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AUTHOR Holm, Wayne
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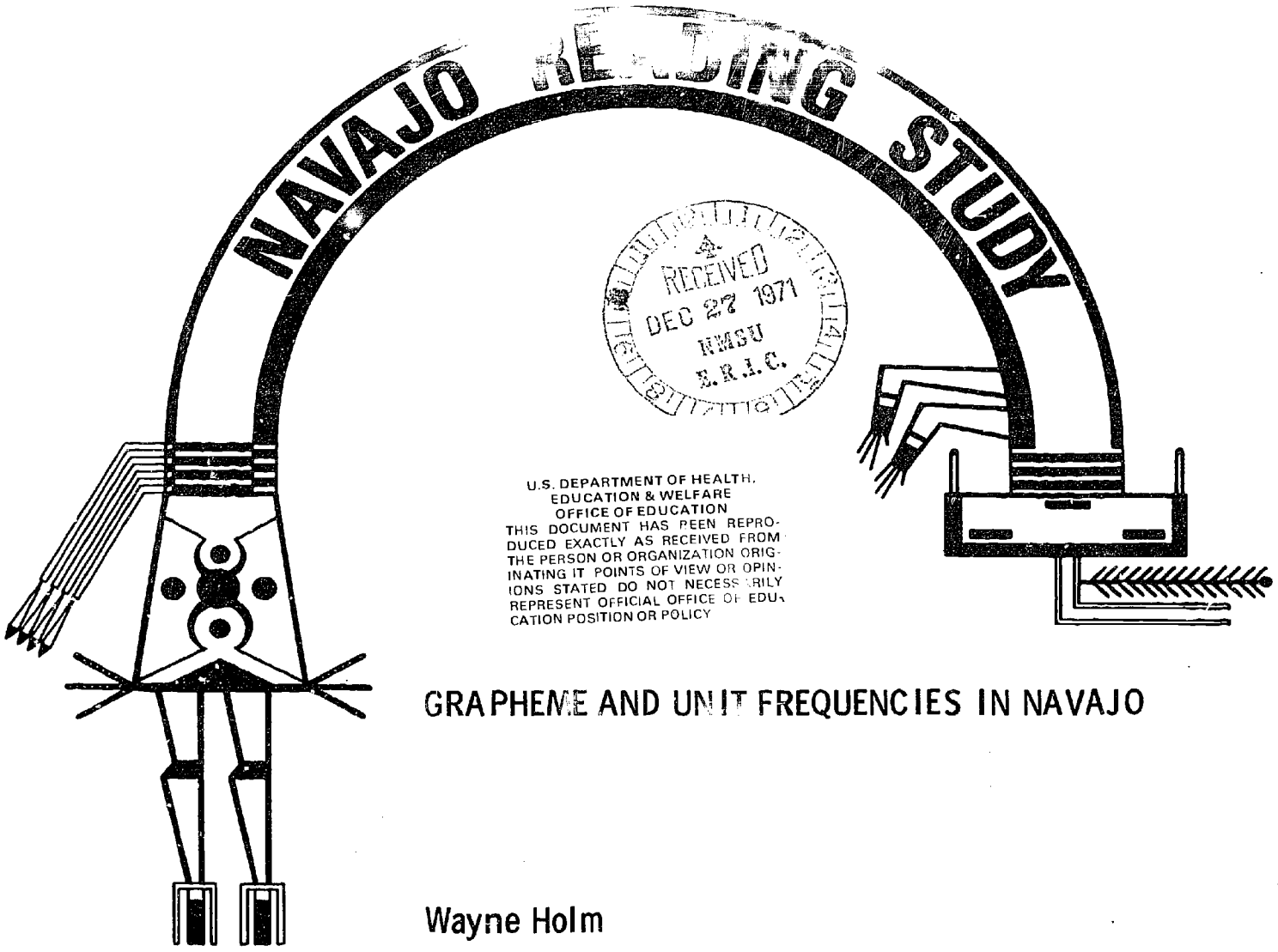
ABSTRACT

As part of a study of the feasibility and effect of teaching Navajo children to read their own language first, the results of analysis of grapheme and unit frequencies noted in the speech of Navajo 6-year-olds are presented in this report. Material gathered by means of interviews conducted by 22 adult Navajos with over 200 Navajo children is analyzed and the linguistic structure is compared with that used by adult Navajos. The grapheme and unit frequencies are computed for children and adults and reported separately. Graphemes, vowel units, dipthong units, absolute frequencies, and relative frequencies are listed in tabular form and described. A 26-item bibliography is included. Related documents are ED 035 484, ED 043 004, ED 043 005, ED 043 413, and ED 048 584. (PS)



GRAPHEME AND UNIT FREQUENCIES IN NAVAJO

Wayne Holm

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NAVAJO READING STUDY

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Preface

As part of a study of the feasibility and effect of teaching Navajo children to read in their own language first, we have collected a corpus of 11,128 sentences of spoken Navajo. The text consists of interviews conducted by twenty adult Navajos with over two hundred children, most of them six-year-olds. Full details of the collection and analysis of this corpus is given in Navajo Reading Study Progress Report No. 9.

This present study reports on the results of the analysis of grapheme and unit frequencies in the text: it should be of value to those concerned with the developing interest in Navajo literacy.

Bernard Spolsky
Principal Investigator

I. INTRODUCTION

Venezky,[1] in The Structure of English Orthography, makes a useful distinction between a grapheme and a functional unit. A grapheme is a single letter or character; a unit is one or more letters or characters that function as a spelling unit. Thus the Navajo word CH'IL would have five graphemes, C - H - ' - I - L, but only three units, CH' - I - L.

Grapheme counts should be of interest to those concerned with the printing of Navajo; unit counts should be of interest to those concerned with the spelling, and the teaching of reading, in Navajo.

The Werner-Begishe alphabet used in this study is essentially a form of the Young and Morgan alphabet modified for computer use. The alphabets differ only as shown below.

< 1 > —— < LH >

< tl > —— < TL >

< tl' > —— < TL' >

< ' > —— < 7 >

< ą > —— < 8 >

(High tone is written as a < 7 > after each high tone vowel grapheme; nasality is written as an < 8 > before a vowel grapheme sequence in its entirety.)

There are, then, 23 graphemes required to write Navajo in this alphabet.

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[1] Richard Venezky. The Structure of English Orthography. Mouton: The Hague. 1970.

'	E	K	S	Z
A	G	L	T	7
B	H	M	W	8
C	I	N	X	1
D	J	O	Y	

But, because there are a number of English loan words in the speech of Navajo six-year-olds (See Navajo Reading Study Progress Report No. 16), the graphemes < F >, < P >, < Q >, < R >, and < V > do occur in the text. Many of these words, especially personal and place names are, for the speaker, Navajo words. Thus, we can say that to write Navajo as it is spoken by six-year-olds requires 29 graphemes--the 26 ordinarily found in English plus < ' >, < 7 >, and < 8 >.

Grapheme frequencies for consonants are computed by combining the frequencies of all graphemes and defining the frequency of each grapheme as a percentage of that total.

The functional units of Navajo are a bit more difficult to arrive at. To facilitate explanation here, we discuss consonantal, vowel, and diphthongal units in turn.

Consonantal units.

A relatively large number of Navajo units are digraphs or trigraphs. Larger units sharing a grapheme (or contiguous graphemes) with a smaller unit or grapheme will be counted, by the computer, as an occurrence of the latter. Thus, the < T > of < TS > will be counted as an occurrence

of < T >. Similarly, with the < TS' >, the < T >, the < S >, the < ' > and the < TS > will be counted as occurrences of each of those graphemes or units. Thus, to obtain the true frequency of such consonantal units, one must discount the other occurrences by computation. Simplifying things a bit, we would obtain the true frequency of the < T > units by finding the remainder of all < T > graphemes minus the number of < TS > and < TS' > units.

< X > is something of a problem. One use of < X > is as an alternant to < H > after < S >--thus avoiding confusion between < S > < H > and < SH >. But the < X > is also used to mark heavier aspiration which is used to indicate intensification or a derogatory sense. < X > is only marginally phonemic; two or three minimal pairs can be found. We have counted both uses of < X > as an instance of the first unit and < X >.* The transcriber seems to have been disturbed by the use of stem-initial < H > after a prefix-final < H >. Here she writes < HX >. This has been counted as an occurrence of both < H > and < X >.

The transcriber did not write < 'N > after consonantal units; thereby avoiding apparent three-consonant sequences which otherwise do not occur in normalized orthography. Only in such an environment is < 'N > mechanically distinguishable from a sequence of < ' > < N >. The same is the case with < 'M > and < 'Y >.

*An inspection of all words containing < X > in the corpus showed that Navajo < X > occurred only in < TSX > and < CHX > sequences. There were no < SX > sequences; all apparent < SX > sequences turned out to be sequences of < S > < X > as noted earlier, where the < X > replaces an < H >. Thus, the use of < X > < X > in this corpus is not as ambiguous as it could be. All occurrences of < X > were very small.

The consonantal units of Navajo, then, are as follows:

'	DZ	K	S	TS	ZH
B	G	K'	SH	TS'	
CH	GH	KW	T	W	
CH'	H	L	T'	X	
D	HW	LH	TL	Y	
	J	M	TL'	Z	

Vowels

Both vowels and digraphs pose some problems. There are so many potential digraph sequences that the nesting of shorter sequences within longer ones becomes rather complex. Here it is easier to search for instances of given vowel or digraph sequences bounded by non-vowel graphemes (i.e., consonants, space, or punctuation marks). Thus, using * here to mark non-vowel, it is easier to search for a sequence of < *EI* > than to work out which other vowels and diphthongs occur in sequences such as < EI >, < EI7 >, < EI7I7 >, etc. The Young and Morgan orthography lends itself to an analysis of Navajo vowels in which any of four vowels may be short or long (in duration), oral or nasal (in nasality), and high or low (in tone). With the proviso that rising or falling tone occurs only with long vowels, one obtains 12 basic vowel types.

V	8V
V7	8V7
VV	8VV
V7V7	8V7V7

Given four basic vowels, < A >, < E >, < I >, and < O >, one obtains a matrix of 48 possible vowel sequences. Probably all of these do occur although some, like < 8E7 > are not at all common.

Diphthongs

Diphthongs are much more poorly defined. Young and Morgan list < AI >, < AO >, < EI >, and < OI > type diphthongs. But < IO > type diphthongs do occur.

Orthographically there are what might be called two-vowel and three-vowel diphthongs. But Hoijer (1945) gives examples of a number of diphthongs which, due to normalization, are of types that would not occur in the Young and Morgan orthography: overtly marked nasal diphthongs, what might be called four-vowel diphthongs, and diphthongs with what might be called circumflex tone.

Rather than arbitrarily decide which sequences should occur, we have simply tried to list all possible combinations which might occur--with the expectation that many of these will not occur.

Unit frequencies are then computed by combining the frequencies of all consonants, vowels, and diphthongs together and computing the frequency of each unit as a percentage of that total.

Children and Adults

Our initial analysis of grapheme frequencies showed a marked difference in the frequencies of < H > for children and adults--7.1 and 8.7 respectively. This may well reflect that in the interviews from which we derive our corpus, the adults are asking

most of the questions. Both -I7SH, the yes-no question marker and -SH as a reduced form of SH8A', a generalized information question marker, contain < H>. As about a third of the corpus, by length, is adult speech, marked differences in adult unit frequencies might affect overall frequency figures. We have, therefore, computed grapheme and unit frequencies for children and adults separately.

II. GRAPHEMES

Graphemes are single characters or letters. In the Werner-Begishe computer-compatible alphabet, there are 21 Navajo letters and two diacritics--<7> marking high tone and <8> marking nasality. An additional six letters occur in personal names and other English loanwords.

Absolute Grapheme Frequencies

There are more than 350,000 graphemes in the corpus. The frequency of the 29 graphemes is given in Table I. It should be realized that while those graphemes which occur only in English have been listed last, those graphemes which occur in Navajo as well as in English have been subsumed under the Navajo grapheme. The distinction is an arbitrary one; all 29 graphemes must be considered as part of current Navajo orthography.

Relative Grapheme Frequencies

Because there are a different number of graphemes for adults and children, it is a bit difficult to compare relative frequencies. In Table II, the absolute grapheme frequencies have been converted to percentages. Due to rounding, and the fact that several graphemes have frequencies of less than 0.1%, the totals are a bit more than 100%.

TABLE I

Absolute Grapheme Frequencies

	Adult	Child	Total
'	8,178	12,223	20,401
A	16,800	26,683	43,483
B	1,336	2,704	4,040
C	563	1,488	2,051
D	5,176	10,077	15,253
E	7,916	14,575	22,491
G	2,105	3,138	5,243
H	11,437	15,511	26,948
I	17,614	28,041	45,655
J	861	1,548	2,409
K	1,741	3,200	4,941
L	4,747	8,587	13,334
M	271	740	1,011
N	6,210	9,931	16,141
O	7,641	15,361	23,002
S	3,993	5,923	9,916
T	3,737	5,678	9,415
W	623	1,110	1,733
X	34	101	135
Y	1,901	3,520	5,421
Z	921	1,729	2,650
7	25,032	41,246	66,278
8	2,706	4,651	7,357
F(E)	63	200	263
P(E)	70	319	389
Q(E)	2	3	5
R(E)	328	969	1,297
U(E)	73	249	322
V(E)	62	105	167
	132,141	219,610	351,751

TABLE II

Relative Grapheme Frequencies

	Adult %	Child %	Total %
'	6.1	5.6	5.8
A	12.7	12.2	12.4
B	1.0	1.2	1.1
C	.4	.7	.6
D	3.9	4.6	4.3
E	6.0	6.6	6.4
G	1.6	1.4	1.5
H	8.7	7.1	7.7
I	13.3	12.8	13.0
J	.7	.7	.7
K	1.3	1.5	1.4
L	3.6	3.9	3.8
M	.2	.3	.3
N	4.7	4.5	4.6
O	5.8	7.0	6.5
S	3.0	2.7	2.8
T	2.8	2.6	2.7
W	.5	.5	.5
X	>.1	>.1	>.1
Y	1.4	1.6	1.5
Z	.7	.8	.7
7	18.9	18.8	18.8
8	2.0	2.1	2.1
F(E)	>.1	.1	.1
P(E)	>.1	.1	.1
Q(E)	>.1	>.1	>.1
R(E)	.2	.4	.3
U(E)	.1	.1	.1
V(E)	>.1	>.1	>.1

Rank-Ordering of Graphemes

To enable a closer comparison of the relative grapheme frequencies of adults and children, they are shown in order of descending relative frequency in Table III. Here it may be seen that the rank-ordering of adults and children is very close.

TABLE III

Rank Ordering of Graphemes

Adult			Child		
Rank	Unit	%	Rank	Unit	%
1.	7	18.9	1.	7	1[illegible] 8
2.	I	13.3	2.	I	[illegible]2.2
3.	A	12.7	3.	A	[illegible].2
4.	H	8.7	4.	H	.1
5.	'	6.1	5.	O	7.0
6.	E	6.0	6.	E	6.6
7.	O	5.8	7.	'	5.6
8.	N	4.7	8.	D	4.6
9.	D	3.9	9.	N	4.5
10.	L	3.6	10.	L	3.9
11.	S	3.0	11.	S	2.7
12.	T	2.8	12.	T	2.6
13.	8	2.0	13.	8	2.1
14.	G	1.6	14.	Y	1.6
15.	Y	1.4	15.	K	1.5
16.	K	1.3	16.	G	1.4
17.	B	1.0	17.	B	1.2
18.	Z	.7	18.	Z	.8
19.	J	.7	19.	J	.7
20.	W	.5	20.	C	.7
21.	C	.4	21.	W	.5
22.	R(E)	.2	22.	R(E)	.4
23.	M	.2	23.	M	.3
24.	U	.1	24.	U	.1
25.	P(E)	>.1	25.	P(E)	.1
26.	F(E)	>.1	26.	F(E)	.1
27.	V(E)	>.1	27.	V(E)	>.1
28.	X	>.1	28.	X	>.1
29.	Q	>.1	29.	Q	>.1

III. UNITS

Units are single or multigrapheme sequences that function as units. Thus ⟨C⟩, ⟨H⟩, and ⟨'⟩ would be graphemes. ⟨CH⟩ and ⟨CH'⟩, ⟨H⟩ and ⟨'⟩ but not ⟨C⟩ are units in Navajo.

While there are more than 350,000 graphemes in the corpus, there are roughly 210,000 units--indicating (in the Werner-Begishe computer-compatible orthography) a relatively high frequency of multigrapheme units.

Vowel-Consonant Frequencies

Of the units in the text, roughly 45% are vowels and roughly 55% are consonants--seeming to indicate a preponderance of CV (rather than CVC) syllabels.

The relative vowel consonant frequencies are shown in Table IV.

TABLE IV

Relative V - C Frequencies

	Number	% age
Vowels	95,620	45.0%
Consonants	117,038	55.0%
All Units	212,658	

III. A. VOWEL UNITS

Errors: A total of 57 vowel units are considered to be errors. Some of these seem to have come from transcription errors. Others seem to have come from word or morpheme separation errors. The result in both instances are sequences that we consider to be impossible Navajo vowel units.

57 known errors among roughly 95,000 vowels is not enough to affect the overall percentages.

The errors are shown in Table V. There has not been time to correct these errors.

TABLE V

Vowel Unit Errors

Transcription Errors:		
* AAI7I7	1	
* A7AA7	1	
* A7A7A	1	
* A7A7A7	1	
* A77	1	
* E7IOI	1	
* E7I7U	1	
* IA7A	1	
* I7A7	3	
* I7E7I7	1	
* OOO	1	
* OOU	1	
* O7O77	1	
* O8E7E7	1	
* 8I7IE7I	1	
* 87I7	1	
Sub-total		18
Separation Errors		
* 7	28	
* 7E7	1	
* 7I	1	
* 7I7	4	
* 7O7	1	
* 8	4	
Sub-total		39
TOTAL		57

English Vowel Frequencies

Of the roughly 95,000 vowel units, 630 units are definitely English. This is less than 1%. Such a figure is undoubtedly too low; it represents only those vowel units that do not occur in Navajo proper.

Those English vowel units which do not occur in Navajo proper are shown in Table VI. The most frequently occurring word is shown in parenthesis. The fact that a number of these words are given names would seem to indicate that these English vowel units cannot be ignored in the teaching of Navajo orthography.

In Tables VII and VIII, the use of English vowel units by adults and children are compared. While both percentages are quite low, the fact that the figure for the children is twice that of the adults would tend to confirm the notion that children use more English loan words than do adults.[1]

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[1] Agnes Holm, Wayne Holm and Bernard Spolsky. "English Loan Words in the Speech of Six-year-old Navajo Children. Navajo Reading Study Progress Report No. 16. The University of New Mexico. August 1971.

TABLE VI

English Vowel Units

Vowels		
U		237
Diphthongs		
AE	(Mae)	9
AU	(Laura)	10
EA	(bear)	112
EO	(George)	14
EU	(Eugene)	4
IA	(Indian)	30
IE	(Eddie)	73
IO	(lion)	22
OA	???	42[1]
OE	(potatoes)	8
OU	(mouse)	47
OUI	(Louis)	2
UA	(Juanita)	2
UE	(blue)	11
UI	(building)	7
	Total	630

[1] The counting program noted 42 occurrences of an OA unit but the exemplification program did not yield any examples.

TABLE VII

Adult-Child Use of English Vowel Units

	Adult	Child	Total
U	46	191	237
AE	3	6	9
AU	4	6	10
EA	20	92	112
EO	3	11	14
EU	2	2	4
IA	11	19	30
IE	30	43	73
IO	1	21	22
OA	8	34	42 (1)
OE	1	7	8
OU	15	33	48 (2)
OUI	1	1	2
UA	-0-	2	2
UE	1	8	9 (2)
UI	3	4	7
	149	480	629 (2)

(1) See note with Table V.

(2) There are a few slight differences between the original count and the later search program.

TABLE VIII

Adult-Child Percentage of use of English Vowel Units

	Total Units	English Vowel Units	Percentage
Adult	36,121	149	0.41%
Child	59,499	480	0.81%
Combined	95,620	629	0.66%

Absolute Vowel and Diphthong Frequencies.

The absolute frequencies of vowels and diphthongs are shown in Table IX.

The forms preceded by an asterisk are definite errors. (see page 14). Others may turn out, upon inspection, to be errors. The forms followed by an (E) are definite English forms. Those English forms identical to Navajo forms will have been subsumed under the Navajo forms.

TABLE IX

Absolute Vowel and Diphthong Frequencies

	Adult	Child	Total
A	4,490	7,505	11,995
AA	1,636	2,246	3,882
AAI7	28	43	71
*AAI7I7	1	0	1
AA7	4	4	8
AE (E)	3	6	9
AI	209	239	448
AII	100	28	128
AII7	2	10	12
AO	9	3	12
AOO	24	425	449
AU (E)	4	6	10
A7	3,346	4,464	7,810
A7A	506	595	1,101
*A7AA7	1	0	1
A7A7	1,267	2,811	4,078
*A7A7A	1	0	1
*A7A7A7	0	1	1
A7I	4	8	12
A7II	2	8	10
A7I7	116	28	144
A7I7I7 (?)	1	0	1
A7O	5	10	15
A7OO	0	1	1
*A77	1	0	1
E	1,433	2,304	3,737
EA (E)	20	92	112
EE	702	1,112	1,814
EEI7	1	1	2
EI	87	280	367
EII	133	387	520
EII7	30	45	75
EI7	1	1	2
EO (E)	3	11	14
EU (E)	2	2	4
E7	1,362	1,704	3,066
E7E	359	485	844
*E7EI	0	1	1
E7E7	397	986	1,383
E7I	168	703	871
E7II	33	66	99
*E7IOI	0	1	1
E7I7	1,017	1,752	2,769
E7I7I7 (?)	1	1	2
*E7I7U	0	1	1
I	4,176	7,497	11,673
IA (E)	11	19	30
*IA7A	1	0	1

TABLE IX - continued

	Adult	Child	Total
IE( )	30	43	73
II	773	2,212	2,985
II7	35	17	52
IO( )	1	21	22
I7	3,345	5,638	8,983
*I7A7	1	2	3
*I7E7I7	0	1	1
I7I	247	432	679
I7I7	1,998	1,311	3,309
O	2,011	3,031	5,042
OA(?)	8	34	42
OE( )	1	7	8
OI	7	10	17
OII	2	5	7
OI7	1	0	1
OI7I7	1	0	1
OO	959	1,365	2,324
OOI7	9	9	18
*OOO	0	1	1
*OOU	0	1	1
OO7	39	12	51
OU( )	15	32	47
OUI( )	1	1	2
O7	1,176	1,613	2,789
O7I	2	9	11
O7II	4	12	16
O7I7	33	87	120
O7O	135	97	232
O7O7	812	2,732	3,544
*O7O77	1	0	1
*O8E7E7	0	1	1
U( )	46	191	237
UA( )	0	2	2
UE( )	2	9	11
UI( )	3	4	7
*7	17	11	28
*7E7	0	1	1
*7I	1	0	1
*7I7	1	3	4
*7O7	1	0	1
*8	1	3	4
8A	605	115	720
8AA	79	334	413
8A7	93	247	340
8A7A	137	190	327
8A7A7	211	491	702
8EE	2	6	8
8E7	0	2	2
8E7E	96	396	492
8E7E7	238	589	827
8E7I7	0	1	1
8I	127	246	373

TABLE IX - continued

	Adult	Child	Total
8II	52	144	196
8I7	204	393	597
8I7I	82	159	241
*8I7IE7I	0	1	1
8I7I7	517	660	1,177
8O	45	73	118
8OO	12	70	82
8O7	75	87	162
8O7O	15	37	52
8O7O7	114	406	520
*87I7	1	0	1

Relative Vowel and Diphthong Frequencies

The relative frequencies of vowels and diphthongs are shown in Table X.

The comments made with respect to Table IX also apply to Table X.

TABLE X

Relative Vowel and Diphthong Frequencies

	Adult Percentage	Child Percentage	Total Percentage
*AAI7I7	>.1	>.1	>.1
*A7AA7	>.1	>.1	>.1
*A7A7A	>.1	>.1	>.1
*A7A7A7	>.1	>.1	>.1
A7I7I7	>.1	>.1	>.1
A7OO	>.1	>.1	>.1
A77	>.1	>.1	>.1
E7EI	>.1	>.1	>.1
*E7IOI	>.1	>.1	>.1
*E7I7U	>.1	>.1	>.1
IA7A	>.1	>.1	>.1
I7E7I7	>.1	>.1	>.1
OI7	>.1	>.1	>.1
OI7I7	>.1	>.1	>.1
OOO	>.1	>.1	>.1
OOU	>.1	>.1	>.1
O7O77	>.1	>.1	>.1
O8E7E7	>.1	>.1	>.1
7E7	>.1	>.1	>.1
7I	>.1	>.1	>.1
7O7	>.1	>.1	>.1
8E7I7	>.1	>.1	>.1
8I7IE7I	>.1	>.1	>.1
87I7	>.1	>.1	>.1
OUI	>.1	>.1	>.1
EI7	>.1	>.1	>.1
8E7	>.1	>.1	>.1
E7I7I7	>.1	>.1	>.1
UA	>.1	>.1	>.1
EEI7	>.1	>.1	>.1
I7A7	>.1	>.1	>.1
EU	>.1	>.1	>.1
8	>.1	>.1	>.1
7I7	>.1	>.1	>.1
UI	>.1	>.1	>.1
OII	>.1	>.1	>.1
AA7	>.1	>.1	>.1
8EE	>.1	>.1	>.1
OE	>.1	>.1	>.1
AE	>.1	>.1	>.1
AU	>.1	>.1	>.1
A7II	>.1	>.1	>.1
UE	>.1	>.1	>.1
O7I	>.1	>.1	>.1
AO	>.1	>.1	>.1
A7I	>.1	>.1	>.1
AII7	>.1	>.1	>.1
EO	>.1	>.1	>.1

TABLE X - continued

	Adult Percentage	Child Percentage	Total Percentage
A7O	>.1	>.1	.1
C7II	>.1	>.1	.1
OI	>.1	>.1	.1
OOI7	>.1	>.1	.1
IO	>.1	>.1	.1
7	>.1	>.1	.1
IA	>.1	>.1	.1
OA	>.1	.1	.1
OU	>.1	.1	.1
CO7	.1	.1	.1
8O7O	.1	.1	.1
II7	.1	.1	.1
AAI7	.1	.1	.1
IE	.1	.1	.1
EII7	.1	.1	.1
8OO	.1	.1	.1
E7II	.1	.1	.1
EA	.1	.2	.1
8O	.1	.1	.1
C7I7	.1	.2	.1
AII	.3	.1	.1
A7I7	.3	.1	.2
8O7	.2	.2	.2
8II	.1	.2	.2
O7O	.4	.2	.2
U	.1	.3	.3
8I7I	.2	.3	.3
8A7A	.4	.3	.3
8A7	.3	.4	.4
EI	.2	.5	.4
8I	.4	.4	.4
8AA	.2	.6	.4
AI	.6	.4	.5
AOO	.1	.7	.5
8E7E	.3	.7	.5
8O7O7	.3	.7	.5
EII	.4	.7	.5
8I7	.6	.7	.6
I7I	.7	.7	.7
8A7A7	.6	.8	.7
8A	1.7	.2	.8
8E7E7	.7	1.0	.8
E7E	1.0	.8	.9
E7I	.5	1.2	.9
A7A	1.4	1.0	1.2
8I7I7	1.4	1.1	1.2
E7E7	1.1	1.7	1.5
EE	1.9	1.9	1.9

TABLE X - continued

	Adult Percentage	Child Percentage	Total Percentage
OO	2.7	2.3	2.4
E7E7	2.8	2.9	2.9
C7	3.3	2.7	2.9
II	2.1	3.7	3.1
E7	3.8	2.9	3.2
I7I7	5.5	2.2	3.4
O7O7	2.3	4.6	3.7
E	4.0	3.9	3.9
AA	4.5	3.8	4.0
A7A7	3.5	4.7	4.3
O	5.6	5.1	5.3
A7	9.3	7.5	8.2
I7	9.3	9.5	9.4
I	11.6	12.6	12.2
A	12.4	12.6	12.5

Vowel-Diphthong Frequencies

Counting English vowels and diphthongs and errors as either vowels or diphthongs, more than 93% of all vowel sequences are seen to be vowels; only about 7% are diphthongs.

The absolute and relative vowel and diphthong frequencies are shown in Table XI.

TABLE XI

Vowel Diphthong Frequencies

	Number	Percentage
Vowels	89,014	93.1
Diphthongs	6,606	6.9
	95,620	

Vowel Types

Vowels may be thought of as being of 12 basic types. The absolute and relative frequencies of these types are shown in Table XII.

The relative frequencies are shown in terms of a percentage of all vowels (but not diphthongs). Several things may be seen from this table. More than a third of all vowels are unmarked; they are low, short, and oral. Almost half of all vowels have no sub- or superscript diacritics: i.e., they are low and oral (but may be either short or long). The absolute and relative frequencies of these combinations are shown in Table XIII. Almost two-thirds of all vowels are short rather than long. The absolute and relative frequencies of short and long vowels are shown in Table XIV.

A bit more than half of all vowels are low in tone. The absolute and relative frequencies of low, high, rising, and falling tone vowels are shown in Table XV.

A and I combined make up more than two-thirds of all vowels. The absolute and relative frequencies of A, E, I, O, and U vowels are shown in Table XVI.

TABLE XII

Vowel Types

	Number	Percentage
V	32,684 (1)	36.7
VV	11,005	12.4
V7	22,648	25.4
V7V7	12,314	13.8
VV7	111	.1
V7V	2,856	3.2
8V	1,211	1.4
8VV	699	.8
8V7	1,101	1.2
8V7V7	3,226	3.6
8VV7	-0-	-0-
8V7V	1,112	1.2
other	47	.1
	89,014	

TABLE XIII

Marked - Unmarked Vowels

	Number	Percentage
low ∩, short ∩, oral	32,684	36.7
high ∪, long ∪, nasal	56,283	63.2
other	47	.1
	89,014	100.0%
low ∩, oral	43,689	49.1
high ∪, nasal	45,278	50.9
other	47	.1
	89,014	

TABLE XIV

Short - Long Vowels

	Number	Percentage
short	57,644	64.8
long	31,323	35.2
other	47	.1
	89,014	

TABLE XV

Vowel Tone

	Number	Percentage
low	45,599	51.2
high	39,289	44.1
rising	111	.1
falling	3,968	4.5
other	47	.1
	89,014	

TABLE XVI

Oral - Nasal Vowels

	Number	Percentage
oral	81,618	91.7
nasal	7,349	8.3
other	47	.1
	89,014	

TABLE XVII

Vowel Quality

	Number	Percentage
A	31,376	35.2
E	12,173	13.7
I	30,265	34.0
O	14,916	16.8
U	237	.3
other	47	.1
	89,014	

Vowel Frequencies

The absolute frequencies of all vowel units are given in Table XVIII.

The relative frequencies, in terms of percentages of vowels and diphthong units combined, are given in Table XIX.

And, finally, a comparison of adult and child rank ordering is given in Table XX.

TABLE XVIII

Absolute Frequencies: Vowel Units

	Adult	Child	Total
A	4,490	7,505	11,995
AA	1,636	2,246	3,882
A7	3,346	4,464	7,810
A7A7	1,267	2,811	4,078
AA7	4	4	8
A7A	506	595	1,101
8A	605	115	720
8AA	79	334	413
8A7	93	247	340
8A7A7	211	491	702
8AA7	-0-	-0-	-0-
8A7A	137	190	327
E	1,433	2,304	3,737
EE	702	1,112	1,814
E7	1,362	1,704	3,066
E7E7	397	986	1,383
EE7	-0-	-0-	-0-
E7E	359	485	844
8E	-0-	-0-	-0-
8EE	2	6	8
8E7	-0-	2	2
8E7E7	238	589	827
8EE7	-0-	-0-	-0-
8E7E	96	396	492
I	4,176	7,497	11,673
II	773	2,212	2,985
I7	3,345	5,638	8,983
I7I7	1,998	1,311	3,309
II7	35	17	52
I7I	247	432	679
8I	127	246	373
8II	52	144	196
8I7	204	393	597
8I7I7	517	660	1,177
8II7	-0-	-0-	-0-
8I7I	82	159	241
O	2,011	3,031	5,042
OO	959	1,365	2,324
O7	1,176	1,613	2,789
O7O7	812	2,732	3,544
OO7	39	12	51
O7O	135	97	232
8O	45	73	118
8OO	12	70	82
8O7	75	87	162
8O7O7	114	406	520
8OO7	-0-	-0-	-0-
8O7O	15	37	52
U(E)	46	191	237

TABLE XIX

Relative Frequencies: Vowel Units

	Adult Percentage	Child Percentage	Total Percentage
A	13.2	13.6	13.5
AA	4.8	4.0	4.4
A7	9.8	8.	8.8
A7A7	3.7	5._	4.6
AA7	-0-	-0-	-0-
A7A	1.5	1.1	1.2
8A	1.8	.2	.8
8AA	.2	.6	.5
8A7	.3	.4	.4
8A7A7	.6	.9	.8
8AA7	-0-	-0-	-0-
8A7A	.4	.3	.4
E	4.2	4.2	4.2
EE	2.0	2.0	2.0
E7	4.0	3.1	3.4
E7E7	1.1	1.8	1.6
EE7	-0-	-0-	-0-
E7E	1.1	.9	.9
8E	-0-	-0-	-0-
8EE	-0-	-0-	-0-
8E7	-0-	-0-	-0-
8E7E7	.7	1.1	.9
8EE7	-0-	-0-	-0-
8E7E	.3	.7	.5
I	12.3	13.6	13.1
II	2.3	4.0	3.4
I7	9.9	10.2	10.1
I7I7	5.9	2.4	3.7
II7	.1	-0-	.1
I7I	.7	.8	.8
8I	.4	.4	.4
8II	.2	.3	.2
8I7	.6	.7	.7
8I7I7	1.5	1.2	1.3
8II7	-0-	-0-	-0-
8I7I	.2	.3	.3
O	5.9	5.5	5.7
OO	2.8	2.5	2.6
O7	3.5	2.9	3.1
O7O7	2.4	5.0	4.0
OO7	.1	-0-	.1
O7O	.4	.2	.3
8O	.1	.1	.1
8OO	-0-	.1	.1
8O7	.2	.2	.2
8O7O7	.3	.7	.6
8OO7	-0-	-0-	-0-
8O7O	-0-	.1	.1
U(E)	.1	.3	.3

TABLE XX

Rank Ordering: Vowel Units

Adult			Child		
Rank	Unit	%	Rank	Unit	%
1.	A	13.2	1.	A	13.6
2.	I	12.3	2.	I	13.6
3.	I7	9.9	3.	I7	10.2
4.	A7	9.8	4.	A7	8.1
5.	O	5.9	5.	O	5.5
6.	I7I7	5.7	6.	A7A7	5.1
7.	AA	4.8	7.	O7O7	5.0
8.	E	4.2	8.	E	4.2
9.	E7	4.0	9.	AA	4.0
10.	A7A7	3.7	10.	II	4.0
11.	O7	3.5	11.	E7	3.1
12.	OO	2.8	12.	O7	2.9
13.	O7O7	2.4	13.	OO	2.5
14.	II	2.3	14.	I7I7	2.4
15.	EE	2.0	15.	EE	2.0
16.	8A	1.8	16.	E7E7	1.8
17.	A7A	1.5	17.	8I7I7	1.2
18.	8I7I7	1.5	18.	A7A	1.1
19.	E7E7	1.1	19.	8E7E7	1.1
20.	E7E	1.1	20.	8A7A7	.9
21.	8E7E7	.7	21.	E7E	.9
22.	I7I	.7	22.	I7I	.8
23.	8A7A7	.6	23.	8E7E	.7
24.	8I7	.6	24.	8I7	.7
25.	8A7A	.4	25.	8O7O7	.7
26.	8I	.4	26.	8AA	.6
27.	O7O7	.4	27.	8A7	.4
28.	8A7	.3	28.	8I	.4
29.	8E7E	.3	29.	8A7A	.3
30.	8O7O7	.3	30.	8II	.3
31.	8AA	.2	31.	8I7I	.3
32.	8II	.2	32.	U(E)	.3
33.	8I7I	.2	33.	8A	.2
34.	8O7	.2	34.	O7O	.2
35.	II7	.1	35.	8O7	.2
36.	OO7	.1	36.	8O	.1
37.	8O	.1	37.	8OO	.1
38.	U(E)	.1	38.	8O7O	.1
39.	AA7	-0-	39.	AA7	-0-
40.	8AA7	-0-	40.	8AA7	-0-
41.	EE7	-0-	41.	EE7	-0-
42.	8E	-0-	42.	8E	-0-
43.	8EE	-0-	43.	8EE	-0-
44.	8E7	-0-	44.	8E7	-0-
45.	8EE7	-0-	45.	8EE7	-0-
46.	8II7	-0-	46.	II7	-0-
47.	8OO	-0-	47.	8II7	-0-
48.	8OO7	-0-	48.	OO7	-0-
49.	8O7O	-0-	49.	8OO7	-0-

III. B. DIPHTHONG UNITS

Diphthong Types

As noted earlier, 7% of all vowel sequences are diphthongs. The 6,606 diphthongs include 393 definite English diphthongs and at least 10 erroneous forms.

The absolute and relative frequencies of diphthong types are given in Table XXI. Here it should be noted that a number of potential types do not occur and several that do occur turn out to be errors. Those marked with a (?) are sequences the computer failed to exemplify; those marked with a (*) are sequences later found to involve spelling errors.

Thus, it turns out that there are no bona fide nasal diphthongs, "four-vowel" diphthongs, or diphthongs with what one might call circumflex tone. Despite Hoijer's examples, it would seem that these can probably be discarded as real diphthong types.

The absolute and relative frequencies of two-vowel and three-vowel diphthongs is given in Table XXII where it is seen that almost three quarters of all diphthongs are two-vowel diphthongs.

The absolute and relative frequencies of low, high, rising, and falling tone are shown in Table XXIII where it is seen that almost half of all diphthongs are high. It may be noticed

in Table XXI that although, as suggested, tone on rising or falling diphthongs, tends to follow the division between the two vowels involved, there are the 87 V_1 V_2 $V_2$7 forms which do not do so.

The absolute and relative frequencies of oral and nasal vowels are shown in Table XXIV. It was noted earlier that the one nasal diphthong probably involves misspelling. There are, for all practical purposes, then, no overtly marked diphthongs.

The absolute and relative frequencies of the different vowel combinations are given in Table XXV where it is seen that more than two-thirds of all diphthongs are E-I combinations. As E-I seems to result from the conjunction of underlying A and I, the two most common vowels, this is not surprising. No Navajo I-O sequences were found. They do occur; see for example, optative forms such as k'íoodlaad in Young and Morgan (p. 52).

TABLE XXI

Diphthong Types

	Number	Percentage
V_1V_2	844	12.8
$V_1{}^7V_2$	3,033	45.9
$V_1V_2{}^7$	3	>.1
$V_1{}^7V_2$	909	13.8
$V_1V_2V_2$	1,104	16.7
$V_1{}^7V_2{}^7V_2{}^7$	3(?) (1)	>.1
$V_1V_2{}^7V_2{}^7$	1(*) (2)	>.1
$V_1V_2V_2{}^7$	87	1.3
$V_1{}^7V_2V_2$	126	1.9
$V_1V_1V_2$	-0-	-0-
$V_1{}^7V_1{}^7V_2{}^7$	-0-	-0-
$V_1V_1V_2{}^7$	91	1.4
$V_1{}^7V_1{}^7V_2$	-0-	
$V_1{}^7V_1V_2$	1( ) (3)	>.1
$8V_1V_2$	-0-	
$8V_1{}^7V_2{}^7$	1( ) (4)	>.1
English	393	5.9
Errors	10	.2
	6,606	

(1) The exemplification program failed to produce examples of the A7I7I7 and E7I7I7 sequences the counting program had noted

(2) The OI7I7 sequence involves an error in word separation. *NA7NI7SDZA7AGOI7I7SHJ8A7A7 should be written as two words NA7NI7SDZA7AGO and I7I7SHJ8A7A7.

(3) The E7EI sequence involves the misspelling of LE7I' as *LE7EI'.

(4) The 8E7I7 sequence involves either an individual variant or a misspelling. *NI7I'8E7Eu' is usually pronounced, and spelled as NI7T'8E7E7' or NI7T'E7E7'.

TABLE XXII

Diphthong Length

	Number	Percentage
2 vowel	4,790	72.5
3 vowel	1,413	21.4
English	393	5.9
Errors	10	.2
	6,606	

TABLE XXIII

Diphthong Tone

	Two-Vowel		Three-Vowel		Combined	
low	844	12.8	1,104	16.7	1,948	29.5
high	3,034	46.0	4 (1)	.1	3,038	46.0
rising	3 (2)	>.1	178	2.7	181	2.7
falling	909	13.8	127	1.9	1,036	15.7
English					393	5.9
Other					10	.2
					6,606	

1) Not exemplified. See Table XXI, note (1).
2) These are suspect (EI7 and OI7).

TABLE XXIV

Oral - Nasal Diphthongs

	Number	Percentage
oral	6,202	93.9
nasal	1[1]	-0-
English	393	5.9
Errors	10	.2
	6,606	

[1] This turns out to be an error.

TABLE XXV

Diphthong Combinations

	Number	Percentage
A-I	826	12.5
A-O	477	7.2
E-I	4,709	71.3
I-O	-0-	-0-
O-I	191	2.9
English	393	5.9
Errors	10	.2
	6,606	

Diphthong Frequencies

The absolute frequencies of all diphthongs are given in Table XXVI. Despite the fact that IO diphthongs are found in Young and Morgan, none were recorded. This may be due to a convention of the transcriber but more likely it has to do with the relatively low occurrence of optative mode forms.

The relative frequency of all diphthongs, expressed in terms of percentages of vowel and diphthong units combined, are given in Table XXVII. Here it may be noted that all but a few diphthongs have very low frequencies.

And, finally, the rank ordering of child and adult diphthong frequencies are compared in Table XXVIII; but only for those few diphthongs with frequencies greater than .1%.

The high frequency of the diphthong E7I7 is probably to be accounted for by its occurrence in the high frequency demonstrative pronoun, éí, 'that'. The relatively high frequency of the diphthong AOO for children and its virtual absence in adult speech in the corpus would seem to be a function of the interviewing situation. Aoo' is one spelling of the Navajo form glossed as 'yes'.

TABLE XXVI

Absolute Frequencies: Diphthong

	Adult	Child	Total
AAI7	28	43	71
AE(E)	3	6	9
AI	209	239	448
AII	100	28	128
AII7	2	10	12
AO	9	3	12
AOO	24	425	449
AU(E)	4	6	10
A7I	4	8	12
A7II	2	8	10
A7I7	116	28	144
A7I7I7	1	0	1
A7O	5	10	15
A7OO	0	1	1
EA(E)	20	92	112
EEI7	1	1	2
EI	87	280	367
EII	133	387	520
EII7	30	45	75
EI7	1	1	2
EO(E)	3	11	14
EU(E)	2	2	4
E7EI	0	1	1
E7I	168	703	871
E7II	33	66	99
E7I7	1,017	1,752	2,769
E7I7I7	1	1	2
IA(E)	11	19	30
IE(E)	30	43	73
IO(E)	1	21	22
OA(E) (?)	8	34	42
OE(E)	1	7	8
OI	7	10	17
OII	2	5	7
OI7	1	0	1
OI7I7	1	0	1
OOI7	9	9	18
OU(E)	15	32	47
OUI(E)	1	1	2
O7I	2	9	11
O7II	4	12	16
O7I7	33	87	120
UA(E)	0	2	2
UE	2	9	11
UI	3	4	7

TABLE XXVII

Relative Frequencies: Diphthongs

	Adult Percentage	Child Percentage	Total Percentage
AAI7	1.3	.9	1.0
AE(E)	.1	.1	.1
AI	9.7	5.3	6.7
AII	4.6	.6	1..
AII7	>.1	.2	.1
AO	.4	>.1	.1
AOO	1.1	9.5	6.8
AU(E)	.1	.1	.1
A7I	.1	.1	.1
A7II	>.1	.1	.1
A7I7	5.4	.6	2.1
A7I7I7	>.1	-0-	>.1
A7O	.2	.2	.2
A7OO	-0-	>.1	>.1
EA(E)	.9	2.0	1.6
EEI7	>.1	>.1	>.1
EI	4.0	6.2	5.5
EII	6.2	8.6	7.8
EII7	1.4	1.0	1.1
EI7	>.1	>.1	>.1
EO(E)	.2	.2	.2
EU(E)	>.1	>.1	>.1
E7EI	-0-	>.1	>.1
E7I	7.8	15.7	13.2
E7II	1.5	1.4	1.5
E7I7	47.6	39.2	41.9
E7I7I7	>.1	>.1	>.1
IA(E)	.5	.4	.4
IE(E)	1.4	.9	1.1
IO(E)	>.1	.4	.3
OA(E)(?)	.3	.7	.6
OE(E)	>.1	.1	.1
OI	.3	.2	.2
OII	>.1	.1	.1
OI7	>.1	-0-	>.1
OI7I7	>.1	-0-	>.1
OOI7	.4	.2	.2
OU(E)	.7	.7	.7
OUI(E)	>.1	>.1	>.1
O7I	>.1	.2	.1
O7II	.1	.2	.2
O7I7	1.5	1.9	1.8
UA(E)	-0-	>.1	>.1
UE(E)	>.1	.2	.1
UI(E)	.1	>.1	.1

TABLE XXVIII

Rank Ordering: Diphthongs

Adult			Child		
Rank	Unit	%	Rank	Unit	%
1.	E7I7	47.6	1.	E7I7	39.2
2.	AI	9.7	2.	E7I	15.7
3.	E7I	7.8	3.	AOO	9.5
4.	EII	6.2	4.	EII	8.6
5.	A7I7	5.4	5.	EI	6.2
6.	AII	4.6	6.	AI	5.3
7.	EI	4.0	7.	EA(E)	2.0
8.	E7II	1.5	8.	O7I7	1.9
9.	O7I7	1.5	9.	E7II	1.4
10.	EII7	1.4	10.	EII7	1.0
11.	IE(E)	1.4	11.	AAI7	.9
12.	AAI7	1.3	12.	IE(E)	.9
13.	AOO	1.1	13.	OA(E) (?)	.7
14.	EA(E)	.9	14.	OU(E)	.7
15.	OU(E)	.7	15.	AII	.6
16.	IA(E)	.5	16.	A7I7	.6
17.	AO	.4	17.	IA(E)	.4
18.	OOI7	.4	18.	IO(E)	.4
19.	OA(E) (?)	.3	19.	AII7	.2
20.	OI	.3	20.	A7O	.2
21.	A7O	.2	21.	EO(E)	.2
22.	EO(E)	.2	22.	OI	.2
23.	AE(E)	.1	23.	OOI7	.2
24.	AU(E)	.1	24.	O7I	.2
25.	A7I	.1	25.	O7II	.2
26.	O7II	.1	26.	UE(E)	.2
27.	UI(E)	.1	27.	AE(E)	.1
			28.	AU(E)	.1
			29.	A7I	.1
			30.	A7II	.1
			31.	OE(E)	.1
			32.	OII	.1

Diphthongs with a frequency of >.1% are not noted here.

III. C. CONSONANTS

The method of computing consonants was somewhat different than that of computing vowels. The method involved the subtraction of instances of trigraphs from those of digraphs and of both from graphemes. Thus, the actual number of instances of CH was found by subtracting the number of instances of CH' from the number given for CH. Similarly, the actual number of instances of D was found by subtracting the number of instances of DL and DZ from the number given for D.

The absolute frequencies of the consonantal units are given in Table XXIX. The mechanics of the computation of these figures follows.

The relative frequency of consonantal units, expressed in terms of a percentage of all consonantal units, are given in Table XXX.

The rank ordering of consonantal units, based on absolute frequencies are given in Table XXXI.

A few notes may be in order here.

1. <'> would probably be the most common consonantal unit were it not for the convention of word-initial <'> deletion. (This convention was adopted at the Orthography Conference held in Albuquerque in May, 1969.

2. Of the eight most common consonant units, accounting for roughly two-thirds of all consonant unit occurrences, all but the ⟨Y⟩ are units which can occur both initially and finally. (There are only eleven consonant units which can so occur in Navajo).

3. There are 15 di- or tri-graph consonant units. Yet only four of these occur among the 20 most common consonant units. The relative infrequency of most di- tri-graph units would seem to explain the observation that Young and Morgan's use of di- and tri-graphs seems to have added relatively little extra length to written Navajo words (as compared to the Sapir and Hoijer orthography which made use of only unitary symbols).

4. A few English-only consonants turn out to be surprisingly frequent. Thus ⟨R⟩ ranks 16th out of 38 consonant units.

The final Table, XXXII, is a comparison of the consonant frequencies found by Oswald Werner and those of the Navajo Reading Study. Werner's table, showing membership in the first, second, third, or fourth quartile, was based on only a 100 word sample. But it is, to my knowledge, the only other published information on frequencies. Even with such a small sample, his placement agrees with ours for all but seven consonantal units--and for all seven, the difference is only a single quartile.

TABLE XXIX

Absolute Unit Frequencies: Consonants

	Adult	Child	Total
'	5,236	8,227	13,463
B	1,336	2,704	4,040
CH	285	707	992
CH'	217	490	707
D	4,937	9,685	14,621
DL	86	181	267
DZ	1,736	2,614	4,350
GH	369	524	893
H	5,207	6,407	11,614
HW	25	118	143
J	861	1,548	2,409
K	1,192	2,485	3,677
K'	240	386	626
KW	309	329	638
L	2,176	4,127	6,303
LH	2,377	3,698	6,075
M	271	740	1,011
N	6,210	9,931	16,141
S	901	1,901	2,802
SH	2,535	2,790	5,325
T	846	1,557	2,403
T'	2,273	2,559	4,832
TL	14	55	69
TL'	47	263	310
TS	383	903	1,286
TS'	165	298	463
W	289	663	952
X	38	74	112
Y	1,901	3,520	5,421
Z	330	730	1,060
ZH	437	788	1,225
F	63	200	263
P	70	319	389
Q	2	3	5
R	328	969	1,297
U	73	249	322
V	62	105	167
	43,980	73,058	117,038

TABLE XXIX - continued

	Adult	Child	Total
'u = 'g (1)	8,178	12,223	20,401
-CH'	217	490	707
-K'	240	386	626
-T'	2,273	2,559	4,832
-TL'	47	263	310
-TS'	165	298	463
	5,236	8,227	13,463
CHu = CHg	488	1,189	1,677
-CH'	217	490	707
+CHX	14	8	22
	285	707	992
Du = Dg	5,176	10,077	15,253
-DL	86	181	267
-DZ	154	211	365
	4,936	9,685	14,621
Gu = Gg	2,105	3,138	5,243
-GH	369	524	893
	1,736	2,614	4,350
Hu = Hg	11,437	15,511	26,948
-CH	285	707	992
-CH'	217	490	707
-GH	369	524	893
-HW	25	118	143
-LH	2,377	3,698	6,075
-SH	2,535	2,790	5,325
+HX	15	11	26
	5,207	6,407	11,614
Ku = Kg	1,741	3,200	4,941
-K'	240	386	626
-KW	309	329	638
	1,192	2,485	3,677
Ku = Kg	1,741	3,200	4,941
-K'	240	386	626
-KW	309	329	638
	1,192	2,485	3,677

TABLE XXIX - continued

	Adult	Child	Total
Lu = Lg	4,747	8,587	13,334
-DL	86	181	267
-LH	2,377	3,698	6,075
-TL	61	318	379
-TL'	47	263	310
	2,176	4,127	6,303
Su = Sg	3,993	5,923	9,916
-SH	2,535	2,790	5,325
-TS	383	903	1,286
-TS'	165	298	463
-TSX	9	43	52
+SX	-0-	12	12
	901	1,901	2,802
Tu = Tg	3,737	5,678	9,415
-T'	2,276	2,559	4,832
-TL	14	55	69
-TL'	47	263	310
-TS	383	903	1,286
-TS'	165	298	463
-TSX	9	43	52
	846	1,557	2,403
TLu = TLg	61	318	379
-TL'	47	263	310
	14	55	69
TSu = TSg	539	1,158	1,697
-TS'	165	298	463
+TSX	9	43	52
	383	903	1,286
Wu = Wg	623	1,110	1,733
-HW	25	118	143
-KW	309	329	638
	289	663	952
Xu = CHX	14	8	22
+HX	15	11	26
+SX	-0-	12	12
+TSX	9	43	52
	38	74	112

TABLE XXIX - continued

SX = SX	Adult	Child	Total
SX = SX	9	55	64
-TSX	9	43	52
	-0-	12	12
Zu = Zg	921	1,729	2,650
-DZ	154	211	365
-ZH	437	788	1,225
	330	730	1,060

(1) Where u means "unit" and g means "grapheme"; thus, 'u means ' as a unit, 'g means ' as a grapheme.

TABLE XXX

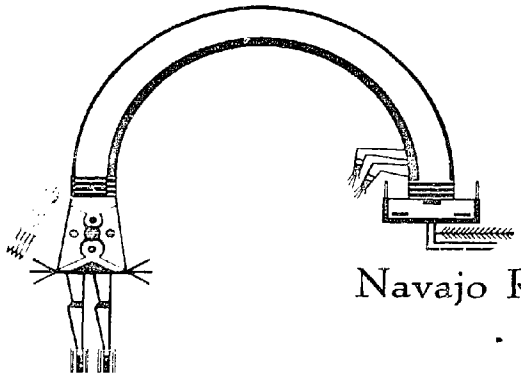
Relative Unit Frequencies: Consonants

	Adult Percentage	Child Percentage	Total Percentage
'	11.9	11.2	11.5
B	3.0	3.7	3.4
CH	.6	.9	.8
CH'	.5	.6	.6
D	11.2	13.2	12.5
DL	.2	.2	.2
DZ	3.9	3.5	3.7
GH	.8	.7	.8
H	11.8	8.7	9.9
HW	.1	.1	.1
J	1.9	2.1	2.0
K	2.7	3.4	3.1
K'	.5	.5	.5
KW	.7	.5	.6
L	4.9	5.6	5.4
LH	5.4	5.0	5.2
M	.6	1.0	.9
N	14.1	13.5	13.8
S	2.0	2.6	2.4
SH	5.7	3.8	4.5
T	1.9	2.1	2.0
T'	5.1	3.5	4.1
TL	>.1	.1	.1
TL'	.1	.3	.3
TS	.9	1.2	1.1
TS'	.3	.4	.4
W	.6	.9	.8
X	.1	.1	.1
Y	4.3	4.8	4.6
Z	.7	.9	.9
ZH	.9	1.0	1.0
F	.1	.2	.2
P	.1	.4	.3
Q	>.1	>.1	>.1
R	.7	1.3	1.1
U	.1	.3	.2
V	.1	.1	.1

TABLE XXXI

Rank Ordering: Consonantal Units

Adult			Child			Total		
Rank	Unit	Number	Rank	Unit	Number	Rank	Unit	Number
.	N	6,210	1.	N	9,931	1.	N	16,141
2.	'	5,236	2.	D	9,685	2.	D	14,621
3.	H	5,207	3.	'	8,227	3.	'	13,463
4.	D	4,936	4.	H	6,407	4.	H	11,614
5.	SH	2,535	5.	L	4,127	5.	L	6,303
6.	LH	2,377	6.	LH	3,698	6.	LH	6,075
7.	T'	2,273	7.	Y	3,520	7.	Y	5,421
8.	L	2,176	8.	SH	2,790	8.	SH	5,325
9.	Y	1,901	9.	B	2,704	9.	T'	4,832
10.	G	1,736	10.	G	2,614	10.	G	4,350
11.	B	1,336	11.	T'	2,559	11.	B	4,040
12.	K	1,192	12.	K	2,485	12.	K	3,677
13.	S	901	13.	S	1,901	13.	S	2,802
14.	J	861	14.	T	1,557	14.	J	2,409
15.	T	846	15.	J	1,548	15.	T	2,403
16.	ZH	437	16.	R(E)	969	16.	R(E)	1,297
17.	TS	383	17.	TS	903	17.	TS	1,286
18.	GH	369	18.	ZH	788	18.	ZH	1,225
19.	Z	330	19.	M	740	19.	Z	1,060
20.	R(E)	328	20.	Z	730	20.	M	1,011
21.	KW	309	21.	CH	707	21.	CH	992
22.	W	289	22.	W	663	22.	W	952
23.	CH	285	23.	GH	524	23.	GH	893
24.	M	271	24.	CH'	490	24.	CH'	707
25.	K'	240	25.	K'	386	25.	KW	638
26.	CH'	217	26.	KW	329	26.	K'	626
27.	TS'	165	27.	P(E)	319	27.	TS'	463
28.	DZ	154	28.	TS'	298	28.	P(E)	389
29.	DL	86	29.	TL'	263	29.	DZ	365
30.	U(E)	73	30.	U(E)	249	30.	U(E)	322
31.	P(E)	70	31.	DZ	211	31.	TL'	310
32.	F(E)	63	32.	F(E)	200	32.	DL	267
33.	V(E)	62	33.	DL	181	33.	F(E)	263
34.	TL'	47	34.	HW	118	34.	V(E)	167
35.	X	38	35.	V(E)	105	35.	HW	143
36.	HW	25	36.	X	74	36.	X	112
37.	TL	14	37.	TL	55	37.	TL	69
38.	Q(E)	2	38.	Q	3	38.	Q	5



Navajo Reading Study • The University of New Mexico

1805 Roma N.E.
Albuquerque, New Mexico 87106
Telephone 505: 277-5749

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