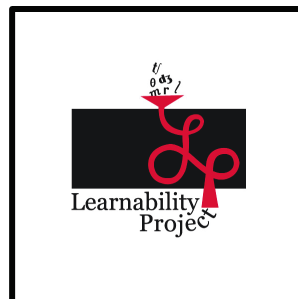




INDIANA UNIVERSITY BLOOMINGTON

Gierut / Learnability Project



The Learnability Project was founded in 1985 by Judith A. Gierut, Professor Emerita of Speech and Hearing Sciences, Indiana University. Through funding from the National Institutes of Health, the project served as a test site in evaluation of the efficacy of clinical treatment for preschool children with functional (nonorganic) phonological disorders. Children who enrolled contributed longitudinal descriptive phonological samples for linguistic analysis. They also received clinical treatment, designed as single-subject experiments, to establish the optimal teaching conditions to promote phonological learning. Experimental studies were based on the triangulation of theoretical models of linguistics, psycholinguistics, and speech-language pathology, with the aim of bridging theory with application and science with best practices. The Gierut / Learnability Project collections accord with the data-sharing plan of the National Institutes of Health and are intended for broad use by scientists, clinicians, and students interested in language and learning.

Content Statement

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Learnability Project Working Paper

Phonological Protocols

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Learnability Project working papers were developed for internal purposes in the training of research assistants. The material herein first appeared in the Learnability Project Lab Manual, version 1, 1986, and was updated as the protocol expanded. This working paper outlines, in part, the phonological protocols and stimuli that were used in descriptive and experimental research. It is the companion to the Developmental Phonologies Archive of the DATA collection of the Gierut / Learnability Project. The working paper is not intended as a comprehensive review of procedures for linguistic analyses or sampling used by the Learnability Project. The reader is referred to primary source material found in the Publications collection of the Gierut / Learnability Project archived in the IUScholarWorks repository. The following texts and publications may be particularly useful as introductions to the population, experimental design, and lab protocols.

Suggested Readings:

- Gast, D. L. (Ed.) (2010). *Single subject research methodology in behavioral sciences*. New York: Routledge.
- Gierut, J. A. (1998). Treatment efficacy: Functional phonological disorders in children. *Journal of Speech, Language and Hearing Research*, 41, S85-S100. PMID: 9493748
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- Gierut, J. A. (2008b). Phonological disorders and the developmental phonologies archive. In D. A. Dinnsen & J. A. Gierut (Eds.), *Optimality theory, phonological acquisition and disorders* (pp. 37-92). London: Equinox.
- Gierut, J. A., Morrisette, M. L., & Ziemer, S. M. (2010). Nonwords and generalization in children with phonological disorders. *American Journal of Speech-Language Pathology*, 19, 167-177. PMCID: PMC3281489
- McReynolds, L. V., & Kearns, K. P. (1983). *Single-subject experimental designs in communicative disorders*. Baltimore, MD: University Park Press.

Phonological Measures

The primary measure to assess a child's phonological system for linguistic purposes was the Phonological Knowledge Protocol (PKP; Gierut, 1985). The PKP is a set of common and picturable words that are in the vocabularies of preschool children. The PKP samples each target English consonant in a minimum of five different exemplars in each of three relevant positions. In addition, the PKP provides an opportunity to sample minimal pairs in establishing phonemic contrasts. It also elicits morphophonemically related forms by adding present progressive and diminutive suffixes to base forms so as to probe for the occurrence of systematic alternations. PKP items include a variety of syllable types, both mono- and multisyllabic, that have varying canonical shapes. Syntactic class is also varied, with about 70% of the sample targeting nouns, 17% verbs, and 13% other categories. The PKP also provides for the examination of psycholinguistic variables associated with word frequency, neighborhood density, word familiarity, age-of-word-acquisition, and phonotactic probability.

Two measures were developed to sample English clusters: the Onset Cluster Probe (OCP; Gierut, 1999) and the Coda Cluster Probe (CCP; Gierut, 2008). The structure of the OCP is similar to the PKP in that each target cluster is elicited in a minimum of five different exemplars; the CCP samples three exemplars per target cluster. The items are again picturable, familiar, and characterized in terms of their lexical properties. Likewise, a Manner Assimilation Probe (MAP; Gierut, 2008) and Place Assimilation Probe (PAP; Gierut, 2008) were developed. The assimilatory probes elicit two kinds of data: baseline items to demonstrate that relevant consonants occurred in nonassimilatory contexts, and mono- and multisyllabic items to establish that these same consonants succumbed to assimilation in triggering contexts. A demonstration of the differential occurrence of sounds is crucial to establishing assimilatory patterns.

The probe measures provide basic data for phonological description and analysis. The probe measures also serve an experimental purpose in establishing baseline performance, stability of baseline, and generalization learning following from a child's production accuracy over time. The Learnability Project typically obtained probe data longitudinally from each child at a minimum of five points in time: prior to enrollment in a treatment experiment, at a midpoint of treatment, immediately posttreatment, two weeks following the completion of treatment, and again two months following treatment. The extent and type of probe data, however, varied by child, experimental design, and question of interest.

Appendices 1-5 provide a complete listing of probe words for each phonological measure of the Learnability Project. Appendix 6 reports the lexical characteristics of these same forms. Children's longitudinal probe responses are reported in the Developmental Phonologies Archive in the DATA collection of the Gierut / Learnability Project.

General Sampling Procedures

Probes are elicited as a spontaneous picture-naming task. A child is shown a picture and asked to name it, using cues like "What's this?" or "Who is this?" When needed, a child's attention is drawn to a particular aspect of the picture using a question like "What color is the girl's dress?" or "What's she sitting on?" Cloze sentences are also used. Following such cues, a child is afforded a chance to name the word independently. If spontaneous naming does not occur, then the elicitation switches to delayed or direct imitation. Here, the examiner states the word in the context of a longer utterance, and after the intervening delay, the intended response is expected from the child. Alternatively, the examiner states the word for the child to imitate.

Probe responses are audio recorded and phonetically transcribed by trained assistants, using standard notation of the IPA. Reliability of transcriptions is established by two judges, who independently transcribe the data. Transcriptions are then compared consonant-by-consonant for approximately 10% of the data within and across children. Resulting transcriptions are then entered into an electronic database, where mean interjudge reliability of consonant transcriptions was established as 93% agreement. The collective data form the Developmental Phonologies Archive of the DATA collection of the Gierut / Learnability Project.

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For more information, visit the [Gierut / Learnability Project](#) at IUScholarWorks.

APPENDIX 1

Phonological Knowledge Protocol (PKP; Gierut, 1985)

Target Sound	Probe Words by Context		
	Initial	Medial	Final
/m/	mud mouth mother mouse moon	gum-i comb-i thumb-i game-i swimming camera hammer	gum comb thumb game swim
/n/	knife nose noise nail nothing	raining running moon-i van-i sunny piano money	rain run moon van sun
/ŋ/		finger	tongue ring nothing
/p/	pig pie pants peach paint	soupy chip-i soapy cup-i sleeping happy open	soup chip soap cup sleep
/b/	big bite back bus boot	tub-i rubbing cob-i robe-i web-i rabbit bubble	tub rub cob robe web

Appendix 1 PKP continues...

/t/	tub tear toes tail tooth	eating foot-i cutting bootie biting button potato	eat foot cut boot bite
/d/	duck deer done door dog	bed-i reading muddy riding hiding ladder lady	bed read mud ride hide
/k/	cup cob cut coat comb	book-i duckie sock-i rocky back-i pocket cracker	book duck sock rock back
/g/	gum gate girl gun goat	doggie frog-i piggie baggy hugging wagon tiger	dog frog pig bag hug
/f/	foot face fire five fish	laughing coughing knife-i leafy roof-i Goofy elephant	laugh cough knife leaf roof

Appendix 1 PKP continues...

/v/	van vegetable vanilla vacuum valentine	waving shaving glove-i driving stove-i seven over	wave shave glove drive stove
/θ/	thumb thank (you) thunder thief thirsty	toothy bath-i mouth-i teeth-i wreath-i	tooth bath mouth teeth wreath
/ð/	them these there theirs that	feather mother brother father other	
/s/	soup soap sock sun santa	juicy mouse-i icy bus-i dressy eraser baseball	juice mouse ice bus dress
/z/	zebra zipper zoo zipping zero	cheezy nosy noisy rosy buzzing raisin scissors	cheese nose noise rose buzz
/ʃ/	shave shoe shirt shovel shampoo	fishing washing brushing crashing pushing marshmallow lotion	fish wash brush crash push

Appendix 1 PKP continues...

/tʃ/	chip cheese chalk chair chicken	peach-i catching pinching punching watch-i picture kitchen	peach catch pinch punch watch
/dʒ/	juice jail jeep jump jelly	orange-i bridge-i badge-i cage-i page-i angel vegetable	orange bridge badge cage page
/l/	laugh leaf light ladder leg	tail-i nail-i shovel-i calling hilly color yellow	tail nail shovel call hill
/r/	read rock rain run ride	starry deer-i door-i fire-i chair-i carrot giraffe	star deer door fire chair
/w/	water watch wash wave window	growing sewing throwing blowing snowing flower towel	grow sew throw blow snow
/j/	yes yellow you yawn yard	crayon onion	
/h/	hide hug hill hat house	treehouse grasshopper behind forehead bluehouse	

APPENDIX 2

Onset Cluster Probe (OCP; Gierut, 1999)

Sonority Difference	Target Cluster	Probe Words	
6	/tw-/	Twinkie Tweety twelve	twins twist
	/kw-/	quack queen quick	quiet quilt
	/pj- kj-/	pu	cute
5	/pl-/	plate plane plant	play plug
	/kl-/	clean clown clock	clothes cloud
	/pr-/	pretzel princess pretty	prize present
	/tr-/	tree truck train	trick or treat triangle
	/kr-/	crayon cry crawl	crack cream
	/bj-/	beauty	
	4	/bl-/	black blocks blow
/gl-/		glasses glove glue	globe glow

Appendix 2 OCP continues...

	/br-/	bread brush broom	bridge brown
	/dr-/	dress drum drive	draw drink
	/gr-/	grass green grow	grapes grandma
	/sw-/	swing swim sweep	sweater sweet
	/fj-/	few	
3	/fl-/	fly flower flag	flute floor
	/sl-/	sleep sled slide	slipper sleeve
	/fr-/	fruit frog front	french fries friend
	/θr-/	three throw thread	throne throat
	/ʃr-/	shrink shred shrub	shrug shrimp
	/vj-/	viewmaster	

Appendix 2 OCP continues...

2	/sm-/ 	smell smile small	smoke smooth
	/sn-/ 	sneeze snowman snake	snail snack
	/mj-/ 	music	
Adjuncts	/sp-/ 	spill spider spaghetti	spoon space
	/st-/ 	stop stove star	store stamp
	/sk-/ 	skunk skirt school	skate scarf
3-element clusters	/spl-/ 	splash splinter split	splitting splashing
	/spr-/ 	spread sprite spring	spray sprinkle
	/str-/ 	stripe street straw	straight strong
	/skr-/ 	scream scratch scrub	scribble screw
	/skw-/ 	squeak square squirrel	squeeze squirt

APPENDIX 3

Coda Cluster Probe (CCP; Gierut, 2008)

Target Cluster	Probe Words
/-mp/	lamp jump stamp
/-nt/	tent paint point
/-nd/	blonde hand stand
/-nθ /	ninth tenth month
/-nts/	fence bounce dance
/-ntʃ /	lunch branch punch
/-ndʒ /	orange sponge change
/-ŋk/	pink sink trunk
/-ks/	box six fix
/-ft/	lift soft raft

Appendix 3 CCP continues...

/-sp/ wasp
 gasp
 grasp

/-st/ nest
 toast
 vest

/-sk/ mask
 desk
 ask

/-lp/ help
 scalp
 gulp

/-lt/ belt
 salt
 melt

/-ld/ old
 gold
 cold

/-lk/ milk
 sulk
 silk

/-lf/ wolf
 golf
 shelf

/-lθ/ health
 wealth
 filth

/-rm/ arm
 worm
 farm

/-rn/ barn
 corn
 horn

Appendix 3 CCP continues...

/-rp/	burp sharp chirp
/-rb/	curb verb barb
/-rt/	shirt heart cart
/-rd/	bird card yard
/-rk/	fork bark park
/-rg/	iceberg burglar hamburger
/-rf/	scarf surf Nerf
/-rv/	curve carve starve
/-rθ/	hearth Earth birth
/-rs/	horse purse nurse
/-rz/	ours Mars cars

Appendix 3 CCP continues...

/-rtʃ/

church
torch
porch

/-rdʒ/

large
George
sarge

/-rɪ/

girl
curl
squirrel

APPENDIX 4

Manner Assimilation Probe (MAP; Gierut, 2008)

Target	Probe Words	
Baseline items		
CV	mow pie key see sew	zoo shoe chew row you
VC	in ape off edge	ear eat ice
CVC	man moon pig boot bite bed back book bag big duck dog cob	cat cut coat goat face fish five vase thief these shave judge roll
Monosyllabic Assimilation		
Nasal-Stop	map mop mud	nap nut
Nasal-Fricative	mouse mouth knife	nose noise
Nasal-Affricate	match	much
Nasal-Liquid	mail mall more	nail near

Appendix 4 MAP continues...

Stop-Nasal	open pan pinecone bone tongue	done comb game gum
Stop-Fricative	push bath bus buzz teeth tooth	toes dish cough kiss give
Stop-Affricate	peach page badge	catch cage
Stop-Liquid	pool ball bear tail tear	towel deer door call
Fricative-Nasal	fan van them thumb	same sun song
Fricative-Stop	fat feet that soap	soup shot sick sock
Fricative-Affricate	fetch	fudge
Fricative-Liquid	fall full four there	seal other over
Affricate-Nasal	chime chain	chin

Appendix 4 MAP continues...

Affricate-Stop	chip chalk cheek	chick jeep jet
Affricate-Fricative	chief chase cheese	juice jaws
Affricate-Liquid	chair cheer jail	Jill jar jelly
Liquid-Nasal	lime limb room	rain run ring
Liquid-Stop	lake lick leg robe	rub read rake rock
Liquid-Fricative	laugh leaf lash	roof wreath rose
Liquid-Affricate	latch ledge	rich
Glide-Nasal	win wing	yawn
Glide-Stop	web wet	wick
Glide-Fricative	wave wash	wish yes
Glide-Affricate	watch	witch
Glide-Liquid	wear yellow	yell your

APPENDIX 5

Place Assimilation Probe (PAP; Gierut, 2008)

Target	Probe Words	
Baseline items		
Labial-V	pie	boy
Coronal-V	knee	tie
Dorsal-V	cow	go
V-Labial	ape	up
V-Coronal	on	eat
V-Dorsal	egg	ache
Labial-Labial	bib	
Labial-Dorsal	pig back book	bug wing
Coronal-Coronal	done	
Dorsal-Labial	comb cap cup	game gum
Dorsal-Dorsal	cake	
Dorsal-Labial-Dorsal	comic	
Monosyllabic Assimilation		
Labial-Coronal	moon mouse pin	boot fish
Coronal-Labial	tape top tub	knife soup

Appendix 5 PAP continues...

Coronal-Dorsal	neck duck dog	sick cheek
Dorsal-Coronal	can cat kiss	gun goat
Multisyllabic Assimilation		
Labial-Labial-Coronal	muppet muffin puppet	pepper woman
Labial-Coronal-Labial	bottom	
Labial-Coronal-Coronal	mitten mother police	button feather
Labial-Coronal-Dorsal	magic music pushing	biting fishing
Labial-Dorsal-Coronal	pocket package bacon	bucket wagon
Coronal-Labial-Coronal	towel seven zipper	shovel rabbit
Coronal-Labial-Dorsal	napping dipping zipping	shaving laughing
Coronal-Coronal-Labial	tulip giraffe	syrup
Coronal-Coronal-Dorsal	nothing tooting raining	reading riding

Appendix 5 PAP continues...

Coronal-Dorsal-Coronal	naked ticket tiger	chicken jacket
Coronal-Dorsal-Dorsal	knocking ticking digging	sucking joking
Dorsal-Labial-Coronal	comet camel	cabin cover
Dorsal-Coronal-Labial	ketchup	gallop
Dorsal-Coronal-Coronal	kitten kitchen color	carrot
Dorsal-Coronal-Dorsal	cutting kissing	catching calling
Dorsal-Dorsal-Coronal	cocoon	

APPENDIX 6

Characteristics of Probe Words

Appendix 6 provides a full listing of the Learnability Project probe words that are used in sampling children's sound systems. It includes words from the Phonological Knowledge Protocol, Onset Cluster Probe, Coda Cluster Probe, Manner Assimilation Probe, and Place Assimilation Probe. Each word is coded in terms of dimensions of structure that may be of value to scientists, clinicians, and students in the design of research and/or clinical programs. The codings include the canonical shape of a word, its raw frequency, neighborhood density, phonotactic probability, lexical familiarity, and estimated age of word acquisition. The codings are, for the most part, based on published analyses of phonological and lexical structure, and are consistent with general research use and application in the published literature. Where there is departure, this is noted. Also, some of the probe items are not included in published corpora, and consequently, corresponding structural data are unavailable. In these instances, the relevant cell is left blank. The operational definitions and source of the codings is outlined below.

Canonical shape^a is the consonant-vowel composition of the intended target output. Each sound of a word is given full segmental status, which departs from some codings that weight sonorants as vocalic in nature. In alternate codings, the canonical structure of a word like "bear" would be CV, whereas in our usage, this same word is coded as CVC on the Learnability Project probes.

Raw frequency^b is the number of times a given word occurs in printed form in target English. The counts are taken from Kučera and Francis (1967) and based on a sample size of 1,000,000 words. A raw frequency value of 4, as for example for the word "ache," means that this particular word occurred 4 times out of the pool of 1,000,000 words studied. Frequency values were retrieved from <http://www.psych.wustl.edu/sommers/>.

Neighborhood density^c defines the degree of phonetic similarity of a given word based on one-phoneme substitutions, additions, and deletions (Luce, 1986). For example, for the probe word "ache," some possible neighbors include "ate" (substitution), "bake" (addition), or "A" (deletion). The density counts are drawn from the Hoosier Mental Lexicon, which is based on the 20,000 word Merriam-Webster Pocket Dictionary, <http://www.psych.wustl.edu/sommers/>.

Phonotactic probability^d refers to the statistical likelihood of a given segment in English. The likelihood of occurrence has been defined in terms of biphone frequency and positional segment frequency. Biphone frequency refers to the likelihood of a given pair of phonemes occurring in sequence relative to all other possible sequences that could occur in the language. For example, in the word "ache," biphone frequency establishes the likelihood of [e] being followed by [k] relative to all other cooccurrences, such as [et], [ep], or [sk] as examples. The biphone values reflect the sum of individual biphone frequencies within a word. Positional segment frequency refers to the likelihood of a given sound occurring in a given position in a form. In our example, positional segment frequency establishes that probability that [e] occurs in the first position of a form relative to [s] or [u] or [h] as examples. The positional segment values reflect the sum of individual segment frequencies within a word. An on-line phonotactic probability calculator was used to compute the values reported herein, <http://www.people.ku.edu/~mviteviti/>. It should be stressed that biphone and positional segment frequencies reported in the appendix are raw values and do not take into account word length. To control for the effects of word

length on phonotactic probability, the user must apply the method of z-score conversion to the raw values following Storkel (2004).

Familiarity^e is based on subjective ratings of the familiarity of words, as reported for the Hoosier Mental Lexicon. Adult judges rated words of the Merriam-Webster Pocket Dictionary on a 7-point scale, with 7 being most familiar. Values were retrieved from <http://www.psych.wustl.edu/sommers/>.

Age-of-word acquisition^f (AoA) is a learner's estimate of when a given word was acquired. Like familiarity, it too is based on a subjective rating. The AoA ratings reported herein are based Bird, Franklin, and Howard (2001), as the most current and comprehensive set of estimates available. It is based on a 7-point rating scale, where the rating of 1 equals an estimated age of word learning between 0 and 2 years; 2, between 3 and 4 years; 3, between 5 and 6 years, and so on to the rating of 7, which corresponds to an estimated age of word learning of 13 years and older. In cases where probe words were not included in the Bird et al. corpus, we supplemented the AoA ratings with comparable data from Gilhooly and Logie (1980a; 1980b). This is denoted in the appendix by the letter 'g' following the rating.

Appendix 6 References Cited

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Appendix 6

Characteristics of Probe Words

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
ache	VC	4	24	0.0004	0.0313	7	
angel	VCCVC	18	1	0.0016	0.0958	7	2.42g
ape	VC	3	17	0.0003	0.0243	7	3.24
arm	VCC	94	9	0.006	0.1528	7	1.92g
ask	VCC	128	8	0.0027	0.0937	7	1.95
back	CVC	967	32	0.0113	0.1841	7	3.13
back-i	CVCV			0.0127	0.2273		
bacon	CVCVC	10	5	0.021	0.2514	7	
badge	CVC	5	13	0.0067	0.1414	6.9167	
badge-i	CVCV			0.0071	0.1846		
bag	CVC	42	28	0.0087	0.1485	7	2.17g
baggy	CVCV	4	3	0.0092	0.1917	6.9167	
ball	CVC	110	24	0.0043	0.1414	7	1.5g
barb	CVCC	1	10	0.0221	0.208	5.8333	5.28g
bark	CVCC	14	15	0.0228	0.2323	7	
barn	CVCC	29	11	0.0227	0.2368	7	2.98g
baseball	CVCCVC	57	0	0.0062	0.2192	7	
bath	CVC	26	17	0.0069	0.138	7	1.91
bath-i	CVCV			0.0072	0.1812		
bear	CVC	57		0.0107	0.2025		2.2
beauty	CCVCV	71	3	0.0123	0.2036	7	3.44g

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
bed	CVC	127	25	0.0069	0.1621	7	1.69g
bed-i	CVCV			0.0106	0.2053		
behind	CVCVCC	258		0.0104	0.2201		2.27
belt	CVCC	29	17	0.0158	0.2872	7	
bib	CVC	2	13	0.0064	0.1734	6.8333	
big	CVC	360	20	0.0076	0.1653	6.9167	1.55
bird	CVCC	31	22	0.0031	0.1139	7	2.06g
birth	CVCC	66		0.0022	0.0833		3.17
bite	CVC	10		0.0057	0.1515		2.14g
biting	CVCVC	6	2	0.0193	0.2125	6.8333	
black	CCVC	203	10	0.0156	0.1664	7	2.08
blanket	CCVCCVC	30	0	0.0316	0.3305	7	2.11g
blocks	CCVCC	37		0.0115	0.2134		
blonde	CCVCC	20	5	0.0151	0.1959	7	
blow	CCV(C)	33	15	0.0079	0.1145	7	
blowing	CCV(C)VC	19		0.0107	0.1666		
blue	CCV	143		0.0075	0.1106		2.06
bluehouse	CCVCVC			0.0081	0.172		
bone	CVC	33	30	0.0045	0.1966	7	
book	CVC	193	18	0.0022	0.1149	6.9091	1.74
book-i	CVCV			0.0036	0.1581		
boot	CVC	13	32	0.0039	0.1393	7	2.51g
bootie	CVCV	1	7	0.0069	0.1825	6.8333	
bottom	CVCVC	88	2	0.0068	0.1793	6.9167	1.85

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
bounce	CVCC	8	4	0.0147	0.2071	6.9167	
box	CVCC	70	5	0.0122	0.2153	7	3.4
boy	CV	242	13	0.0003	0.0546	7	1.5
branch	CCVCC	33	5	0.0265	0.2237	6.75	3.03g
bread	CCVC	42	15	0.0166	0.2083	7	
bridge	CCVC	98	6	0.0218	0.1887	6.9167	2.84
bridge-i	CCVCV			0.0226	0.2291		
broom	CCVC	2	10	0.0135	0.1867	6.9167	
brother	CCVCVC	73	0	0.0121	0.1986	7	2.19g
brown	CCVC	176	10	0.0107	0.1931	7	2.43
brush	CCVC	44	5	0.0114	0.1631	7	2.36
brushing	CCVCVC	6		0.0176	0.2172		
bubble	CVCVC	12	10	0.0096	0.1392	7	2.72g
bucket	CVCVC	7	1	0.0202	0.2658	7	
bug	CVC	4	26	0.0047	0.1083	7	3.83
burglar	CVCCVC	1		0.0044	0.1725		
burp	CVCC	1	8	0.0026	0.113	6.3333	
bus	CVC	35	20	0.0073	0.1692	7	
bus-i	CVCV			0.0094	0.2124		
button	CVCVC	10	6	0.0082	0.1665	7	1.92g
buzz	CVC	13	15	0.0044	0.1105	7	
buzzing	CVCVC	6		0.0139	0.1715		
cabin	CVCVC	23	1	0.0287	0.3156	6.9167	
cage	CVC	9	17	0.0027	0.1327	7	3g
cage-i	CVCV			0.0031	0.1759		

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
cake	CVC	13	26	0.004	0.1754	7	2.14g
call	CVC	188	26	0.006	0.1829	7	2.54
calling	CVCVC	45	3	0.0199	0.2439	7	
camel	CVCVC	1	8	0.0177	0.2443	7	3.03
camera	CVCCV	36	0	0.0225	0.3539	7	
can	CVC	1772	35	0.0266	0.2682	7	1.97
cap	CVC	27	30	0.017	0.2092	7	
card	CVCC	26	15	0.0362	0.2719	6.5	
carrot	CVCVC	1		0.0146	0.3722		
cars	CVCC	112		0.033	0.2437		
cart	CVCC	5	14	0.0392	0.321	7	2.58g
carve	CVCC	3	4	0.033	0.2463	6.9167	3.62
cat	CVC	23	35	0.0181	0.2381	7	
catch	CVC	43	20	0.0137	0.1801	7	
catching	CVCVC	9		0.0216	0.2411		
chain	CVC	50	19	0.0036	0.1342	7	3.11g
chair	CVC	66	20	0.0085	0.1602	7	
chair-i	CVCV			0.0076	0.1597		
chalk	CVC	3	13	0.0011	0.0789	7	
change	CVCC	240	3	0.0062	0.1454	6.5	3.32
chase	CVC	18	17	0.0036	0.1169	7	2.82
cheek	CVC	20	21	0.0028	0.0942	7	2.67g
cheer	CVC	8	27	0.0065	0.1835	7	3.08
cheese	CVC	9	13	0.0021	0.0608	7	2.11g
cheezy	CVCV			0.0036	0.104		

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
chew	CV	2	19	0.0002	0.031	7	2.23
chick	CVC	3	23	0.0099	0.1586	7	
chicken	CVCVC	37		0.0099	0.1687		2.5g
chief	CVC	119	12	0.0015	0.0604	7	
chime	CVC	1	8	0.0018	0.0926	7	
chin	CVC	27	21	0.0108	0.2012	7	
chip	CVC	17	24	0.0062	0.1422	6.9167	
chip-i	CVCV			0.0075	0.1854		
chirp	CVCC	1	9	0.0011	0.0707	7	
church	CVCC	348	8	0.0013	0.0416	7	2.78g
clean	CCVC	70	11	0.0103	0.2029	7	2.13
clock	CCVC	20	15	0.0106	0.2	7	
clothes	CCVC	89	7	0.0101	0.1681	6.4167	1.94g
cloud	CCVC	28	7	0.0079	0.1816	7	
clown	CCVC	3	5	0.0089	0.188	7	
coat	CVC	43	31	0.0105	0.208	7	1.97g
cob	CVC	1	22	0.0185	0.1792	6.5	
cob-i	CVCV			0.0201	0.2224		
cocoon	CVCVC	3	0	0.0188	0.2748	7	
cold	CVCC	171	15	0.0159	0.256	7	1.8
color	CVCVC	141	8	0.0114	0.2564	7	
comb	CVC	6	24	0.0086	0.1914	7	2.17
comb-i	CVCV			0.0103	0.2346		
comet	CVCVC	2	4	0.0397	0.3619	6.9167	
comic	CVCVC	9	3	0.0341	0.2891	6.6667	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
corn	CVCC	34	20	0.0268	0.2671	6.5	
cough	CVC	7	11	0.0031	0.1289	7	2.26
coughing	CVCVC	3		0.0123	0.1899		
cover	CVCVC	88	4	0.0084	0.2063	7	2.89g
cow	CV	29	19	0.0018	0.1024	7	1.74
crack	CCVC	21	18	0.0233	0.2545	6.9091	3.05
cracker	CCVCVC	1	2	0.0244	0.2977	6.8333	
crash	CCVC	20	13	0.0205	0.2214	7	
crashing	CCVCVC	7		0.0267	0.2755		
crawl	CCVC	11	9	0.0119	0.2242	7	
crayon	CCVCVC	1	2	0.0175	0.2908	7	
cream	CCVC	20	12	0.0185	0.2323	6.9167	2.45
cry	CCV	48	10	0.015	0.196	7	1.59
cup	CVC	45	18	0.0055	0.169	7	
cup-i	CVCV			0.0068	0.2122		
curb	CVCC	13	12	0.0029	0.1434	6.5	
curl	CVCC	2	23	0.0026	0.1911	7	3.2
curve	CVCC	45	13	0.0028	0.141	7	3.64g
cut	CVC	192	25	0.0067	0.1979	7	
cute	CCVC	5	6	0.0085	0.2047	7	
cutting	CVCVC	66	2	0.0203	0.2589	7	
dance	CVCC	90	6	0.0264	0.2774	6.75	2.69
deer	CVC	13		0.003	0.162		2.81g
deer-i	CVCV			0.01	0.2052		
desk	CVCC	65	3	0.0198	0.2457	6.9167	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
digging	CVCVC	7		0.0269	0.2269		
dipping	CVCVC	1		0.0291	0.2461		
dish	CVC	16	12	0.0164	0.1557	7	
dog	CVC	75	8	0.0016	0.0862	7	1.69g
doggie	CVCV			0.0021	0.1294		
done	CVC	321	30	0.0081	0.1871	7	
door	CVC	312	13	0.0018	0.1108	7	2.14g
door-i	CVCV			0.002	0.154		
draw	CCV	56	6	0.0066	0.1478	7	2.22
dress	CCVC	67	9	0.0145	0.2187	6.8333	2.31
dressy	CCVCV	2		0.0175	0.2591		
drink	CCVCC	82	6	0.0229	0.2215	7	1.66
drive	CCVC	105	9	0.0115	0.1698	7	3.3
driving	CCVCVC	53	3	0.0185	0.2239	6.8333	
drum	CCVC	11	10	0.0103	0.1841	7	3.19
duck	CVC	9	25	0.0043	0.1445	6.75	1.64g
duckie	CVCV			0.0057	0.1877		
ear	VC	29	31	0.0026	0.1536	7	
Earth	VCC	150	12	0.0003	0.0032	7	3.17g
eat	VC	61	24	0.0002	0.0308	7	1.67
eating	VCVC	32		0.0041	0.0714		
edge	VC	78	15	0.0003	0.0195	7	3.08g
egg	VC	12		0.0001	0.0092		1.86g
elephant	VCVCVCC	7	1	0.0345	0.3764	7	2.22g
eraser	VCVCVC	2		0.008	0.1932		

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
face	CVC	371	21	0.0049	0.1546	7	1.78
fall	CVC	147	26	0.005	0.1368	7	2.1
fan	CVC	18	21	0.0178	1.2221	7	
farm	CVCC	125	6	0.0214	0.215	7	2.56
fat	CVC	60	28	0.0093	0.192	7	2.36g
father	CVCVC	183	6	0.0039	0.161	7	1.85
feather	CVCVC	6	8	0.0051	0.1734	7	
feet	CVC	283		0.0042	0.1444		
fence	CVCC	30	10	0.0278	0.2657	7	4.67
fetch	CVC	6	9	0.0031	0.1275	7	2.84
few	CCV	601	12	0.007	0.0692	6.9167	2.92
filth	CVCC	2	9	0.014	0.2211	7	
finger	CVCCVC	40	1	0.0122	0.2114	7	
fire	CV(CV)C	187	22	0.0036	0.1593	7	1.89
fire-i	CV(CV)CV			0.0106	0.2025		
fish	CVC	35	13	0.0059	0.1505	7	2.75
fishing	CVCVC	32		0.0139	0.2115		
five	CVC	286	12	0.0032	0.1045	7	2.08
fix	CVCC	14	10	0.0182	0.2464	7	
flag	CCVC	16	8	0.0147	0.1333	7	2.58g
floor	CCVC	158	6	0.0093	0.1607	7	2.04
flower	CCVCVC	23	5	0.0072	0.146	7	1.83
flute	CCVC	1	12	0.0107	0.1954	7	
fly	CCV	33	13	0.0085	0.1033	7	2
foot	CVC	70	10	0.0014	0.1228	7	1.63

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
foot-i	CVCV			0.0044	0.166		
forehead	CVCCVC	16	0	0.0258	0.2427	6.5	
fork	CVCC	14	13	0.0267	0.2165	7	2.25g
four	CVC	359		0.0239	0.1743		1.89
french (fries)	CCVCC	139	4	0.0198	0.2163	7	
friend	CCVCC	133	5	0.0242	0.243	7	2.36
(french) fries	CCVC			0.0115	0.162		
frog	CCVC	1	4	0.0076	0.1563	7	2.58g
frog-i	CCVCV			0.0077	0.1967		
front	CCVCC	221	5	0.016	0.2756	7	2.44
fruit	CCVC	35	7	0.0113	0.242	6.9167	2.19g
fudge	CVC	1	6	0.0015	0.0966	7	2.78g
full	CVC	230	15	0.0026	0.1305	7	
gallop	CVCVC	4	2	0.0234	0.2784	6.8333	
game	CVC	123	20	0.0028	0.1046	6.9167	2.42g
game-i	CVCV			0.0045	0.1478		
gasp	CVCC	3	6	0.0185	0.2204	7	4.35
gate	CVC	37		0.0042	0.1212		
George	CVCC	129		0.0042	0.1199		
giraffe	CVCVC	1	1	0.0023	0.067	7	3.42
girl	CVCC	220	16	0.0014	0.1244	7	1.83g
give	CVC	391	7	0.0043	0.1458	7	2.43
glasses	CCVCVC	29		0.0162	0.2073		
globe	CCVC	13	8	0.0068	0.1072	6.8333	3.64g
glove	CCVC	9	3	0.0067	0.0969	7	2.28g

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
glove-i	CCVCV			0.0077	0.1373		
glow	CCV	16	13	0.006	0.0893	7	
glue	CCV	8	11	0.0056	0.0854	7	3.04
go	CV	626	26	0.0015	0.0753	6.8333	2.21
goat	CVC	6	26	0.0056	0.1413	7	2.82
gold	CVCC	52	15	0.011	0.1893	7	3.05
golf	CVCC	56	4	0.0079	0.1548	7	4.63
Goofy	CVCV			0.0014	0.111		
grandma	CCV(CC)CV	13		0.0208	0.1892		
grapes	CCVCC	7		0.0145	0.2227		
grasp	CCVCC	17	3	0.0225	0.2152	7	
grass	CCVC	53	13	0.021	0.1957	7	
grasshopper	CCVCCVCVC			0.0218	0.2264		
green	CCVC	116	13	0.0171	0.1828	7	2.25g
grow	CCV(C)	63	18	0.0146	0.1359	7	
growing	CCV(C)VC	108		0.0212	0.1966		
gulp	CVCC	2	5	0.0073	0.1751	7	
gum	CVC	14	16	0.0067	0.1146	7	
gummy	CVCV	2		0.0084	0.1578		
gun	CVC	118	20	0.0073	0.1613	7	2.28g
hamburger	CVCCVCCVC	6	0	0.0149	0.2306	7	
hammer	CVCVC	9	6	0.0124	0.219	7	2.97
hand	CVCC	431	13	0.0327	0.2552	7	
happy	CVCV	98	3	0.0113	0.1991	7	2.58
hat	CVC	56	34	0.0111	0.1848	7	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
health	CVCC	105	7	0.0131	0.1906	7	4g
heart	CVCC	173		0.0262	0.2677		2.81g
hearth	CVCC	4	6	0.0205	0.1829	5.8333	
help	CVCC	311	11	0.0139	0.2222	7	2.62
hide	CVC	22	21	0.0056	0.1117	7	2.56g
hiding	CVCVC	17	3	0.0172	0.1727	6.9167	3.72
hill	CVC	72	33	0.013	0.2093	7	2.56g
hilly	CVCV			0.0189	0.2525		
horn	CVCC	31	13	0.0232	0.2138	7	3.08g
horse	CVCC	117		0.0066	0.1844		2.08
house	CVC	591	7	0.0019	0.1279	7	1.89
hug	CVC	3	21	0.0037	0.0965	7	2.45
hugging	CVCVC	7		0.0119	0.1575		
ice	VC	45	16	0.0008	0.0142	7	2.53
iceberg	VCCVCC			0.0014	0.0591		
icy	VCV	12	4	0.0009	0.033	6.8333	
in	VC	21350	26	0.0359	0.1206	7	2.05
jacket	CVCVC	33		0.0088	0.2749		
jail	CVC	21		0.0033	0.1167		
jar	CVC	16	16	0.0172	0.1527	7	2.42g
jaws	CVC	10		0.0018	0.0944		
jeep	CVC	16		0.002	0.0827		
jelly	CVCV	3	5	0.0176	0.2036	7	
jet	CVC	29	20	0.0079	0.1527	7	
Jill	CVC			0.01	0.1837		

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
joking	CVCVC	5		0.0113	0.1776		
judge	CVC	77	6	0.0019	0.0638	7	4.48
juice	CVC	11	13	0.0027	0.1147	7	2.5g
juicy	CVCV	6	1	0.0048	0.1579	7	
jump	CVCC	24	8	0.0156	0.1386	7	2.22g
ketchup	CVCVC	1		0.0021	0.2006		
key	CV	88		0.006	0.1245		
kiss	CVC	17	13	0.0188	0.2677	7	
kissing	CVCVC	6		0.0304	0.3287		
kitchen	CVCVC	90	0	0.0172	0.3144	7	2.34
kitten	CVCVC	5	7	0.0103	0.265	7	2.13
knee	CV	35	31	0.0017	0.0556	7	2.31g
knife	CVC	76	8	0.0027	0.0778	6.75	
knife-i	CVCV			0.0033	0.121		
knocking	CVCVC	5		0.0096	0.1548		
ladder	CVCVC	19	10	0.0115	0.2023	6.75	
lady	CVCV	80	6	0.0079	0.1445	7	2.31g
lake	CVC	54	32	0.0039	0.1168	7	
lamp	CVCC	18	11	0.0185	0.1991	7	2.83g
large	CVCC	361	7	0.0189	0.1842	7	2.84
lash	CVC	6	26	0.0065	0.1212	6.1667	
latch	CVC	5	18	0.006	0.1215	7	3.86g
laugh	CVC	28	19	0.0058	0.1332	7	2.3
laughing	CVCVC	27		0.015	0.1942		
leaf	CVC	12	25	0.0033	0.0856	7	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
leafy	CVCV	1		0.0039	0.1288		
ledge	CVC	6	18	0.0056	0.1178	6.8333	
leg	CVC	58	15	0.0056	0.1249	7	1.65
lick	CVC	3	32	0.0148	0.1838	6.75	
lift	CVCC	23	11	0.0115	0.2394	7	2.77
light	CVC	333	35	0.007	0.1344	7	2.95
limb	CVC	5	20	0.013	0.1797	7	
lime	CVC	13	23	0.0047	0.1178	6.9167	3.78g
lotion	CVCVC	8	5	0.0187	0.2086	7	
lunch	CVCC	33	7	0.0102	0.1795	7	2.75g
magic	CVCVC	37	0	0.0202	0.2339	7	3.08
mail	CVC	84	35	0.0057	0.1601	7	
mall	CVC	3	24	0.0044	0.1474	7	5.89g
man	CVC	1207	26	0.0245	0.2327	7	1.76
map	CVC	13	20	0.0149	0.1737	7	3.61
Mars	CVCC	21	8	0.0228	0.2082	6.9167	
marshmallow	CVCCVCV(C)	1	0	0.0263	0.2997	6.9167	3.14g
mask	CVCC	10	8	0.023	0.2576	7	
match	CVC	41	14	0.0116	0.1446	7	4.26
melt	CVCC	4	15	0.0185	0.2932	7	3.03
milk	CVCC	49		0.0189	0.2693		
mitten	CVCVC	1	8	0.0166	0.2295	6.8333	
money	CVCV	265	10	0.0134	0.2357	6.9167	2.47g
month	CVCC	130	2	0.0101	0.1971	7	2.97
moon	CVC	60	21	0.0033	0.1754	7	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
moon-i	CVCV			0.0071	0.2186		
mop	CVC	3	16	0.0089	0.1548	7	3.31
more	CVC	2216		0.0219	0.1849		2.28
mother	CVCVC	216	4	0.006	0.1503	7	1.44g
mouse	CVC	10	14	0.0017	0.1457	7	2.42g
mouse-i	CVCV			0.0038	0.1889		
mouth	CVC	103	7	0.0014	0.0743	7	
mouth-i	CVCV			0.0017	0.1175		
mow	CV(C)	1	20	0.0009	0.0669	6.8333	
much	CVC	937	17	0.0046	0.1044	7	2.95
mud	CVC	32	20	0.0049	0.1344	7	2.39g
muddy	CVCV	10		0.0086	0.1776		
muffin	CVCVC	1	2	0.0241	0.271	6.9167	
muppet	CVCVC			0.008	0.2617		
music	CCVCVC	216	0	0.021	0.1805	6.9167	2.72g
nail	CVC	6	26	0.0046	0.1267	7	2.72g
nail-i	CVCV			0.0105	0.1699		
naked	CVCVC	32	0	0.011	0.1818	7	
nap	CVC	4	20	0.0067	0.1403	7	
napping	CVCVC	1		0.0157	0.2013		
near	CVC	198	25	0.0071	0.1984	7	2.6
neck	CVC	81	13	0.0094	0.1502	7	
Nerf	CVCC			0.001	0.0682		
nest	CVCC	20	15	0.0324	0.2649	6.5	
ninth	CVCC	20	1	0.0068	0.1588	6.5	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
noise	CVC	37	4	0.0005	0.0473	7	2.17
noisy	CVCV	6	3	0.002	0.0905	7	
nose	CVC	60	18	0.0047	0.0932	7	2.06g
nosy	CVCV	1	7	0.0062	0.1364	6.75	
nothing	CVCVC	412	0	0.0096	0.1314	7	2.73
nurse	CVCC	17	10	0.0035	0.1273	7	3.03
nut	CVC	15	25	0.0038	0.129	7	
off	VC	639	12	0.0011	0.0127	6.9167	2.19
old	VCC	660	11	0.0008	0.0922	7	2.6
on	VC	6745		0.0005	0.0658		1.93
onion	VCCVC	15	1	0.0249	0.2283	7	2.86g
open	VCVC	319	4	0.0058	0.1009	7	
orange	VCVCC	23	2	0.019	0.191	7	2.03g
orange-i	VCVCCV			0.0197	0.2386		
other	VCVC	1702	5	0.0004	0.0223	7	3.25
ours	VCC	27	1	0.0006	0.1152	7	2.64
over	VCVC	1236	10	0.0057	0.0265	7	2.84
package	CVCVC	20	1	0.0189	0.2765	7	3.64g
page	CVC	66	16	0.0033	0.1244	7	2.58
page-i	CVCV			0.0037	0.1676		
paint	CVCC	37	12	0.0214	0.2991	7	2.38
pan	CVC	16	31	0.0231	0.2599	7	
pants	CVCC	9	11	0.0332	0.31	7	
park	CVCC	94	18	0.0267	0.2655	7	2.51
peach	CVC	3	22	0.0029	0.1242	7	2.92g

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
peach-i	CVCV			0.003	0.1674		
pepper	CVCVC	13	5	0.0109	0.2452	7	2.69g
piano	CVCVCV	38	0	0.0108	0.2111	7	2.53g
picture	CVCCVC	162	2	0.0162	0.2874	6.8333	2.32
pie	CV	14		0.0017	0.1187		
pig	CVC	8	19	0.0083	0.1985	7	2.33g
piggie	CVCV			0.0088	0.2417		
pin	CVC	16	31	0.0143	0.2767	7	2.61g
pinch	CVCC	6	10	0.017	0.2868	6.75	2.88
pinching	CVCCVC	2		0.0228	0.3409		
pinecone	CVCCVC			0.0108	0.3601		
pink	CVCC	48	16	0.0131	0.2345	7	2.77
plane	CCVC	114		0.0105	0.1901		5.22
plant	CCVCC	125	8	0.0259	0.2836	7	3.08
plate	CCVC	22		0.0103	0.2328		
play	CCV	200	16	0.0087	0.1434	7	1.92g
plug	CCVC	23	8	0.0098	0.1543	7	2.42g
pocket	CVCVC	46	7	0.0261	0.3203	7	2.28g
point	CVCC	395	8	0.017	0.2733	6.9167	2.79
police	CVCVC	155	1	0.018	0.2984	7	2.92
pool	CVC	111	18	0.0018	0.1802	7	2.39g
porch	CVCC	43	7	0.0232	0.2222	7	3.19g
potato	CVCVCV	15	0	0.0124	0.3072	7	2.33g
present	CCVCVCC	377	3	0.0341	0.3205	7	2.21
pretty	CCVCV	107	4	0.044	0.3405	6.9167	2.73

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
pretzel	CCVCVC	1	0	0.0337	0.3677	7	
princess	CCVCCVC	10	0	0.0595	0.4234	7	2.95
prize	CCVC	28		0.0298	0.1998	0	
pu	CCV			0.0068	0.107	0	
punch	CVCC	5	8	0.0108	0.2298	7	3.01
punching	CVCCVC	2		0.0166	0.2839		
puppet	CVCVC	6	0	0.0152	0.32	7	
purse	CVCC	14	19	0.0066	0.1879	7	
push	CVC	37	5	0.0012	0.1023	6.9167	2.39
pushing	CVCVC	17		0.0092	0.1633		
quack	CCVC	9	8	0.0052	0.1363	6.75	
queen	CCVC	41		0.0069	0.1735		2.47g
quick	CCVC	68	14	0.0122	0.1852	7	2.69
quiet	CCV(C)VC	76	1	0.0175	0.2419	7	2.21
quilt	CCVCC	1	4	0.0119	0.258	6.75	5.42
rabbit	CVCVC	11		0.0106	0.2837		2.06g
raft	CVCC	4	14	0.0081	0.2386	7	
rain	CVC	80	38	0.0061	0.1754	7	2.11g
raining	CVCVC	7		0.0179	0.2364		
raisin	CVCVC	1	7	0.0057	0.1095	7	
rake	CVC	11	30	0.0051	0.1328	7	3.36g
read	CVC	178	28	0.0066	0.1199	6.8333	
reading	CVCVC	140	1	0.0182	0.1809	7	
rich	CVC	74	21	0.0184	0.1543	7	
ride	CVC	49	30	0.0045	0.1224	7	2.43

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
riding	CVCVC	45	7	0.0161	0.1834	7	
ring	CVC	49	23	0.0203	0.158	7	3.31
robe	CVC	6	18	0.0039	0.1254	7	
robe-i	CVCV			0.0055	0.1686		
rock	CVC	75	23	0.0045	0.1641	6.6667	
rocky	CVCV	10		0.0059	0.2073		
roll	CVC	35		0.0081	0.1731		
roof	CVC	59	13	0.0024	0.0919	7	5.19
roof-i	CVCV			0.003	0.1351		
room	CVC	383		0.0041	0.1216		2.44g
rose	CVC	86	26	0.0039	0.1195	6.8333	3.01
rosy	CVCV	9	7	0.0054	0.1627	7	
row	CV(C)	35		0.0026	0.0994		3.89
rub	CVC	6	23	0.0062	0.1153	6.9167	
rubbing	CVCVC	11		0.0154	0.1763		
run	CVC	212	26	0.0083	0.1854	7	
running	CVCVC	123	1	0.0201	0.2464	7	
salt	CVCC	46	11	0.0086	0.282	7	2.33g
same	CVC	686	21	0.0034	0.181	7	
santa	CVCCV	28		0.0405	0.4489		
sarge	CVCC			0.0193	0.2525		
scalp	CCVCC	4	2	0.0101	0.2131	6.8333	
scarf	CCVCC	4	2	0.0113	0.2063	7	
school	CCVC	492	8	0.0087	0.18	7	2.28g
scissors	CVCVCC	1	0	0.0154	0.281	7	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
scratch	CCCVC	9	2	0.0119	0.2313	7	2.69g
scream	CCCVC	13	6	0.0181	0.2796	7	2.88
screw	CCCV	21	4	0.0108	0.2195	6.9167	
scribble	CCCVCVC	1	1	0.0184	0.2963	7	
scrub	CCCVC	9	2	0.0112	0.2329	7	3.18
seal	CVC	17	31	0.0055	0.2079	7	3.76
see	CV	772		0.0028	0.1342		2.39
seven	CVCVC	113	2	0.0322	0.3538	7	2.39
sew	CV	1990	29	0.0027	0.1517	7	2.82
sewing	CVCVC	10	5	0.0052	0.1923	7	
shampoo	CVCCV	2	0	0.0156	0.1896	7	
sharp	CVCC	72	5	0.0182	0.1848	7	
shave	CVC	6	16	0.0022	0.0625	7	
shaving	CVCVC	6		0.012	0.1235		
shelf	CVCC	12	6	0.0113	0.1722	6.9167	
shirt	CVCC	27	15	0.0026	0.1004	7	2.69g
shoe	CV	14	24	0.0002	0.0318	6.9167	
shot	CVC	112	23	0.0033	0.1362	7	3.4
shovel	CVCVC	5	4	0.0033	0.0953	7	
shovel-i	CVCVCV			0.0039	0.1357		
shred	CCVC	3	8	0.0101	0.1668	6.75	
shrimp	CCVCC	2	2	0.0189	0.185	7	
shrink	CCVCC	5	6	0.0191	0.1794	6.5	4.04
shrub	CCVC	1	4	0.0052	0.1304	7	3.83g
shrug	CCVC	2	3	0.005	0.1262	7	4.08g

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
sick	CVC	51	29	0.0182	0.2521	7	
silk	CVCC	12	10	0.0202	0.3145	7	
sink	CVCC	23	17	0.0179	0.2525	7	2.36
six	CVCC	220	8	0.0231	0.3022	7	2.32
skate	CCVC	1	11	0.01	0.2335	6.5	3.57
skirt	CCVCC	21	10	0.009	0.2232	7	2.58g
skunk	CCVCC	1	5	0.0124	0.1847	6.5	5.01
sled	CCVC	1	10	0.0099	0.2129	7	
sleep	CCVC	65	13	0.0073	0.2021	7	1.93
sleeping	CCVCVC	39		0.0145	0.2562		
sleeve	CCVC	11	7	0.0076	0.1806	7	2.72g
slide	CCVC	20	10	0.0074	0.1994	7	2.47
slipper	CCVCVC	3	7	0.0144	0.2615	7	2.51
small	CCVC	542	5	0.0027	0.1619	7	2.17
smell	CCVC	34	7	0.0043	0.1827	7	2.41
smile	CCVC	58	5	0.0026	0.1692	6.75	2.15
smoke	CCVC	41	7	0.0041	0.1825	7	3.48
smooth	CCVC	42	1	0.002	0.1378	6.9167	3.92
snack	CCVC	6	10	0.0061	0.2312	7	
snail	CCVC	1	5	0.0031	0.2105	6.75	
snake	CCVC	44	6	0.003	0.2172	7	2.89g
sneeze	CCVC	1	3	0.003	0.1916	7	
snow	CCV(C)	59		0.002	0.1793		2.3
snowing	CCV(C)VC	4		0.0086	0.24		
snowman	CCV(C)CVC			0.007	0.3088		

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
soap	CVC	22	21	0.0037	0.1888	7	2.22g
soapy	CVCV	2		0.005	0.232		
sock	CVC	4	26	0.0056	0.2164	7	1.72g
sock-i	CVCV			0.007	0.2596		
soft	CVCC	61	5	0.0036	0.228	7	2.39
song	CVC	70	11	0.0021	0.1306	7	2.42g
soup	CVC	16	22	0.0041	0.1616	7	2.32
soupy	CVCV			0.0054	0.2048		
space	CCVC	184	6	0.0106	0.1872	7	3.87
spaghetti	CCVCVCV	1	0	0.0232	0.3419	7	
spider	CCVCVC	2	1	0.0137	0.2183	7	2.54
spill	CCVC	1	13	0.0133	0.1933	7	2.49
splash	CCCVC	3	2	0.0128	0.2283	7	2.39
splashing	CCCVCVC	3		0.0098	0.2688		
splinter	CCCVCCVC	4	1	0.0371	0.4511	6.5833	
split	CCCVC	30	3	0.0185	0.3247	7	3.55
splitting	CCCVCVC	3		0.0304	0.3775		
sponge	CCVCC	7	1	0.0121	0.1915	7	
spoon	CCVC	6	11	0.01	0.1842	7	1.86g
spray	CCCV	16	7	0.014	0.2156	7	3.83
spread	CCCVC	83	1	0.0141	0.2607	7	
spring	CCCVC	127	5	0.0239	0.2622	7	
sprinkle	CCCVCCVC	7	0	0.0281	0.3356	7	
sprite	CCCVC	1	5	0.015	0.293	6.5	
square	CCCVC	143	3	0.0135	0.2102	7	2.5g

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
squeak	CCCVC	1	3	0.0125	0.2159	6.9167	
squeeze	CCCVC	11	2	0.0126	0.1896	7	
squirrel	CCCVC(V)C	1	2	0.0116	0.1696	7	3.53
squirt	CCCVCC	1	5	0.0124	0.2225	7	
stamp	CCVCC	8	4	0.0237	0.2071	7	2.69
stand	CCVCC	148	3	0.0329	0.2377	7	
star	CCVC	25	12	0.0213	0.193	7	
starry	CCVCV			0.0267	0.2334		
starve	CCVCC	1	4	0.0216	0.2045	7	
stop	CCVC	120	11	0.0214	0.1864	7	2.43
store	CCVC	74	18	0.0238	0.1912	7	3.94
stove	CCVC	15	8	0.0197	0.1631	6.5	2.97g
stove-i	CCVCV			0.0207	0.2035		
straight	CCCVC	119	8	0.0283	0.3021	7	3.01
straw	CCCV	15	3	0.0245	0.2125	7	2.89g
street	CCCVC	244	6	0.0316	0.3309	7	2.47
stripe	CCCVC	4	8	0.0249	0.24	7	3.08g
strong	CCCVC	202	3	0.0251	0.2248	7	2.8
sucking	CVCVC	8		0.0097	0.2271		
sulk	CVCC	1	7	0.0121	0.2575	7	3.33
sun	CVC	112		0.0008	0.2087		1.81g
sunny	CVCV	13		0.0046	0.2519		
surf	CVCC	1		0.0041	0.1468		
sweater	CCVCVC	14	3	0.0149	0.2758	7	
sweep	CCVC	15	9	0.005	0.1727	6.9167	2.88

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
sweet	CCVC	70		0.0056	0.2259		1.72
swim	CCVC	15	11	0.0099	0.1822	7	2.75
swimming	CCVCVC	37		0.0175	0.2363		2.91
swing	CCVC	24	12	0.0093	0.1583	7	2.37
syrup	CVCVC	4	1	0.0051	0.1876	7	
tail	CVC	45	30	0.0041	0.1474	7	
tail-i	CVCV			0.01	0.1906		
tape	CVC	35	16	0.0029	0.1108	7	4.06g
tear	CVC	11		0.0012	0.1547		2.38
teeth	CVC	103	12	0.0016	0.0837	7	
teeth-i	CVCV			0.0019	0.1269		
tent	CVCC	20	19	0.0371	0.3029	7	2.83g
tenth	CVCC	7		0.0218	0.2181		
thank (you)	CVCC	36	11	0.009	0.1401	7	2.91
that	CVC	10595	14	0.0063	0.1483	6.4167	2.48
theirs	CVCC	21	1	0.009	0.1663	6.75	3.02
them	CVC	1789	5	0.0059	0.1252	7	2.66
there	CVC	2724		0.0087	0.1542		2.45
these	CVC	1573	9	0.0017	0.0548	6.25	2.6
thief	CVC	8	8	0.0018	0.0583	7	3.22g
thirsty	CVCCCV	5		0.0206	0.2726		
thread	CCVC	15	6	0.0109	0.1639	7	2.67g
three	CCV	610	9	0.0098	0.1169	6.5	1.78
throat	CCVC	51	6	0.0099	0.2061	6.75	
throne	CCVC	45	8	0.0097	0.1634	7	

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
throw	CCV(C)	42		0.0083	0.1167		2.64g
throwing	CCV(C)VC	17		0.0149	0.1774		
thumb	CVC	10	15	0.0055	0.0954	7	1.83g
thumb-i	CVCV			0.0072	0.1386		
thunder	CVCCVC	14	3	0.0221	0.2256	7	3.14
ticket	CVCVC	16	4	0.026	0.3161	7	2.94g
ticking	CVCVC	1	0	0.0195	0.2552	7	
tie	CV	23		0.0021	0.0788		
tiger	CVCVC	7	0	0.0038	0.1475	7	3.31
toast	CVCC	19	11	0.0281	0.262	7	3.64
toes	CVC	19		0.0038	0.1139		
tongue	CVC	35	16	0.0041	0.0954	6.8333	
tooth	CVC	20	14	0.0027	0.074	7	
toothy	CVCV			0.003	0.1172		
tooting	CVCVC			0.0184	0.1936		
top	CVC	204	21	0.0047	0.1421	7	2.28
torch	CVCC	2	8	0.0209	0.1823	7	
towel	CV(CV)C	6	9	0.0007	0.0568	7	
train	CCVC	82	15	0.0195	0.1968	7	4.43
(trick or)							
treat	CCVC	26	10	0.0216	0.244	7	3.74
tree	CCV	59	16	0.0204	0.1546	7	2.13
treehouse	CCVCVC			0.0212	0.216		
triangle	CCV(C)VCCVC	4	0	0.0205	0.2154	6.9167	
trick (or							
treat)	CCVC	15	13	0.0291	0.0213	7	3.2

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
truck	CCVC	57	9	0.0167	0.1895	7	
trunk	CCVCC	8	3	0.0198	0.1907	7	3.28g
tub	CVC	13	17	0.005	0.1097	6.5	
tub-i	CVCV			0.0066	0.1529		
tulip	CVCVC	4	1	0.0152	0.2396	7	
Tweety	CCVCV			0.0079	0.2084		
twelve	CCVCC	48	0	0.0057	0.1323	7	3.01
Twinkie	CCVCCV			0.0057	0.1696		
twins	CCVCC	12		0.0091	0.153		
twist	CCVCC	18	3	0.0198	0.2244	7	3.38
up	VC	1895	7	0.0022	0.0327	6.5	1.89
vacuum	CVCCVC	20	0	0.0155	0.2133	7	4.39
valentine	CVCVCCVC	2	0	0.0441	0.5182	7	
van	CVC	32	12	0.0169	0.1979	7	2.67g
van-i	CVCV			0.0207	0.2411		
vanilla	CVCVCV	1	0	0.0239	0.323	7	
vase	CVC	4	16	0.0042	0.1304	7	2.97g
vegetable	CVCCVCVC	10	0	0.0226	0.3208	7	2.69g
verb	CVCC	4	6	0.0037	0.0731	7	4.36g
vest	CVCC	4	19	0.0336	0.2635	6.9167	
Viewmaster	CCVCVCCVC			0.0281	0.2828		
wagon	CVCVC	55	0	0.0179	0.2351	6.8333	
wash	CVC	37	7	0.0026	0.0445	7	1.95
washing	CVCVC	44		0.0106	0.1055		
wasp	CVCC	2	2	0.0113	0.1958	7	2.79

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
watch	CVC	81	5	0.0022	0.0448	7	
watch-i	CVCV			0.0023	0.088		
water	CVCVC	442	3	0.0139	0.1536	7	1.8
wave	CVC	46		0.0029	0.0731		2.13
waving	CVCVC	13		0.0127	0.1341		
wealth	CVCC	22	6	0.0114	0.1715	7	4.37
wear	CVC	36		0.0099	0.1716		2.6
web	CVC	6	10	0.0031	0.1192	7	
web-i	CVCV			0.0047	0.1624		
wet	CVC	53	29	0.0073	0.1592	7	
wick	CVC	4	26	0.0132	0.17	6.6667	3.53g
win	CVC	55	31	0.0141	0.2126	7	2.69g
window	CVCCV(C)	119	5	0.0277	0.2728	7	2.31g
wing	CVC	18	18	0.0078	0.1282	6.9167	
wish	CVC	110	13	0.0058	0.1242	6.9167	2.6
witch	CVC	5	20	0.0059	0.1245	7	2.58g
wolf	CVCC	6	3	0.0048	0.1201	7	3.16
woman	CVCVC	224	2	0.0269	0.2348	7	2.58g
worm	CVCC	4	10	0.0043	0.0944	7	2.49
wreath	CVC	8	17	0.0048	0.0893	7	
wreath-i	CVCV			0.0051	0.1325		
yard	CVCC	35	10	0.0201	0.1871	7	3.08g
yawn	CVC	2	12	0.0015	0.1205	7	2.84
yell	CVC	9	19	0.0093	0.1545	7	
yellow	CVCV(C)	55	7	0.0119	0.1755	7	2.56

Probe word	Canonical Shape ^a	Raw Frequency ^b	Neighborhood Density ^c	Phonotactic Probability ^d		Familiarity ^e	Age-of-Word Acquisition ^f
				Biphone Frequency	Positional Segment Frequency		
yes	CVC	144	9	0.0075	0.1596	7	1.69
you	CV	3293		0.0033	0.03		2.13
your	CVC	924		0.0182	0.1356		2.56
zebra	CVCCV	1	1	0.0123	0.1848	6.8333	3.7
zero	CVCV	24	1	0.0082	0.1982	7	
zipper	CVCVC	1	6	0.0089	0.1867	7	
zipping	CVCVC			0.0144	0.1969		
zoo	CV	9		0.0001	0.0247		