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Comparisons of Phonetic Context Distributions in Lexical and Adult-Generated Nonsense Utterances

Patricia Diane Frankland
Eastern Illinois University

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COMPARISONS OF PHONETIC CONTEXT DISTRIBUTIONS IN LEXICAL AND ADULT-GENERATED NONSENSE UTTERANCES

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BY

PATRICIA DIANE FRANKLAND

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CHAPTER I

INTRODUCTION

Our language contains many words. People seem to agree that these words differ from one another in length, frequency of usage, and sound usage. However, what constitutes human word choice and make-up seems to be a controversial point. "Words are not useful because they are frequent, but frequent because they are useful" (C. K. Ogden, 1927). It seems that words such as "the," "for," "a," "and," "I," and "in" are used many times in our everyday communication. Is there a reason why this occurs?

Speech is only a form of human communication (Zipf, 1965). Zipf applied statistical principles to the "observable phenomena of the stream of speech" (1965) and found that probably "the most striking feature of words is difference in lengths" (1965). They can range in length from one phoneme to a sequence of phonemes. Of greater importance for this study, he noted that shorter words occurred more frequently. After studying many languages and speech units of various sizes from phonemes, syllables, words, and sentences, he formulated his Law of Abbreviation. It states that "the length of a word tends to bear an inverse relationship

to its relative frequency" (1965). This Law of Abbreviation seems to hold for other sizes of speech units. Another name for this concept is the Law of Economy of Effort. In simpler terms, people would rather use shorter words that require the least amount of effort.

The most remarkable feature of Zipf's Law is the orderliness of the frequency distribution of words in the speech stream. Just as the words vary in their rank order of frequency usage, so do the phonetic contexts, syllables, and phonemes that make up these words. For this study, phonetic context is defined as the totality of phonetic conditions affecting the production of a given speech sound (Evans, 1974). Thus, Zipf's Law predicts that phonetic contexts vary in their frequency of occurrence.

Why does this relationship exist?

> Faced with this massive statistical regularity, you have two alternatives. Either you assume that it reflects some universal property of the human mind, or you can assume that it represents some necessary consequences of the laws of probability. Zipf chose the synthetic hypothesis and searched for a principle of least effort that would explain the apparent equilibrium between uniformity and diversity in our use of words (Zipf, 1965).

Simply put, there seems to be two possible explanations concerning this relationship between word length and frequency: "(1) the length is a cause of the frequency of usage, or (2) the frequency of usage is a cause of the length" (Zipf, 1965). It does not seem feasible that the shortness of a word could cause its frequency of occurrence because a speaker selects his words according to the meanings and ideas he wants

to convey and not according to lengths. Thus, there seems to be no plausible reason to support the idea that a word's small magnitude causes its high frequency of usage (Zipf, 1965).

Another factor should be mentioned in the analysis of speech-sound occurrence-comparative philology (the science of language meaning). Philological study(Zipf, 1965) shows that the articulation of any phoneme is favored more in certain positions than in others, depending upon the adjacent sounds. The basis for these productions is found in a principle of coarticulation. Namely, ease of production is greater when the vocal mechanism producing the sound is already, to some extent, arranged for the following sound. Thus, because of the organization of the vocal mechanism, any given phoneme is easier to produce in some phonetic contexts than in others--coarticulation effects. Ease of production depends upon the structure of the combinations in which the phoneme occurs (Zipf, 1965; Evans, 1974). Consequently, it is probable that people arrange their vocal mechanisms for sound combinations where the production is comparatively smooth, this is the most favorable position of the phoneme. However, favorable position is a matter of degree. Thus, frequency of occurrence varies in an orderly manner (Evans, 1974).

> Now the varying degrees of difficulty in the articulation of a phoneme resulting from the different combinations in which it occurs, together with the various relative frequencies of occurrences of the phonemes in its different combinations, may introduce a modification in the normal distribution of speech-sounds about the phonemic norm, which,it seems, may well be termed 'skewness' (Zipf, 1965).

STATEMENT OF PURPOSE

Several factors of speaking are important to phonetic context (Fleming, 1971). Among those related to phonetic context are ease of production, discrimination, and learning. Thus, it seems that speaking people have a repertoire of phonetic contexts that they call upon in various degrees. How can spontaneous utterances be tested to verify this fact and at the same time maintain validity? One answer might be to analyze words not based on prior semantic learning and examine the resulting phonetic contexts. Thus, adults could be asked to expressively respond with nonlexical items in an artificial situation. These nonlexical utterances could be analyzed and rank ordered for phonetic context. This could also prove the theory that phonetic contexts occur in varying degrees. The content validity of the Thorndike--Lorge list of 1,000 words, which was the original locus of content study, would be measured, too.

Since previous studies have dealt with the rank orderings of phonetic contexts, it would be important to find the contexts most frequently used in an artificial situation, and whether people use certain phonetic contexts more often than others on a regular basis.

This was a study of content validity. Kerlinger (1964) stated that "Content validity is guided by the question: Is the substance or content of this measure representative of the content or universe of content of the property being measured?" Content validity involves the adequacy of the

sampling or the representativeness of the part as a measure for the whole. Here, the universe is phonetic context frequency distributions, represented by the Thorndike-Lorge list of 1,000 most frequently occurring words. But, are the context distributions in adult-generated nonsense utterances representative of the universe?

The purpose of this study was to compare the phonetic context distributions in lexical and adult-generated nonsense utterances.

Specifically, the following questions were posed at the onset of the study.

1. What is the resultant rank order of frequency of occurrence of phonetic contexts in nonlexical utterances for the following twenty phonemes: /r/, /s/, /l/, /z/, /tʃ/, /dʒ/, /ɚ/, /ɝ/, /ʃ/, /f/, /aI/, /k/, /n/, /u/, /d/, /I/, /a/, /e/, /g/, and /i/?

2. To what extent do the phonetic contexts of the nonlexical utterances rank order themselves in a manner similar to their frequency of occurrence for each of the twenty phonemes in the English language?

Stated as research hypotheses:

1. The above twenty phonemes can be rank ordered according to frequency of occurrence of phonetic contexts.

2. There is no significant difference in the phonetic context distributions in lexical and adult-generated nonsense utterances.

CHAPTER II

REVIEW OF THE LITERATURE

Word counts are not new in the literature. Many have been compiled over the years. Godfrey Dewey (1923) made an extensive study of the frequency of occurrence of words, syllables, and basic vowel and consonant sounds from written material. The Horns (E. Horn, 1925; M. D. Horn, 1928) did a word count on children's language. In 1930, French, Carter, and Koenig compiled an oral word count list based on telephone conversations terminating in New York City. Travis (1931) and Mader (1931) also reported ranking of sounds according to their frequency. The Thorndike-Lorge frequency lists (1944), which supplanted the earlier word counts of Thorndike (1932), were developed from printed texts for both adults and children. Rinsland (1945) completed a word list from school writing. Another word list was compiled by Dale and Chall (1948) using written texts. Burroughs (1957) and Haywood (1959) compiled spoken word counts based on children in interview situations and in free play, respectively. Language used in school texts has also been the basis for word lists (Fullmer and Kolson, 1961; Olson, 1965). Howes (1966) obtained a count of spoken language for adults by interviewing university

students and V. A. hospital patients. Jones and Wepman (1966) did a similar count for the Thematic Apperception Test (TAT) protocols of normal adults. In 1967, Kucera and Francis compiled a word count based on general written American English. Emans (1969) based his word count on common signs. Carroll (1971) has composed the most recent word count based on oral language.

Past word counts, based on purpose, sample size, source, year, and findings are summarized on the following pages.

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
Literary Word Count	Dewey, Melvil	1900	Word count	60,000 words in English literature	counted 60,000 words in twelve 5,000 word selections from standard English literature	did not itemize the infrequent words counted, so could not be used as a basis for analysis of syllables and sounds
The London Point Sistem [sic] of Reading for the Blind	Knowles, Rev. J.	1904	word count from Bible	not given to detail, other than 100,000 words	100,000 words of 'passages from the English Bible and from various authors'	gives in frequency order, the frequency of occurrence of the 353 most common words (those words which occur 25 times or more)
Six Thousand Common English Words, Their Comparativ [sic] Frequency and What Can Be Done With Them	Eldridge, R. C.	1911	newspaper word count	four different issues of Sunday newspapers published in Buffalo, N. Y. in July and August of 1909	four newspapers and 34,989 words	gives the order of frequency of occurrence of the 6,002 different words found in the newspapers of which the most frequent 750 constitute over 75% of the whole material analyzed

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
The Spelling Vocabularies of Personal and Business Letters	Ayres, Leonard P.	1913	letter word count	2,000 people's letters	tabulates 23,629 words from 2,000 short letters	found 2,001 different words and reports frequency of the more common
The Child and His Spelling	Cook, W. A. and O'Shea, M. V.	1914	word count from adult correspondence	thirteen adult family letters	adult letters of correspondence	gives several alphabet lists, with frequencies given; shows 186 words used by all 13 correspondents; 577 words used by a majority of the correspondents; no clear statement made of the most frequent words or their combined frequency, only 5,200 different words are found in the total 200,000
Concrete Investigation of the Material of English Spelling	Jones, W. Franklin	1914	word count in written themes	15,000,000 words	15,000,000 words of specifically written grade themes, according to the grade in which each was first used by at least 2% of the students	found 4,532 different words; lists 100 "spelling demons" or the most 100 frequently misspelled words, but gives no direct information as to the relative frequency of words

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
A Measuring Scale for Ability in Spelling	Ayres, Leonard P.	1915	written word count	2,500 persons	based on the material of the lists of Cook, Knowles, Eldridge, and Ayres properly weighted and combined and reduced to a basis of occurrence per 100,000 words	368,000 written words; more than 2/3 of the words came from personal and business letters; gives in order of frequency the frequency of each per 100,000 words; the most common 1,000 make up 91,899 per 100,000; and the 100 most common words make up 59,591; lists in alphabetical order with frequencies, the second and third most common 1,000 words
Teacher's Word Book	Thorndike, Edward L. and Lorge, Irving	1921 (revised 1931-2 1944	written word count	41 sources of writing from adults and children	a count of 4,565,000 words from literature for children; words from the Bible and English classics; elementary school text books; books about cooking, sewing, farming and the trades; daily newspapers and correspondence	counted only lexical units, to make an alphabetical list of 10,000 words most frequent; a measure of range and frequency of word occurrence are both given. (Range=how many of the 41 sources used the word.) (Frequency= how

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						often it is used. The measure of range and frequency of occurrence are given by the credit number following the word. (Credit number of 49 or over means word is in first 1,000; 29-48=second 1,000; 19-28= third 1,000.)
		1932 revision		200 sources	as above	gave 20,000 most frequent words
		1944 revision		sources from first two studies plus three other counts	as above; but was first two studies, plus three other counts, including Lorge's magazine word count	counted over 4½ million words in three last counts; lead to list of 30,000 words of frequency
Relativ [sic] Frequency of English Speech Sounds	Dewey, Godfrey	1923 revised 1950	to determine relative frequency of occurrence of simple sounds and sound combinations in written and spoken English,	5,000 sources of written, spoken, and printed material	15% newspaper editorial English 15% newspaper news English 15% modern fiction 5% novel 5% short story 5% drama	Nearly all previous studies had dealt with wholly the frequency of words found 10,161 different words in 100,000; listed according to the following:

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
			plus the frequency of syllables and words		10% modern American speeches 5% personal correspondence 5% business correspondence 5% modern advertising 5% religious English--Bible, sermons, editorials 5% (popular) scientific English magazines 5% modern "special articles" from magazines 5% magazine editorial English 5% Saturday Evening Post 5% Literary Digest	a.) phonetically transcribed in notation based on Revised Scientific Alphabet (based on 48 sounds); b.) analyzation of phonetic transcriptions with respect to syllables c.) analysis of separate single sounds, with every variant of a singl root treated as a separate word Found 10,119 different words arranged in order of frequency of occurrence. Found 1,027 most common words based on occurrence more than 10 times each Used the Standard Dictionary (Funk & Wagnalls, N. Y.). total of 143,000 syllables for the 100,000 words; the 1,370 most frequent of these syllables formed

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						133,586 syllable occurrences, or over 93% of the total. Single sounds counted according to occurrence in I, M, or F in syllables and similarly in words Also gave summaries of occurrences of proper names, numerals, abbreviations, and punctuation.
"Conversation Among Children"	Zyne, Claire T.	1927	analysis of children's tendencies in unhampered conversation	31 third grade children	13 boys and 18 girls in a free conversation period in the Training School of San Jose State Teacher's College during three months, from March 10 to June 10, 1926 Done in two 15 minute conversation periods each day, one at 9:00 a.m. and one at 2:45 p.m. All conversations were recorded and stenographically transcribed later.	found percentage of discussion time around certain topics; percentage of time talking spent by each speaker in the conversation; percentage of total number of words used, and frequency of use of different parts of speech

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
"The Commonest Words in the Spoken Vocabulary of Children up to and Including Six Years of Age"	Horn, Ernest	1925	find words used most up to age six	over 150 children	combined three studies with: Ernest Horn's 80 children from age 1-6 years; Mrs. Horn's kindergarten students of Iowa and Minneapolis; and P. C. Packer's first graders in Detroit	from putting together these three groups, found nearly 5,000 different words; found a list, more limited, that average first graders should know, by finding words in the first three lists with a total frequency of 15 or more to make the list of 10,000 words
"A Basic Writing Vocabulary"	Horn, Ernest	1926	to compile the 10,000 words most commonly used in writing	untold amount of adult correspondence	business correspondence, personal letters, letters from people of more than average literary ability, letters printed in magazines and metropolitan newspapers, letters of application, and letters of recommendation, other miscellaneous correspondence, minutes, resolutions, and committee reports, excuses written to teachers by parents	all words, including slang, colloquial and supposedly slang words were recorded, wit proper names, words of less than four letters and most prepositions (41 more words) deleted. Each form of a word was tabulated separately. All abbreviations and contractions were recorded as written; frequency tabulations and analyses of each

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						type of correspondence were made separately; from this then, a percentage of total words in each category which occurred most frequently was taken to make up a general list of the "10,000 words most commonly used in adult writing"
"The Words and Sounds of Telephone Conversations"	French, Norman R.	1930	find frequency of occurrence of words, sounds, syllabic structure, and consonants	approximately 3,800 different speakers, mainly adults	telephone conversations over typical toll circuits terminating in New York; a woman observer recorded certain parts of speech for 1500 conversations; the next week she counted only verbs in 500 conversations; and the next week, only adjectives and adverbs were counted in 500 conversations; also recorded for 150 conversations each	has tables listing the most frequently occurring words, relative occurrences of sounds, syllabic structure of words and the percentage of distribution of consonants both preceding and following each vowel; comparisons for words were made based on ratios of total number of words to number of different words; obtained approxi-

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
					were pronouns, prepositions, conjunctions, and articles. The entirety of all conversations were recorded.	mately 80,000 words, of which less than 3% or 2,240 words were different words. The 50 most common words were different words in the conversations listed in order of their respective frequencies of occurrence. Words were divided into phonetic syllables then sounds, then frequency of occurrence of each sound was given. Found /w/ to be the most frequently occurring initial consonant.
"An Analysis of the Conversation of Children and Adults"	Nice, M. M.	1932	finding parts of speech most frequently used by children and adults	four children six adults	Margaret Morce Nice's four daughters, from age 30 months to 10 years, her husband, and five people in the family from a course of general conversation in household activities	In general, the findings were that adults use more nouns and prepositions and fewer pronouns and adjectives than children. Found a great difference in the frequency of word

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
					for the adults and in play with children (no subject suspected his or her words being recorded.)	counts for the children and adults based on four categories of 2½ years; 3-4 years; 5-10 years; and adults. for 5-10 years was much agreement wit the frequency of words and Horn's (1943) list of most common words for kindergarten children. Could note a progressive decrease in the frequency of the use of the word "I"; decrease in concrete and vivid ideas to mor abstraction; less use of nouns and more of pronouns; less use of ges-tures and more of prepositions, and less emotional speech with more intellectual con-tent and the ability to draw finer distinctions

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
The Basic Vocabulary of Business Letters	Horn, Ernest & Peterson, Thelma	last c.w. 1943 initial work 1919 and 1922	to improve selection of words for spelling, and words which present little spelling difficulties	5,136,815 words from adult business letters	Following sources were investigated: a.) vocabulary of business correspondence b.) vocabulary of personal letters c.) vocabulary of letters of people with more than average literary ability d.) vocabulary of letters of application and recommendation e.) vocabulary of adult writing, other than correspondence f.) letters of a single adult written over a period of 8 years. All words were recorded, (including colloquialism, "obsolete" words and slang, but excluding names of persons, places (proper names), months, and days or words of less than four letters.	Total number of words compiled was 5,136,815. The words for each class of business were arranged in alphabetical order with the total frequency of each word, the compiled frequencies were also computated.

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
A Basic Vocabulary of Elementary School Children	Rinsland, Henry D.	1947	written word count	100,212 children grades 1-8	Children's writings from 1500 selected schools in all kinds of geographic, economic, and social areas in the U.S. Obtained all kinds of children's writings representing their freest and most natural compositions; this included personal notes, poems, examination papers, stories, compositions, articles for school papers, and reports on projects, trips, and observations. Used only one composition from each child in grades 1-8.	Tallied words according to inflectional units (as did Horn, rather than by lexical units as did Thorndike). Therefore, plurals etc. were tallied separately. Found 25,632 different words for a total of 6,012,359 running words. Lists the first 100; 500; 1,000; and 2,000 words for each grade.
"Tested Word Knowledge Vs. Frequency Counts"	Dolch, E. W.	1951	to ascertain word knowledge of children via interview test and frequency count--Previous word counts were based on words children have	19,000 words--100 children beginners in grade one	Used the words found in the Interview Vocabulary Study and the word counts in the Combined Vocabulary List (1936). Thus having 19,000 words from these eleven counts.	

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
			spoken or written. These word counts were based on what could then be used in basal readers. Therefore, the assumption was that children are using all the words they know in proportion to the familiarity of the words to them. However, this was a word count based on word knowledge, not word use.		Used pictures of the objects themselves, or an explanation when objects or pictures couldn't be used.	To say a word was known to the majority of these children meant that 75 of 100 had to know what it meant. Found the generated list to be useful. However, also found that children often appear to know a word through opportunity and emotional set. They do not speak and write about everything they know, but about interests, attractions, or things they have opportunity to communicate about.
"The Relative Frequency of Occurrence of English Consonant Speech Sounds in Words in the Speech of Children in Grades One, Two, and Three"	Mader, John B.	1954	to find frequencies of occurrences of consonants of English in the I, M, F positions of words for the children of this age	81 students in grades 1-3	were students of the Demonstration School of Florida State University; 46 boys, 35 girls, ranging in age from 5-9 years to 9-0 years; was an interview-type of situation with	Found that five sounds, /n/, /t/, /d/, /r/, and /s/, made up 49% of the total occurrences of all sounds regardless of position of occurrence The general frequency of occur-

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
					questions directed toward trips made by the students, movies, and school activities. Each interview was approximately 10 minutes. Recorded all conversations, then, from this, made a typewritten copy of each conversation, analyzed each text to determine frequency and position of occurrence of each consonant sound used. I= first sound in word; F=last; M=all other. /r/ was considered a consonant even when it appeared as a vowel or semivowel. Blends were not considered as such, for example, in /str/, /s/ was I, /t/=M, /r/= F. Used Webster's Collegiate Dictionary and the first listed pronunciation of each word.	rence of consonants was in the same relative order for both boys and girls. Rank ordering of frequencies were in close correlation with those found by Voelker and Travis. Found consonants did not occur equally or approximately equally in the I, M, F positions of words. Found in all grade levels that 5 consonants occur in the initial position over 90% of the time: /ʃ/, /h/, /w/, /ʃ/, and /hw/. Nine sounds occur in initial position over 70% of the time. One sound occurs in F position over 90% of the time: /z/. Every sound but /ʤ/ was recorded at least once in

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						every position. /ʤ/ did not occur in the final position. Four sounds /s/, /θ/, /w/, and /h/ made up 46% of all I sounds. Five sounds: /n/, /d/, /t/, /r/, and /z/ made up over 69% of all F sounds. True of all grades and both sexes, there was little variance between the two for either frequency or position of occurrence of sounds.
"Quantitative Study of the Speech of Australian Children"	Harwood, F. W.	1959	to record speech of these children in a variety of situations to obtain a speech vocabulary representative of such children	24 "poor" children; aged 4 years, 11 months up to 5 years 8 months	Utterances from transcript of children's utterances were recorded for the Australian Council for Educational Research. Speech was recorded by stenographers.	Obtained approximately 12,700 utterances of about 99,000 running words. Transitions in sentence structures were then studied.

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
"A Beginning Reading Vocabulary"	Fullmer, Daniel W. and Kolson, Clifford J.	1961	to develop a word list to "guide the teacher in developing a word recognition necessary for success in beginning reading"	eleven basal readers	eleven basal readers totalling 45 pre-primers, primers, and first readers published between 1954 and 1959	Occurrence of individual words, according to a frequency criterian, and correlation with the Kindergarten Union List and Dolch Basic Sight Vocabulary (1951) were tabulated. Final list contained 184 words. Had a complete overlap of this list and the IKU list. 64% overlap with this and Dolch.
"A Word Count of Spoken English"	Howes, David	1965	spoken word count	41 adults (20 sophomores, 21 hospital patients)	Used 20 students from the Boston University School of Medicine and 21 patients from the Boston Veterans Administration Hospital in Massachusetts. Recorded from 1960-1965. Used interview technique and recorded 250,000 words--50 inter-	Transcribed into Standard English orthography with variations in dialect not considered and omitted sounds in pronunciation added. Webster's Third International Dictionary used for spellings. Found a total of 9,699 different

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
					views of 5,000 words each. Used 100,000 words from student population and 150,000 words from hospital patients. To obtain a sample of general conversation, the initial stimulus for the patients was, "Tell me what brought you to the hospital;" and, to the students, "Tell me about the field you're majoring in." When conversation lagged, the interviewer would interject, "Tell me about your family," or "What do you think of the political situation?"	words of which 4,097 occurred only once in the complete sample. Student and patient counts were tabulated separately.
"Analysis of the Vocabulary of Seven Primary Reading Series"	Olson, Arthur V.	1965	to check for a smooth and progressive increase in vocabulary development between and among reading series	seven basal readers	seven basal readers at the pre-primer, primer, and first reader levels-- The vocabulary of each reader series was placed in alphabetical order,	Found uneven transitions of vocabulary development both between and among reading series. Found a core vocabulary of 92 words

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
					then total number of words and number of new words introduced were checked at each level. Also gave a count of frequency of words appearing in five or more of the series.	common to five or more of the series.
A Spoken Word Count	Jones, Lyle V.	1966	to compare normal to aphasic adult speech	54 adults aged 18-80; with educational level of second grade to Ph. D. with a preponderence of older people	Speech was collected by asking each adult to tell a story based on 20 pictures from the Thermatic Apperception Test (Murray, 1943). Was a more spontaneous speech collection than by many other means.	Presents a composite list of different words spoken by a selected sample of 54 English speaking adults. Gives a frequency count with which the different words were used. The most frequent 33 spoken words were found tc account for more than 50% of all words uttered, averaged over the speakers. Found (as Zipf, 1935, 1949) that the word length was related to the frequency of usage

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						Mean length of first ten was 2.20 letters and second ten was 3.70 letter Lists, in order of mean relative frequency, the 1,102 most frequent words used by the 54 adults (all occurring at a mean rate of at least 4 per 100,000 Lists all words spoken by at least two respondents in alphabetical order under its grammatical class and all in alphabetical order combined. Total number of words from the 54 speakers was 136,450 with a range of words per person of 1,032 to 5,276. Transcribed tapes in traditional orthography with dialectual variations ignored and omitted sounds in pronunciation added in transcription.

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						Punctuation added on subjective judgment. In sequential word repetitions, only the first occurrence of the word was recorded. Separated words into 13 grammatical classes.
A Spoken Word Count	Wepman, Joseph M. and Hass, Wilbur	1969	count word frequency of spoken English	90 children; 30-5 yr. olds, 30-6 yr. olds, 30-7 yr. olds; equally divided between boys and girls into three groups	Each given a 20 card array of the Thermatic Apperception Test (Murray, 1943) in a single session. Responses were recorded and transcribed in traditional orthography. Dialectical variations were ignored and omitted consonants or vowels in pronunciation were replaced in transcription. Punctuation was added on the basis of subjective judgment.	Words were categorized for analysis by parts-of-speech. Found 402 to be frequent at a rate of at least 2 per 10,000. Words are listed by frequency of occurrence for parts of speech and for which of the three age levels used them.

NAME OF THE STUDY	RESEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
"The Assessment of Readability by Noun Frequency Counts"	Elley, Warwick B.	1969	to describe and illustrate a new means of assessment of the readability of children's reading material; the basis of which is a noun rate count per given passage	20 secondary school students	Used a cloze test with 10 prose passages of approximately 150 words.	Found readability of material can be sensitively measured by noun analysis and frequency counts. Gives list of mean noun frequency levels and suitable ages for such reading material.
A Comparative Study of Vocabulary Diversity	Moe, Alden J.	1974	to compare the vocabularies of 1.) first-grade children (speaking) 2.) first-grade primers 3.) first-grade trade books	15 first graders 15 primers 15 trade books	15 first graders, 8 boys and 7 girls for oral language samples from 3 school districts all in middle-class socioeconomic status areas. Were students identified by teachers to be of average ability and achievement. Mean age=6-11 years. Age range=6-4 to 7-4 years. Primers used were 15 published basal reader series. Used 15 trade books taken from a list of 110 widely used trade books.	1.) less vocabulary deviation among oral language samples than written; 2.) in all 3 vocabularies, found 7,568 total words and 1,183 different words; 3.) the 100 words most frequently used in the oral samples accounted for 64% of the total words used--are listed according to frequency of occurrence; 4.) 56 words were common to at least 10 of the 15 oral language samples--

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						listed by frequency of occurrence; 5.) of all 15 primer samples, found 7,533 total words and 738 different words. 6.) the 100 most frequently used words in the primer samples accounted for 67% of the total words used--listed by frequency of occurrence; 7.) 50 words were common to at least 10 of the 15 primer samples--listed by frequency of occurrence; 8.) of all 15 trade books, has 7,539 total words and 1,536 different words 9.) most frequently used 100 words accounted for 56% of the total words used--listed by frequency of occurrence;

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						10.) 46 words common to at least 10 of 15 trade books--listed by frequency of occurrence; 11.) comparison of oral and primer vocabularies shows 1,183 different words in the combined oral samples; 738 different words in combined primer samples; with 379 words common to both vocabularies; 12.) comparison of oral and trade book vocabularies show 1,183 different words in the combined oral samples, 1,536 different words in combined trade book samples, with 515 words common to both vocabualries; 13.) in analysis of variance, the primer vocabu-

NAME OF THE STUDY	RE-SEARCHER	YEAR	PURPOSE	SAMPLE SIZE	SOURCE	FINDINGS
						laries means were considerably lower than oral or trade book vocabulary means; 14.) vocabularies of children's samples reflected much more diversity than the primer samples; 15.) chance of finding vocabulary items common to many oral or primer samples is relatively small; 16.) no significant difference between oral and trade book vocabulary diversity but, trade books are more diverse in vocabulary than primers; 17.) only 32 words in common on the 100 most frequently used words from the oral language and trade book samples.

For the present study, a word will be defined as an articulate sound or series of sounds that symbolize and communicate an idea. Words may be two types--relational or notational. Relational words present relationships between ideas of thought, such as with. Notational words express ideas as terms of thought, such as blue. Words are used as signs of conception.

Word frequency and phonetic contexts of words are relevant to speech pathology. When working with children with articulation errors, speech pathologists would be interested in which phonetic contexts occur most frequently for the misarticulated sounds. These contexts are heard more frequently in speech. Thus, when establishing the initial goals and limitations according to need, they should be based upon those words and contexts that occur with the greatest frequency. There would be little reason to emphasize words and sound combinations that occur infrequently.

In early years, the main use for word counts was to establish a list of words to be used for basic children's reading books. However, these word counts did not consider the graphemic and phonological word structures and the contexts within which the words occurred. In 1951, Dolch found that word frequency lists do not always correlate with vocabulary lists. Thus, one possible use of word frequency counts is to select reading words.

A second use of word counts is to find children's interests (Zyve, 1927; Nice, 1932). These studies find differences in what children of various ages focus their attention upon. Words that have an apprent referential function are then examined.

A third approach is to look at word usage as "indicative of parameters of lexical organization, as a structural characteristic of the speaker" (Evans, 1974). The interest here would be the properties of vocabulary distribution used in the frequently occurring words. Zipf (1965), Mandelbrot (1961), Carroll (in Kucera and Francis, 1967) and Rapoport (1964) conducted research in this area. Relationships between age and change to adult usage, and how the semantic nature of new vocabulary word develops have been established (Leopold, 1953-54; Straight, 1968). However, this research has never elaborated on its developmental and psychological implications.

If Zipf's Law is true, a great deal of overlap among the most frequently occurring words would be expected. The Thorndike-Lorge (1944) word count was the largest of frequency counts. It was based on word frequency in the Bible, textbooks, reader, English classics, books for children in grades three through eight, recent and popular magazines, and miscellaneous adult and juvenile reading. Its size and scope implies a smaller sampling error. Thus, Griffith and Miner (1973) selected it as the basis of comparison with other word lists. A comparison between the first 3,000

words in the Dale-Chall (1948) list revealed an 82% overlap. The Thorndike-Lorge list was then compared with an oral language sample list by Black (1955). Between the first 1,000 words from both lists, an 88% overlap was found. Comparison of the first 1,000 words from the Thorndike-Lorge list and Carroll (1971) list revealed a 93% overlap. The high percentage of overlap is amazing since these lists were based on a variety of sources (oral, print, adult, and children). Due to sampling error and proper name usage, a complete (100%) agreement would not be expected.

Research has been conducted based upon the Thorndike-Lorge list. In 1973, Griffith and Miner analyzed the phonetic context distributions for the /r/ and /s/ among the first 1,000 words. Dorn (1973) and Schneider (1973) compared the first 1,000 words to the next 1,500 Thorndike-Lorge words for the /r/ and /s, l/, respectively. The proportions and rank orderings of phonetic contexts were not statistically different from Griffith and Miner's research. Additional studies have been done to find the rank orderings for /z/, /ʧ/, /ʤ/, /ɚ/, /ɝ/, and /ʃ/ from the first 1,000 words. Thorndike-Lorge termed the first 1,000 words as first and second grade level and the next 1,500 words as third and fourth grade level. The agreement of findings supports the hypothesis that analysis of words beyond the fourth grade level would show similar rank orderings of context frequency.

Summary and conjections.

From this review, four primary findings predominate:

1. Words are phonetic units that vary in frequency.
2. Many word counts have been compiled for various reasons.
3. The Thorndike-Lorge list seems to be a statistically valid word frequency list for analyzing phonetic contexts.
4. Words and their most frequent phonetic contexts are important to speech pathology as a means of analyzing and limiting therapy material for speech rehabilitation.

From these summarizations, it may be conjectured that:

1. It is useful to review past studies and analyses of words and their phonetic contexts. But,
2. the analysis of spontaneous human speech, not dependent upon any past learning, is of equal importance. And,
3. the comparison of past lexical word counts and analyses of phonetic contexts of spontaneously generated nonsense utterances of adults today is relevant to speech pathology because of its need in speech rehabilitation.

CHAPTER III

METHODOLOGY

The subjects, procedures, and equipment used for this study are discussed in this chapter.

Selection of subjects.

For this study, sixty subjects were chosen from college students at Eastern Illinois University, Charleston, Illinois. The adults ranged from freshmen to graduate students. Those with severe organic disorders, such as cerebral palsy and cleft palate, foreign students, and those who had any additional speech disorders, such as articulation errors, were excluded from the study. One verbal directive from the Length-Complexity Index (Miner, 1969) was used to evoke a conversational sample of speech for judgment of adequacy, specifically, "Tell me about your family."

Excluded from the study were those students who had been or presently were in exceptional ability classes or EMH (Educably Mentally Handicapped) classes in an attempt to get an "average" intellectual range of adults. Also excluded were students who had hearing losses. Subjects had to pass a 25 dB hearing screening test at 500, 1,000, 2,000, 4,000, and 8,000 Hertz air conduction.

Selection of stimulus, a pilot study.

Since no standardized method of eliciting nonsense utterances from adults exists, a stimulus method was selected. It consisted of a short story with the key words deleted. The subjects were to fill in the blanks with nonsense words.

A pilot study using three subjects, who met the previously stated selected criteria, was conducted to determine if nonsense utterances could be elicited by this stimulus method. All three subjects filled in all thirty-four blanks with a range of responses for all twenty phonemes. The range of occurrence for the consonants was from thirty-seven times to two times. The /g/ occurred most frequently with thirty-seven occurrences; /l/ was next with twenty-nine occurrences; and /r/ and /s/ followed with twenty-eight occurrences. The range of occurrence for the vowels was from thirty-three to two times. The /a/ occurred most frequently with thirty-three occurrences; /i/ followed with twenty-seven; and /u/ was next with fourteen occurrences. Thus, this stimulus method was used.

Selection of phonemes to be tested.

Twenty phonemes from the English language, as stated previously, were used in this study as representative of the distribution of order of the remaining twenty-three phonemes. The first nine phonemes that were chosen are the nine most frequently misarticulated sounds in the English language and, thus, are of special interest to the speech pathologist.

The other eleven phonemes were chosen randomly from the remaining thirty-four phonemes.

Method of testing.

Since the pilot study was successful, that stimulus method was used to elicit nonsense utterances. The adults chosen for the study were screened for speech and hearing and had met the other selection criteria as previously stated. Each subject was tested individually in a speech therapy room at the Eastern Illinois University Speech and Hearing Clinic between July 26 and August 2, 1974, and August 26 and 30, 1974. The instructions and story can be found in Appendices I and II, respectively. The responses were recorded with a Rheem Califone TC-74 Solid State tape recorder on Scotch Magnetic Tape, silicone lubricated 1,5 mil acetate backing at a speed of seven and one-half inches per second. These responses were phonetically transcribed according to Kenyon and Knott (1953). To have a response unit long enough for analysis, each subject was required to produce at least thirty "word units."

Means of transcription and word analysis.

During the period of August 31 to September 9, 1974, the responses of each of the sixty subjects were transcribed phonetically. Each word was divided into syllables, and an accent mark was placed above the stressed syllable of each word.

Phonemes are physiologically influenced by adjacent phonemes. Thus, phonetic contexts were classified as either singles (consonant-vowel combinations) or blends (consonant-consonant-vowel combinations). Another aspect is accent. Syllables may be accented or unaccented. Griffith and Miner (1973) reviewed the literature dealing with stress in relation to phonetic context analysis.

> Fry (1955) reports that vowels in stressed syllables have longer duration than unstressed syllables. Bollinger (1955) argues that intonation is crucial to stress identification. Mol and Uhlenbeck (1955-56) point out that the ear as an acoustic analyzer is particularly sensitive to differences in duration among syllables. A later study by Fry (1958) concluded that both duration and intensity have influence upon stress perception. Lieberman (1960) reports that stressed syllables have higher fundamental frequencies, higher peak envelope amplitudes and longer durations than unstressed syllables. Stetson (1951) concludes that stress production is the result of increased intrapulmonic pressure, a conclusion essentially supported by more recent electromyographic studies (Ladefoged, Draper, and Whitteridge, 1958). Generally, muscle activity increases during the production of stressed syllables.[1]

It is customary to classify positions of phonemes as initial, medial, and final. This classification will not be used in this study. Stetson (1951) found that syllables were the basic phonetic units of speech and each existed on a separate chest pulse. Each chest pulse defined a syllabic boundary. Griffith and Miner (1973) found that syllable boundaries

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[1]Griffith, J. and L. E. Miner. "A Phonetic Context Approach to Articulation Therapy." Paper presented at ISHA Convention. Eastern Illinois University, Charleston, Illinois (March, 1973), p. 10.

were also defined by differences in stress of the succeeding syllable. According to Stetson, the vowel is the core of every syllable. The consonant releases or arrests the vowel. Thus, the consonant functions only within its syllables. Consequently, only initial (prevocalic) and final (postvocalic) consonantal positions are created. Keenan (1961) defined the medial position as being neither the first nor last sound in a word. He labeled the medial position as vague and ambiguous. He supported a classification system based upon the relationship to its syllables.

Thus, in this study, phonetic contexts were described according to their functions in the syllable-releasing (initial position) or arresting (final position), and described according to their appearance in accented or unaccented syllables.

Intra-examiner reliability.

Since the examiner was the only experimenter involved in collecting and transcribing the nonlexical utterances, intra-examiner reliability needed to be established for the examiner's ability to transcribe, syllabify, and accent these taped responses. Three taped samples were randomly selected to determine this reliability. Two weeks after the initial transcriptions, they were again transcribed. Thirty-four words were transcribed for each subject. The overall percentage of agreement between the transcriptions was 99%. This was interpreted to mean that the examiner's reliability with herself was 99%. In repeated transcriptions, 99% of the responses would be transcribed identically; one percent would not.

Analysis of results.

The purpose of this study was to compare the phonetic context distributions in lexical and adult-generated nonsense utterances. The resulting rank order of the phonetic contexts' frequency of occurrence in nonlexical utterances was the first step in analysis. The following steps were taken to find the rank ordering for the twenty phonemes. Griffith and Miner's (1973) method of analysis was used for the nonlexical utterances. Each word was transcribed and then analyzed according to position in the syllable of the specific phoneme, syllabic accent (only to one degree), and context of the phoneme. Thus, the transcribed phonetic context was analyzed based on its occurrence in the releasing or arresting position in the syllable, for consonants; in the initial, medial, or final position, for vowels; and in an accented or unaccented syllable.

The second question posed asked to what extent do the phonetic contexts of the nonlexical utterances rank order themselves in a manner similar to their frequency of occurrence for each of the twenty phonemes in the English language. To answer this, a difference test was run. The information for the nonlexical utterances was compared to that of the lexical utterances. To analyze the data, Mann-Whitney U's, a test of significant difference, were tabulated.

An alpha level of .05 was established. Thus, if the U score was significant for that phoneme the rank order relationship between lexical and

nonlexical utterances would not be similar. If the U score was not significant, the phonetic contexts for that phoneme rank order themselves in a similar way in lexical and nonlexical utterances.

CHAPTER IV

RESULTS

The purpose of this study was to compare the phonetic context distributions of the Thorndike-Lorge list of 1,000 most frequently occurring words and adult generated nonlexical utterances. This chapter reports the statistical computations and interprets the results.

Frequency rank order for nonlexical utterances.

As previously described, the phonetic contexts for each of the twenty phonemes were ranked according to their frequency of occurrence. The resultant rank orderings are found in Appendix III. These distributions were the basis for comparison with the Thorndike-Lorge frequency data.

One research hypothesis for this study was: The nonlexical phonemes can be rank ordered according to frequency of occurrence of phonetic contexts. The data show that the twenty phonemes can be rank ordered to frequency of occurrence in a manner similar to the Thorndike-Lorge data. It was found that certain contexts occur more frequently than others and can be listed according to frequency, as Zipf's Law would predict.

Comparison of rank orders for lexical and nonlexical utterances.

The second question asked in this study was: To what extent are the phonetic context distributions of the Thorndike-Lorge list of 1,000 words and adult-generated nonlexical utterances similar? Therefore, the transcribed utterances were analyzed using the Mann Whitney U Test (Downie and Heath, 1970, pp. 270-73; Siegel, 1956, pp. 117-18). The Mann Whitney U is one of the most powerful non-parametric tests (Siegel, 1956). It is a statistical measure used with independently drawn random samples which may be of unequal sizes. It is the most useful alternative to the parametric t test to test for significant differences in samples.

U's were run for each of the twenty phonemes in each of their possible positions of appearance. Blends and singles were analyzed separately. A total of 82 U 's were run. An alpha level of .05 was set. Thus, a significant U meant that for that particular phoneme's position, the rank order relationship between lexical and nonsense utterances would not be similar. Those phonemes and their significant U's are listed in Tables 1 and 2.

Thus, nine of the consonant positions were significant, and two of the vowel positions were significant.

Inspection of these values for the twenty phonemes illustrates a variety of findings.

1. Eight contexts found in the nonlexical utterances were not present in the Thorndike-Lorge data. The contexts found

*MANN WHITNEY U COMPARISON BETWEEN THORNDIKE-LORGE AND NONSENSE UTTERANCES

TABLE 1

Consonants

Phoneme	Singles				Blends			
	I/A	I/UA	F/A	F/UA	I/A	I/UA	F/A	F/UA
r								
s			ss					ss
l	37.5				.006			
z	2					-		
t		ss		-	-	-	ss	-
d				NSU	-	-	ss	-
f	NSU			ss		-		-
		ss		ss				-
		ss		ss				-
k			25				.02	ss
d	13				ss		3	NSU
g	20.5	.024				NSU		

TABLE 2

Vowels

Phoneme	I/A	I/UA	F/A	F/UA	M/A	M/UA
aI		NSU		ss		NSU
u						NSU
e	.036					-
i	.004					
		NC		NC		NC
	NC		NC		NC	

numbers = level of significance of the U, alpha level of .05
ss = sample sizes too small for statistical analysis
NSU = context absent in nonsense utterances
- = context absent in both samples
NC = contexts not considered in this position
*This was a two-tailed test

only in the nonlexical list were primarily vowels and initial and final consonant blends. These contexts and their distributions can be found in Appendix IV.

2. Twelve contexts were absent in both distributions. These were primarily in the initial and final blends. These contexts and their distributions can be found in Appendix V.

3. Eleven of the phonetic context distributions had samples too small for statistical analysis. Lists of these distributions appear in Appendix III.

   a. /s/ singles--F/UA shows two contexts in both the Thorndike-Lorge and nonlexical distributions. The /ə s/ appeared in both.

   b. /s/ blends--F/UA shows two contexts for both lexical and nonlexical distributions. These contexts are in no way similar.

   c. /tʃ/ singles--I/UA shows two contexts for both distributions. The /tʃə/ predominates in both.

   d. /tʃ/ blends--F/A shows two contexts in each distribution. These are /ntʃ/ and /rtʃ/ with /ntʃ/ being predominant in both.

   e. /dʒ/ blends--F/A gives two contexts for each distribution. Both contained /ndʒ/.

f. /f/ singles--F/UA contains one context for each distribution. They are in no way similar.

g. /ʃ/ singles--I/UA shows one context--/ʃə/--for both.

h. /ʃ/ singles--F/UA shows one context for each and are not similar.

i. /k/ blends--F/UA gives one context for the lexical distribution and two for the nonlexical distribution. The contexts are completely dissimilar.

j. /d/ blends--I/A shows one context--/dr/--in both distributions.

k. /aI/ vowels--F/UA shows one context for both distributions. They were not similar.

4. 13% of the U's were found to be significant. These contexts can be found in Appendix VI.

Looking more closely at the eleven contexts in which there was a significant difference between the lexical and nonlexical distributions, one can see the influence of statistical artifacts. Several of these contexts are significantly different because the lexical distributions have a lesser variety of contexts than the nonsense utterances. However, the frequency of similar contexts in the lists may not differ greatly, and the rankings are similar.

The second research hypothesis stated at the onset of this study was: There is no significant difference in the phonetic context distributions of

lexical and adult-generated nonsense utterances. Thirteen percent, or eleven out of 82, of the Mann Whitney U's were significant. The probability of getting 13% significant U's by chance is .001791. Probability values range from 0 to 1. A value of 1 stands for absolute certainty, and 0 indicates there is no chance at all that the event will occur. Therefore, the probability of getting 13% significant U's by chance is very slim. Thus, the research hypothesis was accepted. Certain phonetic contexts are generated by speakers more regularly than others. Zipf's Law of least effort has been given validity. There appears to be content validity for the nonsense utterances in comparison to the lexical ones. The context distributions obtained from adults seem to be representative of the universe of lexical distributions. People tend to call upon certain contexts more often than others. Thus, theseare the ones that should be emphasized in therapy.

Conclusions.

The twenty phonemes were analyzed according to phonetic contexts and could be rank ordered by frequency of occurrence. Statistical analysis showed that only 13% of the phonetic context distributions in the two lists were significantly different. Some of these were due to statistical artifacts. Thus, both research hypotheses, stated previously, were accepted.

Content validity, as described earlier, involves the adequacy of the sampling or representativeness of the part as a measure for the whole.

Here, the universe was the phonetic context distributions, represented by the Thorndike-Lorge list of 1,000 most frequently occurring words. It was found that the context distributions in adult-generated nonsense utterances are representative of the universe of phonetic contexts.

CHAPTER V

SUMMARY AND CONCLUSIONS

Various word studies of vocabulary usage have evolved through the years. Many word frequency counts have been done, but little has been done to obtain an objective evaluation of frequency of context usage. George Zipf began studies of this type in 1927. He stated that people tend to speak in the shortest and most effortless means available to them. Griffith and Miner (1973) found an orderliness in the frequency distributions of words during speech. Their information was centered around the Thorndike-Lorge list of 1,000 most frequently occurring words. However, it was not known if people used certain phonetic contexts more often than others. There was a need for a tool to evaluate phonetic context usage since the present stress is upon accountability and verification of semantic usage.

The main purpose of this study was to compare the phonetic context distributions of lexical and nonlexical utterances and to determine if there was a significant difference between the frequency rank order of phonetic contexts in the two distributions. The steps taken were: (1) selecting a sampling method for eliciting nonsense utterances from adults,

(2) collecting and taping these samples of nonlexical utterances, (3) transcribing the nonlexical utterances, (4) dividing the transcriptions into syllables and placing the accent marks over the stressed syllables, (5) determining the examiner's reliability in transcribing responses, (6) categorizing the contexts according to syllabic positions and stress, (7) rank ordering each phonetic context according to frequency of occurrence for each possible position, (9) comparing the lexical and nonlexical distributions, and (10) determining whether there was a significant difference between lexical and nonsense distributions.

The questions posed at the beginning of this study were:

1. What is the resultant rank order of frequency of occurrences of phonetic contexts in nonlexical utterances for the following twenty phonemes: /r/, /s/, /l/, /z/, /tʃ/, /dʒ/, /ʃ/, /ɝ/, /ɚ/, /f/, /aI/, /k/, /n/, /u/, /d/, /I/, /a/, /e/, /g/, and /i/?

2. To what extent do the phonetic contexts of the nonlexical utterances rank order themselves in a manner similar to their frequency of occurrence for each of the twenty phonemes in the English language?

Nonsense utterances were elicited from college students of Eastern Illinois University, Charleston, Illinois, by giving them a paragraph with the key words left out. Thirty-four responses were produced by each subject. These responses were recorded with a Rheem Califone, model 70-TC, tape recorder at a speed of seven and one-half inches per second on silicone lubricated 1.5 mil acetate concert tape. The utterances were transcribed with the aid of Kenyon and Knott (1953) and according to the

method used by Griffith and Miner (1973). The utterances were divided into syllables and accent marks were placed over the primary stressed syllables. Then, each syllable was analyzed according to phonetic context.

Intra-examiner reliability was determined by transcribing again the utterances and syllabicating the words of three randomly selected tape samples two weeks after the initial transcription. A percentage of agreement index was then computed--99%.

Each phoneme was then analyzed according to context of occurrence and position of occurrence in syllables. For consonants, the initial and final positions, accented and unaccented, were used. For vowels, initial, final, and medial positions, accented and unaccented, were used. The contexts found were then rank ordered according to frequency of occurrence for each of the positions.

For each of the context positions containing three or more items, a Mann Whitney U Test (Downie and Heath, 1970) was computed. A total of 82 U's were computed. An alpha level of .05 was set. Eleven of the 82 U's were significant at this level. Therefore, 13% of the phonetic context distributions varied in the nonsense utterances from the lexical Thorndike-Lorge list. Eleven of the comparisons yielded samples too small for statistical analysis. However, several of these eleven contained contexts that were of equal proportions in both samples. Also, many

statistical artifacts came into play in the 13% that were significantly different.

This was a study of content validity. Were the nonlexical utterances representative of the universe of phonetic contexts? The Thorndike-Lorge list analysis by Griffith and Miner (1973) was the universe of phonetic contexts. Because of the high percentage of nonsignificant U's, it seems that people tend to call upon certain contexts more regularly than others, and that these contexts produced in artificial situations represent the universe of lexical contexts.

The research hypotheses posed at the beginning of this study were accepted. Thus, phonemes can be rank ordered according to frequency of occurrence of phonetic contexts, and there is not a significant difference in the phonetic context distributions in lexical and adult-generated nonsense utterances. Although the context distributions were not identical, a general overview shows that speech is repetitive.

Implications for future research.

Several applications for further study seem to be indicated from the results of this study. Follow up studies might indicate:

1. An investigation of how these nonlexical phonetic context distributions compare with the Thorndike-Lorge list of 10,000 words.

2. An investigation of phonetic contexts in artificial situations according to specific age and educational levels.
3. An investigation of specifically, misarticulated sounds according to phonetic contexts when nonlexical items are used as articulation stimuli.

APPENDIX I

INSTRUCTIONS TO SUBJECTS

A short story will be given to you. The key words have been left out. I want you to fill in these blanks with nonsense words--words that are not known to our language. Here are two examples:

The tass is liggy.

The lutz bined the dows. (Berry, 1969)

APPENDIX II

STORY GIVEN TO SUBJECTS

A _____ and _____ were _____ and _____ in the _____. The _____ _____ to the _____ _____ _____ in the _____ to _____. The _____ _____ _____ _____ with _____. The _____ to the _____ and the _____ _____ to the _____ _____. The _____ _____ for the _____ by the _____. _____ and _____ _____ in the _____ and _____ _____ _____.

APPENDIX III

RESULTANT RANK ORDER DISTRIBUTIONS OF PHONETIC CONTEXTS FOR TWENTY PHONEMES

T-L = Thorndike-Lorge
Ns. = Nonsense

/r/ Singles

I/A

T-L		Ns.	
[rɛ]	7	[rI]	25
[ri]	6	[ra]	18
[re]	5	[ræ]	17
[raI]	5	[ri]	12
[rI]	4	[ru]	9
[ro]	4	[ro]	5
[ru]	3	[rɛ]	5
[ræ]	2	[raI]	4
[rʌ]	2	[raU]	3
[raU]	2	[rʌ]	1
[ra]	1	[re]	1
[rɔ]	1	[rU]	1
	42		101

I/UA

[rI]	16	[rə]	4
[rə]	2	[ræ]	2
[ro]	1	[ri]	1
	19	[ru]	1
		[re]	1
			9

F/A

[ɛr]	24	[or]	24
[Ir]	13	[ar]	21
[ɔr]	13	[ɛr]	12
[ar]	11	[Ir]	3
[or]	7	[er]	1
[Ur]	6		61
[ær]	5		
[aIr]	4		
[aUr]	2		
	85		

T-L	F/UA	Ns.	
		[or]	3
		[ɛr]	3
			6

/r/ Blends

I/A

[pr]	13	[fr]	31
[tr]	12	[kr]	23
[gr]	11	[tr]	20
[br]	10	[br]	19
[fr]	9	[gr]	15
[dr]	7	[dr]	6
[str]	7	[pr]	5
[kr]	5	[θr]	4
[θr]	2	[skr]	4
[spr]	2	[str]	4
	68	[ʃr]	3
		[mr]	2
		[ʒr]	1
		[wr]	1
		[sr]	1
			139

I/UA

[pr]	3
[tr]	3
[dr[	2
	8

T-L		F/A	Ns.	
[rt]	10		[rk]	12
[rd]	8		[rp]	12
[rm]	5		[rt]	7
[rk]	3		[rf]	7
[rs]	3		[rn]	6
[rdʒ]	3		[rtʃ]	5
[rθ]	2		[rm]	4
[rn]	2		[rd]	3
[rt]	1		[rb]	2
	37		[rʃ]	1
			[rst]	1
			[rg]	1
			[rθ]	1
			[rz]	1
			[rs]	1
			[rv]	1
				65

F/UA

———		[rf]	1
			1

/s/ Singles

I/A

[sɛ]	22	[sI]	31
[sI]	12	[si]	12
[sʌ]	10	[so]	8
[saI]	9	[sa]	6
[si]	9	[sæ]	5
[sɹ]	6	[su]	5
[se]	5	[sɛ]	4
[sɔ]	5	[saI]	3
[so]	4	[se]	2
[su]	2	[sʌ]	2
[saU]	2	[sɹ]	2
[sæ]	1		80
[sɔI]	1		
	88		

T-L		Ns.	
	I/UA		
[sə]	8	[sə]	7
[sɚ]	3	[sI]	5
[sɛ]	1	[si]	5
[so]	1	[sa]	3
	13	[su]	3
		[sɛ]	1
		[so]	1
			25
	F/U		
[Is]	10	[Is]	15
[ɛs]	9	[as]	14
[es]	6	[æs]	12
[æs]	6	[ɛs]	9
[is]	3	[ʌs]	6
[ɔs]	3	[us]	6
[aIs]	3	[aUs]	4
[ʌs]	2	[aIs]	3
[as]	1	[es]	3
[os]	1	[is]	2
[us]	1	[ɔIs]	1
[aUs]	1	[ɝs]	1
[ɔIs]	1	[os]	1
	47		77
	F/UA		
[is]	8	[əs]	7
[əs]	4	[ɝs]	1
	12		8
	/s/ Blends		
	I/A		
[st]	19	[st]	22
[sp]	11	[sl]	16
[str]	7	[sk]	15
[sk]	4	[sn]	13
[sm]	3	[sw]	7
[spr]	2	[sm]	5

T-L		Ns.	
[spl]	1	[st]	4
[skw]	1	[skw]	4
[sn]	1	[str]	4
[sl]	1	[sr]	1
[sw]	1	[sp]	1
	51		92

I/UA

		[sn]	2
		[sk]	2
		[st]	1
			5

F/A

[st]	19	[ks]	17
[ns]	8	[st]	16
[ts]	4	[sk]	13
[rs]	3	[ts]	13
[ks]	2	[ps]	6
[sk]	1	[ns]	2
[nst]	1	[rs]	1
[ls]	1	[sp]	1
[psɚ]	1		69
[kst]	1		
	41		

F/UA

[ns]	4	[ts]	2
[st]	2	[sk]	1
	6		3

/l/ Singles

I/A

[lɛ]	9	[lI]	30
[lɔ]	7	[læ]	19
[le]	6	[la]	15
[laI]	5	[lʌ]	10
[lI]	5	[lu]	10

T-L		Ns.	
[li]	4	[li]	8
[lo]	4	[lo]	7
[læ]	3	[laI]	5
[la]	2	[le]	5
[lʌ]	2	[lɛ]	3
[lɝ]	1	[lɜ]	3
[laU]	1	[laU]	1
	51		116

I/UA

[lI]	10	[li]	24
[lə]	3	[lə]	11
[laI]	1	[lI]	5
	14	[lɜ]	3
		[la]	2
		[laI]	2
			47

F/A

[Il]	12	[Il]	13
[ɔl]	10	[il]	6
[ol]	8	[al]	6
[ɛl]	6	[æl]	5
[al]	4	[ɛl]	5
[ul]	4	[ol]	3
[æl]	3	[ʌl]	3
[el]	3	[ɜl]	2
[aIl]	3	[Ul]	2
[ɔIl]	2		45
[Ul]	2		
[il]	2		
[ʌl]	1		
[ɜl]	1		
	61		

F/UA

[əl]	9	[əl]	139
[ɔl]	2	[al]	2
	11	[æl]	1
		[il]	1
			143

T-L		Ns.	
		/l/ Blends	
		I/A	
[kl]	10	[bl]	49
[bl]	4	[fl]	46
[fl]	4	[kl]	34
[gl]	2	[pl]	18
[ɚl]	1	[gl]	17
[sl]	1	[sl]	16
[spl]	1	[ʃl]	6
	23		1
			187
		I/UA	
[gl]	2	[bl]	2
[bl]	1	[pl]	1
	3	[fl]	1
		[ʃl]	1
			5
		F/A	
[ld]	13	[lt]	4
[lf]	5	[lp]	2
[lt]	4	[rl]	1
[lp]	1	[lf]	1
[lk]	1	[ltʃ]	1
[lv]	1	[ld]	1
[lvz]	1		10
[ls]	1		
[lθ]	1		
	28		
		F/UA	
_____		[ld]	26
			26

/z/ Singles

T-L		Ns.	
I/A			
[zI]	1	[zI]	25
[zæ]	1	[zæ]	8
[z^]	1	[zi]	8
[zaI]	1	[zu]	8
	4	[zɛ]	6
		[ze]	6
		[z^]	4
		[za]	3
		[zo]	2
		[zɝ]	2
		[zaU]	1
			73
I/UA			
[zə]	3	[za]	3
[zI]	1	[zi]	2
	4	[zɚ]	2
		[zI]	2
		[zu]	2
		[zə]	2
		[zo]	1
			14
F/A			
[Iz]	6	[æz]	10
[uz]	6	[Iz]	9
[oz]	5	[az]	5
[iz]	4	[oz]	3
[^z]	4	[uz]	2
[aIz]	4	[iz]	1
[ɛz]	3		30
[æz]	2		
[ɔz]	2		
[ez]	1		
	37		

T-L		Ns.	
	F/UA		
[aIz]	2	[uz]	5
[Iz]	1	[iz]	5
[ez]	1	[az]	4
	4	[ɔz]	3
		[oz]	1
		[æz]	1
			19
	/z/ Blends		
	I/A		
		[zw]	1
		[zl]	1
			2
	I/UA		
	F/A		
[lvz]	1	[tz]	8
	1	[gz]	3
		[bz]	2
		[rz]	2
		[nz]	2
		[dz]	1
		[ŋz]	1
			19
	F/UA		
[mz]	1	[ŋz]	2
	1	[zd]	1
		[gz]	1
		[lz]	1
		[nz]	1
			6

T-L		Ns.	

/tʃ/ Singles

I/A

[tʃɛ]	2	[tʃu]	6
[tʃi]	1	[tʃa]	4
[tʃɪ]	1	[tʃɪ]	3
[tʃe]	1	[tʃi]	2
[tʃæ]	1	[tʃʌ]	1
[tʃa]	1	[tʃæ]	1
[tʃaɪ]	1	[tʃo]	1
[tʃɚ]	1	[tʃaʊ]	1
	9	[tʃaɪ]	1
			20

I/UA

[tʃɚ]	3	[tʃɚ]	2
[tʃə]	1	[tʃɛ]	1
	4		3

F/A

[itʃ]	5	[ɪtʃ]	6
[ɪtʃ]	3	[itʃ]	5
[ʌtʃ]	3	[atʃ]	5
[ætʃ]	2	[utʃ]	3
[atʃ]	1	[ʌtʃ]	2
[ɚtʃ]	1	[ætʃ]	2
	15	[ɛtʃ]	1
			24

F/UA

_____ _____

/tʃ/ Blends

I/A

_____ _____

I/UA

_____ _____

T-L		Ns.	
	F/U		
[ntʃ]	3	[ntʃ]	5
[rtʃ]	1	[rtʃ]	1
	4		6
	F/UA		

dʒ / Singles

	I/A		
[dʒɛ]	4	[dʒɪ]	8
[dʒɝ]	3	[dʒʌ]	6
[dʒɔɪ]	3	[dʒi]	5
[dʒa]	2	[dʒa]	5
[dʒʌ]	2	[dʒe]	4
[dʒɔ]	1	[dʒo]	3
	15	[dʒɝ]	2
		[dʒɛ]	2
		[dʒu]	1
		[dʒæ]	1
		[dʒaʊ]	1
		[dʒaɪ]	1
			39
	I/UA		
[dʒə]	2	[dʒi]	2
[dʒɪ]	1		2
[dʒe]	1		
	4		
	F/U		
[edʒ]	2	[adʒ]	4
[ɪdʒ]	1	[ædʒ]	1
[ɛdʒ]	1	[ʌdʒ]	1
[ʌdʒ]	1	[ɝdʒ]	1
	5	[idʒ]	1
			8

T-L		Ns.
	F/UA	
[ɪdʒ]	1	———
	1	
	/dʒ/ Blends	
	I/A	
———		———
	I/UA	
———		———
	F/A	
[rdʒ]	3	[ndʒ] 3
[ndʒ]	2	[dʒd] 2
	5	5
	F/UA	
———		———
	/f/ Singles	
	I/A	
[fɪ]	8	———
[fɔ]	7	
[fa]	6	
[faɪ]	6	
[fe]	4	
[fæ]	4	
[fo]	4	
[fi]	3	
[fʊ]	2	
[fu]	2	
[fɝ]	2	
[faʊ]	1	
	54	

T-L		Ns.	
	I/UA		
[fə]	2	[fə]	9
[fo]	1	[fu]	1
[fɚ]	1	[fI]	1
	4	[fa]	1
		[fo]	1
			13
	F/A		
[æf]	1	[ɝf]	14
	1	[ʌf]	4
		[æf]	2
		[If]	2
		[ɛf]	2
		[af]	2
		[Uf]	2
		[if]	2
		[aIf]	1
		[uf]	1
		[ɔf]	1
			35
	F/UA		
[af]	1	[uf]	1
	1		1

/f/ Blends

	I/A		
[fr]	9	[fl]	48
[fl]	4	[fr]	29
	13	[fw]	2
		[fj]	1
			80
	I/UA		

T-L		Ns.	
	F/A		
[lf]	5	[ft]	9
[ft]	3	[rf]	6
	8	[pf]	3
		[lf]	1
			19
	F/UA		

/ʃ/ Singles

	I/A		
[ʃo]	4	[ʃo]	2
[ʃU]	3	[ʃi]	2
[ʃi]	2	[ʃI]	2
[ʃe]	2	[ʃu]	1
[ʃI]	1	[ʃɚ]	1
[ʃɛ]	1		
[ʃæ]	1		
[ʃu]	1		
[ʃaU]	1		
	12		
	I/UA		
[ʃə]	7	[ʃə]	2
	7		2
	F/A		
[Iʃ]	5	[aʃ]	8
[eʃ]	3	[Iʃ]	2
[aʃ]	2	[æʃ]	1
[æʃ]	1	[uʃ]	1
[~ʃ]	1		12
	12		
	F/UA		
[Iʃ]	3	[uʃ]	2
	3		2

T-L		Ns.	
	/ʃ/ Blends		
	I/U		
———		[ʃɪ]	5
		[ʃm]	3
		[ʃɹ]	3
		[ʃn]	2
			13
	I/UA		
———		[ʃɪ]	1
			1
	F/A		
———		[ɹʃ]	1
		[ʃt]	1
			2
	F/UA		
———		———	
	/k/ Singles		
	I/A		
[kʌ]	9	[ka]	19
[kæ]	8	[ke]	15
[kɔ]	7	[ki]	13
[ka]	5	[kɪ]	10
[ko]	5	[kæ]	8
[kɪ]	4	[ko]	5
[ke]	2	[kɜ]	4
[kɛ]	2	[ku]	3
[kʊ]	2	[kaʊ]	3
[ki]	1	[kʌ]	3
[ku]	1	[kaɪ]	2
[kaɪ]	1	[kɛ]	2
[kaʊ]	1		87
	48		

T-L		I/UA	Ns.	
[kəˌ]	9		[kiˌ]	6
[kl̩ˌ]	3		[kə]	6
[kIˌ]	1		[ku]	3
[keˌ]	1		[ka]	3
	14		[ko]	2
			[kɚ]	2
			[kI]	1
				23

F/A

[ɛk]	6		[ak]	40
[Ik]	5		[æk]	39
[ek]	5		[ik]	32
[æk]	4		[Ik]	31
[Uk]	4		[ɝk]	18
[ik]	3		[uk]	15
[ak]	3		[ɛk]	14
[ok]	3		[ok]	10
[ɔk]	2		[ʌk]	10
[ɝk]	1		[ek]	10
[aIk]	1		[aIk]	3
	37		[ɔk]	2
			[Uk]	1
				225

F/UA

[Ik]	8		[Ik]	5
[ək]	2		[æk]	1
	10		[Uk]	1
				7

/k/ Blends

I/A

[klˌ]	10		[kl]	32
[kwˌ]	6		[kr]	25
[krˌ]	5		[sk]	15
[sk]	5		[kw]	5
[skw]	1		[skrˌ]	4
	27		[skw]	4
				85

T-L		I/UA	Ns.	
			[sk]	3
				3
		F/A		
[kt]	5		[ŋk]	45
[nk]	4		[ks]	16
[rk]	3		[kt]	14
[ks]	2		[rk]	12
[sk]	1		[sk]	11
[lk]	1		[ŋkt]	5
[kst]	1		[kst]	1
	17		[ŋks]	1
				105
		F/UA		
[kt]	1		[sk]	1
	1		[ŋk]	1
				2

/n/ Singles

I/A

[no]	6		[nɹ]	13
[ne]	5		[nI]	10
[nʌ]	5		[ni]	9
[naI]	5		[nɑ]	9
[nɛ]	4		[nu]	8
[ni]	3		[næ]	6
[næ]	3		[nɛ]	4
[nI]	2		[no]	4
[nɑ]	2		[naU]	2
[nɔ]	2		[nʌ]	1
[nu]	1			66
[naU]	1			
	39			

T-L		I/UA	Ns.	
[nI]	4		[no]	9
[nɨ]	2		[ni]	4
[nɚ]	1		[na]	3
	7		[nu]	2
			[nə]	1
			[nɚ]	1
			[nI]	1
				21

F/A

[ɚn]	19		[æn]	13
[In]	18		[In]	11
[ʌn]	13		[an]	11
[æn]	11		[in]	9
[en]	9		[un]	6
[in]	8		[ʌn]	5
[on]	5		[aIn]	4
[aIn]	4		[ɛn]	3
[an]	4		[en]	3
[ɝn]	4		[on]	3
[aUn]	4		[aUn]	3
[un]	3		[ɝn]	1
[ɔn]	1			72
[ɔIn]	1			
[jun]	1			
	106			

F/UA

[ɔn]	40		[ən]	26
[In]	9		[an]	6
[ɚn]	2		[In]	2
[ʌn]	1		[in]	1
	52		[ɛn]	1
				36

/n/ Blends

I/A

[sn]	1		[sn]	13
	1		[ʃn]	2
			[nj]	1
				16

T-L		I/UA	Ns.	
			[sn]	2
				2

F/A

[nd]	22		[nt]	16
[nt]	16		[nd]	9
[ns]	8		[rn]	6
[nk]	4		[nʧ]	6
[nʧ]	3		[ndʒ]	3
[ndʒ]	2		[nz]	3
[rn]	2		[ns]	2
[nst]	1		[ntz]	1
	58			46

F/UA

[nt]	6		[nd]	7
[ns]	4			7
[nd]	3			
	13			

/d/ Singles

I/A

[dI]	7		[da]	20
[de]	5		[dI]	15
[dU]	5		[do]	13
[di]	4		[dæ]	9
[dɛ]	3		[du]	9
[da]	3		[di]	9
[dɔ]	2		[de]	8
[de]	2		[dɛ]	6
[daU]	2		[dʌ]	6
[dæ]	1		[dɚ]	4
[du]	1		[daI]	2
[daI]	1			101
	36			

T-L		I/UA	Ns.	
[dI]	10		[dI]	7
[də]	6		[dɚ]	5
[dɚ]	6		[du]	3
[du]	2		[do]	3
[de]	1		[də]	3
	25		[di]	2
			[da]	2
			[de]	1
			[dæ]	1
				27

F/A

[ɛd]	11		[æd]	24
[aId]	11		[Id]	21
[Ud]	7		[ɚd]	10
[ed]	6		[ad]	8
[id]	5		[od]	6
[æd]	4		[ɛd]	5
[ʌd]	4		[Ud]	5
[ɚd]	4		[ʌd]	5
[Id]	3		[ud]	3
[aUd]	2		[aId]	2
[ad]	2		[ed]	2
[ud]	2		[aUd]	2
[od]	1		[id]	2
	62		[ɔId]	1
				96

F/UA

[əd]	5		[Id]	11
[ɚd]	3		[əd]	7
[Id]	1		[ɚd]	5
[od]	1		[id]	2
[nd]	1		[ud]	2
	11		[ad]	1
				28

/d/ Blends

I/A

[dr]	7		[dr]	6
	7			6

T-L		I/UA	Ns.	
[dr]	2			
	2			

F/A

[nd]	22	[nd]	10
[ld]	13	[gd]	5
[rd]	8	[rd]	3
	43	[ld]	2
		[dʒd]	2
		[dz]	1
		[vd]	1
		[bd]	1
		[md]	1
		[ŋd]	1
			27

F/UA

[nd]	3		
	3		

/g/ Singles

I/A

[gɛ]	6	[ga]	16
[ga]	5	[go]	14
[go]	4	[gu]	14
[ge]	4	[gɪ]	11
[gɪ]	3	[gɚ]	5
[gæ]	2	[gi]	4
[gɔ]	1	[gæ]	4
[gʊ]	1	[gʌ]	3
[gʌ]	1	[gaʊ]	1
[gɚ]	1		72
[gaɪ]	1		
	29		

T-L		I/UA	Ns.	
[go]	1		[gə]	8
[gɚ]	1		[ga]	5
[gɨ]	1		[gi]	2
	3		[gU]	1
			[gu]	1
			[gɚ]	1
				18

F/A

[Ig]	2		[Ig]	66
[eg]	2		[ag]	32
[æg]	1		[æg]	20
[ɔg]	1		[ug]	18
[Ug]	1		[ʌg]	10
	7		[ig]	8
			[eg]	4
			[og]	2
			[Ug]	1
			[aIg]	1
			[eg]	1
				163

F/UA

[Ig]	1		[Ig]	3
[əg]	1		[ig]	1
	2		[eg]	1
			[ag]	1
				6

/g/ Blends

I/A

[gɹ]	11		[gl]	17
[gl]	2		[gɹ]	17
	13		[gw]	3
			[gj]	1
				38

T-L		I/UA	Ns.	
[gl]	2			
	2			

F/A

		[gd]	5
		[gz]	3
		[rg]	1
			9

F/UA

		[gz]	1
			1

/ə/

I/UA

		[ə]	30
		[əd]	6
		[əs]	1
			37

F/UA

[tə]	16	[pə]	8
[də]	13	[də]	5
[və]	10	[lə]	3
[də]	8	[zə]	2
[pə]	5	[tə]	2
[bə]	5	[mə]	2
[fə]	5	[kə]	2
[nə]	4	[bə]	2
[ə]	4	[tʃə]	2
[tʃə]	4	[nə]	1
[gə]	3	[gə]	1
[sə]	3		30
[mə]	3		
[dʒə]	2		
[ʒə]	2		
[hə]	1		
[lə]	1		
[θə]	1		
	90		

T-L		M/UA	Ns.	
[wɚ]	2			
[dɚ]	1			
[kɚ]	1			
[fɚ]	1			
[vɚ]	1			
	6			

/ɝ/

I/A

[ɝ]	1	[ɝk]	5
[ɝθ]	1	[ɝ]	3
	2	[ɝd]	3
		[ɝt]	2
		[ɝp]	1
		[ɝl]	1
			15

F/A

[sɝ]	4	[kɝ]	3
[dʒɝ]	3	[stɝ]	2
[pɝ]	2	[pɝ]	2
[fɝ]	1	[gɝ]	2
[θɝ]	1	[fɝ]	2
[hɝ]	1	[vɝ]	2
[wɝ]	1	[zɝ]	1
	13	[nɝ]	1
		[lɝ]	1
		[dʒɝ]	1
			17

M/A

[wɝ]	4	[nɝ]	12
[bɝ]	2	[bɝ]	4
[tɝ]	2	[fɝ]	3
[hɝ]	2	[dɝ]	3
[fɝ]	1	[gɝ]	3
[gɝ]	1	[kwɝ]	2
[sɝ]	1	[klɝ]	2

T-L		Ns.	
[θɹ]	1	[mɹ]	2
[lɹ]	1	[sɹ]	2
[tʃɹ]	1	[flɹ]	1
	16	[skwɹ]	1
		[zɹ]	1
		[slɹ]	1
		[stɹ]	1
		[snɹ]	1
		[jɹ]	1
		[pɹ]	1
		[ʃɹ]	1
		[lɹ]	1
		[kɹ]	1
		[swɹ]	1
		[dʒɹ]	1
		[wɹ]	1
		[gwɹ]	1
			48

/aI/

I/A

[aI]	4	[aIn]	2
[aId]	1	[aIs]	1
[aIs]	1		3
[aIm]	1		
[aIl]	1		
	8		

I/UA

[aI]	1		———
	1		

F/A

[baI]	2	[laI]	3
[saI]	2	[taI]	2
[plaI]	2	[baI]	2
[taI]	1	[raI]	1
[daI]	1	[saI]	1
[faI]	1	[daI]	1

T-L		Ns.	
[haI]	1	[waI]	1
[maI]	1	[faI]	1
[naI]	1		12
[laI]	1		
[hwaI]	1		
[traI]	1		
[draI]	1		
[kraI]	1		
[flaI]	1		
[skaI]	1		
	19		

F/UA

[maI]	6	[waI]	1
	6		1

M/A

[saI]	7	[laI]	5
[faI]	5	[saI]	3
[raI]	5	[skaI]	2
[maI]	4	[paI]	2
[naI]	4	[raI]	2
[laI]	4	[baI]	2
[waI]	4	[flaI]	2
[taI]	3	[faI]	1
[dwaI]	2	[snaI]	1
[vaI]	2	[haI]	1
[haI]	2	[twaI]	1
[praI]	2	[taI]	1
[jwaO]	2	[dgaI]	1
[kaI]	1	[braI]	1
[gaI]	1	[waI]	1
[zaI]	1	[waI]	1
[t/aI]	1	[daI]	1
[braI]	1	[naI]	1
[traI]	1	[kaI]	1
[draI]	1	[staI]	1
[smaI]	1		31
	54		

T-L		M/UA	Ns.	
[taɪ]	1		———	
[saɪ]	1			
[laɪ]	1			
	3			

/u/

I/A

———			[u]	13
			[uk]	2
			[up]	2
			[ug]	2
			[uts]	1
			[utʃ]	1
			[un]	1
				22

I/UA

———			[u]	16
			[ud]	1
			[up]	1
				18

F/A

[tu]	3		[bu]	17
[fju]	2		[tu]	10
[dju]	2		[nu]	6
[nju]	2		[t/u]	6
[du]	1		[ru]	5
[ʃu]	1		[du]	5
[hu]	1		[wu]	5
[blu]	1		[zu]	4
[tru]	1		[lu]	4
[gru]	1		[gu]	3
[vju]	1		[ku]	3
[θru]	1		[mu]	2
[hju]	1		[pu]	2
[mju]	1		[fu]	1
	21		[fju]	1
			[gu]	1

T-L		Ns.	
		[fru]	1
		[tru]	1
		[flu]	1
		[stu]	1
		[vu]	1
		[snu]	1
		[θru]	1
		[ʃu]	1
			83

F/UA

[tu]	1	[ku]	3
[nju]	1	[su]	2
	2	[pu]	2
		[zu]	2
		[vu]	2
		[gu]	1
		[hu]	1
		[ru]	1
		[gu]	1
			15

M/A

[mu]	4	[du]	9
[ru]	3	[bu]	9
[fu]	2	[su]	6
[su]	2	[lu]	6
[hu]	2	[fu]	5
[nju]	2	[flu]	5
[ku]	1	[gu]	4
[nu]	1	[wu]	4
[lu]	1	[zu]	4
[pru]	1	[pu]	4
[tru]	1	[nu]	4
[dju]	1	[tu]	4
[klu]	1	[dru]	3
[gru]	1	[ru]	3
[fju]	1	[plu]	3
[fru]	1	[slu]	3
[sku]	1	[ju]	2
	28	[hu]	2

T-L		Ns.	
		[blu]	2
		[mu]	2
		[kru]	2
		[klu]	2
		[bru]	1
		[swu]	1
		[vu]	1
		[dʒu]	1
		[tru]	1
		[sku]	1
		[gru]	1
		[glu]	1
		[nju]	1
			98

M/UA

[bju]	1	———	
	1		

/e/

I/A

[e]	1	[e]	2
[et]	1	[en]	1
[edʒ]	1	[es]	1
	3	[ev]	1
		[ep]	1
			6

I/UA

———		[e]	3
			3

F/A

[ne]	4	[ze]	5
[le]	3	[de]	4
[pe]	2	[pe]	3
[be]	2	[be]	3
[de]	2	[te]	2

T-L		Ns.	
[fe]	2	[ke]	2
[ste]	2	[dge]	2
[we]	2	[fle]	2
[teɹ]	1	[kreɹ]	1
[ðeɹ]	1	[sle]	1
[se]	1	[skwe]	1
[me]	1	[me]	1
[ple]	1	[le]	1
[gre]	1	[be]	1
	25	[ble]	1
		[se]	1
			31

F/UA

———		[we]	3
		[te]	2
		[de]	1
			6

M/A

[te]	5	[te]	6
[re]	5	[deɹ]	5
[pe]	4	[be]	4
[geɹ]	4	[ste]	4
[se]	4	[leɹ]	3
[we]	4	[me]	3
[keɹ]	3	[fe]	2
[me]	3	[bleɹ]	2
[leɹ]	3	[dgeɹ]	2
[deɹ]	2	[ke]	2
[feɹ]	2	[treɹ]	2
[ʃeɹ]	2	[he]	2
[pleɹ]	2	[peɹ]	1
[treɹ]	2	[ze]	1
[steɹ]	2	[sleɹ]	1
[streɹ]	2	[jeɹ]	1
[beɹ]	1	[sne]	1
[tʃeɹ]	1	[re]	1
[neɹ]	1	[ve]	1
[breɹ]	1	[seɹ]	1
[kleɹ]	1	[greɹ]	1
[greɹ]	1		46

T-L		Ns.	
[fre]	1		
[spe]	1		
[ske]	1		
[sple]	1		
	59		

M/UA

/I/

I/A

[In]	6	[Ig]	7
[Iz]	2	[Id]	6
[In]	2	[Im]	6
[Its]	2	[Ik]	5
[It]	1	[Is]	4
[If]	1	[Iŋ]	4
[I∫]	1	[It]	3
[Il]	1	[I]	3
[Ir]	1	[Ip]	2
[Int∫]	1	[Iz]	2
	18	[In]	2
		[Ink]	1
		[I∫]	1
		[Int]	1
		[Iθ]	1
		[Ivd]	1
			49

I/UA

[I]	32	[In]	106
[Iŋ]	9	[Ik]	3
[In]	8	[Its]	2
[Ik]	6	[It]	2
[It]	4	[Id]	2
[Idʒ]	4	[Iŋz]	2
[Is]	3	[I]	1
[I∫]	2	[Ind]	1
[Ist]	2		119

T-L		Ns.	
[Ig]	1		
[Iz]	1		
	73		

F/A

		[fI]	1
		[sI]	1
		[zI]	1
		[bI]	1
		[tI]	1
			5

F/UA

[rI]	16	[sI]	1
[bI]	10		1
[dI]	10		
[lI]	9		
[tI]	8		
[trI]	3		
[mI]	2		
[nI]	1		
[prI]	1		
[blI]	1		
	61		

M/A

[sI]	12	[sI]	30
[mI]	9	[lI]	29
[bI]	8	[zI]	27
[fI]	8	[rI]	26
[wI]	8	[mI]	19
[dI]	7	[wI]	13
[hI]	6	[dI]	13
[pI]	5	[frI]	13
[tI]	5	[tI]	13
[lI]	5	[gI]	12
[kI]	4	[fI]	11
[rI]	4	[nI]	10
[gI]	3	[blI]	9
[θI]	3	[flI]	9

T-L		Ns.	
[bɹɪ]	3	[bɪ]	9
[spɪ]	2	[kɪ]	9
[vɪ]	2	[gɹɪ]	8
[pɹɪ]	2	[dʒɪ]	8
[stɪ]	2	[hɪ]	5
[ðɪ]	1	[pɪ]	5
[zɪ]	1	[kɹɪ]	4
[ʃɪ]	1	[vɪ]	4
[tʃɪ]	1	[plɪ]	3
[nɪ]	1	[tʃɪ]	3
[hwɪ]	1	[slɪ]	2
[tɹɪ]	1	[glɪ]	2
[dɹɪ]	1	[swɪ]	2
[klɪ]	1	[stɪ]	2
[kwɪ]	1	[skɪ]	2
[skɪ]	1	[stɹɪ]	2
[spɹɪ]	1	[ʃɪ]	2
	111	[θɹɪ]	2
		[twɪ]	2
		[ʃnɪ]	1
		[kwɪ]	1
		[pɹɪ]	1
		[dɹɪ]	1
		[skwɪ]	1
		[klɪ]	1
		[snɪ]	1
		[ʃlɪ]	1
		[tɹɪ]	1
		[ʃɹɪ]	1
		[ʒɹɪ]	1
		[ʒɪ]	1
		[jɪ]	1
		[mɹɪ]	1
		[zwɪ]	1
		[ɚɪ]	1
			326

M/UA

[tɪ]	5	[dɪ]	8
[θɪ]	3	[sɪ]	4
[nɪ]	3	[lɪ]	3

T-L		Ns.	
[wI]	3	[bI]	2
[kI]	1	[zI]	2
[vI]	1	[pI]	1
[zI]	1	[plI]	1
[hI]	1	[wI]	1
[dʒI]	1	[nI]	1
[lI]	1	[mI]	1
[glI]	1	[fI]	1
	21	[kI]	1
			26

/i/

I/A

[i]	2	[i]	14
[it]	1	[ik]	5
[iv]	1	[it]	2
[iz]	1	[ip]	2
[itʃ]	1	[ig]	2
[ist]	1	[is]	1
	7	[il]	1
			27

I/UA

———		[i]	63
		[id]	2
		[in]	1
		[ig]	1
		[ib]	1
			68

F/A

[ri]	4	[ni]	6
[si]	3	[ti]	5
[bi]	2	[zi]	4
[ði]	2	[si]	4
[ni]	2	[ki]	4
[gri]	2	[fi]	3
[pi]	1	[ri]	3
[di]	1	[mi]	3

T-L		Ns.	
[ʃi]	1	[bi]	2
[hi]	1	[li]	2
[mi]	1	[vi]	2
[wi]	1	[ʃi]	2
[tri]	1	[wi]	2
[fri]	1	[ji]	2
[θri]	1	[gi]	2
	24	[tʃi]	2
		[tri]	1
		[hi]	1
		[smi]	1
		[skwi]	1
		[di]	1
		[pi]	1
		[dgi]	1
			55

F/UA

———		[li]	21
		[ki]	6
		[ni]	4
		[ti]	3
		[pi]	3
		[bi]	3
		[si]	3
		[dgi]	2
		[ski]	2
		[wi]	1
		[ri]	1
		[zi]	1
		[kri]	1
		[mi]	1
		[gi]	1
			53

M/A

[si]	6	[bi]	16
[li]	5	[si]	10
[mi]	4	[ri]	9
[di]	3	[ki]	8
[fi]	3	[di]	8

T-L

[spi]	2
[stri]	2
[bi]	1
[ki]	1
[ði]	1
[ʃi]	1
[tʃi]	1
[ni]	1
[wi]	1
[twi]	1
[dri]	1
[kli]	1
[kri]	1
[kwi]	1
[gri]	1
[sli]	1
[swi]	1
	50

Ns.

[ti]	8
[li]	6
[fi]	4
[zi]	4
[bli]	3
[ni]	3
[gli]	3
[gi]	3
[wi]	3
[tri]	3
[fli]	3
[mi]	3
[sli]	2
[fri]	2
[vi]	2
[gri]	2
[kli]	2
[ʃli]	2
[pi]	1
[pri]	1
[bri]	1
[sti]	1
[ʃmi]	1
[dʒi]	1
[ji]	1
[pli]	1
[ski]	1
	118

M/UA

———

[bi]	2
[di]	2
[pi]	1
	5

T-L		Ns.	
		/a/	
		I/A	
[ar]	4	[at]	5
[a]	1	[a]	5
[av]	1	[ak]	5
[an]	1	[and]	5
[art]	1	[ag]	3
[arm]	1	[ap]	3
	9	[aps]	3
		[ar]	2
		[arn]	2
		[az]	2
		[ars]	2
		[at/]	2
		[alt]	2
		[arf]	1
		[an]	1
		[as]	1
		[ad]	1
		[aθ]	1
			46
		I/UA	
———		[an]	1
		[az]	1
		[av]	1
			3
		F/A	
[ka]	1	[ba]	6
[fa]	1	[ga]	4
	2	[wa]	3
		[la]	3
		[ka]	3
		[ra]	2
		[ma]	2
		[ta]	2
		[ha]	2
		[va]	2

T-L		Ns.	
		[za]	1
		[tra]	1
		[da]	1
		[sra]	1
		[fa]	1
		[na]	1
		[pla]	1
		[bla]	1
		[kla]	1
		[kra]	1
			39

F/UA

———		[ga]	4
		[ba]	3
		[za]	3
		[na]	2
		[la]	2
		[ma]	1
		[fa]	1
		[wa]	1
		[sa]	1
			18

M/A

[pa]	5	[wa]	29
[ga]	5	[fa]	21
[fa]	5	[da]	20
[wa]	5	[ta]	17
[ka]	4	[ra]	17
[ma]	4	[ba]	16
[pra]	4	[ka]	16
[sta]	4	[ma]	13
[da]	3	[pa]	12
[ha]	3	[la]	12
[ba]	2	[ga]	12
[ʃa]	2	[fla]	11
[dʒa]	2	[ha]	10
[na]	2	[fra]	10
[la]	1	[bra]	9

T-L		Ns.	
[ra]	1	[na]	9
[dra]	1	[na]	8
[spa]	1	[bla]	8
[ta]	1	[tra]	7
[tʃa]	1	[gla]	6
[hwa]	1	[sna]	6
	58	[kla]	6
		[dga]	5
		[va]	5
		[sta]	4
		[tʃa]	4
		[sla]	3
		[swa]	3
		[pla]	3
		[za]	2
		[ska]	2
		[dra]	2
		[kwa]	2
		[pra]	2
		[fwa]	2
		[kra]	2
		[gwa]	2
		[ʃma]	1
		[ʃna]	1
		[ja]	1
		[ʃla]	1
		[bwa]	1
		[sma]	1
		[twa]	1
		[stra]	1
		[θra]	1
		[θa]	1
			328

M/UA

[hwa]	1	[ba]	5
	1	[ka]	3
		[da]	2
		[sa]	2
		[ma]	2
		[sna]	2

T-L	Ns.
[ga]	1
[fa]	1
[wa]	1
[ja]	1
[na]	1
	21

APPENDIX IV

PHONETIC CONTEXTS PRESENT IN ONLY NONLEXICAL UTTERANCES

Singles

I/A	I/UA	F/A	F/UA	M/A	M/UA
			r		

Blends

I/A	I/UA	F/A	F/UA	M/A	M/UA
z ʃ	s ʃ k n	ʃ g	r l g		

Vowels

I/A	I/UA	F/A	F/UA	M/A	M/UA
u	ɚ u e i a	I	e i a		i

APPENDIX V

PHONETIC CONTEXTS ABSENT IN BOTH DISTRIBUTIONS

Singles

I/A	I/UA	F/A	F/UA	M/A	M/UA
			tʃ		

Blends

I/A	I/UA	F/A	F/UA	M/A	M/UA
tʃ	tʃ		tʃ		
dʒ	dʒ		dʒ		
	f		f		
	z		ʃ		

Vowels

I/A	I/UA	F/A	F/UA	M/A	M/UA
					e

APPENDIX VI

PHONETIC CONTEXTS FOUND TO BE SIGNIFICANTLY DIFFERENT BETWEEN LEXICAL AND NONLEXICAL UTTERANCES

Singles

I/A	I/UA	F/A	F/UA	M/A	M/UA
g l z d	g	k			

Blends

I/A	I/UA	F/A	F/UA	M/A	M/UA
		d			

Vowels

I/A	I/UA	F/A	F/UA	M/A	M/UA
e i					

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