Child language experience in a Tseltal Mayan village

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Abstract

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Keywords: Child-directed speech, Linguistic input, Non-WEIRD, Vocal maturity, Turn taking

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 (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. These findings have had little impact on mainstream theories of word learning and language acquisition, partly due to a lack of directly comparable measures (Brown, 2014). If, however, these children indeed acquire language without delay

despite little or no CDS, we must 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 ~5 minutes of CDS per hour, with no increase for older children (but see Cristia et al., 2017). 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 (REFS: Bergelson, Casillas, et al., see also REFS the newer Tamis-LeMonda paper; maybe give estimates w/ age ranges for each??). In addition to CDS, Tsimane children also hear ~10 minutes of other-directed speech per hour (e.g., talk between adults)—more than the ~7 minutes of adult-directed speech per hour North American children are estimated to hear (REFS Bergelson, Casillas, et al.). This difference may be attributable to the fact that the Tsimane live in extended family clusters of 3–4 households, and so speakers are typically in close proximity to 5–8 other people (REFS Cristia et al., 2017).

Laura Shneidman and colleagues (REFS; 2010; 2012) analyzed speech from 1-hour at-home video recordings of children between ages 1;0 and 3;0 in two communities: Yucatec Mayan (Southern Mexico) and North American (in a major US 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 by 3;0 months, 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.

These groundbreaking studies establish a number of important findings: First, children in each of these communities appear able to acquire their languages with relatively little CDS. Second, CDS may become more frequent as children get older, though this may be largely due to speech from other children. Finally, despite these differences, CDS from adults may still be the most robust predictor of vocabulary growth.

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 speak directly to their children until the children themselves begin speaking (REFS: Brown??). Nonetheless, Tseltal children develop language with no apparent delays. Tseltal Mayan language and culture has much in common with the Yucatec Mayan communities Shneidman has worked with (REFS: 2010 + add other stuff that's not nec lg), which allows us to compare differences in child language environments between the two sites more directly than before.\footnote{For a review of comparative work in developmental linguistic anthropology, particularly on Mayan cultures, see Pye (2017).) We provide more details on this community and dataset in the Methods section.

Similar to previous work by Shneidman, Scaff, Cristia, and colleages, we estimated how much speech children overheard, how much was directed to them, and how those quantities changed with age. To this foundation we added new sampling techniques for investigating variability in children's speech environments within daylong recordings. We also analyzed

children's early vocal productions, examining both the overall developmental trajectory of their vocal maturity and how their vocalizations are influenced by CDS.

Based on prior work, we predicted that Tseltal Mayan children hear little CDS, that the amount of CDS they hear 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 environments 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

Community

The children in our dataset (REFS: Casillas HomeBank) come from a small-scale, subsistence farming community in the highlands of Chiapas in Southern Mexico. The vast majority of children grow up speaking Tseltal monolingually at home. Primary school is conducted in Tseltal, but secondary and further education is primarily conducted in Spanish. Nuclear families are often large (5+ children) and live in patrilineal clusters. Nearly all families grow staple crops such as corn and beans, but also bananas, chilies, squash, and coffee. Families also cultivate and collect a range of other local plants, raise poultry for eggs and meat and, very occasionally, raise other animals (e.g., bulls) for slaughter. Additional produce, meat, and processed foods are available for purchase at small local shops and from vendors driving through town. Household and farming work is divided among men, women, and older children. Women do much of the daily cleaning and food preparation, but also frequently work in the garden, haul water and firewood, and do other physical labor. A few community members—both men and women—earn incomes as teachers and shopkeepers but are still expected to regularly contribute to their family's household work.

Based on more than forty years of fieldwork in this community, the second author has characterized Tseltal children's language environments as non-child-centered. During their waking hours, Tseltal infants are typically tied to their mother's back while she goes about her work for the day. Infants receive very little direct speech until they themselves begin to initiate interactions as they near their first birthday. Even then, interactional exchanges are often brief or non-verbal (e.g., object exchange routines) and most often take place within a multi-participant—non-dyadic—context (Brown 2011; 2014). Rarely is attention given to words and their meanings, even when objects are central to the activity. Instead, interactions tend to focus on appropriate actions and responses, and young children are socialized to attend to the interactions taking place around them (REFS). Young children are often cared for by other family members, especially older siblings, and are rarely put down on the ground before they are ready to start walking, so they rarely have the opportunity to independently pick up objects before age 1;0. Even so, toys are scarce and books are vanishingly rare, so the objects children do get their hands on tend to be natural or quotidien objects with clear functions in daily life (e.g., spoons, baskets, etc.). By age five, most children are competent speakers who engage in chores and caregiving of their younger siblings. This caregiving approach is similar to those described for other Mayan communities (e.g., REFS Rogoff, Gaskins, de Leon, Shneidman).

Corpus and data selection

- fertility info
- carrying info
- info on older sibling caregivers Extended households in our dataset (defined as those who share a kitchen or other primary living space) ranged between between 3 and 15 people *[TASK 06: Check this range].*

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).

Data analysis

Results

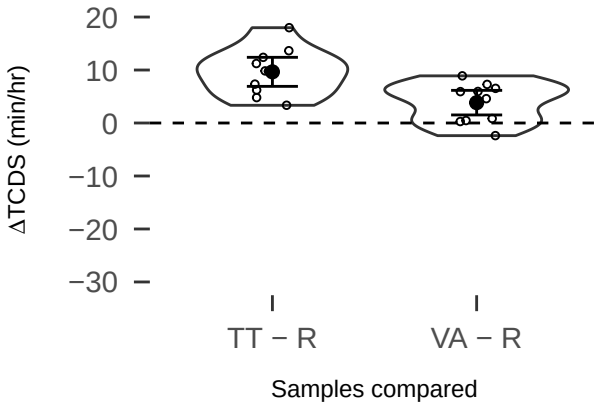
Still to graph

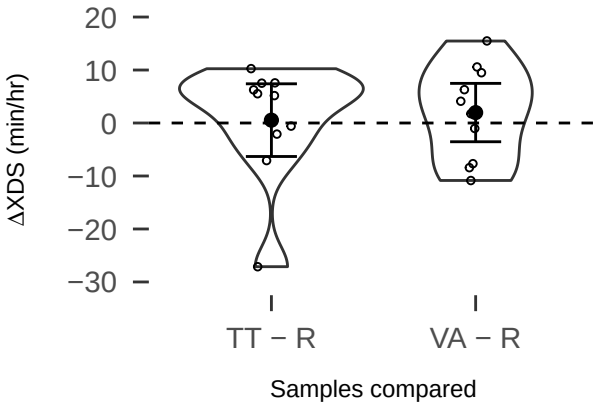
3: sliding window in random to match mean TDS rate/TT transition rates 4: utt length, repetitiveness, F0 peaks and ranges

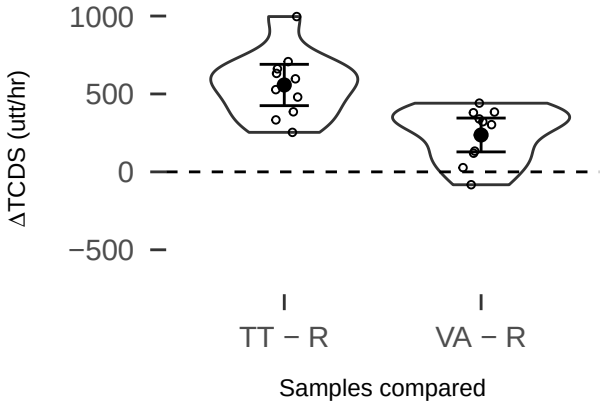
SHOULD I ADD DATAPOINTS ON THE UPH FIGS TO SHOW SHNEIDMAN'S DATA?

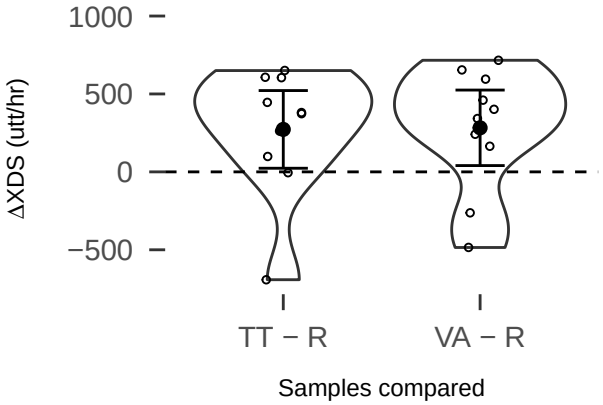
Age 1: - US: CDS 616 (SD=231); ADS/OCDS 278 (SD=247) – 79% XDS from MOT (~60% XDS MOT is CDS); 8% XDS from children (mostly ADS/OCDS) - Mayan: CDS 86 (SD=59); ADS/OCDS 342 (SD=201) – 31% XDS from MOT (~4% XDS MOT is CDS); 60% XDS from children (~50% XDS other kids was ADS/OCDS) Age18mo?: Age 2: - US: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

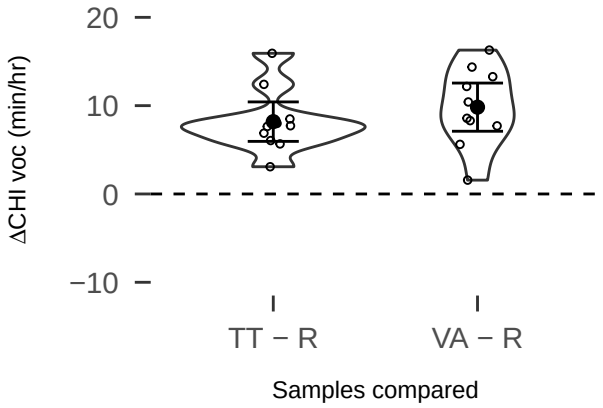

ΔTCDS (min/hr)
20
10
0
−10
−20
−30
TT − R
VA − R
Samples compared

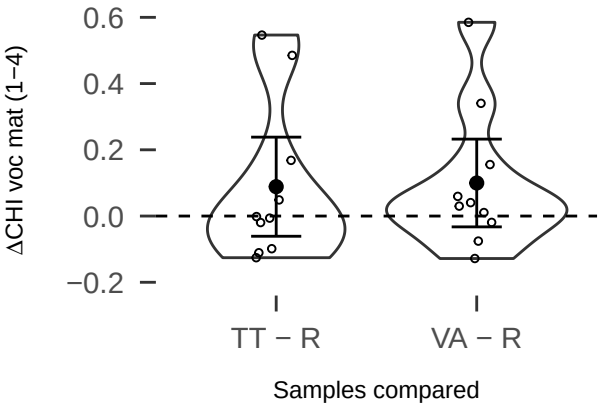

ΔXDS (min/hr)
20
10
0
−10
−20
−30
TT − R
VA − R
Samples compared

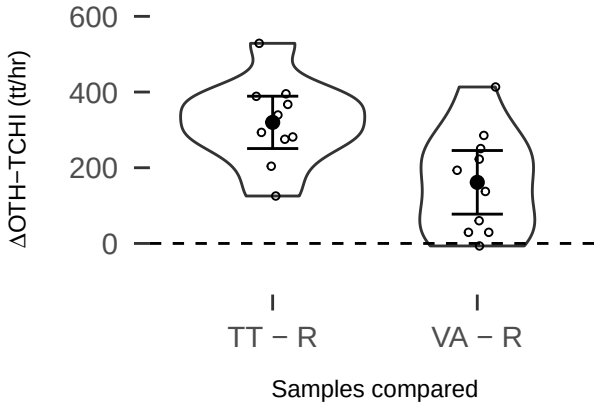

ΔTCDS (utt/hr)
1000
500
0
−500
TT − R
VA − R
Samples compared

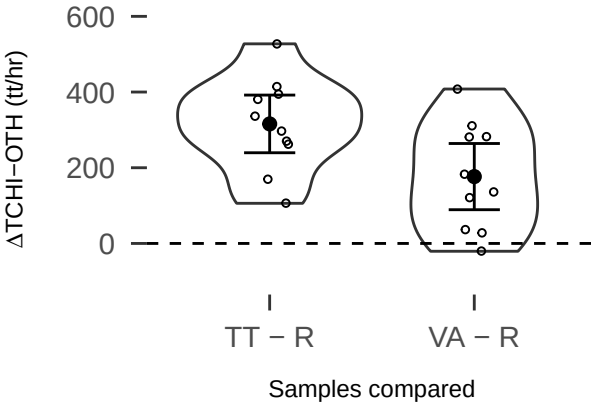

ΔXDS (utt/hr)
1000
500
0
−500
TT − R
VA − R
Samples compared

206


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

207

Discussion

Future directions

Conclusion

211 **References**

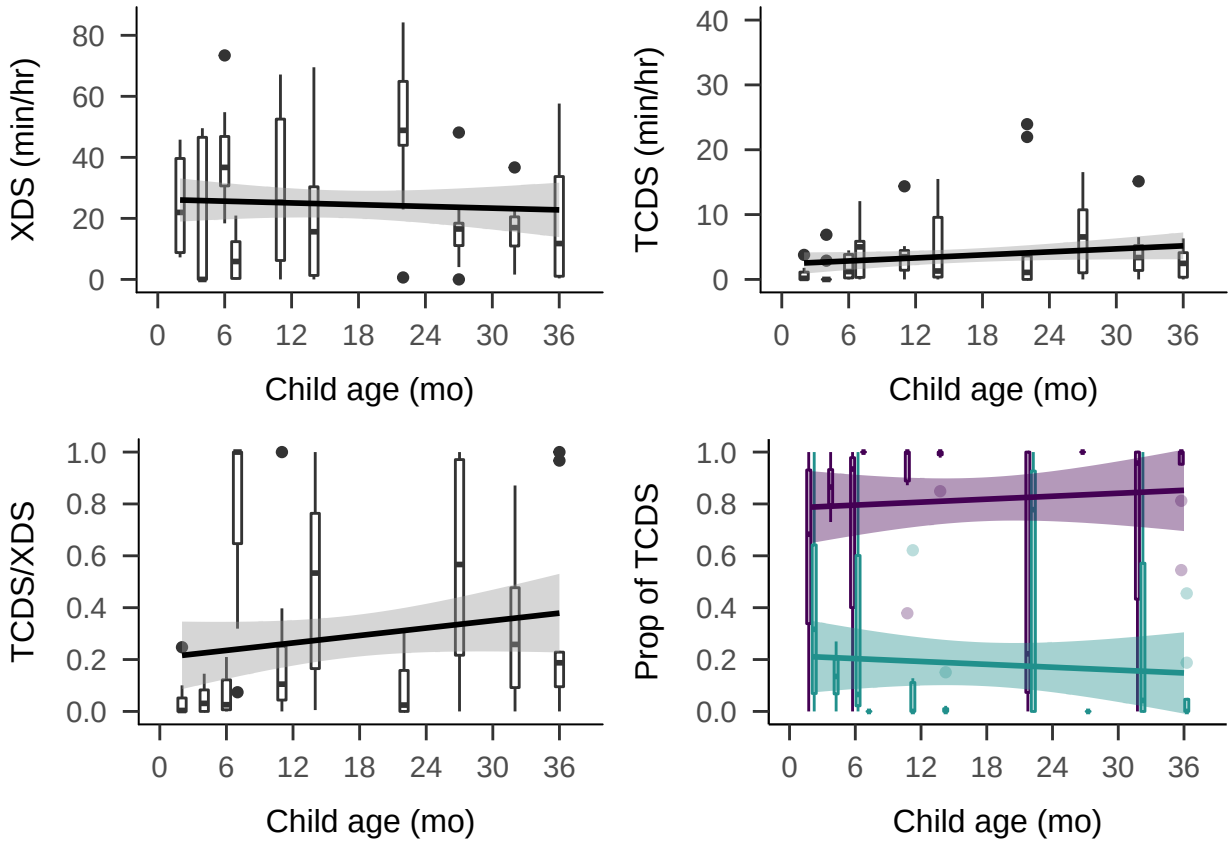

XDS (min/hr)
TCDS (min/hr)
TCDS/XDS
Prop of TCDS
Child age (mo)
0
6
12
18
24
30
36

Figure 1

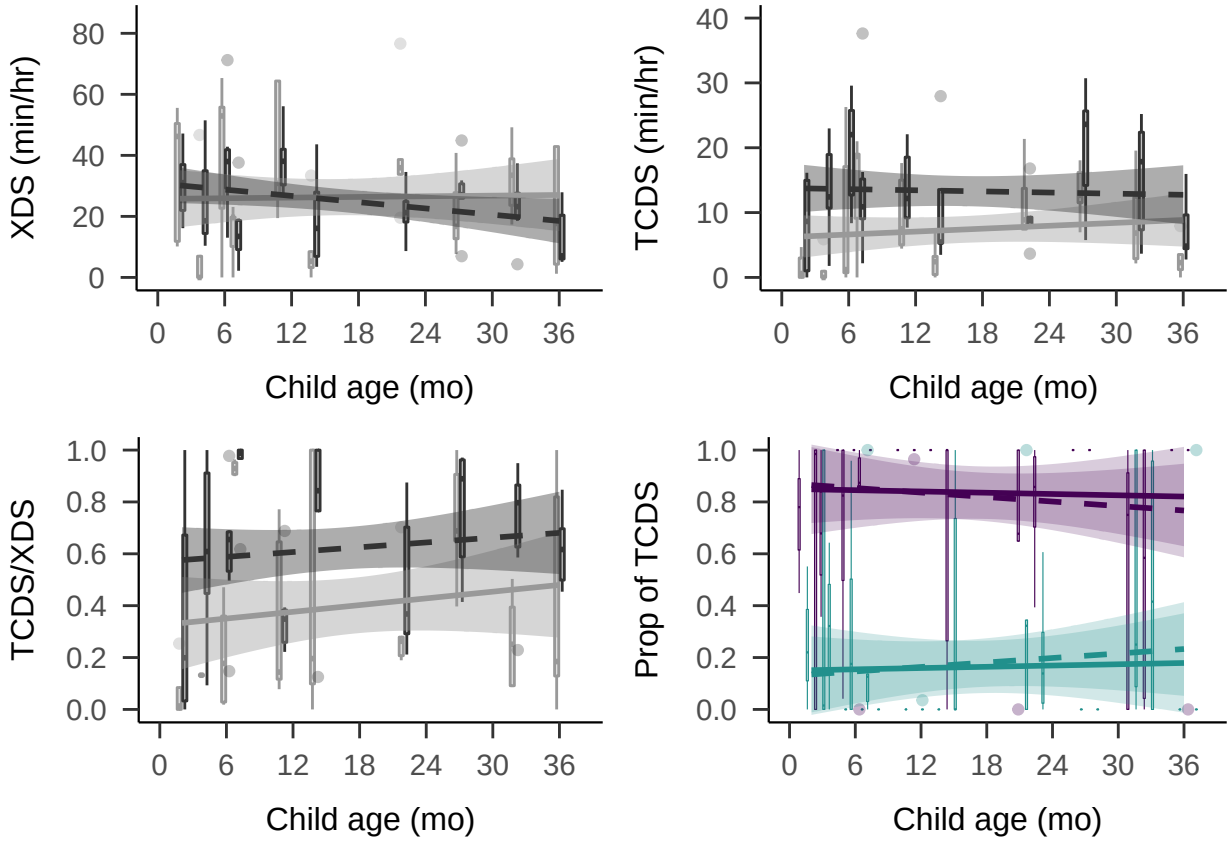

XDS (min/hr)
TCDS (min/hr)
TCDS/XDS
Prop of TCDS
Child age (mo)
0
6
12
18
24
30
36

Figure 2

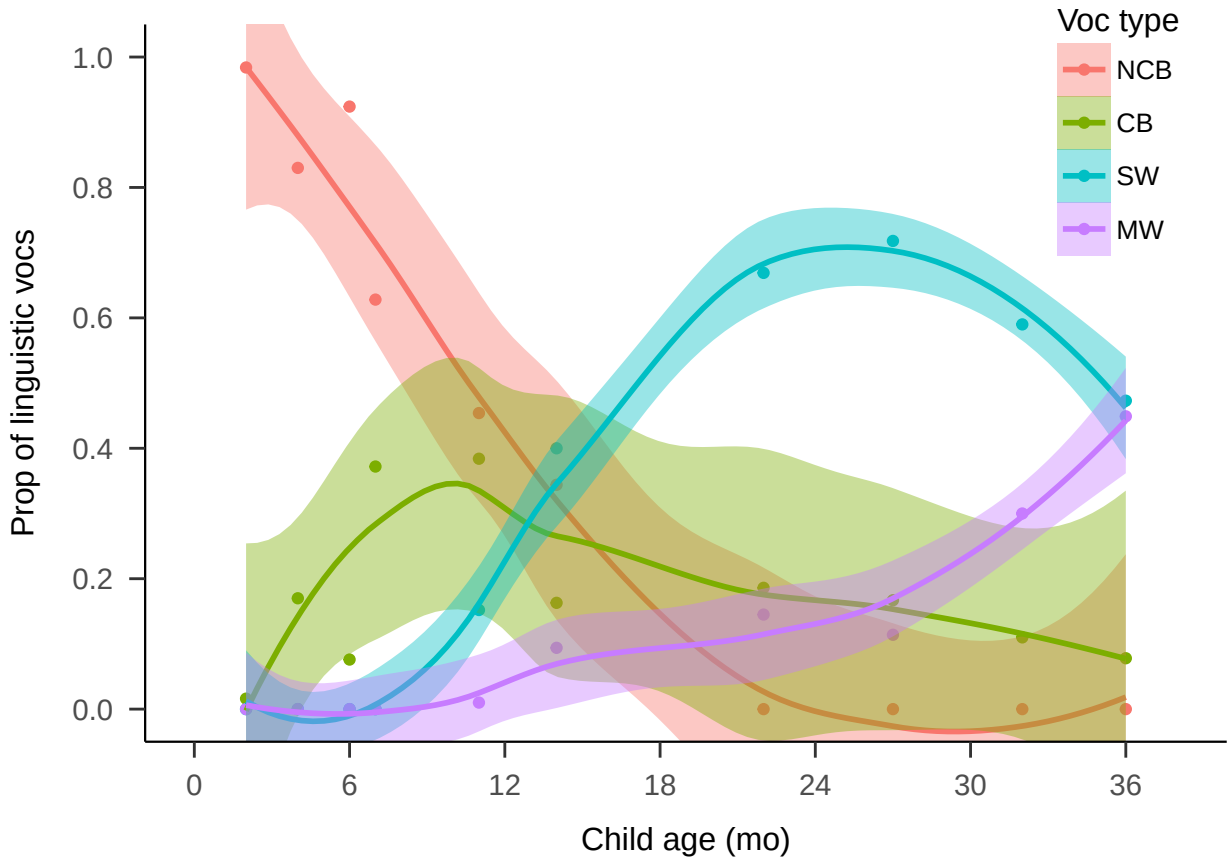

Voc type
NCB
CB
SW
MW
Prop of linguistic vocs
1.0
0.8
0.6
0.4
0.2
0.0
0
6
12
18
24
30
36
Child age (mo)

Figure 3