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Coding for infant vocalizations amongst mid and low socioeconomic status families

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Coding for Infant Vocalizations Amongst Mid and Low Socioeconomic Status Families

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Abstract

Many studies have been conducted to examine the various effects on infant and toddler speech development. Numerous studies have proven that there are a myriad of factors that impact the production of speech. Some of these factors include family dynamics, physical ability, health, socioeconomic status, etc. This Honors Project investigated the differences in infant vocalizations from low and mid SES families. We first developed a classification system to define and categorize intentional vocalizations; and then applied this classification system to determine differences in the low and mid SES recordings. A comparison of five recordings from both low and mid SES reveled no significant differences in infant vocalizations and conversational turns between parent and infant.

Introduction

Socioeconomic status (SES) plays a substantial role in the various facets of child development (e.g. Hoff, 2003; Eilers, 1993; Fernald, 2013; Fury, 2011; Hart & Risley, 1995; Hoff, 2003; Song, 2014). Many studies have been conducted to examine the differences in development of vocabulary amongst children in poverty and children from mid to upper SES (e.g. Furey 2011, Hart & Risley 1995, Hoff, 2003; Song, 2014). Studies have shown that children from low SES families develop vocabulary at slower rates than those from mid to upper SES families (e.g. Hoff, 2003; Hart & Risley, 1995). The correlation could be due to a variety of factors including the child's actual ability based on genetic factors or physical heath, exposure to a myriad of different language experiences, and difference in overall family dynamics (e.g. Hoff, 2003; Linver, 2002).

Hart & Risley (1995) conducted a landmark study investigating language development in young children and found that SES affects language development. They discovered that children from "professional" families heard roughly 30 million more words by age 3 than children from "welfare" families (Hart & Risley 1995). Many other studies have replicated Hart & Risley's research (e.g., Hammer, 1999; Linver, 2002; Hoff, 2003; Huttenlocher, 2007, 2010; Fernald, 2013).

Because we know that the way primary caregivers respond to infant vocalizations is vital to the later production of speech, the importance of parent-infant interaction is clear (Beebe 1988; Bloom, 1986; Goldstein, 2009; West, 2006). Much can be learned by observing turn-taking between infants and mothers (LeMonda, 2006). Social feedback is essential for infant speech development, noting that certain aspects of parent-infant interaction display characteristics of mature adult communication (Bloom, 1986, West 2006).

Communication begins even before the ability to produce speech sounds or first words. Therefore, infant-caregiver interactions are vital, and can promote the development of communication. Infant communication development reflects the child's sensory and motor development and cognitive development. At eight months of age, children should be producing consonant-vowel combinations with adult-like timing, sets of vowels, glides, stops, and nasals, and both reduplicated and variegated babbling. The importance of the auditory feedback through interactions with adults is critical for continued development. In summary, we know that both expressive and receptive language provide and facilitate learning. Additionally, language provides the framework for children to communicate with others (Song, 2014; Timler 2016, Vihman, 1996).

Many studies have sought to understand and create coding systems to classify infant vocalizations and parent-infant interactions (e.g. Oller, 2000; Shoen, 2011; Plumb 2013). Before the 1970's, scientists would transcribe or acoustically measure infant vocalizations the same way they would for adult speech (Buder, 2013). In the late 1970's and early 1980's, Oller et al. (1976) identified infant babbling as protophones. They recognized precanonical protophones as quite distinct from the sounds included in the International Phonetic Alphabet (IPA); and therefore, should be examined differently. Oller (2000) has sought to develop a categorization system for protophones that has been replicated by other researchers (e.g. Schoen, 2011; Plumb, 2013). The categorization system was based off the sounds thought to later develop into adult-like, mature speech. Consequently, sound signals (i.e., crying, burping, laughing, squealing, etc.) were excluded in his categorization system.

Like mature speech, protophones can be broken up into two main categories, that is the ability to produce speech sounds; and the ability to break speech sounds into syllables. (Oller,

2000; Buder, 2013; Eilers, 1993). The protophones produced by the infant are thought to represent their ability to produce different types of vocalizations as intentional communication with the caregiver (Buder, 2013).

Plumb (2013) sought to observe the vocalization development of toddlers with Autism Spectrum Disorder (ASD) and create a reliable coding system. The coding system used was broken into three different categories: transcribable vocalizations, non-transcribable vocalizations, and could not be determined. The transcribable vocalizations were defined as vocalizations containing at least a vowel and sometimes a consonant. The non-transcribable utterances were divided into three categories: laugh, distress, and atypical. A laugh consists of chuckles or giggles; a sign of pleasure. A distressed vocalization could be a cry, whine, or a scream. An atypical vocalization might be a grunt, a yell, or a squeal. (Plumb, 2013).

This Honors Project focused on analyzing infant vocalizations from both low and mid SES and sought to replicate previous coding systems. With a focus on the turns between infant and caregiver, the classification system developed was applied to both low and mid SES sound files to observe the correlation. This study drew from and analyzed data recordings from a previous study in the Infant and Toddler Language Laboratory at James Madison University (JMU) that replicated and extended (Hart & Risley's) research. The emphasis of the study was on the relationship between mothers' infant directed speech (IDS) and SES. The mother's IDS had been observed and transcribed, but the infant vocalizations had not yet been listened to and coded for. This Honors Project focused on the infant vocalizations. Overall, this study drew from previous and current research, developing a reliable system of classifying infant vocalizations to understand the purpose of these vocalizations and the outside effects that contribute to the

formulation of them. The hypothesis was that the low SES infants would vocalize less and participate in less turns than the mid SES infants.

Methods

Participants

This analysis used data from a research study at James Madison University. There were ten infants in the low SES group (8 months) and eleven infants from the mid SES group (8 months). The mid SES was controlled in this study by requiring at least one parent to have the equivalent of a four-year college degree. The low SES was controlled by the families being enrolled in a community hospital program. Five of the ten low SES recordings and five of the eleven mid SES recordings were listened to and coded for to determine the correlation between SES.

Procedures

The data was collected using LENA, a digital recorder worn by the infant that holds up to 16 hours of interaction. The LENA device allows for data to be collected in the home, without the presence of an observer. In addition to LENA, parents of the infants were also given two picture books, one entitled “Home” and the other “Toys.” They were asked to read the books to their babies and elaborate on each picture. The two-day recordings were broken up into the book readings and the infant’s post nap hour. The data collection was transcribed using ELAN transcription software. The mother’s speech was also transcribed using this software.

The LENA software is a digital software system that automatically computes the words, turns, and other aspects of the recordings in the infant’s environment. This analysis focus is to listen to the LENA recordings. This Honors Project analyzed and coded the vocalizations of the babies. By reviewing five of the ten low SES recordings; and five of the eleven mid SES recordings, this analysis reviewed the recordings of the infant’s post hour nap (PHN). Using

ELAN transcription software, this analysis sought to replicate a coding system as Oller (2000); Plumb (2011); and Schoen (2013) have done previously.

Previous studies have used video footage to categorize and code the vocalizations. This analysis accounted for the absence of video footage as a potential factor affecting results. Initially, this analysis coded for all vocalizations (i.e. cries, grunts, laughs, burps, raspberries, CV utterances, etc.). Upon listening for these vocalizations, it was determined that transcription of utterances was probable. With the help of Dr. DePaolis and other members of the Infant and Toddler Language Laboratory, a system was developed to categorize intentional verses non-intentional vocalizations. Additionally, to best determine which vocalizations are intentional and which are not, a system of interrater reliability was created. After a reliable system of classification was developed, this analysis attempted to further break down the categories more specifically (i.e. vocalizations of distress, pleasure, communicative intent, etc.).

Coding System

Speech: Any vocalization that imitates adult-like speech.

- Level 1 (L1): Just a vowel sound
- Level 2 (L2): 1 consonant sound and 1 vowel sound
- Level 3 (L3): Consonant cluster – glides (i.e. wawawaw)
- Level 4 (L4): Consonant cluster – stops, nasals, etc. (i.e. dadadada)

Non-Speech: Any vocalization that does not resemble adult-like speech.

- 1: Positive – laugh, giggle, squeal
- 2: Negative – cry, fuss, whine
- 3: Unclassifiable – any vocalization listened to no more than 3 times and is unidentifiable

Turn-Taking: Any response between the mother and/or infant.

Reliability

A second and third researcher were consulted for discussion of the methods used and then were asked to independently measure five-minute segments from 3 of the 5 low SES recordings and 3 of the 5 mid SES recordings. The correlation between the three researchers' measurements was 0.85, which indicates that this is a reliable method of classification.

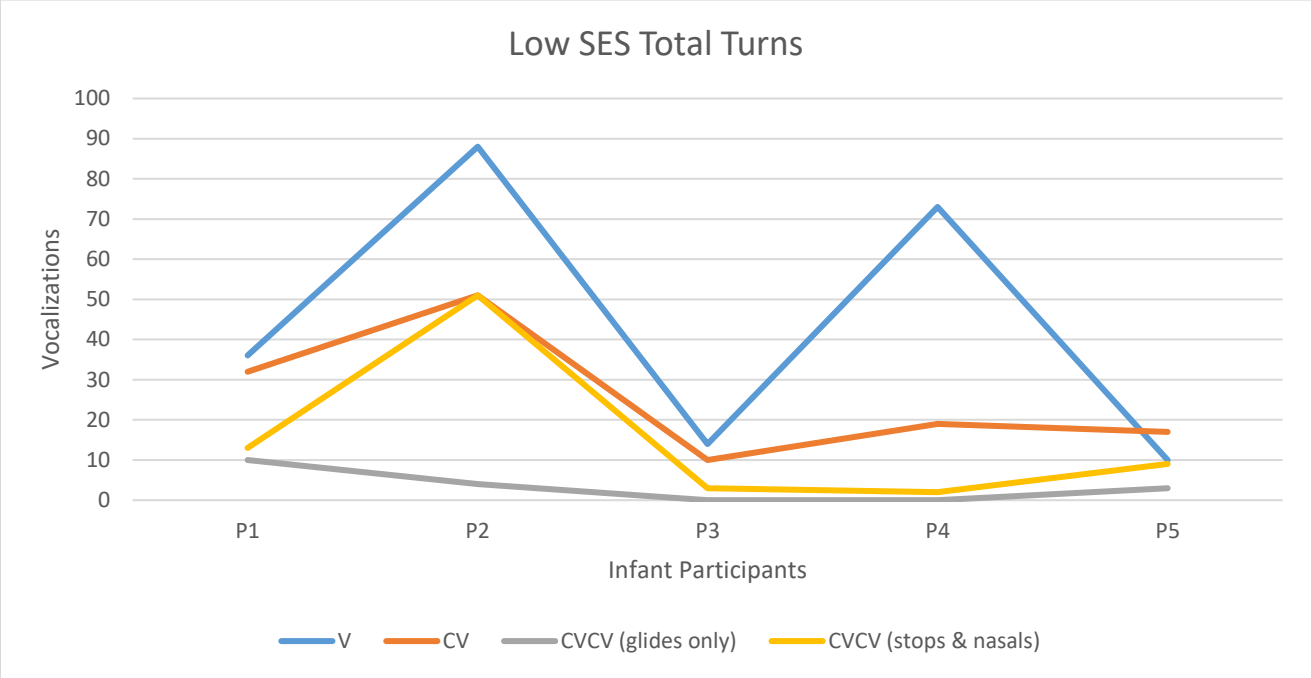
Results

The total number of infant vocalizations for low SES was 445; and the total for mid SES was 458. The total number of conversational turns for low SES was 123; and the total for mid SES was 149. The mean infant vocalizations for the low SES group (M = 22.25; SD = 25.26) was not a significant difference from the mid SES group (M = 22.9; SD = 16.37). The hypothesis was tested with independent-measures t-tests for the following variables: total number of vocalizations for low SES and mid SES and total number of turns for low SES and mid SES. For total vocalizations $t(8) = -0.08$, $p = 0.94$. For total turns $t(8) = -0.66$, $p = 0.53$. The results show that there is no significant difference between vocalizations and turns amongst mid and low SES. There were some trends and results of interest, yet none of which are significant. Thus, further research will need to be conducted with a larger sample size to better determine the differences amongst mid and low SES.

Low SES and Mid Vocalization Trends

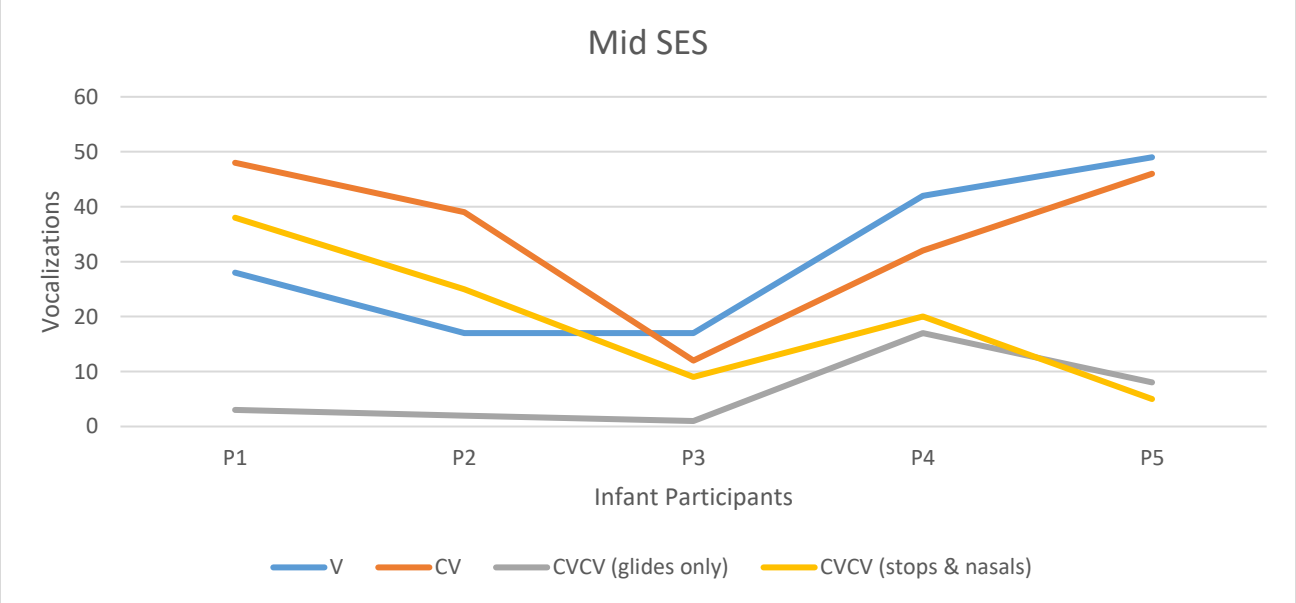
Figures 1 and 2 below depict the variability amongst each infant across low and mid SES. The X axis indicates the participant (P1 – P5) for both low and mid SES, while the Y axis indicates the total vocalizations per level. Level 1 is indicated as vowels only (V). Level 2 is indicated as consonant vowel (CV). Level 3 is indicated as consonant vowel consonant vowel – glides only (CVCV). Level 4 is indicated as consonant vowel consonant vowel – stops and nasals (CVCV).

Figure 1



Graph depicting low SES vocalization trends amongst each infant

Figure 2

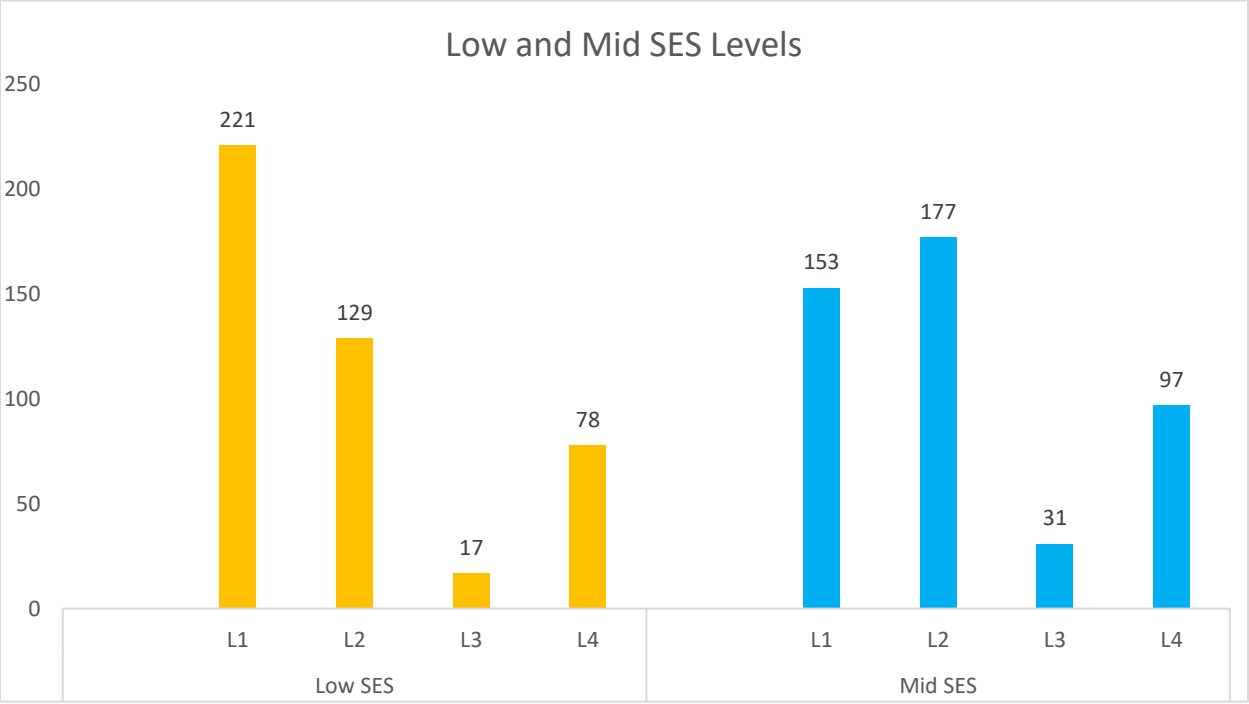


Graph depicting Mid SES vocalization trends amongst each infant

Low and Mid SES Individual Level Totals

Figure 5 shows the totals of each level (1-4) amongst mid and low SES. All five infants' vocalizations are included below (i.e. The five low SES infants vocalized 221 level 1 vocalizations in total). The figure shows that low SES infants were doing more level 1 vocalizations. For levels 2, 3, and 4, the graph shows that mid SES infants were doing more.

Figure 3



Graph depicting variation amongst speech levels 1-4, comparing mid and low SES.

Discussion

In conclusion, there were no significant differences between mid and low SES infants with regards to total vocalizations and total turns. Thus, our hypothesis that low SES infants would participate in less vocalizations and less turns was not supported. This contrasts with Oller et al, 1994.

Since we have developed a reliable method of classifying and coding for infant vocalizations, it would be interesting to continue this research with a larger sample size. As seen in Figure 5, the low SES infants were doing more level 1 vocalizations, while the mid SES infants were doing more level 2, 3, and 4 vocalizations. Though this data is not significant, a larger sample might show more differences with regards to complexity of vocalizations. Furthering this research, observing and measuring the response of the parent as dependent on the complexity of the vocalization could also be interesting. Since there were no statistical differences with regards to turns, it would be worth observing if there is a pattern of parental response with regards to type and complexity of vocalizations.

Additionally, this study did not account for difference amongst affect. Furthering this research, studies should go back and look at the already coded Non-Speech category to observe differences amongst affect between low and mid SES.

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