Child language experience in a Tseltal Mayan village

Marisa Casillas[1], Penelope Brown[1], & Stephen C. Levinson[1]

[1] Max Planck Institute for Psycholinguistics

Author Note

Correspondence concerning this article should be addressed to Marisa Casillas, Wundtlaan 1, 6525 XD Nijmegen, The Netherlands. E-mail: Marisa.Casillas@mpi.nl

Abstract

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Keywords: keywords

Word count: X

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Introduction

Much of 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? Early claims about children's language environments characterized linguistic 'input' as syntactically complex and error-prone, with no negative evidence (REFS). However, decades of work has overturned this view entirely: the speech that children hear and use in their interactions with others is rich with multimodal information that children can leverage to infer linguistic knowledge. In fact, children's own speech productions appear to closely mirror the stochastic patterns in their linguistic input (REFS), convincingly accounting for the kinds of errors children do and don't make in spontaneous speech (REFS; see also REFS for similar work regarding phonological learning).

In the last two decades, the role of children's linguistic environments on their language development has become a topic of intense focus in developmental psychology, with studies showing repeatedly that the amount of child-directed speech (CDS) children hear influences their language development, particularly their vocabulary (REFS). For example, [TO DO: Fill in later]. Some studies have also linked the quantity of directed speech children hear to their speed of lexical retrieval and their syntactic development (REFS; Weisleder; LuCiD; Huttenlocher). [TO DO: Fill in later after reading Huttenlocher]. Child-directed speech estimates have traditionally come from short at-home or in-lab video recordings of caregiver-child interaction. But recently many researchers have also used daylong audio recordings (e.g., with the LENA(C) system) to track the approximate amount of spoken language in children's at-home language environments; tracking information about how much of the talk is child-directed by annotating sub-samples of the recording (REFS; Weisleder) or looking at other cues to interactional behavior (REFS; Romeo).

The conclusion drawn in much of this work is that child-directed speech is the ideal register for learning words; especially for *referential* word learning (i.e., concrete nouns and verbs; REFS). In line with this idea, experimental studies have conclusively shown that infant-directed speech is nearly universally preferred over adult-directed speech by young children (REFS ManyBabies, etc.). Perhaps more importantly, child-directed speech is often produced under conditions of joint activity, in which caregivers and children coordinate their behavior in order to accomplish interactional goals (e.g., daily routines of feeding, diaper changing, and play). Using head-mounted eyetrackers, Chen Yu and colleagues (REFS) have demonstrated that coordination during object-play exchanges [TO DO: Fill in later]. Crucially, then, estimates of child-directed speech quantity may functionally predict children's word learning because they index the frequency with which children engage in rich, multimodal interactions with their caregivers; interactions in which children can actively and contingently elicit just the right linguistic information at just the right time to be optimally interesting and useful for learning (REFS; Eve's paper on homophonic Vs in French). There are, however, at least two major caveats to this body of work relating CDS quantity and language development.

First, while there is overwhelming evidence linking CDS quantity to vocabulary size, links to grammatical development are much more scant (REFS: Huttenlocher; others???). Learning a language involves mastery of its systemic underpinnings, e.g., its phonology, morphology, and syntax. While there is clear reason for CDS to have referentially more clear speech–which is good for learning concrete vocabulary—it's less obvious that the ability to learn syntactic structures is similarly facilitated [TO DO: Start with Yurovsky paper + refrences therein]. On the other hand, many usage-based approaches to language development and processing (e.g., REFS) suggest that much of our syntactic knowledge is wrapped up in lexically specified representations; what is good for the lexicon may also be good for syntax. Taken together with Huttenlocher's findings, the relationship between CDS and syntactic development may be less linear (i.e., more exposure != more skill) and more like [TO DO: fill in].

Second, findings regarding the importance of CDS quantity for language development have typically only focused on Western (primarily North American) populations (e.g., REFS), fundamentally limiting our ability to generalize the effects to children acquiring language worldwide (REFS: WEIRD). While there is certainly insight to be gained by looking at within-population variation, researchers are more likely to find the places where their assumptions break down when they study child language development in new populations. Ethnographic work with traditional non-Western communities has demonstrated that caregiver-child interaction styles vary immensely from place to place, with some reports of little or no child-directed speech (*Table 1*; Gaskins, 2006; Lieven, 1994??). Although some of these children hear very little CDS, there are no reports of significant delay in their linguistic development. On the contrary, children in these communities are reported to acquire language with 'typical'-looking benchmarks: they tend to start pointing (REFS: Liszkowski) and talking (REFS: Rogoff et al., 2003?; Brown??) around the same time we would expect for Western middle-class infants. However, it is difficult to make direct comparisons between these ethnographic reports and reports from Western settings that use entirely different methods of sampling and analysis. To our knowledge, only a handful of researcherers have attempted to quantitatively describe the language environments of children growing up in traditional non-Western communities. We briefly highlight two recent efforts.

Scaff, Cristia, and colleagues (REFS: 2017; in preparation) have used a number of different data collection methods to estimate how much speech children hear in an indigenous Tsimane community in Bolivia. Collectively, their results suggest that Tsimane children NN or fewer minutes [TO DO: << fill in numbers] of CDS per hour. For comparison, children from Western middle-class homes are reported to hear between NN and NN minutes of CDS per hour [TO DO: << fill in numbers] (REFS: Alex's paper + the refs therein, but also the newer Tamis-LeMonda paper; maybe give estimates w/ age ranges for each??), with children in working-class homes hearing between NN and NN minutes of CDS per hour [TO DO: << fill in numbers].

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

- In this paper we examine the linguistic experiences of 10 Tseltal Mayan children. Why Mayan?
- Non-WEIRD
- Rich area of research: Little CDS from report—potentially a great case for looking at a functioning acquisition system with minimal environmental input
- Many linguistically and culturally similar communities for comparison (see Shneidman, Pye, etc.)
- See slides for more
- A major contribution of this work is to use daylong recordings, which allow us to estimate... (TLM paper on short vs. longer recs).

  - At the same time, there is potentially great value in knowing about what happens during interactional bursts when they happen, so we track … tt and va as well

- Our aim is to develop a child language environment profile for Tseltal Mayan, one that gives an impression of the speech children hear around them and the type of speech that is addressed to them directly.

- Results:
- How much speech do children hear overall and what proportion of that is directed to them? How does that compare to other communities we've studied?
  - *measures*: XDS and TDS minutes per hour and proportion (from random selections only)
- How do ADS and TDS differ?
  - *measures*: utt length, repetitiveness, F0 peaks and ranges, questions, imperatives (?)
- How much speech do children hear during bouts/bursts of interaction? How often do these bursts occur?
  - *measures*: deltas for m/h TDS, #utts TDS, # TT transitions between random, tt, and va: are they actually different?
  - *measures*: XDS and TDS minutes per hour and proportion (from tt and va selections: do they show similar age effects?)
  - *measures*: sliding window in random to match mean TDS rate/TT transition rates
- Does interaction influence linguistic practice?
  - *measures*: m/h CHI vocs, # CHI vocs, & voc mat between random, tt, and va
- Discussion
- Summary of findings

- When thinking about quantity: Do we care about the avg over the day or do bursts matter more?
    - Benefits of naps between bursts? Natural input cycle? How many "good" minutes are enough to spur learning on?
- How should we think about CDS? What is universal about its format?
- So what is the impact of input in this community? What do we predict?
    - One point often raised: do these kids show a delay? Problematize this.
    - More interesting: language experience itself shapes use of mechanisms for learning, e.g., learning fro overhearing (Shneidman)
- Big issue we have to face as work continues in this vein: what are these kids learning? We can't continue to pretend that we are capable of defining and encapsulating a phenomenon as emergent as language.
- Limitations
    - no video data
    - only 10 kids

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

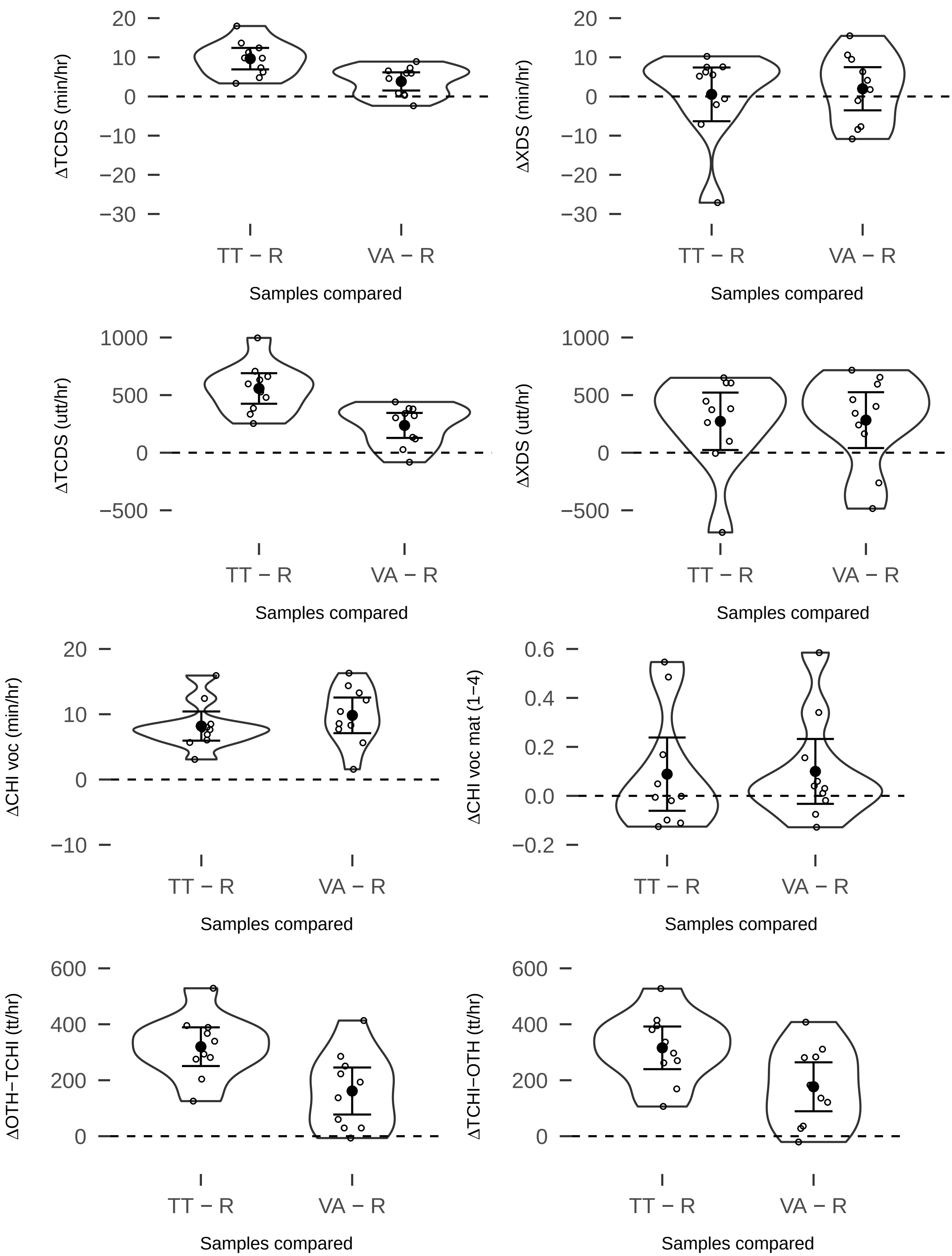
3: sliding window in random to match mean TDS rate/TT transition rates 4: utt length, repetitiveness, F0 peaks and ranges

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)
ΔXDS (min/hr)
ΔTCDS (utt/hr)
ΔXDS (utt/hr)
ΔCHI voc (min/hr)
ΔCHI voc mat (1−4)
ΔOTH−TCHI (tt/hr)
ΔTCHI−OTH (tt/hr)
TT − R
VA − R
Samples compared

Discussion

LATERGRAM

One serious issue is how we define adult-like linguistic competence, especially within models in which we consider that adults still continue learning and that individual differences are rampant between adults in both linguistic knowledge and skill at every level, from phonetics to syntax to pragmatics, and of course vocabulary too. When we talk about language acquisition, especially cross-culturally, we have to be careful about what we think the "target" is and what are considered to be the developmental benchmarks children achieve. The focus recently has been on vocabulary acquisition, for some of the reasons outline above. However, vocabulary is a particularly literacy-centric view of language development. If we were to go back in time and set the seed of developmental language science in another culture, we might be much more concerned about the acquisition of kinship systems and other complex relational language, or in the ability to design elaborately indirect speech acts. Acquiring a language involves the mastery of a shockingly diverse array of skills and knowledge: not just linguistic symbols and systems, but also the infrastructure underlying their use (e.g., interactional skills), the cognitive-general skills supporting those systems. There's no reason *a priori* to believe that every aspect of language acquisition is equally influenced by environmental input. For example, children's pointing frequency is influenced by the amount of pointing in their environment, but the age of pointing onset—the age which they first begin to point—appears unaffected by the frequency of pointing in their environment (REFS: Matthews, Liszkowski).

References

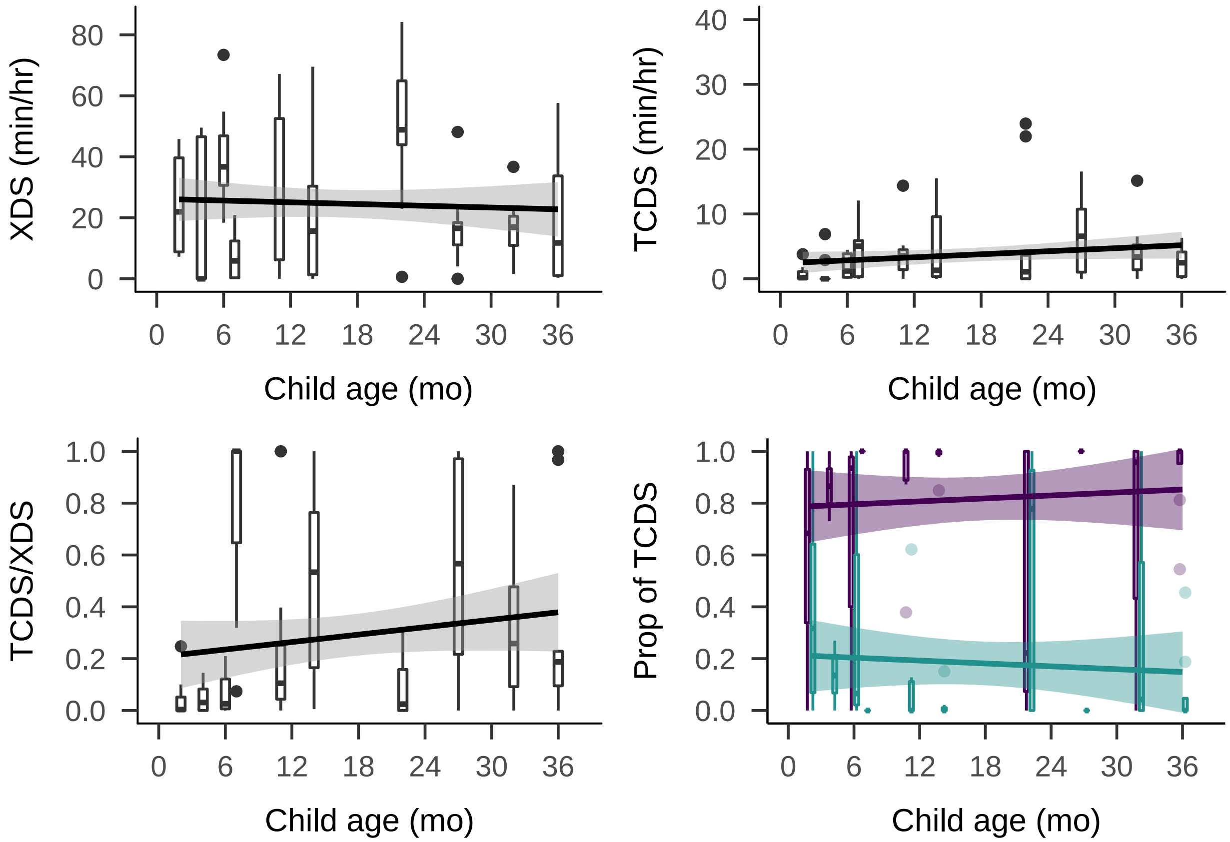

XDS (min/hr)
0
20
40
60
80
TCDS (min/hr)
0
10
20
30
40
TCDS/XDS
0.0
0.2
0.4
0.6
0.8
1.0
Prop of TCDS
0.0
0.2
0.4
0.6
0.8
1.0
0
6
12
18
24
30
36
Child age (mo)

Figure 1

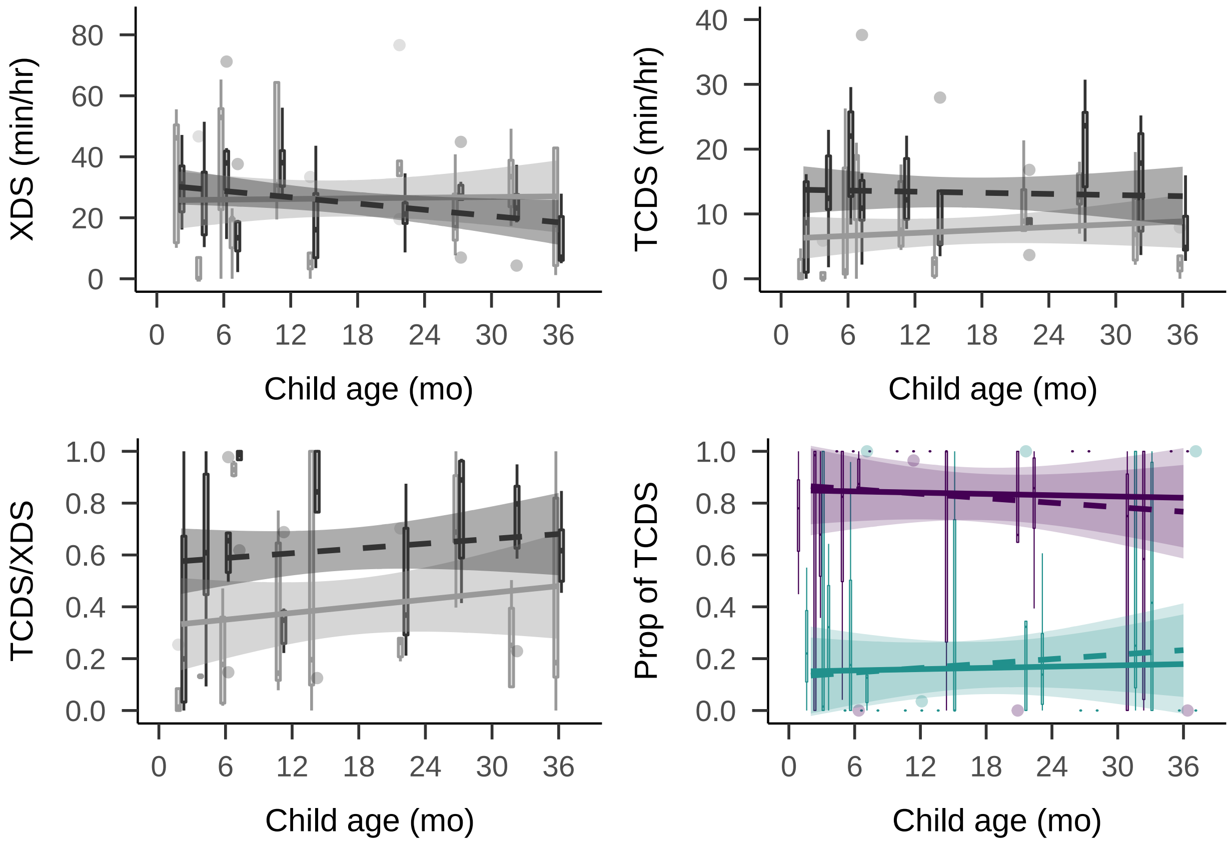

XDS (min/hr)
80
60
40
20
0
0
6
12
18
24
30
36
Child age (mo)
TCDS (min/hr)
40
30
20
10
0
Child age (mo)
TCDS/XDS
1.0
0.8
0.6
0.4
0.2
0.0
Child age (mo)
Prop of TCDS
Child age (mo)

Figure 2

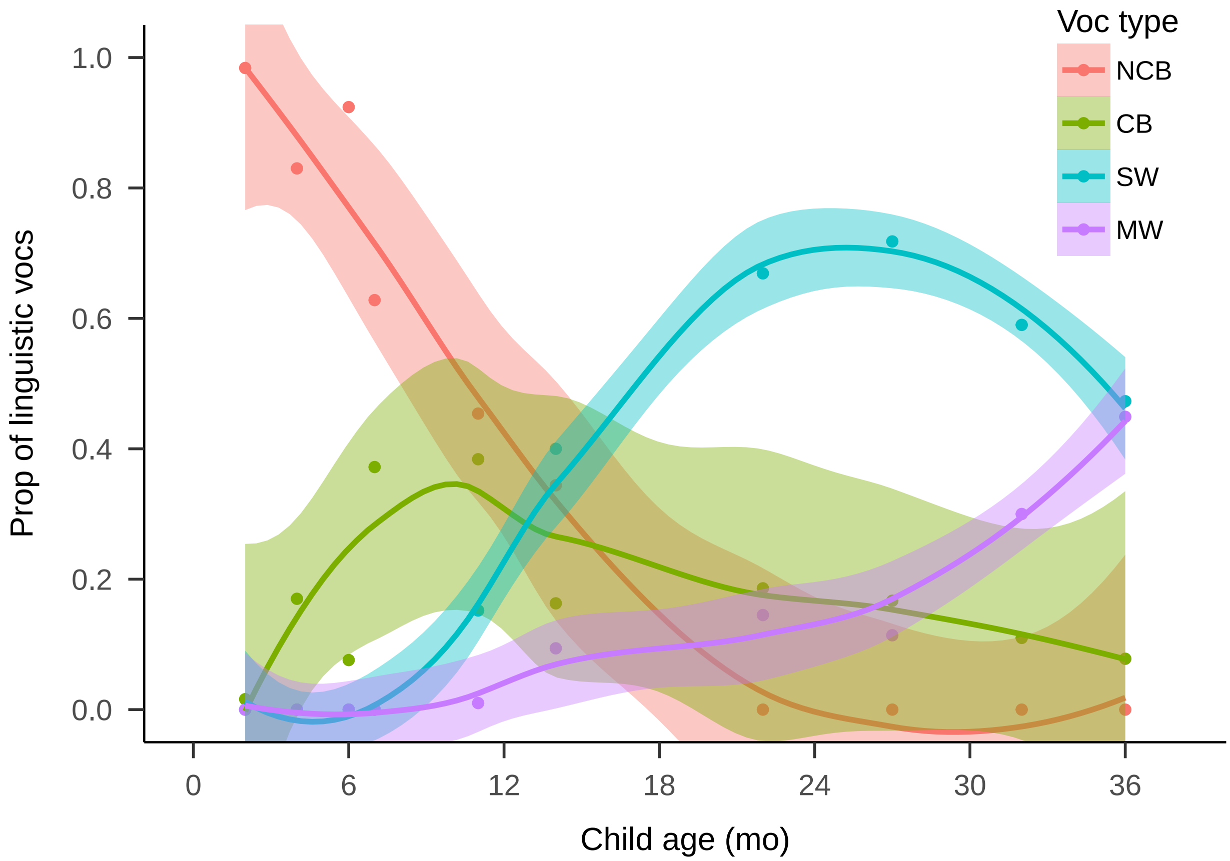

Voc type
NCB
CB
SW
MW
Prop of linguistic vocs
1.0
0.8
0.6
0.4
0.2
0.0
0
6
12
18
24
30
36
Child age (mo)

Figure 3