Towards a Typology of English Accents

The Speech Accent Archive and STAT

Steven H. Weinberger
George Mason University

Stephen Kunath
Georgetown University

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Outline

- Archive architecture
- Theoretical and applied utility
- Phonological Speech Patterns (PSP)
- Speech Transcription Analysis Tool (STAT)

Archive Architecture

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- 1,214 samples (and growing)
- 250 native language backgrounds
  - American English to Zulu
  - ≥ 1 speaker per native language
- Segmental
- Searchable
- Collaborative
- Qualified remote submissions
- 1 million hits per month

Elicitation paragraph

- Please call Stella. Ask her to bring these things with her from the store: six spoons of fresh snow peas, five thick slabs of blue cheese, and maybe a snack for her brother Bob. We also need a small plastic snake and a big toy frog for the kids. She can scoop these things into three red bags, and we will go meet her Wednesday at the train station.

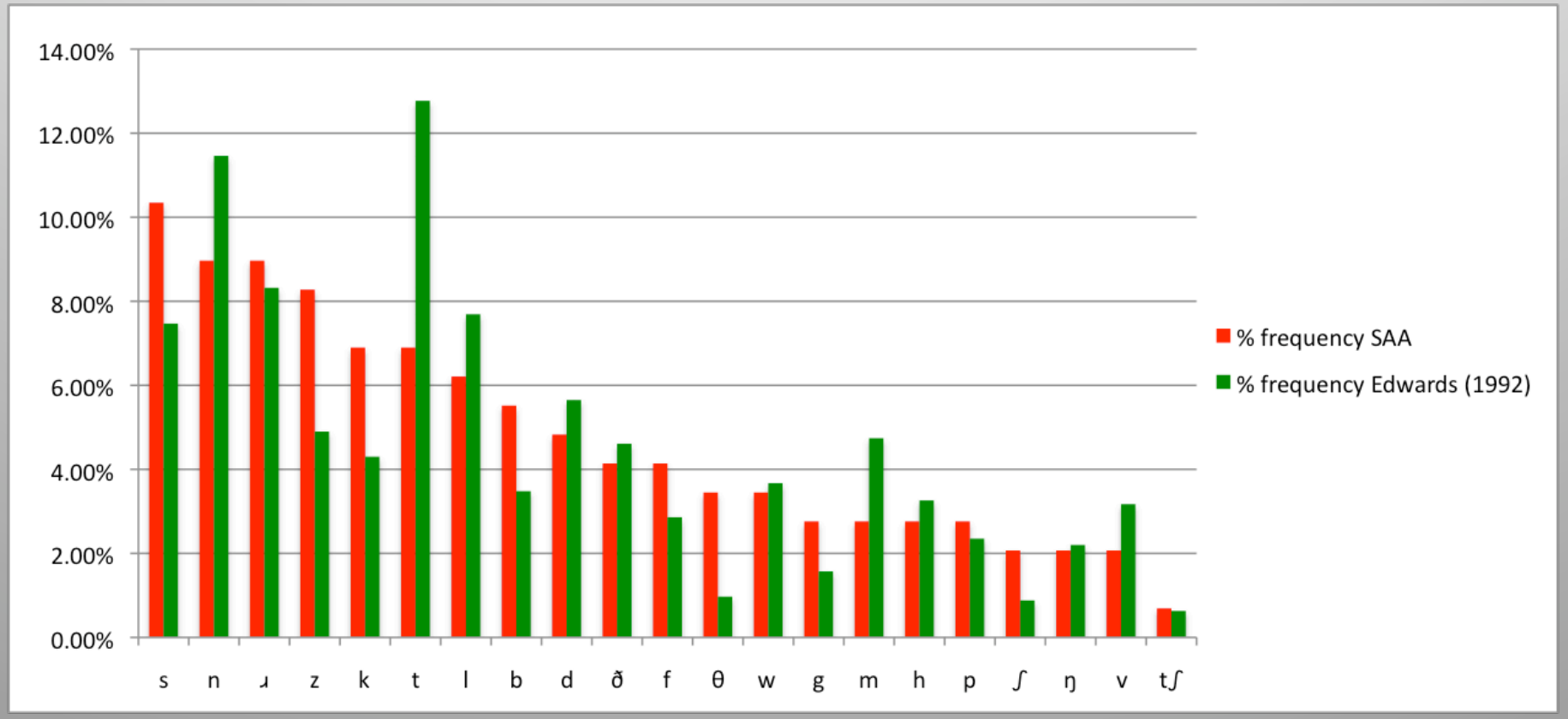
Total words

- 83,766 words and growing

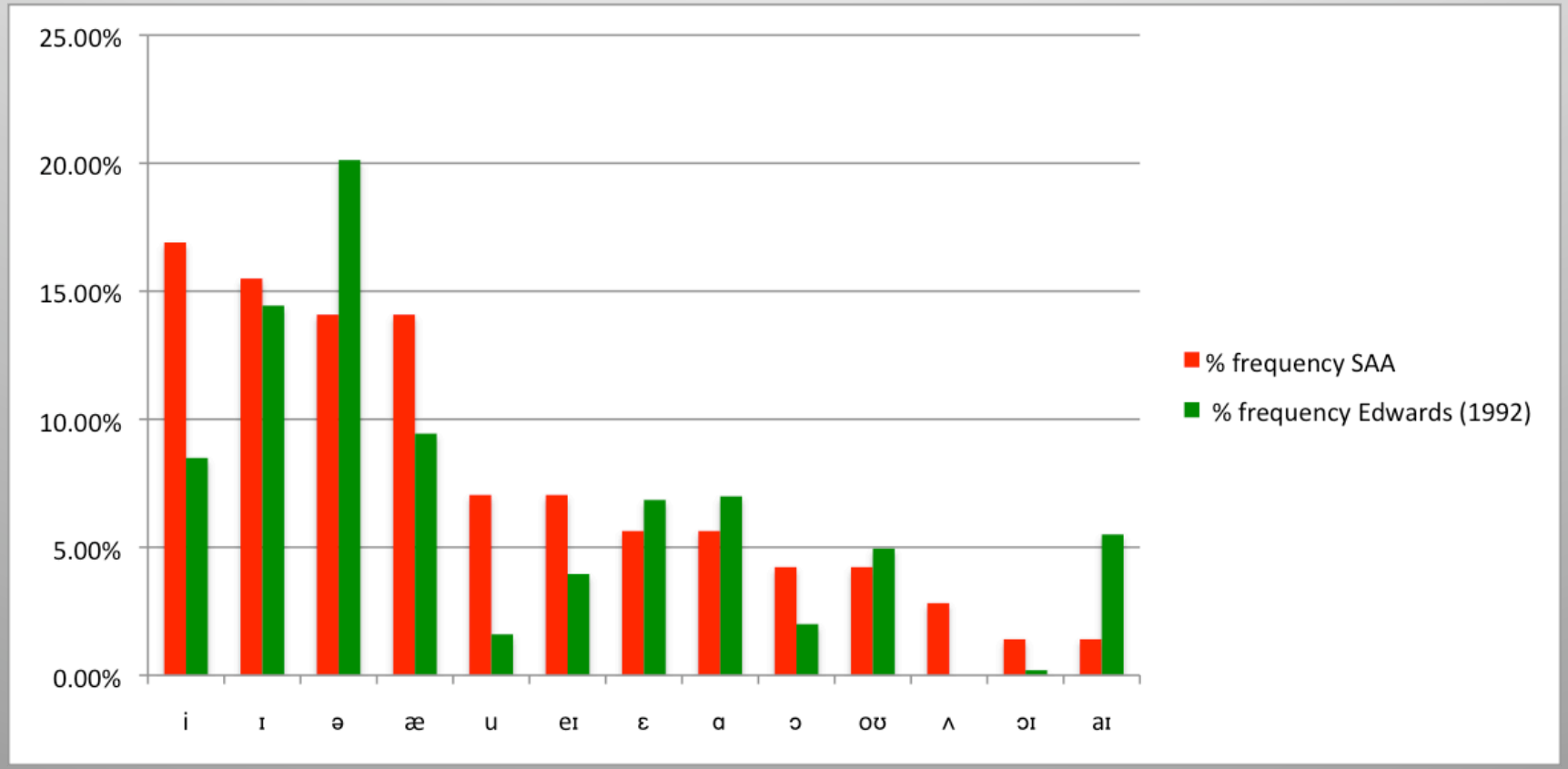
Representative sounds

single consonants		vowels	clusters	
initial	final		initial	final
k (3)	z (5)	i (12)	pl (2)	sk (1)
t (3)	l (4)	ɑ (4)	st (4)	ŋz (2)
ð (6)	ŋ (1)	ɛ (4)	bɹ (2)	ks (1)
θ (3)	θ (1)	æ (10)	fɹ (3)	nz (2)
w (5)	m (1)	ɪ (11)	sp (1)	bz (1)
s (2)	ɹ (5)	ʌ (2)	sn (3)	nd (3)
f (3)	v (3)	ə (10)	sl (1)	dz (1)
tʃ (1)	ʃ (1)	u (5)	bl (1)	gz (1)
n (1)	k (4)	oʊ (3)	sm(1)	
b (3)	b (1)	aɪ (1)	sk (1)	
l (1)	d (2)	eɪ (5)	θɹ (1)	
ʃ (2)	g (2)	ɔ (3)	tɹ (1)	
d (1)	n (4)	ɔɪ (1)		
ɹ (1)	p (1)			
g (1)	t (2)			
m (2)				
h (4)				

Frequency of consonants



Frequency of Vowels



Phonetic transcription

- Narrow segmental IPA transcription
  - Produced by 3 trained transcribers
  - Spaces added for readability
  - Unicode
    - Vietnamese 7

[pəliz kʰɑ ʂ stɪlə æs hə tə pɹ̃ĩn̪ d̪ɪs f̪ĩŋgs wɪt hə˞ fɹʌ̃m d̪ə stɔɹ sɪks spũns ɻ̩ ʌf fɹɛs sno pʰis faɪ θɪk slɑɸs əf blu tʃis æ̃n meɪbi ɛ snæx fɔɹ hə bɹʌðə bɑ wi ɑlˠso nid ə smɑ plæstɪk˥ sːneɪkʰ æ̃n ə bɪg˥ tʰɔɪ fɹɑx̌ fɔː ðə kʰɪs ʃi kæ̃ skup˥ ðɪs θĩŋz ĩntu θɹi ɹɛd˥ bæxs æ̃n wi wɪlˠ goʊ mit hə˞ wɛ̃nsdeɪ æt̪˥ ðə tʃɹɪ̃n steʃə̃n]

Annotated Audio

- Strict recording protocol
- Cd-quality (44.1 khz. 16-bit mono.)
- Reduced to: 22.050 khz., 16-bit mono., IMA 4:1
- Quicktime movie soundtrack

Speaker Demographics

- Gender
- Place of birth
- Native language
- Other language(s)
- Age
- Age of onset
- English Residency
- Learning style

Phonetic inventories

- Uniform inventories for 200 languages

  Vietnamese:

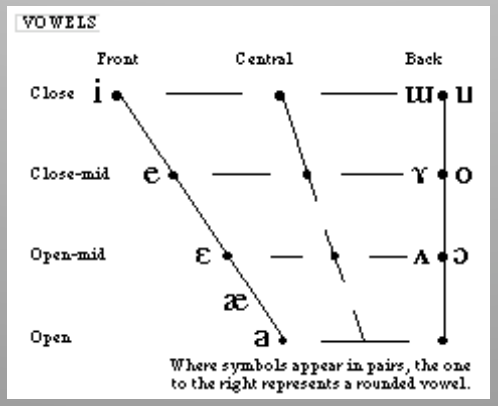
  – Consonants

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive				t			c	k			ʔ
Nasal	m			n			ɲ	ŋ			
Trill											
Tap or Flap											
Fricative		f v		s z				x ɣ			h
Affricate											
Lateral fricative											
Approximant							j				
Lateral approximant				l							

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

  – Vowels



Theoretical Utility

- Accents are theoretically interesting
- Uniform database to test:
  - Phonological hypotheses
    - The representation of onset clusters in L_2
  - Factors responsible for accent variation
    - Native language
    - Onset age
    - Length of residence
    - Learning style

Applied Utility

- The archive as an assessment and diagnostic tool
- It reinforces the view that accents are systematic
- It serves to justify or challenge textbook predictions for learning problems

Archive PSPs compared to various predictions for Vietnamese production of /θ/

Text	/θ/
Avery and Ehrlich (1992)	[t^h]
Baker and Goldstein (1990)	No prediction
Kenworthy (1988)	Language not listed
Nilsen and Nilsen (1973)	[f], [s], [t], [ʃ]
Swan and Smith (1991)	[t^h]
Speech Accent Archive (2009)	[t]

Phonological Speech Patterns (PSPs)

Consonants	Vowels	syllables
final devoicing	vowel shortening	consonant deletion
non-aspiration	vowel lengthening	vowel insertion
consonant voicing	vowel raising	consonant insertion
interdental fricative → t/d	vowel fronting	
interdental fricative → s/z	vowel backing	
interdental fricative → f/v		
w → v		
r → trill		
r → uvular		
r ←→ l		
liquid → flap		
stop → fricative		
dentalization		
palatalization		
nasal fronting		

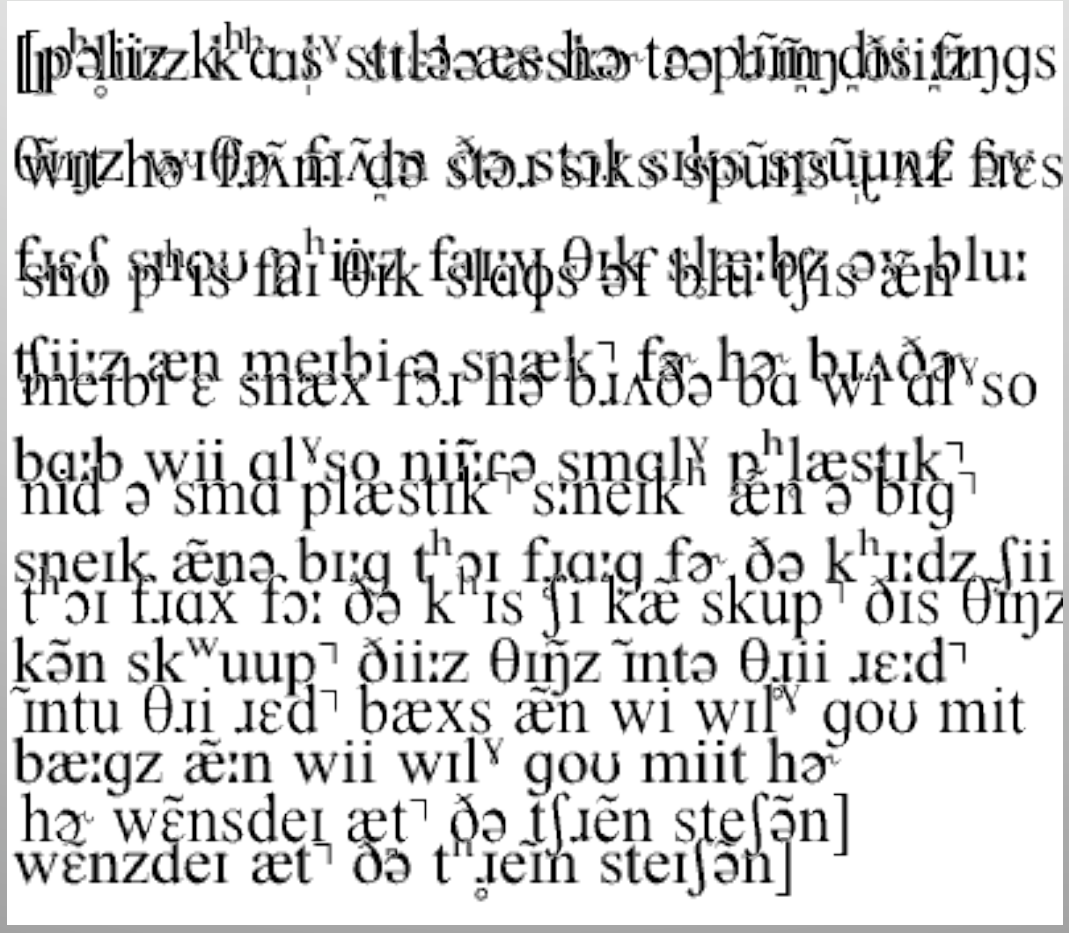
Vietnamese 7 (PSPs)

Consonants	Vowels	syllables
final devoicing	**vowel shortening**	**consonant deletion**
non-aspiration	vowel lengthening	**vowel insertion**
consonant voicing	vowel raising	consonant insertion
interdental fricative → t/d	vowel fronting	
interdental fricative → s/z	vowel backing	
interdental fricative → f/v		
w → v		
r → trill		
r → uvular		
r ←→ l		
liquid → flap		
stop → fricative		
dentalization		
palatalization		
nasal fronting		

Tigrigna 3(PSPs)

Consonants	Vowels	syllables
final devoicing	vowel shortening	**consonant deletion**
non-aspiration	vowel lengthening	**vowel insertion**
consonant voicing	**vowel raising**	consonant insertion
interdental fricative → t/d	vowel fronting	
interdental fricative → s/z	vowel backing	
interdental fricative → f/v	**vowel lowering**	
w → v		
r → trill		
r → uvular		
r ←→ l		
liquid → flap		
stop → fricative		
dentalization		
palatalization		
nasal fronting		

The problem with computationally comparing samples



PSP determination: Human versus STAT

Human	STAT
Slow and labor intensive (30 minutes per sample)	Fast and computationally inexpensive (< 5 seconds per sample)
Inconsistent	Consistent and uniform
Arbitrary comparison	Selectable and controlled comparison
Static	Parameterized and adaptable

Speech Transcription Analysis Tool (STAT)

Components:

- Unicode compliant
- Web-based frontend (Ruby)
- Alignment processing mechanism (Java)
- Transcription alignment search (XML DB)
- Demographic search (MySQL)
- Transcription Management (MySQL)

Alignment

Two-level Alignment

- Word level – This provides a link between a target utterance and the speaker's attempt
- Phoneme level – The phonemic level is where the analysis takes place. This mapping is accomplished by comparing feature vectors for each target and source phoneme mapping.

Alignment Example

the speech *accent* archive

how to browse search resources about

language/ speakers
vietnamese
atlas/ regions
language/ speakers

Biographical Data

birth place: hue, vietnam
(map)
native language:
vietnamese (vie)
other language(s):
...tswana...
age, sex: 29, female
age of english onset: 18.0
english learning method:
naturalistic
english residence:
length of english
residence: 10.0 years

Phonological Speech Patterns Count

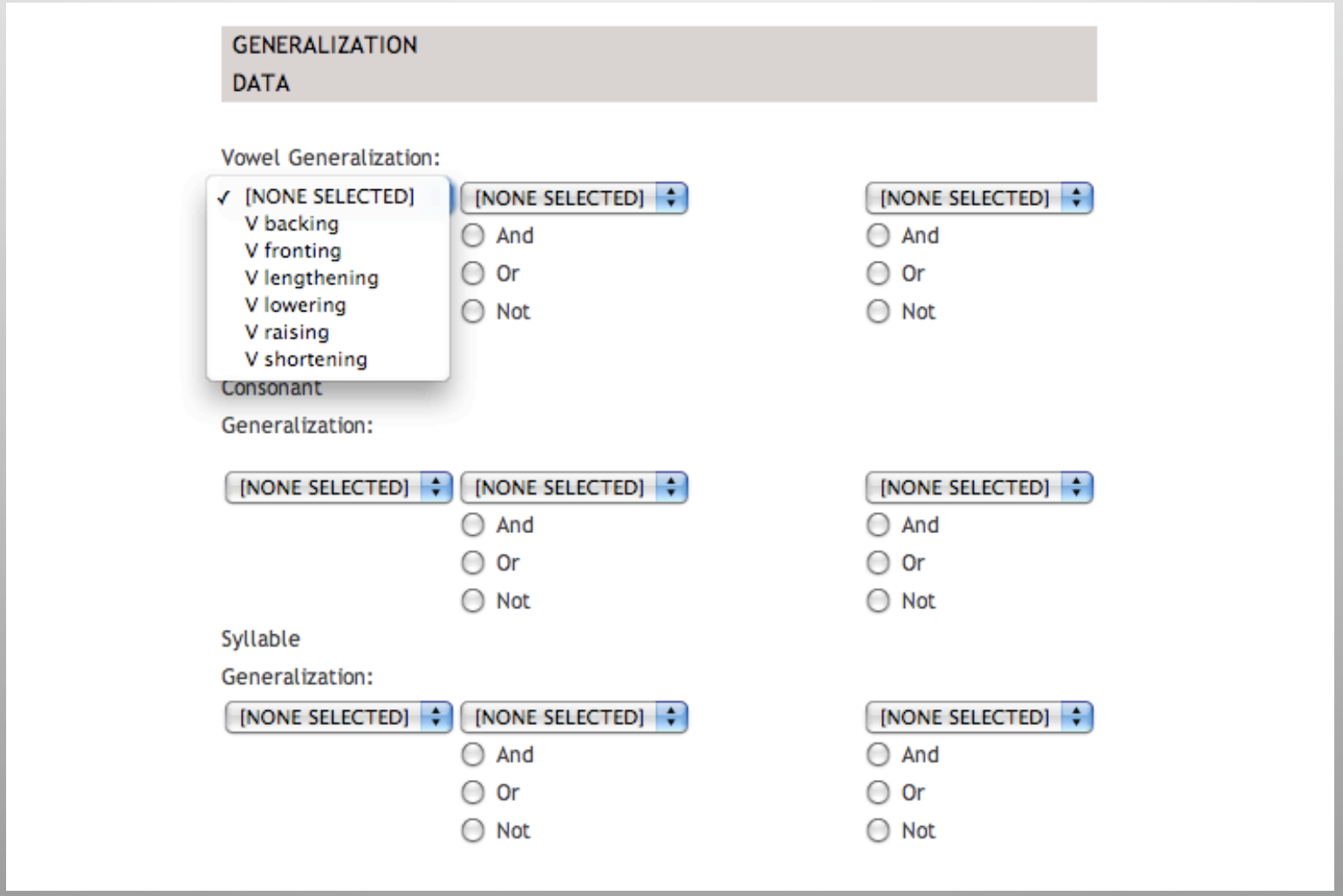
stop to fricative	3
final obstruent devoicing	11
ʃ to s	1
stop to fricative final obstruent devoicing	1
θ to stop	2

Target	Source	Rules
english 1	vietnamese 7	
pʰl̥iːz	pəliz	
kʰɑlʸ	kʰɑ	
	s̪	
stɛlə	stɪlə	
æskəˑ	æs	
	hə	
ɾə	tə	
bm̃ŋ	pm̃n̪	
ðiːz	d̪ɪs	**final obstruent devoicing**
θĩŋz	t̪ĩŋ gs	**θ to stop final obstruent devoicing**
wɪθəˑ	wɪt	**θ to stop**

Alignment Search

- Alignments are constructed automatically but are later verified by a linguist. These alignments are stored in an XML database which allows for searching of word and phoneme mappings.
- The search capabilities also allows for corpus counts of alignments. (e.g. how frequently word-final devoicing for Vietnamese speakers of English)

Search Example



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Steven H. Weinberger
Director, Program in Linguistics
George Mason University
Fairfax VA 22030

weinberg@gmu.edu

Stephen Kunath
Department of Linguistics
Georgetown University
Washington DC

sak68@georgetown.edu