

In presenting this thesis in partial fulfillment of the requirements for an advanced degree at Idaho State University, I agree that the Library shall make it freely available for inspection. I further state that permission for extensive copying of my thesis for scholarly purposes may be granted by the Dean of the Graduate School, Dean of my academic division, or by the University Librarian. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature _____

Date _____

Running head: LINGUISTIC INPUT, FOCUS ON NOUNS

Linguistic Input to Infants and Later Vocabulary Development:
Noun Phrases and Noun-Related Inflectional Morphemes

by

Hannah Walsh

A thesis to be
submitted in partial fulfillment
of the requirements for the degree of
Master of Science in the Department of Communication Sciences and Disorders
Idaho State University
Spring 2020

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Hannah Walsh find it satisfactory and recommend that it be accepted.

Dr. Heather Ramsdell-Hudock

Major Advisor

Dr. Diane Ogiela

Committee Member

Dr. Nancy Devine

Graduate Faculty Representative

Table of Contents

List of Figures	vi
List of Tables	vii
Abstract	viii
Linguistic Input, Focus on Nouns	1
Caregiver Input	2
Caregiver responsiveness.....	2
Caregiver vocabulary	4
Caregiver noun use	7
Noun-Related Inflectional Morphemes and Noun Phrases.....	8
Purpose.....	10
Methods.....	11
Participants.....	11
Materials and Procedure	12
Laboratory setting	12
Caregiver input.....	13
Vocabulary ability.....	14
Design	15
Results.....	16
Expressive Noun Vocabulary at 1 Year.....	18

Expressive Noun Vocabulary at 2 Years	20
Expressive Noun Vocabulary at 3 Years	21
Effect Size	23
Discussion	24
Clinical Implications	26
Study Limitations	27
Future Directions	29
Conclusion	31
References	32

List of Figures

Figure 1 Stud purpose, participants, and variables of interest	15
Figure 2 Infant expressive noun vocabulary size per parent report on the MacArthur-Bates Communicative Development Inventories (CDI) at 1, 2, and 3 years of age	18

List of Tables

Table 1 Age of Emergence for Noun-Related Inflectional Morphemes	9
Table 2 Source (session 1, 2, or 3) of Data from Caregivers	17
Table 3 Caregiver Report on Variables of Interest for each Infant Age Group	17
Table 4 Expressive Noun Vocabulary Size per Infant at each Age	17
Table 5 Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 1 year)	19
Table 6 Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 2 years)	20
Table 7 Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 3 years)	22
Table 8 Effect Sizes (R^2) between Criterion and Predictor Variables	23

Linguistic Input to Infants and Later Vocabulary Development:

Noun Phrases and Noun-Related Inflectional Morphemes

Thesis Abstract--Idaho State University (2020)

For 13 parent/child dyads, we looked at how the quality (noun-related inflectional morphemes and noun phrase usage) and quantity of caregiver input directed to infants from 7 to 18 months of age was related to noun vocabulary expression in those same children at 1, 2, and 3 years of age. We expected that the frequency of morpheme use and the presence of elaborated noun phrases would be related to a larger later expressive noun vocabulary size increasing with infant age. Correlation, regression, and effect size values resulted in some statistical and clinical significance on infant noun vocabulary size as demonstrated through parent usage of noun morphology and noun phrases. Findings from the study can be used by speech-language pathologists to strengthen caregiver education regarding the impact of caregiver noun morphology and noun phrase use on expressive noun vocabulary development. Clinical implications, study limitations, and future directions are discussed.

Linguistic Input to Infants and Later Vocabulary Development: Noun Phrases and Noun-Related Inflectional Morphemes

Vocabulary ability can vary dramatically from one child to the next (Rowe, 2012), and can influence social and academic success (Brownlie et al., 2016). For example, when Brownlie et al. (2016) sought to better identify the correlations between childhood language disorders and adult social anxiety, they found that those with language and communication difficulties often miss out on opportunities to connect with others and learn at a different pace than peers who are typically developing. Early identification and provision of appropriate intervention for children with a language delay/disorder can reduce the negative effects on social and academic outcomes. One difficulty in early identification/treatment is the large variability seen across children in vocabulary size and linguistic input that they receive. Many aspects of an infant's development are responsible for this variability and can be indicators of vocabulary size in childhood. For example, Cartmill and colleagues (2013) observed that when parents expose their children to more specific language with more context (e.g., being at the zoo talking about a zebra that you are looking at, rather than discussing going to the zoo to see a zebra) it correlated significantly with children's later vocabulary abilities even after controlling for the effects of the quantity of parent input. For speech-language pathologists, increasing the evidence-based knowledge regarding factors that contribute to variability in vocabulary size could facilitate early identification of language delay/disorder at younger ages and more effective treatment approaches for early intervention.

In order to be able to identify language delay/disorder at younger ages, it is necessary to understand the different influences on later vocabulary abilities. Caregiver linguistic input to

LINGUISTIC INPUT, FOCUS ON NOUNS

infants has been shown to be a predictor of later child vocabulary size (Rowe et al., 2012). However, there are variable methods for identifying or defining the quality of what caregivers say to their infants. For example, does quality refer to the number of unique or novel words spoken to the infant, the types of words spoken (e.g., adjectives, nouns, verbs, etc.), the types of sentence structures used, the types of morphemes used, and so on. Continued exploration of specific measures of caregiver input are expected to provide a more efficient means for tracking development. More focused methods of caregiver education (to support speech/language development) could aid in the translation from basic research to clinical practice.

Caregiver Input

The quality of caregiver linguistic input to infants can be measured in many different ways. To gauge quality, researchers have explored caregiver input through measurement of utterance length, and/or the number of different words spoken. Additional measures have been employed to calculate the quality of caregiver input, such as word use, responsiveness, vocabulary, verb use, indefinite vocabulary, and Brown's morphemes.

Caregiver responsiveness. Caregiver input to children can be operationally defined through consideration of the caregiver's responsiveness. Responsiveness is the caregiver's reaction to their child, particularly the length of a response, or the number of turns taken within a conversation. Vigil et al. (2005) measured the number of caregiver initiations, responses, self-directed speech (caregivers talking to the child about what the caregiver was doing), conversational turns (the number of times the caregiver or child began speaking in response to what the other had said), and proportion of responses (when compared to the total number of utterances) to 24-month-old children in two cohorts (19 participants with typical language development and 10 participants with language delay). Vigil and colleagues (2005) found that

LINGUISTIC INPUT, FOCUS ON NOUNS

parents of children with typical language development provided more responses and participated in more conversational turns than did parents of children with delayed language development. The results of this study supported previous findings that when parents hear their child talk more, they are likely to respond more, especially when compared to parents whose child may not be speaking. Parents with typically developing children are also more likely to participate in two-sided conversations with their child, since their child is most likely able to take the lead in the conversation compared to children with language delay. This study supported previous research in that the quantity of language input for children with and without a language delay followed the same trends, but the function of the language that parents direct to these children differs.

Pancsofar and Vernon-Feagans (2006) also attempted to better understand caregiver input. They examined input from 120 caregivers of 1- to 3-year-old children at a Pennsylvania State University child-care facility (with 92 families following through to completion of the study). Researchers evaluated the total number of questions asked by caregivers, the number of conversational turns between caregivers and children, and the mean turn length of caregiver productions (the average number of utterances or words within each caregiver's turn). In order to measure these aspects of caregiver input, the families completed in-home interviews and questionnaires about daily life and caregiver education level. Parents were also observed while participating in 20-minute free play sessions with their children. Of all factors analyzed, data showed that although fathers produced less overall when compared to mothers during free play with their infants at 24 months of age; the fathers' total number of different word roots was most predictive of children's later vocabulary abilities at 36 months of age, as measured by the *Sequenced Inventory of Communication Development-Revised* (Hedrick et al., 1975).

Similarly, Hirsh-Pasek and colleagues (2015) sought to understand the fluency and

LINGUISTIC INPUT, FOCUS ON NOUNS

connectedness of parent-child interactions (dependent upon whether the parent or child engaged with their partner and took turns, rather than having the partner focus on what they are doing and dominating the conversation). Researchers measured the frequency and quality of parents' use of routines and rituals (defined as the variety, length, and repetition of the routines and rituals discussed by the parents during the session). All of these measures were quantified as parents communicated with their children. From archived data of 60 parent-child dyads, Hirsh-Pasek and colleagues (2015) compared interactions during 15-minute video recordings when the children were 24 months to expressive language scores, as measured by the *Reynell Developmental Language Scales* (Reynell, 1991), when the children were 36 months. Findings showed that the quality of communication, as measured by the variety, length, and repetition of parents' routines and rituals, was a much stronger predictor of children's expressive language abilities 1 year later than socioeconomic status (SES). A balanced interaction between the caregiver and child was also a strong predictor of later language abilities.

These studies were able to help establish the effect of caregiver responsiveness to infants/children on later language ability. However, continued analysis is needed to better understand the influence of caregiver linguistic input on later vocabulary development.

Caregiver vocabulary. Some researchers have analyzed caregiver vocabulary input to children as a means of predicting later development. Vocabulary input is distinct from responsiveness in that vocabulary input looks at the amount and type of words that caregivers are using when speaking with children. Rowe and colleagues (2012) examined different types of words produced by parents to sixty-two, 14-month-old children, in relation to vocabulary growth. The families were visited in their homes and videotaped during 90-minute interactions. The different types of words parents used were examined based on productions of words that

LINGUISTIC INPUT, FOCUS ON NOUNS

were concrete (items that could be identified through senses such as *hot* or *loud*) versus ambiguous (items that are open to more than one interpretation such as *truth* and *kindness*; Huttonlocher et al., 2010; Pan et al., 2005; Weizman & Snow, 2001). Results showed that increases in the use of concrete vocabulary input provided by caregivers across communication settings resulted in greater vocabulary growth over time in children. Further, results from this study were helpful in establishing a positive relationship between input from caregivers, and later productions of children. The positive relationship was observed between the number of different types of words produced by caregivers and overall vocabulary growth of children, measured by the *Peabody Picture Vocabulary Test* (PPVT; Dunn & Dunn, 2007). It is important to point out, that the PPVT, although used in this research study, has been identified as culturally biased, so future researchers should take this into consideration when considering the results of the assessment or research that uses it (Haitana, 2010).

Hart and Risley (2003) evaluated the diversity of children's experiences through caregiver vocabulary input (quantity was measured through the recorded vocabulary size and the average number of utterances per hour, quality was measured through the average number of different words per hour). In order to better understand the different types of experiences children were exposed to (e.g., going to the zoo versus staying within the home), researchers looked at a sample of 42 families within a longitudinal study, over the course of 2 to 4 years (dependent upon participant availability), via hour-long monthly observations. Findings demonstrated that the diversity of early experiences (the different types of opportunities presented to the child, such as going to a park, going to the zoo, having educational activities presented in the home, etc.) had an effect on what children noticed/were interested in 2 years later. The authors concluded that increasing the opportunities for different types of

LINGUISTIC INPUT, FOCUS ON NOUNS

experiences/language resulted in increasing the children's interest. Another vital finding was that by the time the children were 34 to 36 months of age, their average number of different words compared to their total number of words used was similar to that of their parents. In other words, more diverse early experience was related to parents who spoke more, which was related to children who spoke more.

Using other methods, Rowe (2012) examined caregiver input through analysis of vocabulary diversity (the different types of words used by the caregiver), sophistication of statements (or grammatical correctness of statements), and decontextualized utterances. Decontextualized utterances are those produced in the absence of a meaningful relevant context, or not set in the present moment, whether through pretend play (e.g., "I'll save you from the wicked sister") or through narrative (e.g., "We have popcorn in the movie theater, remember?"). These vocabulary measures were tallied in a sample of 50 parent-child dyads when the children were 18, 30, and 42 months of age. Results were compared to child standardized vocabulary scores at 30, 42, and 54 months of age. The diversity of words spoken by parents was shown to significantly affect child vocabulary size, as measured by the PPVT, although the most significant effects were seen at times when children were already likely to have significant increases in their vocabulary given typical developmental patterns. As stated above, the PPVT has been found to be a culturally biased assessment, so this should be taken into consideration by researchers. Rowe (2012) also found that as children get older and talk more, parents who use more rare words and decontextualized language facilitate greater increases in their children's overall language abilities. Caregiver's overall language input can be used as a way to understand what is being said to a child based on the total number of words and number of different words being used. There are still areas that can be expanded on in order to be able to better understand

LINGUISTIC INPUT, FOCUS ON NOUNS

more specific aspects of caregiver's input to children.

Caregiver noun use. There is evidence that caregiver communication across varying environments will facilitate greater language growth in children, as will caregiver use of concrete nouns. Cartmill and colleagues (2013) looked at 50 parent-child dyads over two, 90-minute observation sessions when the children were 14 and 18 months of age. The aim was to understand the effect of parent use of nouns on child vocabulary size at 4 years of age, as measured by the PPVT. Researchers measured parent input through identification of concrete nouns and found that differences across parents in the number of different concrete nouns produced at 14 to 18 months of infant age significantly correlated with an increase in child vocabulary at 4 years of age (Cartmill et al., 2013). In other words, the more concrete nouns parents produced the larger the child's later vocabulary size. Cartmill and colleagues (2013) concluded that children exposed to more specific language use by parents have more high-quality learning opportunities.

Caregiver noun use is linked directly to child noun learning. Piccin and Waxman (2007) discussed the importance of noun learning through varying linguistic contexts, specifically in relation to how children learn about verbs. Participants included 24 children between the ages of 6;6 and 7;11 who were randomly assigned to two test conditions. Individually, the children were shown videos that prompted the identification of a target noun or verb in response to a beep. The *linguistic information* group viewed a video with an intact audio track (and a beep for the target word) providing contextual information to facilitate identification of the target word. The *no linguistic information* group viewed a video with no audio (and a beep for the target word) providing no verbal context to facilitate identification of the target word. Results showed that children were better able to identify nouns than verbs, regardless of whether or not linguistic

LINGUISTIC INPUT, FOCUS ON NOUNS

information was provided, and more successful at identifying target words within the linguistic information group. The ability to identify new words when linguistic context is provided is also known as syntactic bootstrapping, which is defined as a child's ability to understand the meaning of words through the knowledge of the arrangement of words, phrases, and clauses within a sentence, regardless of the syntactic category of the word. In relation to noun understanding, children use the information surrounding the noun (such as an article, a possessive marker, or a plural marker) to help identify that there is a noun present and give them more information about the new word they are learning. Children who are given more context, specific language, and morphological markers when introduced to unfamiliar words, are better able to 1) understand the category to which words belong, and 2) make connections in order to understand meaning. For example, when children are given more specific information and context about unfamiliar nouns, they will be able to more easily expand their expressive noun vocabulary (Gillette et al., 1999). Gillette and colleagues (1999) were able to identify that concrete verbs are more easily acquired than abstract verbs, as well as that children are able to understand nouns more readily than verbs.

Noun-Related Inflectional Morphemes and Noun Phrases

Beyond measurements of caregiver input responsiveness, vocabulary, and noun learning, it is possible that the quality of caregiver input may be measured through use of noun-related inflectional morphemes. Inflectional morphemes are often compared to derivational morphemes as they both modify words, but they are used very differently (Yule, 2005). Derivational morphemes typically change the grammatical category to which the word belongs. For example, adding the derivational morpheme *-ly* to the word *exact*, changes the word from an adjective to an adverb; the addition of the derivational morpheme *-able* to the word *read*, changes the word from a verb to an adjective. Whereas inflectional morphemes are defined as modifications that

LINGUISTIC INPUT, FOCUS ON NOUNS

change the form of the word rather than creating new words. In other words, being able to show that there are multiple of an item, changing a verb from present to regular past tense, and comparing the size of an item, versus changing a word from a noun to a verb (Yule, 2005).

Noun-related inflectional morphemes have been established as important in language development because they are the foundational building blocks for when children are first acquiring nouns (both receptively and expressively; Brown, 1973). Noun-related inflectional morphemes indicate more than one item through plural -s, ownership through possessive -s, and context for identification of nouns through the articles *a*, *an*, and *the*. Table 1 lists noun-related inflectional morphemes in the order with which they develop according to age of emergence. Examples are provided.

Table 1
Age of Emergence for Noun-Related Inflectional Morphemes

Morpheme	Age of Emergence (in months)	Example
Plural -s	27-33	Toys
Possessive -s	26-40	Kayla's doll
Articles "a," "an," and "the"	28-46	This is a car, Put it in the box

In addition to simple noun-related inflectional morphemes, caregiver use of noun phrases directed to infants may influence language development. A noun phrase is defined as a word, or group of words that function as a noun. Noun phrases can be either the subject, direct object, complements following a copula verb, or indirect object of a clause or the sentence as a whole, but it can also be used as the object of a preposition. There are many types of noun phrases. Basic noun phrases are nouns, pronouns, or nouns with an article (for example, *dog*, *he*, and *the boy*). Simple elaborated noun phrases are nouns with an adjective modifier (for example *huge crowd* or *small pig*). Complex elaborated noun phrases are nouns with two or more modifiers (for example *empty soup cans* or *a brand-new mud puddle*; Liss-Bronstein, 2010). For the purpose of

LINGUISTIC INPUT, FOCUS ON NOUNS

this project each of these phrase types (basic noun phrase, simple elaborated noun phrase, and complex elaborated noun phrase), and each noun-related inflectional morpheme will be identified in caregiver input directed to infants to understand how they relate with later expressive noun vocabulary size.

Purpose

The *long-term goal* of the present line of research is to understand how various aspects related to the quantity and quality of caregiver linguistic input to infants (e.g., the total number of words spoken, the number of concrete nouns or decontextualized utterances spoken) influence later speech and language abilities. If caregivers are aware of how their linguistic input is related to later speech and/or language development, they may be more deliberate in the language they choose to use during interactions with their children. They may also be better able to identify the need for early intervention (Leffel & Suskind, 2013). The *objective* of this study was to determine the relationship between caregiver input variables related to noun morphology and later child noun vocabulary size. Specifically, for caregiver input, we calculated the number of noun-related inflectional morphemes per utterance, basic noun phrases, simple elaborated noun phrases, and complex elaborated noun phrases produced during 20-minute recordings. We accomplished this objective by longitudinally exploring caregiver linguistic input to infants from 6 to 18 months of age and vocabulary size at 1, 2, and 3 years of age in the same children. In line with prior research, infant ages are presented in three developmental groupings: “The prelinguistic stage, from 7 to 10 months of infant age, is thought to represent mostly immature prelinguistic vocalizations (e.g., marginal syllables). The early linguistic stage, from 15 to 18 months of age, is thought to represent mostly canonical and early linguistic productions (e.g., well-formed syllables and first word forms). The canonical stage, from 11 to 14 months of infant

LINGUISTIC INPUT, FOCUS ON NOUNS

age, is thought to represent an overlap of both prelinguistic and linguistic vocalizations, with more established canonical vocalizations” (Ramsdell-Hudock et al., 2018, p. 165). The *central hypothesis* was that caregiver linguistic input from 6 to 18 months (as measured by noun-related inflectional morphemes, basic noun phrases, simple elaborated noun phrases, and complex elaborated noun phrases) would be predictive of later expressive noun vocabulary ability at 1, 2, and 3 years of age (as measured by the *MacArthur-Bates Communicative Development Inventories*). The *rationale* for the proposed research was that a more specific measure of caregiver noun input would provide a better predictor of later noun vocabulary ability. If a relationship exists between caregiver noun-related inflectional morpheme use when speaking to children and later noun vocabulary size, we would be able to begin to develop methods for educating caregivers about the importance of noun morpheme and noun phrase input for vocabulary development.

Methods

Participants

Data for this project was obtained from 13 parent/infant dyads, all of which were monolingual English speakers, video/audio recorded monthly between 6 and 18 months of age in a longitudinal study (see Ramsdell-Hudock et al., 2018 for additional detail). Full hearing evaluations were administered to each infant at 6 and 18 months of age, from which hearing was judged to be within normal limits. In addition to recordings, *MacArthur-Bates Communicative Development Inventories* were gathered at 18 months, 2 years, and 3 years of age in follow-up studies.

Materials and Procedure

The University and Medical Center Institutional Review Board at East Carolina University approved the study prior to data collection. All caregivers gave voluntary informed consent for participation in the study. Exemption was obtained from the Human Subjects Committee at Idaho State University, as this study purpose was covered in the original consent. Parent/infant dyads were followed over a 12-month longitudinal period through weekly interviews and monthly recordings.

Laboratory setting. Infants and caregivers went to the lab at East Carolina University once a month for hour-long recordings. During recordings, caregivers were instructed to play with their infants, and interact as they would typically do in a home setting. The lab was designed to simulate a natural environment, such as a nursery in a home; it included stuffed animals, toys, and various objects that would allow both parent and child to feel comfortable. This setting attempted to encourage natural interactions between caregivers and infants, to facilitate capture of a representative sample of the caregiver's input and the infant's vocal abilities.

The lab was equipped with both video and audio recording capabilities. For video data, the recording room contained eight Sony EVI-D70/W wall-mounted cameras with pan and tilt capabilities. Further, three walls contained three by four-foot mirrors to optimize camera angles in recordings. For audio data, an infant vest housed a high-fidelity wireless microphone and caregivers wore a lapel microphone, each to control mouth-to-microphone distance (Buder & Stoel-Gammon, 2002). A signal-to-noise ratio of up to 96 dB was made possible with 16-bit quantization, and with signals digitized at sampling rates of 44.1 or 48 kHz. All video and audio from the recording playroom were relayed to an adjacent control room. During recordings,

LINGUISTIC INPUT, FOCUS ON NOUNS

laboratory staff would attempt to record two of the eight available camera angles from the control room, choosing those with 1) the best view of the infant's face and 2) the best view of the interaction between caregivers and infants (see Ramsdell-Hudock et al., 2018 for more detail).

Caregiver input. Utterances were located using a breath-group criterion (i.e., each vocalization occurred on a single egressive breath; Oller & Lynch, 1992). Caregiver utterances that were directed to the infant were transcribed orthographically for all recording sessions across infants and ages. Due to time constraints, only a 20-minute portion of each recording session was used for transcription and analysis. The middle 20 minutes of each 60-minute session was transcribed (to ensure that the parent and child had time to adjust to the new environment at the start of the recording as well as to reduce the possibility of the child having difficulty because they were hungry or tired at the end of the recording). If hardware or software issues occurred, the first 20 minutes of the 60-minute session was transcribed. Lab assistants located and transcribed caregiver utterances independently. In order to decrease subjectivity, a method of consensus coding was implemented. In the event that a lab assistant had a question regarding a specific utterance, they were able to ask another lab staff who was also working. Caregiver input was judged to be directed when a response, request, or clarification was indicated verbally (by semantic content), or nonverbally (through eye gaze). Conversely, caregiver input was not directed when their utterances were directed to someone else in the room, or to someone on the phone, as indicated verbally, or nonverbally. Caregiver utterances such as animal noises, imitating infant vocalizations, and other non-words were not included in the analysis. Caregiver utterances directed to infants were transcribed orthographically into a Microsoft Excel document, from which noun-related inflectional morphemes, basic noun phrases, simple elaborated noun phrases, and complex elaborated noun phrases were identified

and tallied. Each line (i.e., transcribed caregiver utterance directed to the infant) of each transcript was independently reviewed by the author to calculate the quantity of all predictor variables (e.g., basic noun phrases, etc.).

Vocabulary ability. Parent report has been recognized as both a reliable and valid means of determining speech and language development in infants and toddlers (Feldman et al., 2005; Fenson et al., 1994; Heilmann et al., 2005; Korkman et al., 2004; Oller et al., 2001; Rescorla & Alley, 2001). The CDI was the parent report measure of vocabulary for the present study (Fenson et al., 2000). The CDI in particular has several studies to back up its concurrent and predictive validity as a measure of vocabulary (Feldman et al., 2005; Heilmann et al., 2005). In a study by Feldman and colleagues in 2005, the CDI was shown to have positive and statistically significant concurrent validity when compared to three standardized accepted measures of infant language and cognition (e.g., *McCarthy General Cognitive Index*, the *McCarthy Verbal Scale*, and the *Peabody Picture Vocabulary Test-Revised*) and when compared to number of different words and mean length of utterance determined by recording parent to child conversations. A study by Heilmann and colleagues (2005) found the CDI to be positively correlated with the *Preschool Language Scales III*, the number of different words produced by the child according to the *Systematic Language Transcription Analysis (SALT)*, and the child's mean length of utterance. Results of these studies indicate that the CDI is a valid measure of vocabulary and expressive language in toddlers.

In the present study, caregivers completed the CDI *Words and Gestures* bi-monthly from 10 to 18 months of infant age, and *Words and Sentences* in follow-up studies at 2 and 3 years of age. From the inventories, we tallied expressive noun vocabulary size at three points in time

LINGUISTIC INPUT, FOCUS ON NOUNS

(ranges presented because individual infants varied in age at each point in time): 1 year (15 to 18 months), 2 years (23 to 27 months), and 3 years (37 to 40 months) of infant/child age.

Design

Correlation and multiple regression analyses were conducted to examine the relationship between all criterion and predictor variables (shown in Figure 1). The criterion variables of interest were expressive noun vocabulary at 1, 2, and 3 years of age. The predictor variables of interest were number of basic noun phrases, simple elaborated noun phrases, complex elaborated noun phrases, and noun-related inflectional morphemes (plural -s, possessive -s, and the articles *a*, *an*, and *the*) tallied in caregiver input directed to infants, and infant age group (prelinguistic from 7 to 10 months, canonical from 11 to 14 months, and early linguistic from 15 to 18 months). A significance level (p) was set at 0.05 for the purpose of this study.

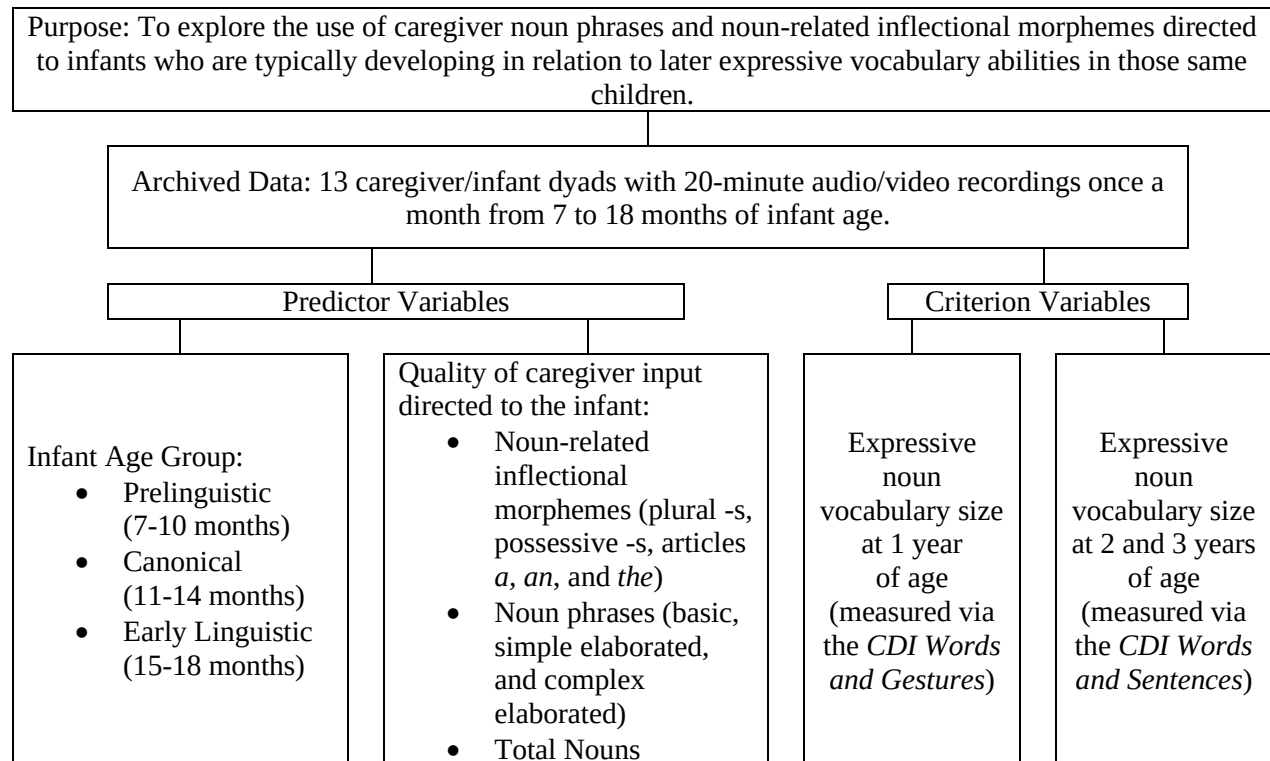


Figure 1. Study purpose, participants, and variables of interest.

We know from prior research that caregiver use of nouns, in general, does influence children's later noun expression (Cartmill et al., 2013; Piccin & Waxman, 2007). This presents a confound and we wanted to control for the frequency of caregiver noun use. Accordingly, an independent variable for the frequency of caregiver noun expression was put into the regression to control for it, as any predictor that is significant in a regression is interpreted as significant while controlling for everything else in the model.

Results

Caregivers produced a total of 6,450 utterances (23,869 words) in the middle 20 minutes of 60-minute recordings with their 13 infants from 7 to 18 months of age. Data for developmental groupings were averaged across corresponding ages for each infant, these values are shown below in Table 2. For example, to generate the number of utterances produced by caregivers for infant 1 in the prelinguistic age group, an average number of utterances was calculated across 7-, 8-, 9-, and 10-month values. For months when data was missing due to either technical difficulties or participant unavailability, shown by empty cells in Table 2, the numbers were simply not included in the calculated averages. The raw number of predictor variables (basic noun phrases, simple elaborated noun phrases, complex elaborated noun phrases, and noun-related inflectional morphemes) provided in caregiver input to infants in prelinguistic, canonical, and early linguistic age groups are shown in Table 3. Expressive noun vocabulary scores for each infant as measured via the CDI are shown in Table 4, missing values were derived from average across infant expressive noun vocabulary size at each age. Descriptive statistics show an increase in expressive noun vocabulary with an increase in infant age (see Figure 2), which follows expected developmental patterns.

LINGUISTIC INPUT, FOCUS ON NOUNS

Table 2

Source (session 1, 2, or 3) of Data from Caregivers

Infant	Infant Age (in Months)											
	Prelinguistic				Canonical				Early Linguistic			
	7	8	9	10	11	12	13	14	15	16	17	18
1	2	2	2	2	1		2	1	2	2	2	
2	2	2	2		2	2	2	2	2	2	2	
3	2	1	1	2		2	2	2	2	2	2	2
4	2	2	2	2	2	2	2	2	2	2	1	
5	2	2	2	2	2	2	2		2	2		
6	2	2	2	2	2		2	2		2	2	2
7	2	2			2	2	2	2	2	2		
8	2	2	1	2	2	2	2	2	2	1	2	2
9	2	2		2	3	2	2	2		2	2	2
10	1	2	2	2	2	2	2	1	2	2	2	
11	2	2	2	2	1	2	2	2	2	2	2	
12	2	2	2	2	2	2	2	2	2	1	2	2
13	2	2		2	2		2	2	2			

Empty cells represent missing data.

Table 3

Caregiver Report on Variables of Interest for each Infant Age Group

Caregiver Report	Infant Age Group			
	Prelinguistic	Canonical	Early Linguistic	Total
Utterances	2160.42	2179.42	2110.25	6450.09
Words	7273.50	7883.25	8711.83	23868.60
Plural -s	97.50	111.50	136.33	345.33
Possessive -s	14.50	23.33	17.67	55.50
Article <i>a</i>	112.08	135.50	156.92	404.50
Article <i>the</i>	157.08	228.00	296.83	681.91
Article <i>an</i>	9.83	8.50	13.50	31.83
Basic NP	2168.50	2439.08	2622.75	7230.33
Simple Elaborated NP	352.50	390.17	423.17	1165.84
Complex Elaborated NP	78.17	57.08	68.42	203.67
Nouns	2599.17	2179.42	7883.25	8599.83

Table 4

Expressive Noun Vocabulary Size per Infant at each Age

Infant	1 Year	2 Years	3 Years
1	117.00	324.00	401.00
2	113.00	340.00	389.00
3	11.00	128.00	386.00
4	197.00	354.00	401.00
5	119.00	331.00	370.00

LINGUISTIC INPUT, FOCUS ON NOUNS

6	35.00	183.00	385.00
7	3.00	229.00*	340.00
8	26.00	116.00	391.00
9	19.00	149.00	378.00
10	7.00	42.00	398.00
11	16.00	309.00	383.00
12	12.00	176.00	385.00*
13	44.00	300.00	393.00
<i>M</i>	55.31	229.31	384.62
<i>SD</i>	60.85	103.31	16.07

*Missing data.

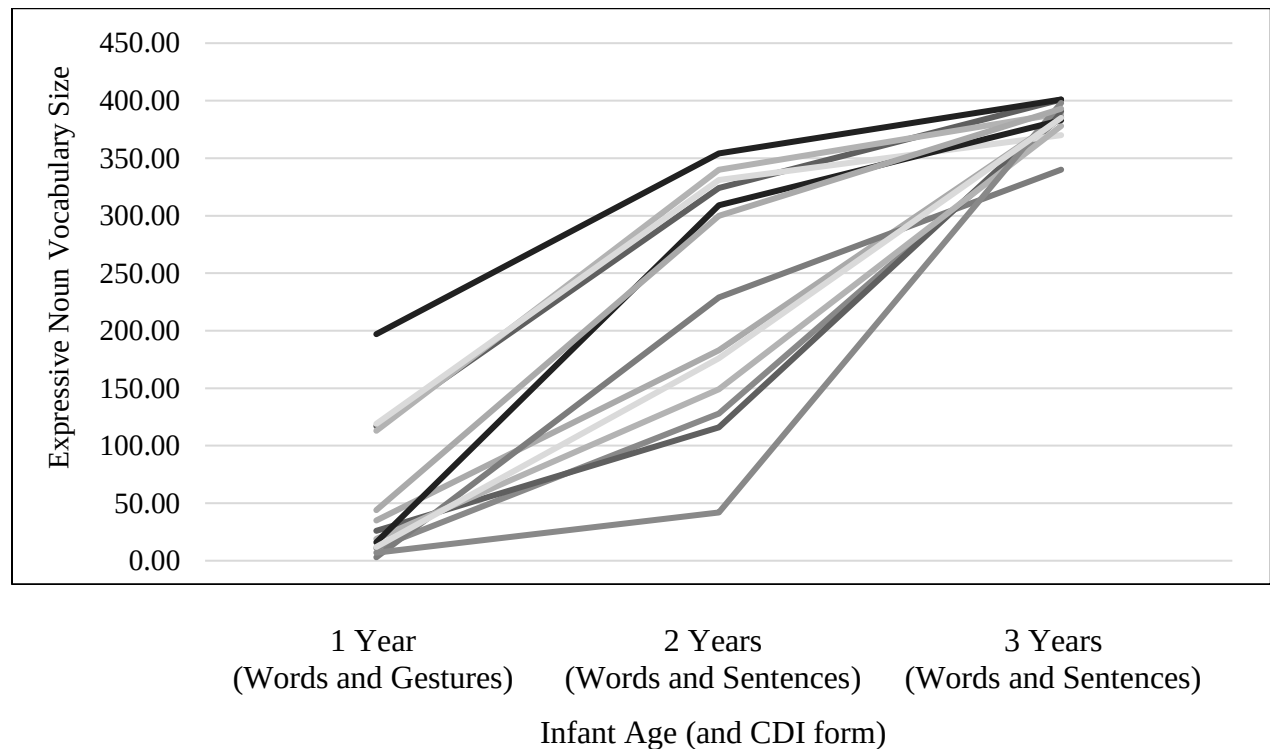


Figure 2. Infant expressive noun vocabulary size per parent report on the *MacArthur-Bates Communicative Development Inventories* (CDI) at 1, 2, and 3 years of age.

Expressive Noun Vocabulary at 1 Year

Table 5 summarizes the descriptive statistics and analysis results when examining the relationship between expressive noun vocabulary size at 1 year with all potential predictor variables. Expressive noun vocabulary size at 1 year of age was positively and significantly correlated with use of the article *the* and basic noun phrases within the canonical and early

linguistic age groups, with higher values related to larger expressive noun vocabulary.

Expressive noun vocabulary at 1 year of age was not significantly correlated with any other predictor variables. For the regression analysis, the predictor variable of basic noun phrases was excluded from the model because it did not provide additional information (i.e., the value was accounted for by other predictor variables in the model). The multiple regression model for all predictors in the prelinguistic age group produced an $R^2 = 0.894$, $F(10, 2) = 1.689$, $p = 0.428$; the canonical age group produced an $R^2 = 0.951$, $F(10, 2) = 3.889$, $p = 0.222$; and the early linguistic age group produced an $R^2 = 0.980$, $F(10, 1) = 4.964$, $p = 0.337$. As can be seen in Table 5, none of the predictor variables from 7 to 18 months of age statistically significantly contributed to the multiple regression model for expressive noun vocabulary size at 1 year.

Table 5

Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 1 Year)

Age Group	Predictor Variables	<i>M</i>	<i>SD</i>	<i>r</i>	Multiple Regression Weights		<i>t</i>	<i>p</i>
					<i>B</i>	β		
Prelinguistic	Utterances	166.19	54.44	0.05	-1.09	-0.97	-1.38	0.30
	Words	559.50	256.49	0.32	-0.53	-2.23	-1.43	0.29
	Plural -s	7.50	3.20	0.18	20.69	1.09	0.95	0.44
	Possessive -s	1.11	1.38	0.08	25.21	0.57	0.97	0.43
	Article <i>a</i>	8.62	7.82	0.03	-15.32	-1.97	-1.56	0.26
	Article <i>the</i>	12.08	8.58	0.45	3.87	0.55	0.91	0.46
	Article <i>an</i>	0.76	0.98	-0.32	58.53	0.95	1.05	0.40
	Basic NP	166.81	83.12	0.47	2.21	3.02	2.23	0.16
	Simple Elaborated NP	27.12	13.74	0.15	1.87	0.42	0.50	0.67
	Complex Elaborated NP	6.01	3.37	-0.06	-16.01	-0.89	-1.20	0.35
	Nouns	199.94	95.31	0.43	2.21	3.47	2.23	0.16
Canonical	Utterances	167.65	67.67	0.15	-1.09	-1.21	-2.26	0.15
	Words	606.40	270.38	0.48	0.29	1.28	0.60	0.61
	Plural -s	8.58	5.41	-0.11	10.61	0.94	1.38	0.30
	Possessive -s	1.79	1.96	0.21	-5.21	-0.17	-0.41	0.72
	Article <i>a</i>	10.42	5.81	0.13	5.37	0.51	0.84	0.49
	Article <i>the</i>	17.54	11.73	0.66*	-14.34	-2.76	-2.01	0.18
	Article <i>an</i>	0.65	0.69	-0.15	9.52	0.11	0.34	0.77
	Basic NP	187.62	93.01	0.56*	2.35	3.59	1.88	0.20
	Simple Elaborated NP	30.01	15.57	-0.14	-8.39	-2.15	-2.50	0.13
	Complex Elaborated NP	4.39	2.54	-0.32	-9.15	-0.38	-0.95	0.44
	Nouns	222.03	103.67	0.47	2.35	3.99	1.88	0.20
Early Linguistic	Utterances	162.33	51.99	0.36	-1.10	-0.76	-1.49	0.38
	Words	670.14	296.85	0.46	-2.81	-12.11	-1.84	0.32
	Plural -s	10.49	5.14	-0.28	20.40	1.69	2.58	0.24

LINGUISTIC INPUT, FOCUS ON NOUNS

Possessive -s	1.47	0.96	-0.41	-41.59	-0.63	-1.95	0.30
Article <i>a</i>	12.07	5.17	-0.06	10.46	0.83	1.23	0.43
Article <i>the</i>	22.83	21.78	0.70**	6.06	2.10	1.28	0.42
Article <i>an</i>	1.04	1.03	-0.31	-89.34	-1.51	-2.79	0.22
Basic NP	201.75	97.88	0.57*	6.98	10.27	2.21	0.27
Simple Elaborated NP	32.55	15.87	0.02	5.97	1.40	1.35	0.41
Complex Elaborated NP	5.26	3.22	-0.28	33.47	1.69	1.52	0.37
Nouns	239.56	110.64	0.49	6.98	11.46	2.22	0.27

NP = Noun Phrase

* $p < .05$, ** $p < .01$, *** $p < .001$

Expressive Noun Vocabulary at 2 Years

Table 6 summarizes the statistically significant descriptive statistics and analysis results when examining the relationship between expressive noun vocabulary size at 2 years with all potential predictor variables. Expressive noun vocabulary size at 2 years of age was positively and significantly correlated with the use of plural -s within the prelinguistic age group. Expressive noun vocabulary size at 2 years of age was not significantly correlated with any of the other predictor variables. As with expressive noun vocabulary at 1 year, for the regression analysis at 2 years, the predictor variable of basic noun phrases was excluded from the model because it did not provide additional information (i.e., the value was accounted for by other predictor variables in the model). The multiple regression model for all predictors in the prelinguistic age group produced an $R^2 = 0.827$, $F(10, 2) = 0.955$, $p = 0.614$; the canonical age group produced an $R^2 = 0.788$, $F(10, 2) = 0.745$, $p = 0.695$; and the early linguistic age group produced an $R^2 = 0.899$, $F(10, 1) = 0.887$, $p = 0.687$. None of the predictor variables from 7 to 18 months of age statistically significantly contributed to the multiple regression model for expressive noun vocabulary size at 2 years.

Table 6

Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 2 Years)

Age Group	Predictor Variables	<i>M</i>	<i>SD</i>	<i>r</i>	Multiple Regression Weights		<i>t</i>	<i>p</i>
					<i>B</i>	β		
Prelinguistic	Utterances	166.19	54.44	0.04	-0.64	-0.34	-0.37	0.74
	Words	559.50	256.49	0.26	-0.80	-1.99	-0.99	0.42
	Plural -s	7.50	3.20	0.56*	43.38	1.35	0.92	0.46

LINGUISTIC INPUT, FOCUS ON NOUNS

	Possessive -s	1.11	1.38	0.46	48.15	0.64	0.85	0.48
	Article <i>a</i>	8.62	7.82	0.38	-16.58	-1.26	-0.78	0.52
	Article <i>the</i>	12.08	8.58	0.29	5.82	0.48	0.63	0.59
	Article <i>an</i>	0.76	0.98	-0.02	48.87	0.46	0.40	0.73
	Basic NP	166.81	83.12	0.33	1.64	1.32	0.76	0.53
	Simple Elaborated NP	27.12	13.74	0.42	11.03	1.47	1.36	0.31
	Complex Elaborated NP	6.01	3.37	0.26	-47.47	-1.55	-1.64	0.24
	Nouns	199.94	95.31	0.35	1.64	1.51	0.76	0.53
Canonical	Utterances	167.65	67.67	0.27	-2.41	-1.58	-1.42	0.29
	Words	606.40	270.38	0.5	-0.17	-0.43	-0.10	0.93
	Plural -s	8.58	5.41	0.25	27.81	1.46	1.03	0.41
	Possessive -s	1.79	1.96	0.33	-9.03	-0.17	-0.20	0.86
	Article <i>a</i>	10.42	5.81	0.35	17.40	0.98	0.77	0.52
	Article <i>the</i>	17.54	11.73	0.46	-40.38	-4.58	-1.60	0.25
	Article <i>an</i>	0.65	0.69	0.16	85.60	0.57	0.87	0.48
	Basic NP	187.62	93.01	0.52	7.56	6.81	1.72	0.23
	Simple Elaborated NP	30.01	15.57	0.27	-16.58	-2.50	-1.40	0.30
	Complex Elaborated NP	4.39	2.54	0.12	-14.07	-0.35	-0.41	0.72
	Nouns	222.03	103.67	0.51	7.56	7.59	1.72	0.23
Early Linguistic	Utterances	162.33	51.99	0.15	1.08	0.45	0.39	0.76
	Words	670.14	296.85	0.23	-4.17	-10.78	-0.72	0.60
	Plural -s	10.49	5.14	0.16	40.09	2.00	1.34	0.41
	Possessive -s	1.47	0.96	-0.34	-88.09	-0.80	-1.10	0.47
	Article <i>a</i>	12.07	5.17	-0.06	15.42	0.74	0.48	0.71
	Article <i>the</i>	22.83	21.78	0.35	6.33	1.32	0.35	0.78
	Article <i>an</i>	1.04	1.03	0.02	-115.40	-1.18	-0.96	0.51
	Basic NP	201.75	97.88	0.29	9.73	8.61	0.82	0.56
	Simple Elaborated NP	32.55	15.87	0	10.13	1.42	0.61	0.65
	Complex Elaborated NP	5.26	3.22	-0.24	28.00	0.85	0.34	0.79
	Nouns	239.56	110.64	0.25	9.74	9.61	0.82	0.56

NP = Noun Phrase

*p < .05, **p < .01, ***p < .001

Expressive Noun Vocabulary at 3 Years

Table 7 summarizes the statistically significant descriptive statistics and analysis results when examining the relationship between expressive noun vocabulary size at 3 years with all potential predictor variables. Expressive noun vocabulary size at 3 year of age was not statistically significantly correlated with any of the predictor variables. As with expressive noun vocabulary at 1 and 2 years, for the regression analysis at 3 years, the predictor variable of basic noun phrases was excluded from the model because it did not provide additional information (i.e., the value was accounted for by other predictor variables in the model). The multiple regression model for all predictors in the prelinguistic age group produced an $R^2 = 0.895$, $F(10,$

LINGUISTIC INPUT, FOCUS ON NOUNS

2) = 1.708, $p = 0.425$; the canonical age group produced an $R^2 = 0.876$, $F(10, 2) = 1.411$, $p = 0.485$; and the early linguistic age group produced an $R^2 = 0.940$, $F(10, 1) = 1.576$, $p = 0.556$.

None of the predictor variables from 7 to 18 months of age statistically significantly contributed to the multiple regression model for expressive noun vocabulary size at 3 years.

Table 7

Summary Statistics, Correlations, and Results from the Regression Analysis (Dependent Variable = Expressive Noun Vocabulary at 3 Years)

Age Group	Predictor Variables	<i>M</i>	<i>SD</i>	<i>r</i>	Multiple Regression Weights		<i>t</i>	<i>p</i>
					<i>B</i>	β		
Prelinguistic	Utterances	166.19	54.44	0.16	-0.08	-0.27	-0.39	0.74
	Words	559.50	256.49	0.25	-0.17	-2.64	-1.70	0.23
	Plural -s	7.50	3.20	0	-9.09	-1.81	-1.59	0.25
	Possessive -s	1.11	1.38	0.16	7.80	0.67	1.14	0.37
	Article <i>a</i>	8.62	7.82	0.16	0.64	0.31	0.25	0.83
	Article <i>the</i>	12.08	8.58	0.4	0.75	0.40	0.67	0.57
	Article <i>an</i>	0.76	0.98	0.23	2.56	0.16	0.17	0.88
	Basic NP	166.81	83.12	0.32	0.63	3.27	2.42	0.14
	Simple Elaborated NP	27.12	13.74	0.18	-0.84	-0.72	-0.86	0.48
	Complex Elaborated NP	6.01	3.37	0.23	6.72	1.41	1.92	0.19
	Nouns	199.94	95.31	0.32	0.63	3.75	2.42	0.14
Canonical	Utterances	167.65	67.67	-0.06	0.17	0.70	0.82	0.50
	Words	606.40	270.38	0.14	0.06	0.94	0.28	0.81
	Plural -s	8.58	5.41	-0.20	-2.95	-0.99	-0.91	0.46
	Possessive -s	1.79	1.96	-0.26	0.08	0.01	0.02	0.99
	Article <i>a</i>	10.42	5.81	0.26	3.01	1.09	1.12	0.38
	Article <i>the</i>	17.54	11.73	0.35	1.42	1.04	0.47	0.68
	Article <i>an</i>	0.65	0.69	-0.24	-7.51	-0.32	-0.64	0.59
	Basic NP	187.62	93.01	0.17	-0.35	-2.03	-0.67	0.57
	Simple Elaborated NP	30.01	15.57	-0.21	-1.01	-0.98	-0.72	0.55
	Complex Elaborated NP	4.39	2.54	0.01	4.50	0.71	1.11	0.38
	Nouns	222.03	103.67	0.12	-0.35	-2.26	-0.67	0.57
Early Linguistic	Utterances	162.33	51.99	0.05	-0.76	-2.02	-2.27	0.26
	Words	670.14	296.85	0.14	-0.15	-2.47	-0.22	0.86
	Plural -s	10.49	5.14	-0.33	0.13	0.04	0.04	0.98
	Possessive -s	1.47	0.96	-0.09	0.08	0.00	0.01	0.99
	Article <i>a</i>	12.07	5.17	-0.22	-2.54	-0.77	-0.66	0.63
	Article <i>the</i>	22.83	21.78	0.21	-0.89	-1.17	-0.41	0.75
	Article <i>an</i>	1.04	1.03	-0.21	-9.44	-0.61	-0.65	0.63
	Basic NP	201.75	97.88	0.19	1.03	5.78	0.72	0.60
	Simple Elaborated NP	32.55	15.87	-0.08	-0.71	-0.63	-0.35	0.78
	Complex Elaborated NP	5.26	3.22	0.15	8.29	1.60	0.83	0.56
	Nouns	239.56	110.64	0.16	1.03	6.46	0.72	0.60

NP = Noun Phrase

* $p < .05$, ** $p < .01$, *** $p < .001$

Effect Size

Small and medium effect sizes were observed between most criterion and predictor variables, as can be seen in Table 8 (with criterion variables listed horizontally and predictor variables listed vertically). Effect sizes, such as the R^2 coefficient of determination, can be useful to describe how much of the variance in the multiple regression model is accounted for by each variable (expressed as a percent; 0.04 – small effect, 0.25 – medium effect, 0.64 – large effect; Ferguson, 2009; Soper, 2006). The observation of small and medium effect sizes in our data suggests clinical importance. Significance tests can be confounded by sample size, while effect size simply quantifies the difference between two groups (Kim, 2015). As such, it could be that the small sample size of 13 caregiver/infant dyads in the present study obscured our ability to quantify statistically significant results, while the magnitude of the effect sizes observed shows that caregiver use of noun elements, is exhibiting a small to medium influence over later vocabulary outcomes at 1 and 2 years in particular. Therefore, if our sample size were larger, it is likely that we would demonstrate more statistical significance.

Table 8
Effect Sizes (R^2) between Criterion and Predictor Variables

Age Group	Variables of Interest	Expressive Noun Vocabulary		
		1 Year	2 Years	3 Years
Prelinguistic	Utterances	0.00	0.00	0.03
	Words	0.10	0.07	0.06
	Plural "s"	0.03	0.31	0.00
	Possessive "s"	0.01	0.21	0.02
	Article <i>a</i>	0.00	0.14	0.03
	Article <i>the</i>	0.20	0.09	0.16
	Article <i>an</i>	0.10	0.00	0.05
	Basic NP	0.22	0.11	0.10
	Simple Elaborated NP	0.02	0.17	0.03
	Complex Elaborated NP	0.00	0.07	0.06
	Total Nouns	0.18	0.13	0.10
Canonical	Utterances	0.02	0.07	0.00
	Words	0.23	0.25	0.02
	Plural "s"	0.01	0.06	0.04
	Possessive "s"	0.04	0.11	0.07
	Article <i>a</i>	0.02	0.12	0.07
	Article <i>the</i>	0.44	0.21	0.12

LINGUISTIC INPUT, FOCUS ON NOUNS

	Article <i>an</i>	0.02	0.02	0.06
	Basic NP	0.31	0.27	0.03
	Simple Elaborated NP	0.02	0.07	0.04
	Complex Elaborated NP	0.10	0.02	0.00
	Total Nouns	0.22	0.26	0.01
Early Linguistic	Utterances	0.13	0.02	0.00
	Words	0.21	0.05	0.02
	Plural "s"	0.08	0.02	0.11
	Possessive "s"	0.17	0.12	0.01
	Article <i>a</i>	0.00	0.00	0.05
	Article <i>the</i>	0.49	0.13	0.05
	Article <i>an</i>	0.09	0.00	0.04
	Basic NP	0.33	0.08	0.04
	Simple Elaborated NP	0.00	0.00	0.01
	Complex Elaborated NP	0.08	0.06	0.02
	Total Nouns	0.25	0.06	0.02

NP = Noun Phrase

An R^2 of 0.04 is interpreted as a small effect size, of 0.25 as a medium, and of 0.64 as a large (Ferguson, 2009; Soper, 2006).

Discussion

Through this study, we aimed to evaluate the relationship between caregiver input directed to infants (specifically through the use of noun-related inflectional morphemes, basic noun phrases, simple elaborated noun phrases, and complex elaborated noun phrases, while controlling for overall noun production) and expressive noun vocabulary development in toddlers. Previous research has indicated that later vocabulary ability is influenced by the use of noun elements by caregivers (Cartmill et al., 2013; Piccin & Waxman, 2007). Through correlation and multiple regression analyses, a cohort of 13 parent and infant dyads were evaluated to determine the relationship between noun-related inflectional morphemes and noun phrases in caregiver input directed to infants during 20 minutes of free-play and expressive noun vocabulary size at a later age for these children. While statistical significance was only found at 1 and 2 years of infant age between the predictor and criterion variables, we did observe clinical significance through effect sizes at all ages. Effect sizes demonstrated clinical relevance for caregiver linguistic noun input directed to infants on later noun vocabulary size at 1 and 2 years, with less relevance at 3 years. Practical significance was seen between many variables across

LINGUISTIC INPUT, FOCUS ON NOUNS

ages through small and medium effect sizes. These findings follow the trend in previous research that as children begin to learn more, there is a need for more descriptive noun usage by caregivers (Cartmill et al., 2013).

There are several factors that could have had an impact on the statistical and clinical significance of the results. One thing to consider was the fact that all of the children in this study were typically developing. As a result, we observed what may be considered a ceiling effect with results on the *CDI* at 3 years of age, where all children were reported to produce nearly all nouns on the inventory. These results were researched by Mayor and Plunkett (2011) who sought to better understand children's overall vocabulary size when they begin to use more unique words that would not be included within the *CDI*. They discovered that when children have a fairly high score on the *CDI* it becomes difficult to get an accurate measure of their total vocabulary size, since they are likely to have a much larger vocabulary than can be measured within a questionnaire. Clinicians then often estimate vocabulary size through diary accounts and direct *CDI* counts in order to get a better picture of a child's vocabulary size. This research showed that at early ages the *CDI* is a good indicator of a child's total vocabulary size, but as children age it is difficult to create an assessment to get the overall picture of a child's vocabulary size because of the variability within children's experiences. Therefore, we may not have observed true expressive noun vocabulary ability at 3 years of age.

Another consideration is the presence of caregivers at each recording: who was there with the child, how many caregivers were in the room? When recordings were performed, the vast majority included the mothers solely, but at times fathers, grandparents, and even aunts were included in the recordings. Coding for the presence of different caregivers could change the overall outcomes of the data analysis. As seen in research performed by Pancsofar and Vernon-

LINGUISTIC INPUT, FOCUS ON NOUNS

Feagans (2006) significant differences were seen when factoring in the differences between input from the mother versus input from the father. Specifically, the most significant positive results were seen when analyzing the input provided by fathers to 24-month-old infants. These results show that there is the possibility of seeing differences within data analysis when coding for different caregivers. All of these questions could have altered the values for caregiver noun-related inflectional morphemes and noun phrase input. There is a possibility that by increasing the total number of participants included within the study we could have seen more statistically significant results outside of the effect sizes.

Upon closer inspection of the data, specifically related to noun phrases produced by caregivers directed to infants from 7 to 18 months of age, it appears that the more advanced the noun phrase (complex elaborated is more advanced than simple elaborated, simple elaborated is more advanced than basic), the greater the influence on later expressive noun vocabulary development with increasing child age from 1 to 3 years. There did not appear to be any trends for noun-related inflectional morphemes produced by caregivers directed to infants from 7 to 18 months of age in terms of how these variables influenced later expressive noun vocabulary ability, as each seemed to play equally important roles.

Clinical Implications

Statistically and clinically (through effect sizes) significant results were obtained for 1 and 2 years of infant age. The current study is in line with previous research showing that, while noun usage in general is important, more specific and complex language used to describe nouns is more significant at later ages (Cartmill et al., 2013). Clinically, this notion is important as we know that environmental factors significantly impact infants' noun vocabulary development. It is

LINGUISTIC INPUT, FOCUS ON NOUNS

imperative to consider which environmental factors have the largest influence on noun development so that we can focus on conveying that information to caregivers.

Caregiver education is a major component to the roles and responsibilities of a speech-language pathologist, particularly during early intervention of children from birth to 3 years of age. Providing caregivers with information on the importance of noun-related inflectional morphemes and noun phrases in their direct language input is likely to be helpful in a caregiver's ability to understand their role in their child's language development. Specifically, it is likely to result in caregivers potentially increasing aspects of their noun input (Piccin & Waxman, 2007). As the total amount nouns produced by caregivers to infants increases, it has been shown that later toddler vocabulary sizes will increase as well (Cartmill et al., 2013; Piccin & Waxman, 2007). Further, caregivers may be able to better identify a need for early intervention through accurate and precise caregiver education provided by clinicians on the importance of noun-related inflectional morphemes and noun phrases in linguistic input. If clinicians are able to provide early intervention services to children at younger ages, those with delays or disorders are likely to develop age-appropriate expressive noun vocabulary more quickly.

Study Limitations

Although clinical significance was observed through the effect size, this study does have a number of limitations. The small sample size was a major limitation for this study. A sample size of 13 caregiver/infant dyads is small and may have contributed to the lack of statistical significance obtained within the study. This was seen especially in comparison with the research performed by Cartmill and colleagues (2013), which had a sample size of 50 and yielded significant statistical results, whereas our research only produced clinically significant results. Although extensive coding and analyzing of audio recordings was performed, we were only able

LINGUISTIC INPUT, FOCUS ON NOUNS

to establish clinical significance from the information. Because of this, further research is needed with a greater number of participants in order to determine statistical significance and be able to generalize the information found in the study.

A second limitation was the fact that we did not assess inter-rater reliability within the study. Noun-related inflectional morphemes and noun phrases were tallied in orthographic transcripts of directed caregiver utterances by a single trained lab assistant; however, the transcripts were not re-analyzed a second time by a separate person to determine inter-rater reliability. This is a threat to the internal validity of the study in that we cannot establish the validity of the values as they were only evaluated at one time by one coder. In future studies, inter-rater reliability should be assessed in order to increase reliability and generalize the results.

A third limitation is related to the fact that each recording file was coded, transcribed, and analyzed by different lab assistants, on different occasions, resulting in the possibility of differing overall values. A study limitation is the potential occurrence of human error during data preparation. While each lab assistant followed the same instructions and guidelines, there was subjectivity to the coding (e.g., related to judging whether or not the caregiver utterances were directed) introducing the potential for individual human error. However, all lab assistants were trained by three graduate students in similar, if not the same manner. Additionally, while coding, transcribing, and analyzing the data, the lab assistants worked independently on each file, but brought any questions or concerns about particular files to other lab assistants in order to gain a second opinion and consensus for questionable data. So, while the potential for human error is present, an attempt was made to decrease the occurrence of human error.

Finally, while data at each age between 7 to 18 months for every infant was to be evaluated, there were a number of data points, or infant ages in months, that did not have actual

LINGUISTIC INPUT, FOCUS ON NOUNS

data present. This resulted from two main issues: 1) lack of a recording session for the specific month during the collection of data in the longitudinal study, or 2) technical difficulties either from hardware or software malfunction. These data errors were not common, but did occur, and the missing data could have decreased the reliability of the results.

Future Directions

This study has the potential for great expansion and investigation. One major direction for future studies would be to look at nouns in greater detail. This could specifically include the difference between abstract and concrete nouns produced by the caregiver and the child and how each relates to expressive noun vocabulary development. As previously published, the use of more concrete nouns can be helpful in development of more advanced vocabulary abilities (Cartmill et. al, 2013). Further, future research could explore differences between caregiver utterances that are spoken compared with those that are sung to children, as this has been shown to positively effect children's later language abilities (Jentschke & Koelsch, 2009).

Another aspect that should be included in a future study is to look at what caregiver (i.e., the mother or the father) is providing the language input. It would be worth investigating whether input from mothers or fathers has a statistically significant difference with respect to influence on later vocabulary ability in children. Also, noteworthy would be other types of caregivers, whether grandparents, nannies, day care providers, and so on. In the present study, a majority of the recording sessions took place with the mother, a number included the father, and an even smaller number included an extended relative such as a grandmother. Due to time constraints, we were unable to differentiate between the utterances provided by the different caregivers. However, this could be an area of interest for a future study.

LINGUISTIC INPUT, FOCUS ON NOUNS

Altering the participant sample is another direction for future work. Changing the participant sample increases external validity allowing for greater generalization to a larger population of people. Expanding the participant sample to include a more diverse group of infants and caregivers could provide more information and generalize to a larger number of people. Increasing the sample size to increase the internal validity is a central concept that could lead to greater statistical significance as well as a higher likelihood of generalization. Although not considered in the present study, SES can be a major factor that is related to vocabulary development (Hirsh-Pasek et al., 2015). Considering SES by including individuals from varying economic backgrounds could increase awareness for individuals who may benefit from increased caregiver education regarding quantity and quality of caregiver language input to infants. Further, including a more diverse population based on number of languages spoken may be an area of interest. Oller and colleagues (1997), performed research looking at bilingual versus monolingual speakers from 4 months to 18 months of age and found no clear differences, positive or negative within this age group, but it would be interesting to see if differences were seen at 2 or 3 years of age, as well as if noun-related inflectional morphemes and noun phrase usage by caregivers would influence later vocabulary ability in bilingual children differently than monolingual children.

Each of these future directions can provide greater insight into the roles that caregivers play in the development of vocabulary. By increasing caregiver and SLP awareness of the effects of caregiver linguistic input, children are likely to develop more advanced vocabulary abilities, which can lead to educational preparedness and social success.

Conclusion

Through correlation and multiple regression analyses we demonstrated that caregiver production of noun-related inflectional morphemes, basic noun phrases, simple elaborated noun phrases, and complex elaborated noun phrases directed to infants is related to noun vocabulary development for this cohort of children who were typically developing. While there are limitations to this study, clinical significance is still a major component. From this information, caregiver education can be developed. Increasing caregiver awareness of the effect of noun-related inflectional morphemes usage and noun phrases, may result in greater linguistic variety in the directed input caregivers provide to infants, and more advanced expressive noun vocabulary at later ages. Toddlers with more advanced expressive noun vocabularies will have the potential for increased literacy skills leading to better preparation for school and academic success in their futures.

References

- Brown, R. (1973). *A first language: The early stages*. Cambridge, MA: Harvard University Press.
- Brownlie, E., Bao, L.Y., & Beitchman, J.H. (2016). Childhood Language Disorder and Social Anxiety in Early Adulthood. *Journal of Abnormal Child Psychology*, 44, 1061-1070.
- Buder, E.H., & Stoel-Gammon, C. (2002). Young children's acquisition of vowel duration as influenced by language: Tense/lax and final stop consonant voicing effects. *Journal of the Acoustical Society of America*, 111. 1854-1864.
- Cartmill, E. A., Armstrong III, B. F., Gleitman L. R., Goldin-Meadow, S., Medina, T. N., & Trueswell, J. C. (2013). Quality of early parent input predicts child vocabulary 3 years later. *Proceedings of the National Academy of Sciences*, 110(28), 11278-11283. doi: 10.1073/pnas.1309518110
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Glendale, NJ: Lawrence Erlbaum, Associates.
- Dunn, L.M., & Dunn, D.M. (2007). *Peabody picture vocabulary test, fourth edition (PPVTTM-4)*. Bloomington, MN: Pearson Education Inc.
- Feldman, H. M., Dollaghan, C. A., Campbell, T. F., Kurs-Lasky, M., Janosky, J. E., & Paradise, J. L. (2000). Measurement properties of the MacArthur Communication Development Inventories at ages one and two years. *Child Development*, 71, 310-322. doi: 10.1111/1467-8624.00146
- Feldman, H.M., Dale, P.S., Campbell, T.F., Colborn, D.K., Kurs-Lasky, M., Rockett, H.E., & Paradise, J.L. (2005). Concurrent and predictive validity of parent reports of child language at ages 2 and 3 years. *Child Development*, 76. 856-868.

LINGUISTIC INPUT, FOCUS ON NOUNS

- Fenson, L., Bates, E., Dale, P., Goodman, J., Reznick, J. S., & Thal, D. (2000). Measuring variability in early child language: Don't shoot the messenger. *Child Development*, 71, 323-328. doi: 0009-3920/2000/7102-0005
- Fenson, L., Dale, P.S., Reznick, J.S., Bates, E., Thal, D. J., & Pethick, S. J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development*, 59(5), 1-173.
- Ferguson, C.J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, 40(5), 532-538.
- Gillette, J., Gleitman, H., Gleitman, L., & Lederer, A. (1999). Human simulations of vocabulary learning. *Cognition* (73), 135-176.
- Hadley, P. A., Rispoli, M., Fitzgerald, C., & Bahnsen, A. (2011). Predictors of morphosyntactic growth in typically developing toddlers: Contributions of parent input and child sex. *Journal of Speech, Language, and Hearing Research*, 54, 549-566. doi: 10.1044/1092-4388(2010/09/0216)
- Hadley, P. A., Rispoli, M., & Holt, J. K. (2017). Input subject diversity accelerates the growth of tense and agreement: Indirect benefits from a parent-implemented intervention. *Journal of Speech, Language, and Hearing Research*, 60, 2619-2635. doi: 10.1044/2017_JSLHR-L-17-0008
- Haitana, Tracy & Pitama, Suzanne & Rucklidge, Julia. (2010). Cultural biases in the Peabody Picture Vocabulary Test (III): Testing Tamariki in a New Zealand Sample. *New Zealand Journal of Psychology*, 39, 24-35.
- Hart, B. & Risley, T. R. (2003). The early catastrophe: The 30 million word gap by age 3. *American Educator*, 4-9.

- Hedrick, D. L., Prather, E. M., & Tobin, A. R. (1975). *Sequenced inventory of communication developmentTM: Revised*. Seattle, WA: University of Washington Press.
- Heilmann, J., Ellis Weismer, S., Evans, J., & Hollar, C. (2005) Utility of the MacArthur-Bates Communicative Development Inventory in identifying language abilities of late-talking and typically developing toddlers. *American Journal of Speech-Language Pathology*, 14, 40-51.
- Hirsh-Pasek, K., Adamson, L. B., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., Yust, P. K. S., & Suma, K. (2015). The contributions of early communication quality to low-income children's success. *Psychological Science*, 26(7), 1-13. doi: 10.11177/0956797615581493
- Huttonlocher, J., Waterfall, H., Vasilyeva, M., Vevea, J., & Hedges, L. V. (2010). Sources of variability in children's language growth. *Cognitive Psychology*, 61(4), 343-365. doi: 10.1016/j.cogpsych.2010.08.002
- Jentschke, S., & Koelsch, S. (2009). Musical training modulates the development of syntax processing in children. *Neuroimaging*, 47, 735-744.
- Kim H. Y. (2015). Statistical notes for clinical researchers: effect size. *Restorative dentistry & endodontics*, 40(4), 328–331. doi:10.5395/rde.2015.40.4.328
- Korkman, M., Jaakkola, M., Ahlroth, A., Pesonen, A.-E., & Turunen, M.-M. (2004). Screening of developmental disorders in five-year-olds using the FTF (Five to Fifteen) questionnaire: A validation study. *European Child and Adolescent Psychiatry*, 13(3), 31-38.

- Kuhl, P. K. (2011). Social mechanisms in early language acquisition: understanding integrated brain systems supporting language. In J. Decety & J. Cacioppo (Eds.), *The Oxford handbook of social neuroscience* (pp. 649-667). Oxford: Oxford University Press.
- Leffel, K., & Suskind, D. (2013). Parent-directed approaches to enrich the early language environments of children living in poverty. *Seminars in Speech and Language* 34(4), 267-278. doi:10.1055/s-0033-1353443
- Liss-Bronstein, L. (2010). RTI for comprehension: Tackling reading comprehension from its language roots. *ASHA Convention 2010* [Elaborated noun phrases handout].
- Mayor, J., & Plunkett, K. (2011). A statistical estimate of infant and toddler vocabulary size from CDI analysis. *Developmental Science*, 14(4), 769-785. doi:10.1111/j.1467-7687.2010.01024.x
- Nelson, K. E., Carskaddon, G., & Bonvillian, J. D. (1973). Syntax acquisition: Impact of experimental variation in adult verbal interaction with the child. *Child Development*, 44, 497-504. doi: 10.2307/1128005
- Oller, D. K., Eilers, R. E., & Basinger, D. (2001). Intuitive identification of infant vocal sounds by patterns. *Developmental Science*, 4, 49-60.
- Oller, D. K., Eilers, R. E., Urbano, R., & Cobo-Lewis, A. B. (1997). Development of precursors to speech in infants exposed to two languages. *Journal of Child Language*, 24, 407-425.
- Oller, D. K., & Lynch, M. P. (1992). Infant vocalizations and innovations in infraphonology: Toward a broader theory of development and disorders. In C. A. Ferguson, L. Menn, & C. Stoel-Gammon (Eds.), *Phonological development: Models, research, implications* (pp. 509-536). Parkton, MD: York Press, Inc.

LINGUISTIC INPUT, FOCUS ON NOUNS

- Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child Development, 76*, 763-782. doi: 10.1111/1467-8624.00498-i1
- Pancsofar, N. & Vernon-Feagans, L. (2006). Mother and father language input to young children: Contributions to later language development. *Journal of Applied Developmental Psychology, 27*, 571-587. doi:10.1016/j.appdev.2006.08.003
- Piccin, T. B. & Waxman, S. R. (2007). Why nouns trump verbs in word learning: New evidence from children and adults in the human simulation paradigm. *Language Learning and Development, 3*(4), 295-323. doi:10.1080/15475440701377535
- Plante, E., Ogilvie, T., Vance, R., Aguilar, J. M., Dailey, N. S., Meyers, C., Lieser, A. M., & Burton, R. (2014). Variability in the language input to children enhances learning in a treatment context. *American Journal of Speech-Language Pathology, 23*, 530-545. doi: 10.1044/2014_AJSLP-13-0038
- Ramierz- Esparza, N., Garcia-Sierra, A. & Kuhl, P. K. (2014). Look who's talking: speech style and social context in language input to infants are linked to concurrent and future speech development. *Developmental Science, 17*(6), 880-891. doi:10.1111/desc/12172
- Ramsdell-Hudock, H.L., Stuart, A., & Parham, D. (2018). Utterance duration as it relates to communicative variables in infant vocal development. *Journal of Speech, Language, and Hearing Research, 61*, 246-256.
- Rescorla, L., & Alley, A. (2001). Validation of the Language Development Survey (LDS): A parent report tool for identifying language delay in toddlers. *Journal of Speech, Language, and Hearing Research, 44*, 434-445.

LINGUISTIC INPUT, FOCUS ON NOUNS

- Reynell, J. (1991). *Reynell Developmental Language Scales* (U.S. ed). Los Angeles, CA: Western Psychological Services.
- Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech in vocabulary development. *Child Development*, 83(5), 1762-1774. doi:10.1111/j.1467-8624.2012.01805
- Rowe, M. L., Raudenbush, S. W., & Goldin-Meadow, S. (2012). The pace of vocabulary growth helps predict later vocabulary skill. *Child Development*, 83(2), 508-525. doi: 10.1111/j.1467-8624.2011.01710.x
- Sawilowsky, S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods*, 8(2), 467-474.
- Song, J. Y., Sundara, M., & Demuth, K. (2009). Phonological constraints on children's production of English third person singular -s. *Journal of Speech, Language, and Hearing Research*, 52, 623-642. doi: 1092-4388/09/5203-0623
- Soper, D. (2006). Free statistics calculators: Home. Retrieved from <https://www.danielsoper.com/statcalc/default.aspx>
- Tsao, F.-M., Lui, H.-M., & Kuhl, P. K. (2004). Speech perception in infancy predicts language development in the second year of life: A longitudinal study. *Child Development*, 75, 1067-1084. doi: 10.1111/j.1467-8624.2004.00726.x
- Vigil, D. C., Hodges, J., & Klee, T. (2005). Quantity and quality of parental language input to late-talking toddlers during play. *Child Language Teaching and Therapy*, 21(2), 107-122. doi:10.1191/0265659005ct284oa

LINGUISTIC INPUT, FOCUS ON NOUNS

- Weizman, Z. O., & Snow, C. E. (2001). Lexical input as related to children's vocabulary acquisition: Effects of sophisticated exposure and support for meaning. *Developmental Psychology*, 37(2), 265-279. doi: 10.1037/0012-1649.37.2.265
- Yule, G. (2005). The study of language. *Cambridge: Cambridge university press*.
doi:10.1017/CBO9780511819742