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Introduction: Is Rich Input to Language Universal?

- Nativist approaches to language acquisition have pointed to the problem of underdetermination, in that the language children hear is not sufficient to account for the final form of the grammar (Vygotsky, 1978)
- Some researchers have suggested that language learning is scaffolded with recasts and expansions of utterances that are indirect ways of correcting grammar (Bohannon & Stanowicz, 1988; Farrar, 1992); this is claimed to solve the underdetermination problem
- Joint attention has also been proposed as a precursor to language learning (Tomasello & Farrar, 1986) that obviates problems pointed out by nativist approaches Cross-cultural studies of language interactions between adults and young children have revealed several cultures where speaking to infants and children is rare (Heath, 1983; Schieffelin & Ochs, 1986; Pye, 1986)
- A recent more systematic study by Schneidman and Goldin-Meadow (2012) showed that direct speech to Yucatec Mayan infants was relatively low (~ 55 utterances per hour), as compared to infants in the US, who heard a mean of 605 utterances per hour. Infants do not learn language in a vacuum. Hence, their linguistic acquisition has to come from overheard speech of other individuals in their environment (Akhtar, 2005; Lieven, 1994)
- In cases of impoverished input, we still find some direct speech to children, which could be argued to be sufficient to overcome problems of underdetermination
- Translations showed that these instances of directed speech were either purposeful (e.g. asking for the cup from the infant) or general comments to the situation (e.g. adults found seeing a baby playing in a wheelbarrow to be funny)
- The present study examines the Pirahã culture in which lack of direct speech to infants and children is more extreme. This study attempts to quantify the amount of direct speech, overheard speech and shared attention in naturalistic everyday activities in this tribe

Pirahã Culture and Background

- The Pirahã tribe are the only living subgroup of Mura people who mainly live by the banks of Maici river in the Amazon forest in Brazil
- They are a monolingual hunter-gatherer society that does not integrate with mainstream Brazilian culture
- There is no system of writing, counting, art, education, or even a formal social hierarchy in this tribe
- Previous studies have examined the relationships between language and culture (Everett, 2005), language and numerical cognition (Gordon, 2004) and lack of recursion in Pirahã grammar (Everett, 2005)



- Left: A Pirahã family in their home (with Dr. Dan Everett)
- Right: An adult male and a child female are playing with an otter

Methods

1. Data Collection

- Filming was carried out by Peter Gordon during trips to two upriver Pirahã villages led by Dan Everett in 1991 and 1992
- Filmed sessions recorded on six 2-hour tapes included spontaneous events – when possible the camera was left on a tripod unattended to capture naturalistic interactions. At times, Everett was speaking with villagers, but no data were included if a non-Pirahã person appeared to be directing activities in any way, and videos of numerical cognition experiments (Gordon, 2004) were not coded
- Footage was uploaded to Databrary (2012)

2. Video Analysis and Translation

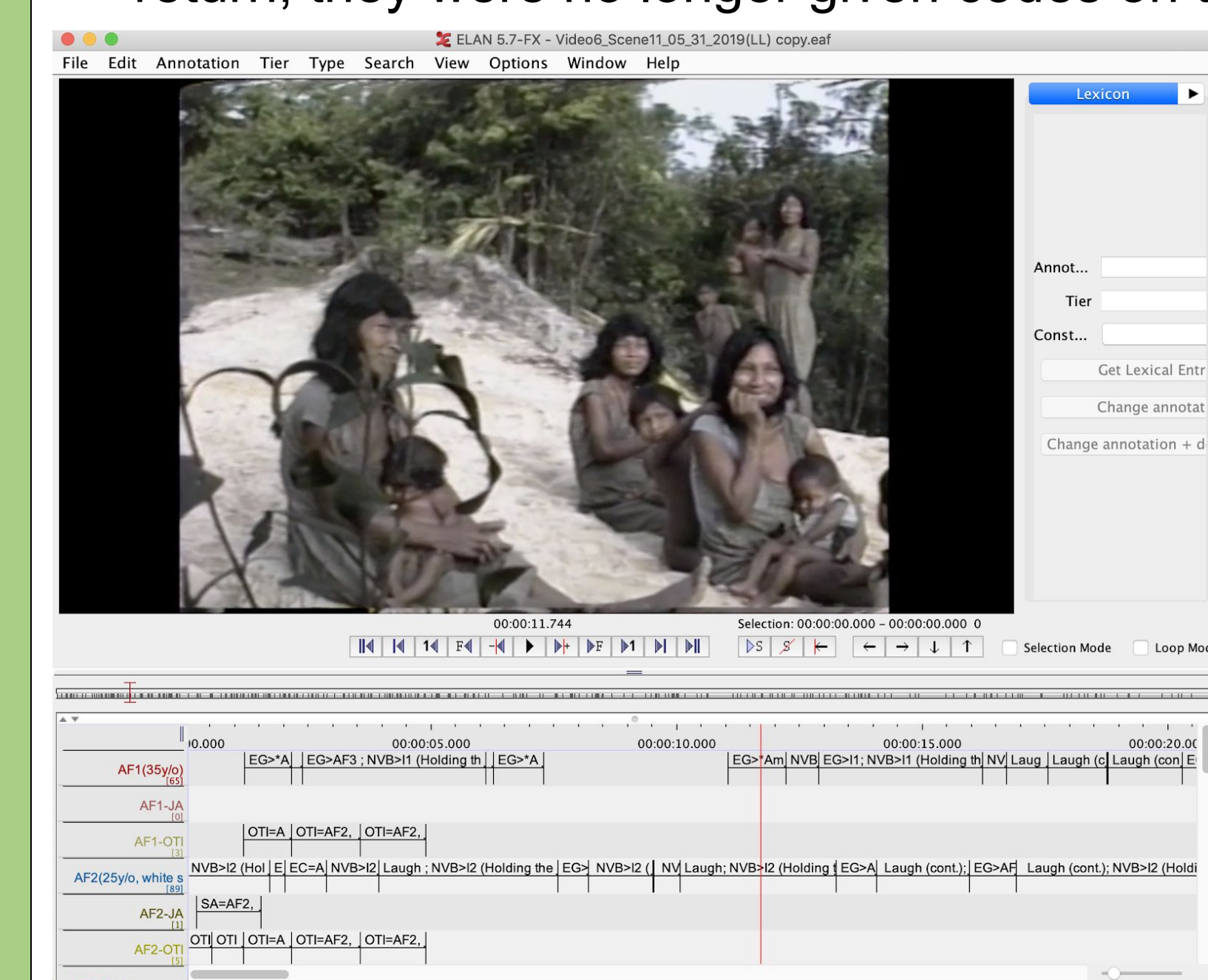
- To systematically analyze adult-infant/child and child-infant interactions and behaviors of the Pirahã villagers from these films, digitized videos of these films were linked into the ELAN (Eudico Linguistic Annotator) System
- ELAN is a video/audio analysis software that allows for the generation of distinct coding tiers. This allowed us to annotate each individual's behavioral-linguistic information within the video
- Behavioral coding was carried out by the graduate student coauthors
- When verbal interactions appeared to occur between adults and children or infants, Dan Everett was consulted to translate
- Ambiguous interactions were translated by Everett, with priority placed on verbal interactions. All other ambiguous interactions (target unclear or initiator unclear/off camera) were removed from data set until such time as they could be confirmed

3. Coding System

- The coding scheme that we developed included codes for:
 - Verbal interactions
 - Verbalizations with no target
 - Non-verbal gesturing
 - Non-verbal behavior (e.g., holding, touching, grooming)
 - Eye gaze/contact, crying, laughing, joint attention
- Participants were coded based on gender and age group:
 - Adult (Female/Male)
 - Child (Female/Male)
 - Infant/Toddler
- Since the Pirahã do not count, age was estimated by the behavioral coders, with Gordon and Everett acting as consultants
- After all behavioral coding has been conducted in the ELAN system, annotation statistics were exported to Microsoft Excel for analysis

4. Measures: Opportunity to Interact (Baseline) vs. Actual Durations of Interaction

- We estimated the duration of the opportunity to interact (OTI), defined as the time that two or more individuals were in close proximity
- Composition of the groups present in the videos was coded
- Actual interaction durations (Verbal and non-verbal) were coded as duration of interaction divided by BASELINE
- Opportunities to Interact (“OTI”) and Out of Frame (“OOF”) codes. An “OTI” code was given when two or more actors were directly visible within the camera’s screen. An “OOF” code was given for tribal members who instead remained close by the camera under an assumption of continuity. If an actor left a scene and did not later return, they were no longer given codes on the third tier



Screenshot from ELAN coding used to analyze a scene where a large group of Pirahã adult females, children and infants were gathering along the beach. Even though they were carrying or feeding their young, Pirahã mothers engaged in minimal eye contact with their infants

Results

- The total time used for the current analysis was 36 minutes (out of 12 hour long recordings) with most scenes containing more than one character. Even though this is a fairly small sample, it is representative of everyday life within the Pirahã tribe
- 108 instances of directed speech and more than 10000 instances of overheard speech were coded
- Details of piraha younger members language input distribution are shown in Figures 1 and 2. These show comparisons of the verbal and nonverbal input received by children and infants
- The diagrams further break down the proportion of time that each individual actor heard a certain form of speech spoken by others (direct or overheard)
- Figures 3 through 6 demonstrated the source of language input for different age group
 - In Pirahã culture older children, in addition to adults, contributed to infants' language input

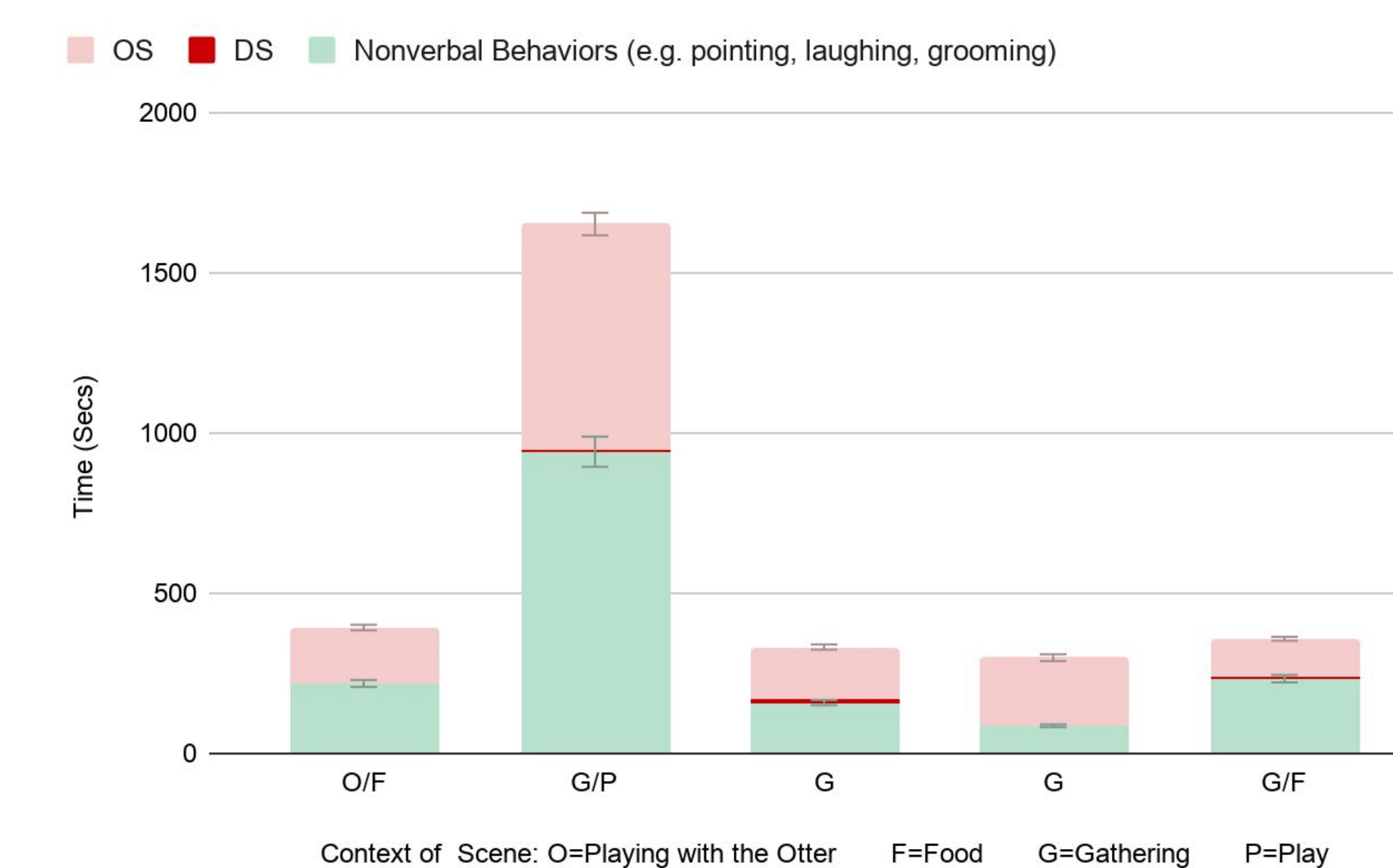


Figure 1. Pirahã children's language input: Distribution of overheard speech (OS) and directed speech (DS) from adults across videos.

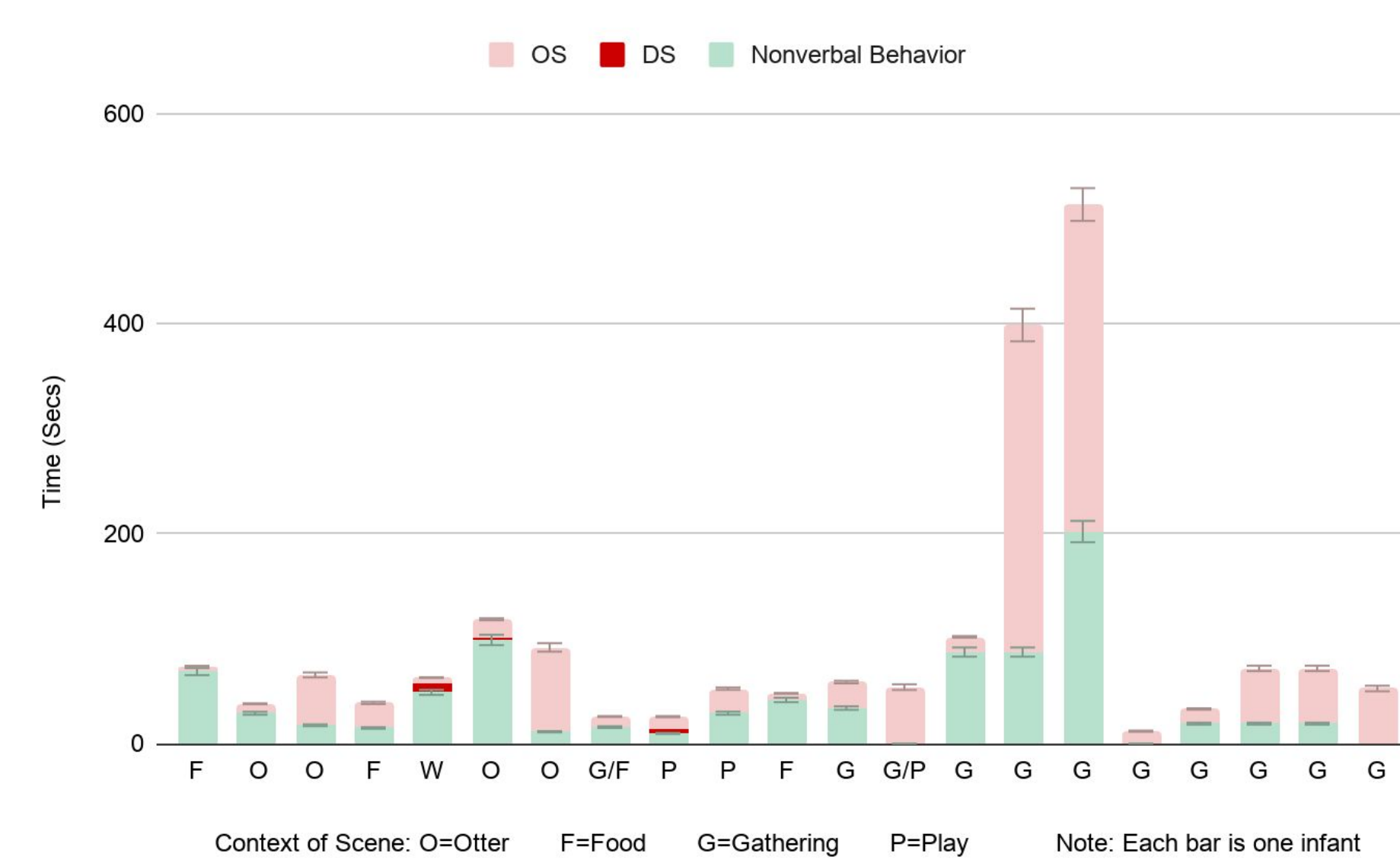
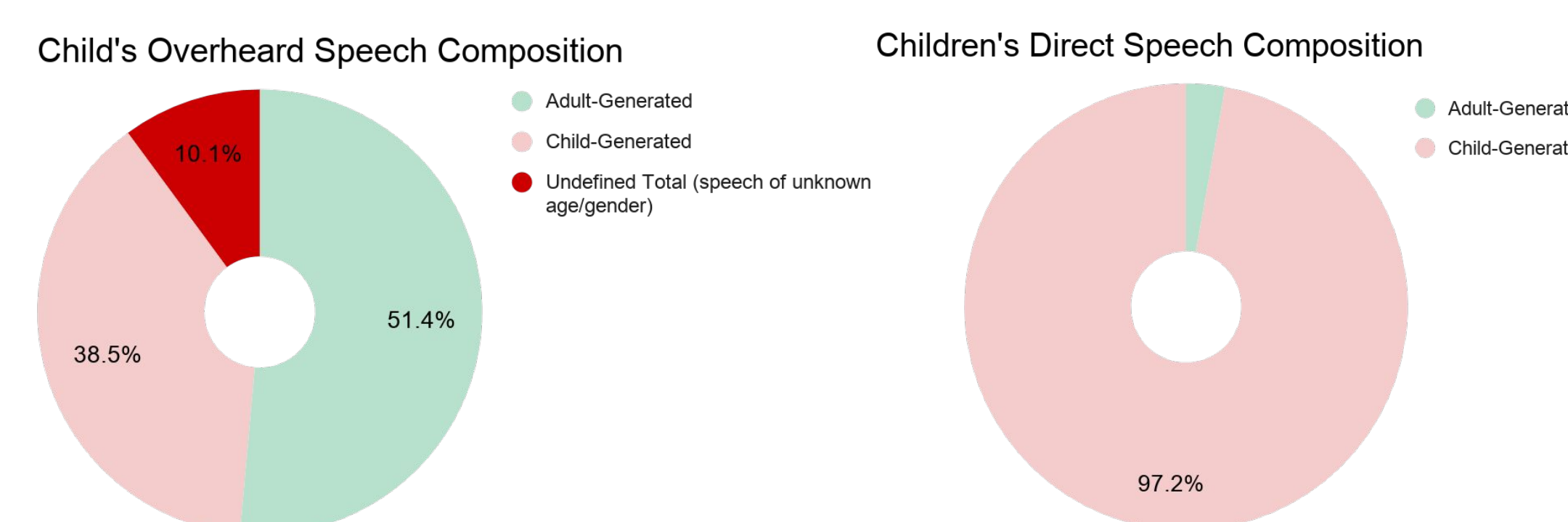
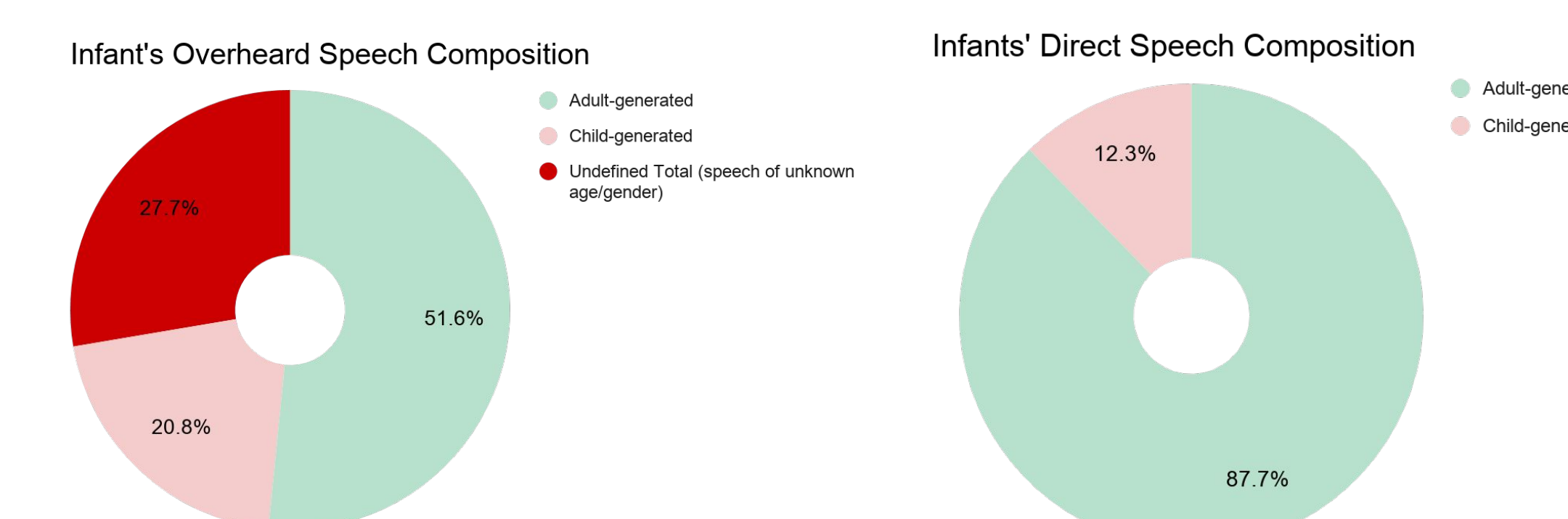


Figure 2. Pirahã infants' language input: Distribution of overheard speech (OS) and directed speech (DS) from adults across videos



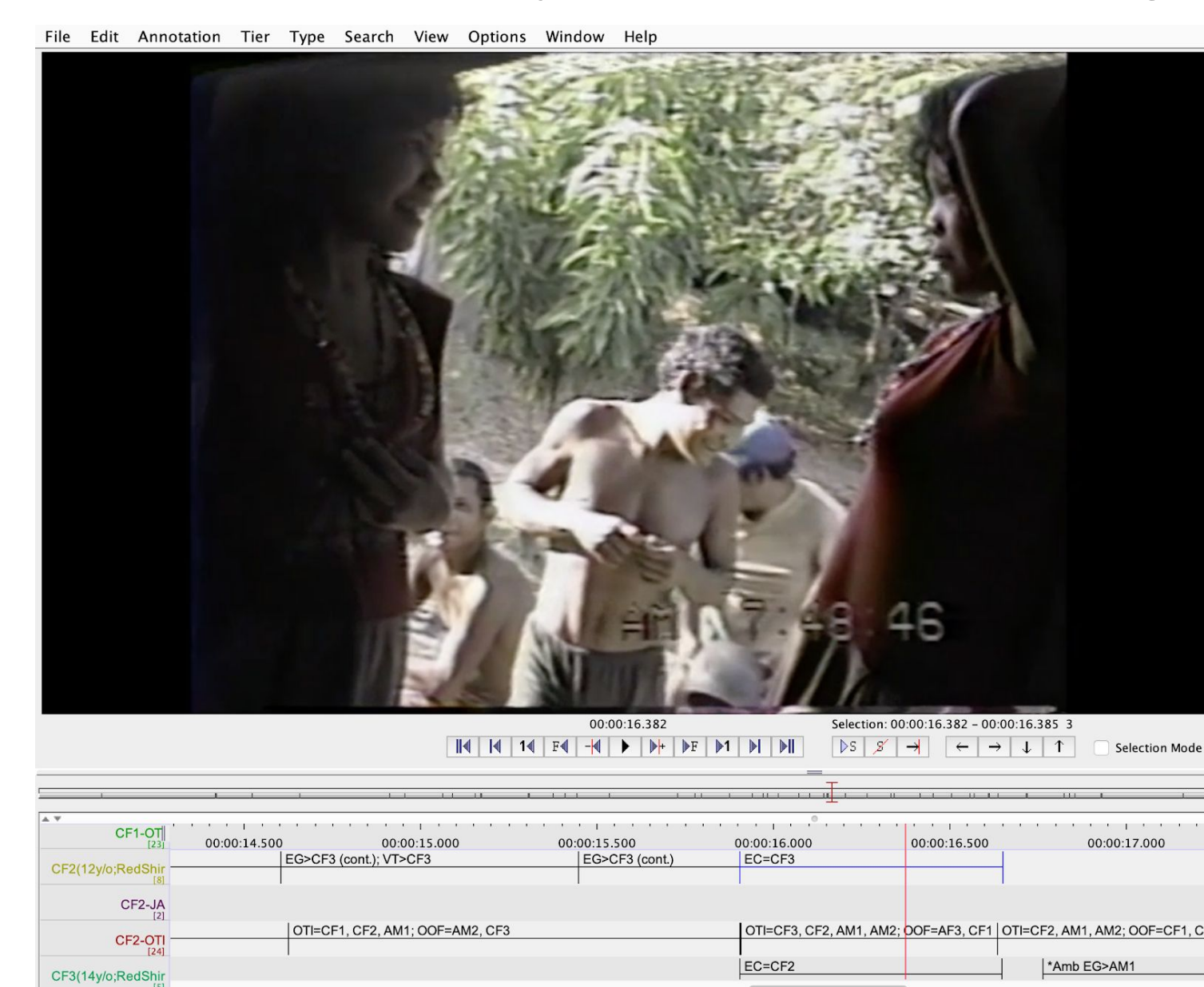
Figures 3&4. Children's language input composition



Figures 5&6. Infants' language input composition

Discussion

- The present data suggest that Pirahã speech from adults to infants is even more impoverished than previous studies of the Mayan Yucatec tribe or any previously documented group
- In cases where some directed speech existed, conversations were mostly quite short (one or two words) and purposeful, or a general comment to the situation/object, such as playing with a wheelbarrow, asking for a cup, or feeding a pet otter (translations provided by Dr. Daniel Everett). None of those utterances were intended to be any form of ritualized language teaching - no conversational recasts or vocabulary expansion were found
- Older children of the tribe also contributed to infants' overheard speech pool in addition to a small portion of the direct speech pool
- Older children tend to talk within their own age group
- Joint Attention was not found to be a precursor to direct language teaching
- In general, we found that there is very little verbal content that is specifically addressed to infants and children. Interaction is not absolutely zero, but is extremely sparse to serve as any form of language learning. Since direct speech to infants and children was almost non-existent, their language input consisted almost entirely of indirect or overheard speech and conversations between pre-teen children
- Our data suggests that in Pirahã culture, preverbal infants ought to acquire language largely through attending to the overheard speech of others around them and mapping the utterances of corresponding situations
- These data suggest that theories of language acquisition must account for situations in which the source of input is almost entirely overheard speech. Parental scaffolding of language is not a necessary component of the language learning process



Screenshot of ELAN coding used to analyze a scene, where a Pirahã adult man was speaking to other tribal members and two child females were engaging in eye contact.

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