Child language experience in a Tseltal Mayan village

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Abstract

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Introduction

A great deal of work in developmental language science revolves around one central question: What linguistic evidence (i.e., what types and how much) is needed to support first language acquisition? In pursuing this topic, many researchers have fixed their sights on child-directed speech (CDS), showing that it is linguistically distinctive (REFS)[**TASK 00: Add missing references**], interactionally rich (REFS), preferred by infants (REFS), and—perhaps most importantly—facilitates word learning (REFS). One might then conclude that CDS is an essential component for acquiring a first language. Yet ethnographic reports from a number of traditional, non-Western communities suggest that children easily acquire their community's language(s) with little or no CDS (REFS). If so, 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 that reportedly uses very little CDS with infants and young children (REFS Brown).

Child-directed speech

The amount of CDS children hear influences their language development, particularly their vocabulary (REFS). For example, [**TASK 01: Add examples of input-vocab link**]. CDS has also been linked to young children's speed of lexical retrieval (REFS Weisleder; LuCiD) and syntactic development (REFS Huttenlocher). [**TASK 02: Read Huttenlocher and add details here**]. The conclusion drawn from much of this work is that CDS is an ideal register for learning words—especially concrete nouns and verbs—because it is tailored to maximize a child's moment-to-moment interest and understanding (REFS). Indeed, even outside of first-person interaction, infants and young children prefer listening to CDS over adult-directed speech (REFS ManyBabies, etc.), suggesting that CDS is useful in catching, maintaining, and focusing children's attention.

There are, however, a few significant caveats to the 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 (REFS: Huttenlocher; Frank et al.). Children must master the systemic underpinnings of their language(s), e.g., the phonology, morphology, and syntax. While the advantage of CDS for referential word learning is clear, it is less obvious how CDS facilitates syntactic learning. [**TASK 03: Add argument from Yurovsky paper + refrences therein**] On the other hand, there is a wealth of evidence that both children and adults' syntactic knowledge is highly lexically specified (REFS), and that, crosslinguistically, children's vocabulary size is one of the most robust predictors of their early syntactic development (REFS). In short, what is good for the lexicon may also be good for syntax. For now, however, the link between CDS and other aspects of grammatical development still needs to be more thoroughly tested.

Second, [**TASK 04: Add paragraph on burstiness**]

Third, prior work has typically focused on Western (primarily North American) populations, limiting our ability to generalize these effects to children acquiring language worldwide (REFS: WEIRD; Lieven, 1994). While we do gain valuable insight by looking at *within-population* variation (e.g., REFS), 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 or no CDS to young children (REFS Gaskins, 2006). Children in these communities reportedly acquire language with 'typical'-looking benchmarks. For example, they start pointing (REFS Liszkowski) and talking (REFS Rogoff et al., 2003?; Brown??) around the same time we would expect for Western middle-class infants. If indeed these children acquire language without delay despite little or no CDS, it forces us to reconsider what kind of linguistic evidence is necessary for children to learn language.

Language development in non-WEIRD communities

To our knowledge, only a handful of researchers have used methods from developmental psycholinguistics to describe the language environments and linguistic development of children growing up in traditional, non-Western communities. We focus here on *quantitative* language development measures because the key claims about CDS and linguistic development are themselves quantitative in nature. We briefly highlight two recent efforts along these lines, but see Cristia et al. (2017) for a recent review.

Scaff, Cristia, and colleagues (REFS 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. Their daylong recordings show that Tsimane' children between 0;6 and 6;0 hear around 5 minutes of CDS per hour, with no evidence of age-related change. For comparison, children from North American homes between 0;3 and 3;0 are estimated to hear around 11 minutes of CDS per hour in daylong recordings (REFS: Bergelson, Casillas, et al., see also REFS the newer Tamis-LeMonda paper; maybe give estimates w/ age ranges for each??). Tsimane' children also heard ~10 minutes of other-directed speech per hour (e.g., talk between adults)—more than the ~7 minutes of adult-directed speech per hour estimated for North American homes (REFS Bergelson, Casillas, et al.). The additional other-directed speech may be attributable to the fact that the Tsimane' live in extended family clusters of 3–4 households; speakers are typically in close proximity to 5–8 others (REFS Cristia et al., 2017).

Laura Shneidman and colleagues (REFS; 2010; 2012) analyzed speech from 1-hour at-home video recordings of Yucatec Mayan children and American children between 13 and 35 months. Shneidman and Goldin-Meadow's (REFS; 2012) analyses of the video recordings yielded four main findings: compared to the American children, (a) the Mayan children heard many fewer utterances per hour, (b) a much smaller proportion of the utterances they heard were *child-directed*, (c) the proportion of child-directed utterances increased dramatically with age, matching American children's by 35 months, and that (d) most of the

added CDS came from other children (e.g., older siblings and cousins). They also demonstrated that the lexical diversity of CDS children heard at 24 months—particularly from adult speakers—predicted their vocabulary knowledge at 35 months.

These groundbreaking studies on Tsimane and Yucatec Mayan children's early language environments lead us to a number of important interim conclusions. First, children in each of these communities appear able to acquire their languages with relatively little CDS. Second, the frequency with which they are addressed increases with age. Third, other children may be the primary source of CDS in similar communities. And finally, despite these differences, CDS from adults may still be the most robust predictor of vocabulary growth.

The current study

We examine the early langage experience of 10 Tseltal Mayan children under age 3;0. Similar to previous work by Shneidman, Scaff, Cristia, and colleages, we aimed to estimate how much speech children overheard, how much was directed to them, and how those quantities changed with age. To this we add new sampling techniques in order to present a more nuanced view of what counts in children's linguistic 'input'. We also present evidence on the vocal maturity children's early productions and discuss how it is influenced (and not influenced) by CDS.

We chose to investigate the early language environments of Tseltal Mayan children because prior ethnographic work (REFS: Brown??) suggests that, as in other traditional Mayan communities, caregivers infrequently speak directly to children, but that children nonetheless develop linguistic skills without any apparent delay. The children in our dataset come from a linguistically and culturally similar community to that in Shneidman's (REFS: 2010 + add other stuff that's not nec lg) work, which allows us to compare differences between the two in early language experience and development more directly than previous work on non-WEIRD communities (see Pye REFS and the comparative ethnographic work previously done on this cultural family: REFS). We provide more details on this community

and the corpus of data analyzed in the *Methods*.

Finally, a major contribution of this work is the use of daylong recordings to estimate the quantity and types of speech that children hear over the course of a day at home. Using a novel combination of a lightweight audio recorder and wearable photo camera, we were able to track children's movements and interactions over the course of a 9–11-hour period in which the experimenter was not present. With long-format recordings of this kind we can make precise descriptive estimates about the speech children hear: typical quantities, variation within a day, and more (REFS: see also Tamis-LeMonda et al. . . .).

Our aim in this paper is to develop a nuanced child language environment profile for Tseltal Mayan. In line with prior work, we predicted that Tseltal Mayan children hear little CDS, that the amount of CDS increases with age, that most CDS comes from other children, and that, despite this, Tseltal Mayan children would hit early speech production benchmarks on par with Western children. We additionally predicted that children's language environment would be bursty—that brief, high-intensity interactions would be sparsely distributed throughout the day, accounting for the majority of children's daily CDS—and that children's responsiveness and vocal maturity would be maximized during these moments of high-intensity interaction.

Methods

How to define temporal contingency for turn taking

Many other studies of child-caregiver turn taking use an arbitrary cut-off for detecting contingency (5 seconds?? Look up references). We base ours on measures of turn taking in interactions with infants and young children. Hilbrink et al. (2015) looked at interaction in a longitudinal corpus from 3 to 18 months and found that infants' responses to mothers began between -700ms and 1200ms relative to the end of the mothers' turns. Complementarily, mothers' responses to infant vocalizations began between -350ms and 650ms relative to the end of the infants' turns. Casillas et al. (2016) investigated the timing of question-answer

responses from caregiver to child and from child to caregiver with children between 20 and 35 months. In their study, children's responses typically started between -500ms and 650ms relative to the end of their caregivers' turns. Caregivers' responses typically started between -1000ms and 400ms relative to the end of their children's turns. Because both studies focused on fairly intensive bouts of interaction, and both within WEIRD parental contexts, we defined contingent responses in the current data with slightly generous allowances for overlap and gap: contingent responses must begin with no more than 1000ms of overlap and 2000ms of gap relative to the offset of the first speaker's turn. We used this same criteria for finding child-to-other turn transitions and other-to-child turn transitions. Transitions were only counted if the other speaker's turn was coded as addressed to "T" (the target child).

Participants

Material

Procedure

Data analysis

Results

Still to graph

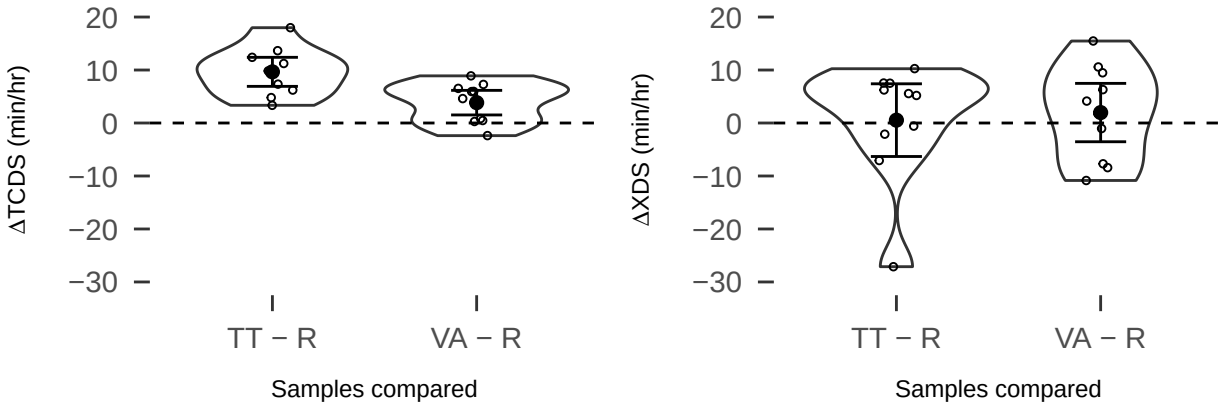
3: sliding window in random to match mean TDS rate/TT transition rates 4: utt length, repetitiveness, F0 peaks and ranges

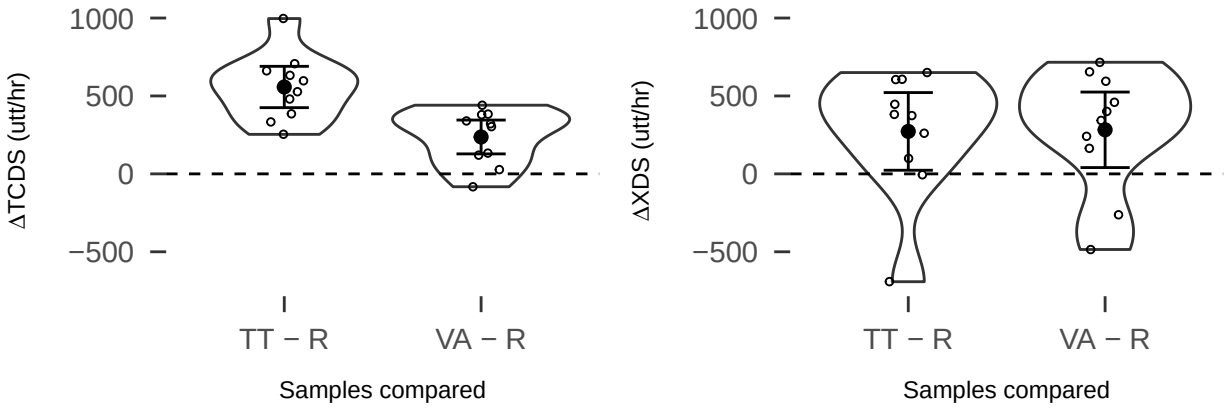
SHOULD I ADD DATAPOINTS ON THE UPH FIGS TO SHOW SHNEIDMAN'S DATA?

Age 1: - US: CDS 616 (SD=231); ADS/OCDS 278 (SD=247) – 79% XDS from MOT (~60% XDS MOT is CDS); 8% XDS from children (mostly ADS/OCDS) - Mayan: CDS 86 (SD=59); ADS/OCDS 342 (SD=201) – 31% XDS from MOT (~4% XDS MOT is CDS); 60% XDS from children (~50% XDS other kids was ADS/OCDS) Age18mo?: Age 2: - US: CDS

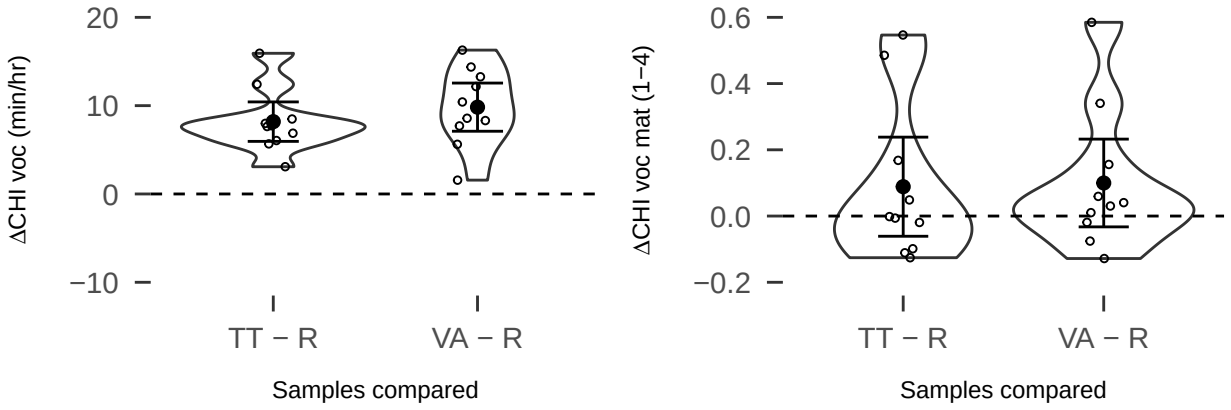
M=815, SD=376; ADS/OCDS M=411, SD=318 – M=65%, SD=28% from MOT (directed: M=800, SD=381; overheard: M=211, SD =55); – M=7%, SD=10% from kids (directed: M=15, SD=22; overheard: M=86, SD=141) - Mayan: CDS M=274, SD=166; ADS/OCDS M=271, SD=136 – M=19%, SD=17% from MOT (directed:M=104, SD=100; overheard:M=82 SD=52); – M=61%, SD=27% from kids (directed:M=104, SD=100; overheard:M=82 SD=52) Age35mo?

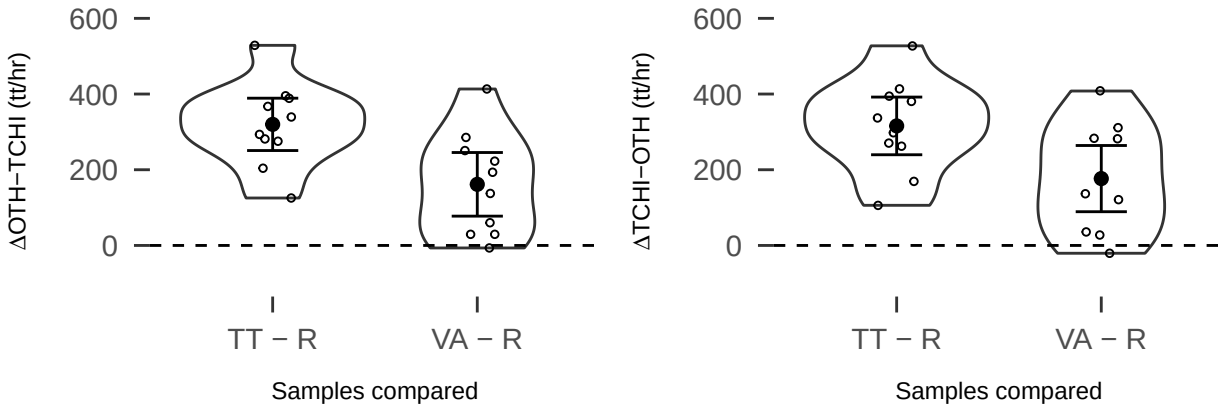
Observation only data. 13 months Directed speech 140 (55); Overheard speech 377 (176) 18 months Directed speech 211 (70); Overheard speech 240 (96) 24 months Directed speech 315 (69); Overheard speech 360 (73) (I think these data weren't coded for adult vs. child speaker)


ΔTCDS (min/hr)
20
10
0
−10
−20
−30
TT − R
VA − R
Samples compared
ΔXDS (min/hr)
20
10
0
−10
−20
−30
TT − R
VA − R
Samples compared


ΔTCDS (utt/hr)
1000
500
0
−500
TT − R
VA − R
Samples compared
ΔXDS (utt/hr)
1000
500
0
−500
TT − R
VA − R
Samples compared

177


ΔCHI voc (min/hr)
20
10
0
−10
TT − R
VA − R
Samples compared
ΔCHI voc mat (1−4)
0.6
0.4
0.2
0.0
−0.2
TT − R
VA − R
Samples compared


ΔOTH−TCHI (tt/hr)
600
400
200
0
TT − R
VA − R
Samples compared
ΔTCHI−OTH (tt/hr)
600
400
200
0
TT − R
VA − R
Samples compared

178

179 ## Discussion

180

References

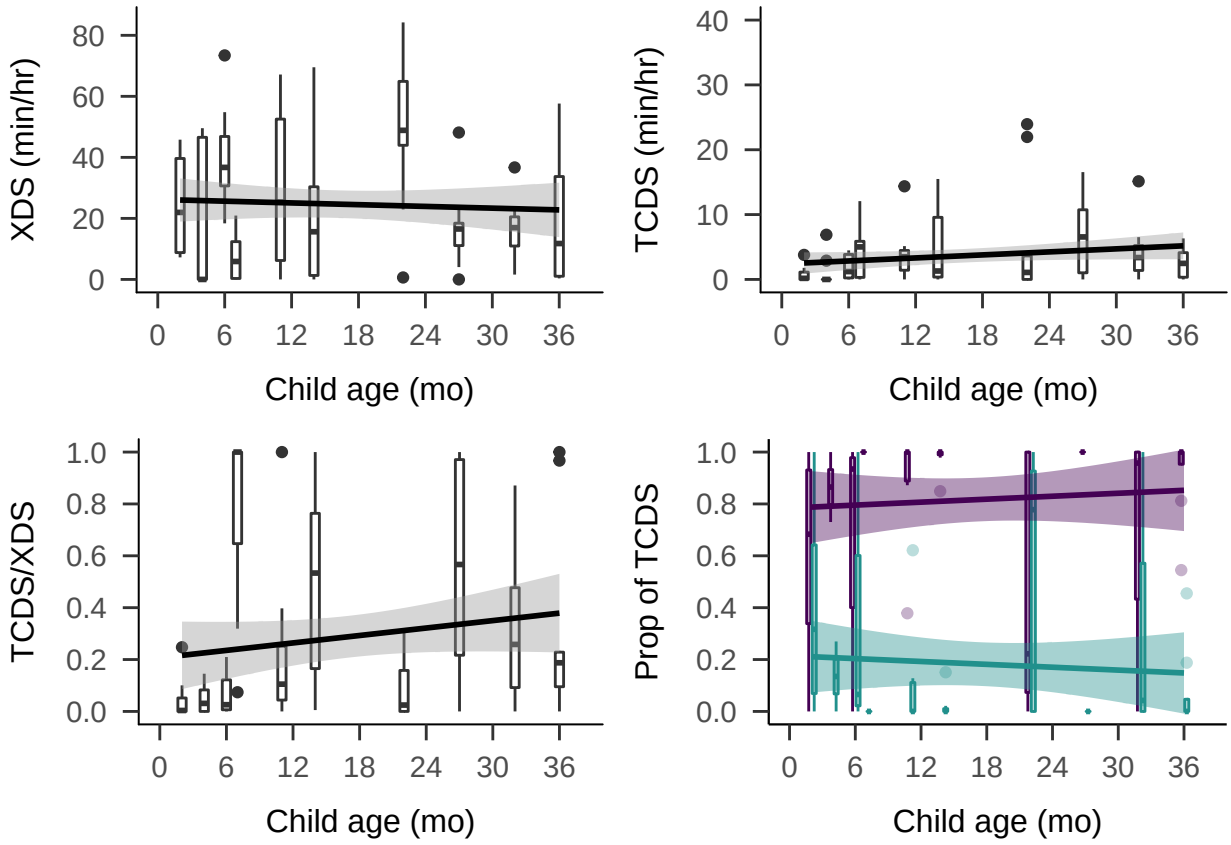

XDS (min/hr)
TCDS (min/hr)
TCDS/XDS
Prop of TCDS
Child age (mo)
0
6
12
18
24
30
36

Figure 1

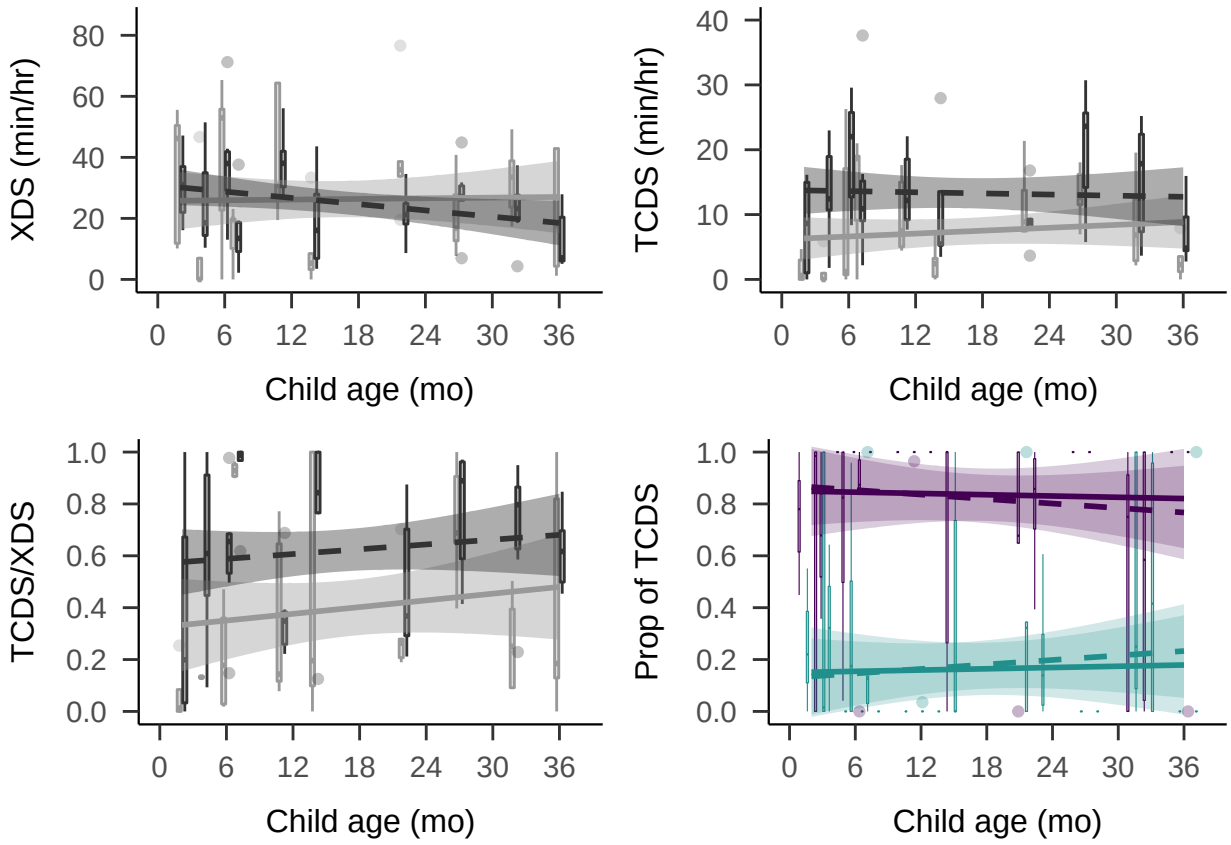

XDS (min/hr)
TCDS (min/hr)
TCDS/XDS
Prop of TCDS
Child age (mo)
0
6
12
18
24
30
36

Figure 2

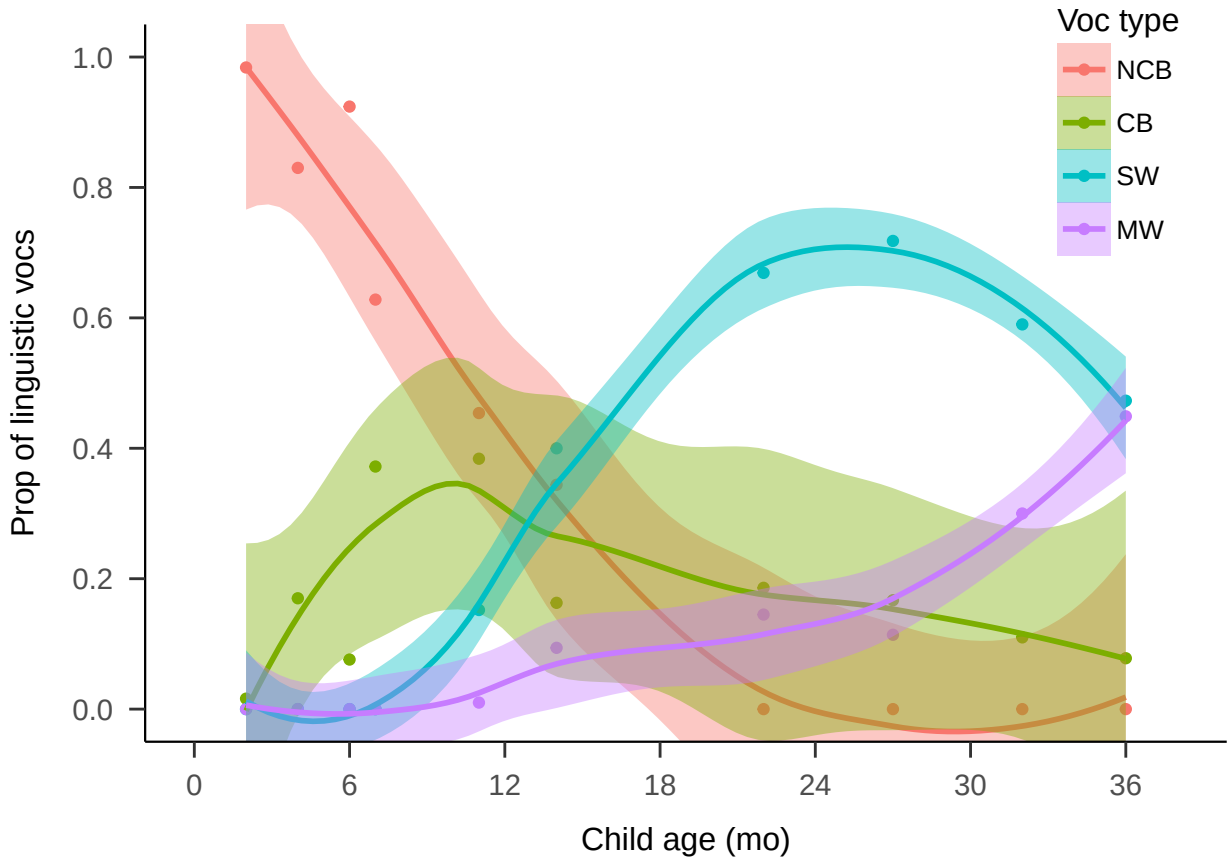

Voc type
NCB
CB
SW
MW
Prop of linguistic vocs
1.0
0.8
0.6
0.4
0.2
0.0
0
6
12
18
24
30
36
Child age (mo)

Figure 3