work hard to maintain and repair the conversational flow when conversing with infants (Golinkoff, 1986; Snow, 1977). Kuhl (2007) coined the term *social gating* to describe how the social interactions in which language is encountered fuel infants' acquisition of language-specific knowledge. For example, English-learning infants maintained sensitivity to Chinese phonemes when interacting directly with a Chinese speaker but not when the same information was presented via a television screen, disrupting the social contingency (Kuhl, Tsao, & Liu, 2003).

Contingent social interaction also affects the quality of vocalizations infants produce. Nine-month-olds produce more linguistically mature vocalizations when mothers respond contingently to their babbling than when mothers are signaled by researchers to include a delay (Goldstein & Schwade, 2008). In studies with real-world recordings, infants' vocalizations more closely approximated speech after responses from their caregivers (Warlaumont, Richards, Gilkerson, & Oller, 2014). Infants and mothers dynamically respond to each other's speech characteristics (Ko, Seidl, Cristia, Reimchen, & Soderstrom, 2015); in mother-infant dyads, their pitch characteristics showed greater similarity within rather than across a conversation. Even premature infants are sensitive to social context and will vocalize in the neonatal intensive care unit significantly more when a parent is present (Caskey, Stephens, Tucker, & Vohr, 2011). These studies suggest that the behaviors associated with IDS—such as increased caregiver responsiveness—may well be at play in fostering infants' language knowledge (Bornstein, Tamis-LeMonda, & Haynes, 1999; Weisleder & Fernald, 2013).

New research has suggested that infants are not just passive recipients of IDS but agents in their own language learning. Ko et al. (2015) found that infants' own utterances are more mature (longer in duration and with shorter response latencies) in conversations initiated by the infant than in those initiated by the mother. Furthermore, infants actively recruit their partners' participation (Begus, Gliga, & Southgate, 2014). When an adult responds to an infant's pointing and demonstrates a function for that referent object, infants are more likely to learn the function than when the adult demonstrates the function of another object the infant did not point to. These findings have begun to identify the mechanism behind the established link between infant pointing and vocabulary acquisition (Rowe & Goldin-Meadow, 2009): contingent responding by the adult to the child's focus of interest.

When parental behavior is time-locked to infants' behavior (contiguous), when it is contingent or dependent on infants' contribution to the "conversation," and when it entails the multimodal input (verbal, emotional, and physical cues) associated with IDS, it promotes language learning in a variety of ways (Tamis-LeMonda et al., 2014). Indeed, if it is contingent and meaningful, toddlers can even learn new words from video conversations over Skype. They do not learn from matched, non-contingent video conversations (Roseberry, Hirsh-Pasek, & Golinkoff, 2014).

A recent study examining the relationship between the quality of language input, as measured by the fluency and connectedness of mother-infant conversations, and language outcomes drives home the importance of social context. Hirsh-Pasek et al. (2015) coded the communicative interaction co-constructed between parent and child in a low-income sample at 24 months. Quality accounted for more of the variance in language outcomes a year later than did the quantity of the language children heard. Thus, even among this low-income sample, there were children who excelled in language if they participated in conversational duets with caregivers.

Language learning is therefore powered by the shared social relationship between infants and caregivers, with infants' active participation in the conversation and maternal responsiveness to that participation being key elements in the acquisition process.

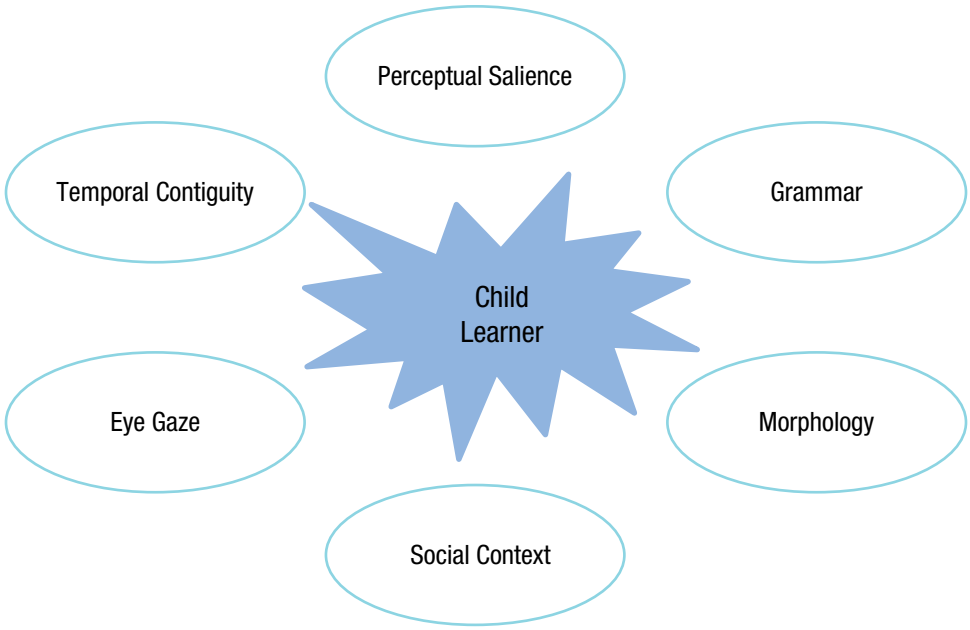

Fig. 2. A graphic representation of the emergentist coalition model of word learning (Hollich, Hirsh-Pasek, & Golinkoff, 2000). Various cues are always available to children in the input; however, children cannot access all of these cues at the start of word learning. As more cues come on-line, they have the effect of changing the process of word learning.

Infants' Use of IDS Changes Across Development

The infant's ability to use the social information that accompanies IDS changes across development. Hollich, Hirsh-Pasek, and Golinkoff (2000) and Pruden, Hirsh-Pasek, Golinkoff, and Hennon (2006) showed how 10-month-old infants initially fail to appreciate that cues like eye gaze and object holding signal an adult's intention to name one of two particular objects. Thus, even though IDS may be available, infants cannot harness it or its associated properties for word learning until at least 12 months.

Thirty years ago, Bohannon and Hirsh-Pasek (1984) argued that IDS served a series of nonlinear functions in its significance for infants' language learning. That is, what is useful for infants at one point in their language-learning trajectory changes as they progressively crack more of the code. This perspective is mirrored in the emergentist coalition model of word learning (Hollich et al., 2000, see Fig. 2): Although many cues are available to infants, they access different cues at different developmental points. Rowe (2012) essentially validated this perspective in a longitudinal study on vocabulary development. Rowe found that the quantity and quality (measured in this case as word diversity) of caregiver input, controlling for SES, matter differentially across the first 3 years of life. Quantity of input was most important during the 2nd year, whereas quality mattered most in the 3rd year.

In sum, IDS serves a number of important functions. Given its exaggerated perceptual qualities, it is an attractor for infants' attention, influencing the time they spend listening to language. Indeed, a failure to prefer IDS over nonspeech analogs (as seen in autism) predicts that language development will be seriously disrupted (Kuhl, Coffey-Corina, Padden, & Dawson, 2005). As its use is embedded in social relationships, IDS may become associated with positive interactions that both foster the burgeoning relationships between adults and infants and promote infants' analysis of the linguistic stream. Finally, IDS's acoustic properties, in the context of its exaggerated features and its role as a carrier of social information, heighten infants' ability to extract linguistic regularities.

Implications of Using IDS and Its Social Context: Future Directions

The evidence showing ties between the use of IDS and child language outcomes supports decades of research showing that IDS has perceptual, social, and linguistic significance for infants learning language. The question now is not whether IDS has a role in language development but rather how and when its properties influence language learning. Answers to these questions will be nuanced. For example, as infants transition to utilizing linguistic information, IDS appears to decline in prominence and likely infants' dependence on it. Recent work

on the role of caregiver responsiveness has also highlighted the importance of the conversational context in which IDS is heard. One important question is the extent to which these roles can be teased apart: Is it IDS or the social context that surrounds its use that influences language acquisition? And how mutually dependent are these properties of adult-infant communication?

Greater attention should be directed to understanding the relationship between quality and quantity of language input, as well as different forms of input, such as speech from non-native speakers. Similarly, the relationship between socioeconomic status and the use of IDS has not been sufficiently explored.

To conclude, the research suggests that parents who engage in IDS promote their children's learning of language. While the precise mechanisms behind the facilitating effect of IDS need to be further explored, it is clear that IDS supports infants' attention to the speech stream and helps highlight some of the linguistic elements children need to uncover in the language they hear. Furthermore, the social context in which IDS is embedded, as well as the infants' role in soliciting it, beg for further consideration.

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