Language input of Cypriot Children: Analysis with LENA

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Abstract

This study utilizes the Language Environment Analysis (LENA) system to examine language acquisition in Greek-speaking children. LENA, a "talk pedometer" combining a wearable audio recorder with automated vocal analysis, aims to understand the role of child-directed speech (CDS) in language development. The research recorded 214 hours of natural interaction from four Cypriot families with children aged 6-46 months, categorizing audio data into various classes like conversational turns and vocalization counts. Results highlight significant correlations between parental language and children's speech production. Interestingly, electronic device usage negatively impacted child vocalizations. Despite limitations in classifying prelinguistic sounds, LENA proved effective in tracking and analyzing linguistic environments, offering valuable insights for optimizing language input for child development.

Keywords: language input, LENA, language development, language acquisition

Introduction

The foundation of cognitive and social development in early childhood is deeply rooted in language development. Traditionally, language acquisition has been studied through various means such as brief recordings of children's spontaneous speech, direct observation, and adult-reported questionnaires (Keller et al., 2007). Enter the Language Environment Analysis (LENA) system, an innovative tool that modernizes the study of language acquisition through the integration of technology. LENA utilizes a wearable audio recorder paired with sophisticated software to objectively evaluate the linguistic environment of young children, circumventing the drawbacks of traditional methods (Gilkerson, Richards, 2009).

The system has shone a spotlight on the disparities in language exposure among children from different socioeconomic backgrounds, prompting a reevaluation of parental engagement strategies that foster cognitive and linguistic development. The insights gleaned from LENA data underscore the deep-seated connection between early language immersion and cognitive prowess, advocating for the nurturing of linguistic diversity in childhood education to bolster cognitive skills (Adams et al., 2018; Gilkerson et al., 2018;

Weisleder, Fernald, 2013; Ferjan Ramirez, Weiss, Sheth, Kuhl, 2023). This study pivots to Cyprus, delving into the Greek-speaking domain, to expand our understanding of language acquisition in diverse linguistic settings.

Method

In this initial research, four families from Cyprus with Greek as their primary language took part, each having children who were developing typically. The ages of these children ranged from 6 to 46 months, and they were born at full-term without any complications related to neurodevelopment or hearing.

After gathering the recordings, they were meticulously analyzed with the help of LENA technology, which necessitates a minimum of 10 hours of audio for a comprehensive analysis. Each child contributed to four sessions of natural interaction, amassing a total of 214 hours of audio data. The LENA Pro software categorizes the sounds into eight precise groups. These categories include: 1) the count of words spoken by adults (AWC), 2) the exchange of turns in conversation between adult and child within a brief time frame (CTC), 3) the number of vocalizations by the child (CVC), and 4) an automatic vocalization assessment (AVA) that considers meaningful interactions, ambient and electronic sounds, noise, and silence.

Results

In the presented figure, a comprehensive analysis of the auditory environment of children during their active hours is depicted. Figure 1 quantifies the average duration allocated to each of the five AVA dimensions as delineated by the LENA system within successive two-hour intervals throughout the children's waking hours.

The incidence of Meaningful interactions occupies the subsequent position, albeit substantially lower than the preceding categories, with Noise and Electronic Devices trailing. Parallel trends are observed in Figure 1, which elucidates the data for AWC, CTC, and CVC. Predominantly, the AWC category encompasses the majority of sounds registered by the recording apparatus, with CTC and CVC manifesting reduced frequencies. To statistically substantiate these findings, a series of univariate Analyses of Variance (ANOVAs) were executed, positing the LENA parameters as the dependent variables against the fixed factor of time slot. The results indicated no significant variances across the majority of the parameters (p-values exceeding .05), with the exception of Distant sounds, which manifested a significant discrepancy ($F(2,190) = 3.44$, $p < .05$). Subsequent post-hoc examinations disclosed a discernible differentiation between the second- and third-time segments ($p < .05$) and a marginally significant distinction between the first and second ($p = .08$). An additional univariate ANOVA, with Time as the dependent variable and AVA Parameters as the fixed factor, unveiled a

pronounced effect ($F(4,1345) = 27.12$, $p < .01$). The post-hoc analyses corroborated that Silence & Background was statistically predominant over other parameters ($p < .01$). Moreover, Distant Sounds were significantly more frequent than all other parameters with the exception of Silence & Background, from which they were notably less ($p < .01$). These results provide a nuanced understanding of the auditory environment's influence on language development during early childhood.

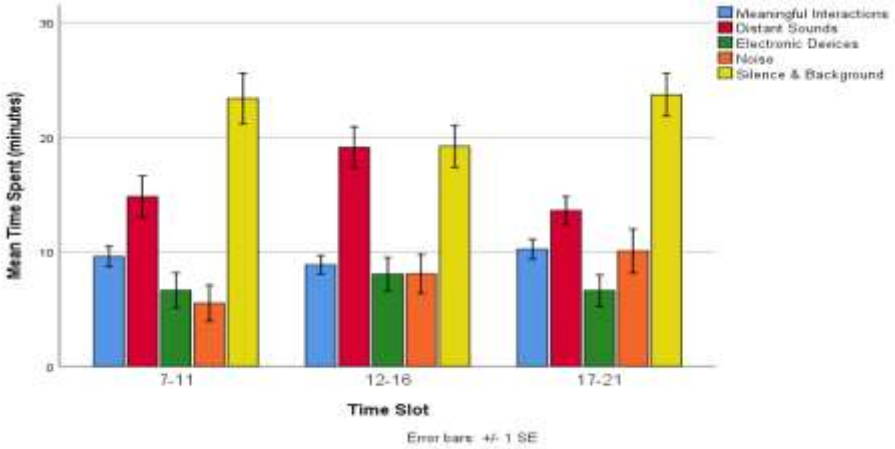

Figure 1. Descriptive communication environment input analysis per 2-hour time slots for the AVA parameters.

Discussion

The central objective of this investigation was to illuminate the nuances of daily communication between adults and their children in the Greek-speaking regions of Cyprus, utilizing the LENA device to delineate the intricacies of speech interactions. Instances of children showing reluctance towards donning the LENA vest have been noted, mirroring findings within extant literature that elucidate a prevalence of distant over meaningful speech (Charron et al., 2016).

The findings gleaned from this study offer a valuable perspective on the linguistic dynamics within families in Cyprus, emphasizing the pivotal role of adult speech in the linguistic development of children. The study underscores the need for fostering enriched and substantive linguistic interactions within the domestic sphere while concurrently limiting electronic device exposure. This knowledge is instrumental for guiding parents, educators, and clinicians towards creating environments rich in language, thereby optimizing linguistic advancement and overall development of children (Cristia, Boulgarelli & Bergelson, 2020). Furthermore, LENA's capabilities could revolutionize the exploration of developmental language disorders (DLD), offering an objective medium to quantify language exposure, evaluate conversational dynamics, and

identify linguistic deficits. Recent research utilizing LENA has contributed important understandings of how the language environment shapes outcomes for children with DLD. However, this study's limitation to the home setting suggests the utility of extending these findings through larger-scale and more varied sample research in the future, allowing for a broader understanding of the language acquisition process across different environments.

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