Child language experience in a Tseltal Mayan village

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Abstract

We analyzed 9–11-hour at-home audio recordings from 10 Tseltal Mayan children between 0;2 and 3;0 to investigate how often they engaged in verbal interaction with others and whether their speech environment changed with age, time of day, household size, and number of speakers present. We found that Tseltal children are not often directly spoken to, that most directed speech comes from adults, and that directed speech does not increase with age. Most of children's directed speech came in the mornings or early evenings, particularly with younger children, and high interactional peaks tended to occur in bursts of turn taking that lasted approximately one minute. With some exceptions, these findings support previous characterizations of Mayan caregiver-child talk. An initial analysis of children's vocal development suggests that, despite relatively little directed speech, these children develop early language skills on a similar timescale to WEIRD children. Given these findings, we discuss multiple proposals for how Tseltal children might be efficient learners.

Keywords: Child-directed speech, linguistic input, non-WEIRD, vocal maturity, turn taking, interaction, Mayan

Word count: X

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Introduction

A great deal of work in developmental language science revolves around one central question: What linguistic evidence is needed to support first language acquisition? In pursuing this topic, many researchers have fixed their sights on the quantity and characteristics of speech addressed to children; that is, speech designed for young recipients who may have limited attention and understanding (e.g., Golinkoff, Can, Soderstrom, & Hirsh-Pasek, 2015; Hoff, 2006). In several languages, child-directed speech (CDS[1]) has been demonstrated to be distinct from adult-directed speech (ADS) in that it is linguistically adapted for young listeners (Cristia, 2013; Soderstrom, 2007), interactionally rich (Bruner, 1983; Butterworth, 2003; Estigarribia & Clark, 2007; Masataka, 2003), and preferred by infants (Cooper & Aslin, 1990; ManyBabies Collaborative, 2017; Segal & Newman, 2015). In those same linguistic communities, these properties of CDS have been found to facilitate early word learning (e.g., Cartmill et al., 2013; Hirsh-Pasek et al., 2015; Hoff, 2003; Hurtado, Marchman, & Fernald, 2008; Rowe, 2008; Shneidman & Goldin-Meadow, 2012; Shneidman, Arroyo, Levine, & Goldin-Meadow, 2012; Weisleder & Fernald, 2013). However, ethnographic reports from a number of traditional, non-Western communities suggest that children easily acquire their community's language(s) even when they are only infrequently directly addressed (P. Brown, 2011). If so, frequent CDS may not be essential for learning language; just useful for facilitating certain aspects of language development. In this paper we investigate the language environment and early development of 10 Tseltal Mayan children growing up in a community where caregivers have been reported to infrequently directly address speech to infants and young children (P. Brown, 1998, 2011, 2014).

[1]Throughout this article, we use "child-directed speech" and "CDS" in the most literal sense: speech designed for and directed toward a child recipient.

Child-directed speech

Prior work on CDS in Western contexts has shown that the amount of CDS children hear influences their language development; more CDS is associated with larger and faster-growing receptive and productive vocabularies (e.g., Hart & Risley, 1995; Hoff, 2003; Hurtado et al., 2008; Peter, Durrant, Bidgood, Pine, & Rowland, in preparation; Ramírez-Esparza, García-Sierra, & Kuhl, 2014, 2017; Shneidman & Goldin-Meadow, 2012; Shneidman et al., 2012; Weisleder & Fernald, 2013). CDS has also been linked to young children's speed of lexical retrieval (Hurtado et al., 2008; Weisleder & Fernald, 2013; but see Peter et al., in preparation) and syntactic development (Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). The conclusion drawn from much of this work is that speech directed to children is well designed for learning words—especially concrete nouns—because it is optimized for a child's attention in the moment the words are uttered. Indeed, infants and young children prefer listening to attention-grabbing CDS over ADS, even outside of first-person interaction (ManyBabies Collaborative, 2017). There are, however, a few significant caveats to this body of work relating CDS quantity to language development.

First, while there is overwhelming evidence linking CDS quantity to vocabulary size, links to grammatical development are more scant (e.g., Brinchmann, Braeken, & Lyster, 2019; Frank, Braginsky, Marchman, & Yurovsky, in preparation; Huttenlocher et al., 2010). While the advantage of CDS for referential word learning is clear, it is less obvious how CDS facilitates syntactic learning. For example, utterance length (a proxy for syntactic complexity; Wasow, 1997) doesn't appear to increase with child age (Newport, Gleitman, & Gleitman, 1977), and parents may be less likely to directly correct their children's syntactic errors than their semantic ones (R. Brown, 1977; but see Chouinard & Clark, 2003)—sometimes themselves producing ungrammatical utterances to make individual words salient (Aslin, Woodward, LaMendola, & Bever, 1996). On the other hand, there is a wealth of evidence that syntactic knowledge is lexically specified (e.g., Arnold, Wasow, Asudeh, & Alrenga, 2004; Goldberg, 2003; Lieven, Pine, & Baldwin, 1997), and that, crosslinguistically,

children's vocabulary size is one of the most robust predictors of their early syntactic development (Bates & Goodman, 1997; Frank et al., in preparation; Marchman, Martínez-Sussmann, & Dale, 2004). In short, what is good for the lexicon may also be good for syntax. For now, however, the direct link between CDS and grammatical development still needs further exploration (see also Yurovsky, 2018).

A second caveat is that most work on CDS quantity uses summary measures that average over the ebb and flow of interaction (e.g., proportion CDS). In both child and adult interactions, verbal behaviors are highly structured: while some occur at fairly regular intervals ("periodic"), others occur in shorter, more intense bouts separated by long periods of inactivity ("bursty"; Abney, Dale, Louwerse, & Kello, 2018; Fusaroli, Razczaszek-Leonardi, & Tylén, 2014). For example, Abney and colleagues (2017) found that, across multiple time scales of daylong recordings, both infants' and adults' vocal behavior was clustered. Focusing specifically on lexical development, Blasi and colleagues (in preparation) found that nouns and verbs were used burstily in child-proximal speech across all six of the languages in their typologically diverse sample. Infrequent words were somewhat more bursty overall, leading them to propose that burstiness may play a key and universal role in acquiring otherwise-rare linguistic units. Experiment-based work also shows that two-year-olds learn novel words better from a massed presentation of object labels versus a distributed presentation (Schwab & Lew-Williams, 2016; but see Ambridge, Theakston, Lieven, & Tomasello, 2006 and Childers & Tomasello, 2002). These structured temporal characteristics in children's language experience imply new roles for attention and memory in language development. Ideally, then, we should be investigating how CDS is distributed over children's daily experiences (Soderstrom & Wittebolle, 2013).

Finally, prior work has typically focused on Western (primarily North American) populations, limiting our ability to generalize these effects to children acquiring language worldwide (P. Brown & Gaskins, 2014; Henrich, Heine, & Norenzayan, 2010; Lieven, 1994; Nielsen, Haun, Kärtner, & Legare, 2017). While we do gain valuable insight by looking at

within-population variation (e.g., different socioeconomic or sub-cultures), we can more effectively find places where our assumptions break down by studying new populations. Linguistic anthropologists working in non-Western communities have long reported that caregiver interaction styles vary immensely from place to place, with some caregivers using little child-directed speech with young children (P. Brown & Gaskins, 2014; Gaskins, 2006; Lieven, 1994; Ochs & Schieffelin, 1984). Children in these communities reportedly acquire language with "typical"-looking benchmarks. For example, they start pointing and talking around the same time we would expect for Western middle-class infants (P. Brown, 2011, 2014; P. Brown & Gaskins, 2014; Liszkowski, Brown, Callaghan, Takada, & De Vos, 2012; but see Salomo & Liszkowski, 2013). These findings have had little impact on mainstream theories of word learning and language acquisition, partly due to a lack of directly comparable measures (P. Brown, 2014; P. Brown & Gaskins, 2014). If, however, children in these communities do acquire language without delay, despite infrequent CDS, we must reconsider what kind of linguistic evidence is necessary for children to learn language.

Language development in non-WEIRD communities

A growing number of researchers are using methods from developmental psycholinguistics to describe the language environments and linguistic development of children growing up in traditional and/or non-Western communities (see also Barrett et al., 2013; Demuth, Moloi, & Machobane, 2010; Fortier, Kellier, Fernández Flecha, & Frank, under review; Ganek, Smyth, Nixon, & Eriks-Brophy, 2018; Garcia, Roeser, & Höhle, 2018; Hernik & Broesch, 2018). We briefly highlight two recent efforts along these lines, but see Cristia and colleagues' (2017) and Mastin and Vogt's work (2016; 2015) for similar examples.

Scaff, Cristia, and colleagues (2017; in preparation) have used a number of methods to estimate how much speech children hear in a Tsimane forager-horticulturalist population in the Bolivian lowlands. From daylong audio recordings, they estimate that Tsimane children between 0;6 and 6;0 hear maximally ~4.8 minutes of directly addressed speech per hour,

regardless of their age (Cristia et al., 2017; Scaff et al., in preparation). For comparison, children from North American homes between ages 0;3 and 3;0 are estimated to hear ~11 minutes of CDS per hour in daylong recordings (Bergelson et al., 2019). Note however, that these estimates from from a non-random sample of clips that were selected based on the presence of adult speech.

Shneidman and colleagues (2010; 2012) analyzed speech from one-hour at-home video recordings of children between ages 1;0 and 3;0 in two communities: Yucatec Mayan (Southern Mexico) and North American (a major U.S. city). Their analyses yielded four main findings: compared to the American children, (a) the Yucatec children heard many fewer utterances per hour, (b) a much smaller proportion of the utterances they heard were child-directed, (c) the proportion of utterances that were child-directed increased dramatically with age, matching U.S. children's CDS proportion by 3;0, and (d) most of the added CDS came from other children (e.g., older siblings and cousins). They also demonstrated that the lexical diversity of the CDS they hear at 24 months—particularly from adult speakers—predicted children's vocabulary knowledge at 35 months.

The current study

We examine the early language experience of 10 Tseltal Mayan children under age 3;0. Prior ethnographic work suggests that Tseltal caregivers do not frequently directly speak to their children until the children themselves begin to actively initiate verbal interactions (P. Brown, 2011, 2014). Nonetheless, Tseltal children develop language with no apparent delays. Tseltal Mayan language and culture has much in common with the Yucatec Mayan communities Shneidman (2010; 2012) reports on.[2] We provide more details on this community and dataset in the Methods section.

We analyzed basic measures of Tseltal children's language environments including: (a) the quantity of speech directed to them, (b) the quantity of other-directed speech they could

[2]For a review of comparative work on language socialization in Mayan cultures, see Pye (2017).

potentially overhear from nearby speakers, (c) the rate of contingent responses to their vocalizations, (d) the rate of their contingent responses to others' vocalizations, and (e) the duration of their interactional dyadic sequences. We link these findings to prior work on speech environment and development, and roughly estimated the number of minutes per day children spent in "high turn-taking" interaction. We also outline a basic trajectory for early vocal development (i.e., from non-canonical babbles to multi-word utterances).

Based on prior work, we predicted that Tseltal Mayan children are infrequently directly addressed, that the amount of CDS and contingent responses they hear increases with age, that most CDS comes from other children, and that, despite this, their early vocal development is on par with Western children. We additionally predicted that children's language environments would be bursty—that high-intensity interactions would be brief and sparsely distributed throughout the day, accounting for the majority of children's daily CDS.

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