

# Effects of Style and Gender on Fronting and Raising of /æ/, /e:/ and /ɛ/ before /g/ in Seattle English



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NWAV38 (October 2009)

National Science Foundation BCS#-0643374

## Motivation

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- 200<sup>th</sup> anniversary of introduction of non-indigenous speakers to the PNW (Pacific Northwestern United States)
- A dearth of information:
- reasons: (1) young region, (2) history of dialect contact (Carver 1987; Wolfram & Schilling-Estes, 1997)
  - Reed (1952, 1956, 1961, 1965, 1973) registers key divergences
  - persistent view (since 1950s) that PNW too young to exhibit unique features
  - like “southern Illinois and Iowa but not a mere extension of northern California”: e.g., (o) COT ~ (oh) CAUGHT, (u) ROOT, raising of (ae) HANG to [e] (Reed 1952:187)
  - note: (Gordon, 2004) does not note divergences
  - “considerable mixing of language patterns” (Labov, Ash and Boberg 2006)



## Motivation

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- *Phonological Atlas of North American English* (Labov, Ash and Boberg, 2006) includes 16 speakers from the PNW (UT, ID, WA, OR)
- “The third dialect” united by a single feature (Labov, 1991)
  - Arizona (Hall-Lew, to appear), California (Eckert, 2005; Moonwomon, 1987, 1991; Luthin, 1987; and, Hinton, *et. al.*, 1987), and Utah (diPaolo and Faber, 1990)
- 200 years may be sufficient time for dialect focusing (*vis-à-vis koineization*) to occur (Trudgill, 2005)



## Research Hypotheses

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### **RQI. What are the phonetic features of the vowel system of the English used in the PNW?**

Hyp 1a: all PNWE speakers' vowel systems have same basic distribution.

Hyp 1b: a predominating tendency for PNWE speakers to monophthongize /e:/ BAKE (Ingle, Wright and Wassink, 2005)

Hyp 1c: raising and fronting of pre-velar /æ/ BAG found. (No NCS pre-nasal tensing and raising)

### **RQII. Are there gender-related differences in front vowel production?**

Hyp II: Females show overlap only between /ɛ/ BEG and /e:/ BAKE

### **RQIII. Are there style-related differences in front vowel production?**

Hyp IIIa: Both Females & Males show separation of V categories in formal styles, with overlap increasing in less-scripted styles

Hyp IIIb: Where there is overlap, *trajectory differentiates the vowel classes*.

## Methods: The Database

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Main Study	This presentation	In Analysis Phase
Judgement & Random samples	Judgement sample	Random (telephone) sample
44 speakers	17 speakers (out of 30)	20
	<u>gender</u> : 12F, 5M	
	<u>3 age cohorts</u> : Gen1 (b.1900-1950) Gen 2 (b. 1951-1971) Gen 3 (b. 1976-1986)	
	<u>3 ethnicities</u> : Caucasian-Am, African-Am, Japanese-American	
	<u>4 Tasks</u> : (1) Word List (2) Interview (demographic) (3) Reading Passage (4) Experimental Tasks (e.g., Semantic Differentials) (5) Conversation]	

## Methods 2

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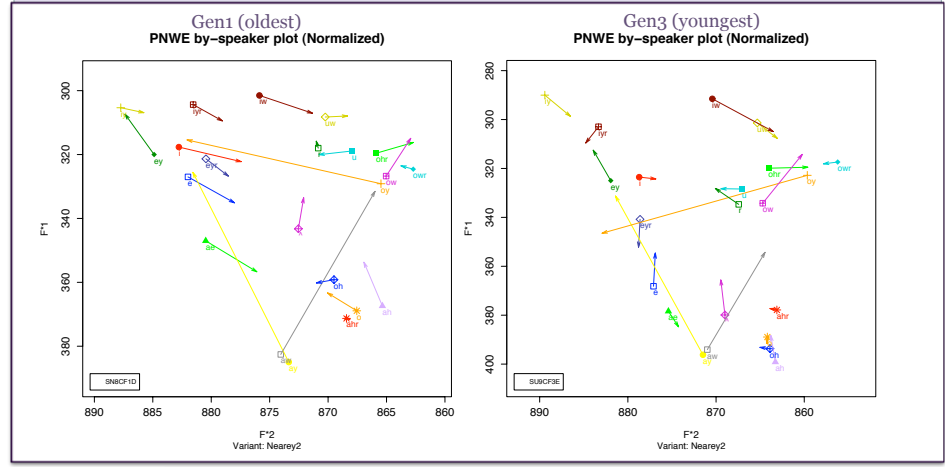
- Materials:
  - (iy) (i) (ey) (e) (ae) (aeh) (o) (ah) (oh) (ʌ) (u) (uw) (ay) (oy) (aw) (ow) [~550 tokens/speaker]
  - Rhotic classes (ihr) (r) (aer) (ohr) (uwr)
  - Particular focus on one subset of vowel system (3 historic classes: (æ) BAT,(e) BET,(e:) BAIT)
  - Velar contexts (aeG) BAG, (eG) BEG, (ey) BAKE
  - Word list h\_t\_h\_d in carrier "Write \_\_\_ today"
  - Additional phonetic contexts targeted for sociolinguistic analysis (patterns such as are associated with the Northern Cities, CA and Southern shifts)
- Recordings:
  - 1.5-3 hours each
  - peer conversation, followed by one-on-one interview
  - M-Audio Microtrack 24/96 Compact Flash Recorder (microphone: Audio Technica 3031)
  - 44kHz sampling rate (downsampled to 11.025kHz)
- Analysis:
  - Auditory & acoustic analysis
  - Measures and Timepoints: fo, F1-F3 and duration (onset, 20%, 50%, 80%, offset)
  - Signal analysis in Praat (customized Praat script, and Akustyk)
  - Uniform Scaling normalization (Nearey, 1977)
  - NORM for visualization of vowel trajectories
  - VOIS3D (Wassink, 1999; 2006) for 2-dimensional geometric assessment of vowel overlap (overlap fractions)
  - Euclidean distances (to represent vowel-inherent spectral change; from 20% to 80%) (Morrison & Nearey, 2007)
  - Appropriate inferential statistical tests (students' t-test; bivariate correlation)

Results

Hyp 1a: all PNWE speakers' vowel systems have same basic distribution.

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- Yes (general distribution)
- No. (o,oh) merged for all Young Female (but not older) M or F PNWE speakers

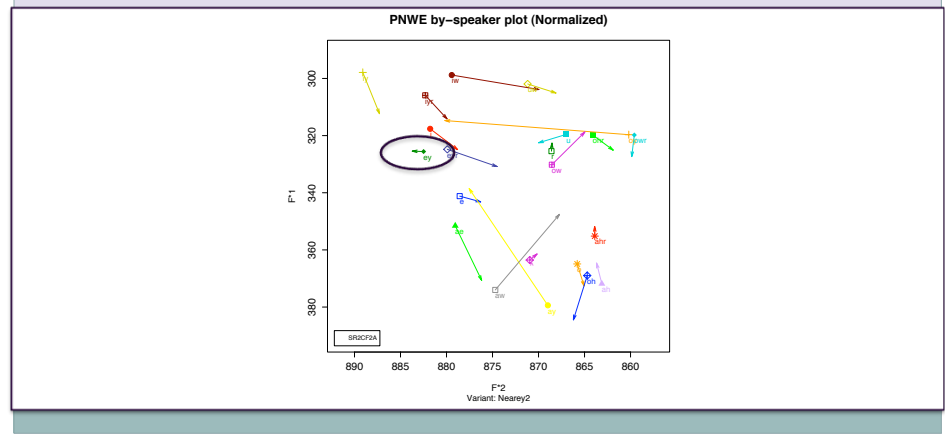


Results

Hyp 1b: a predominating tendency for PNWE speakers to monophthongize /e:/ BAKE

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- Yes. We find similar Euclidean distances for /e:/=221Hz and /e/=241Hz.
- Formant trajectory vectors are short in comparison to vectors of true diphthongs: /e:/:  $\Delta F1 = -1.8\text{Hz}$ ,  $\Delta F2 = 5\text{Hz}$ ; /aw/:  $\Delta F1 = -6.9\text{Hz}$ ,  $\Delta F2 = -24.1\text{Hz}$

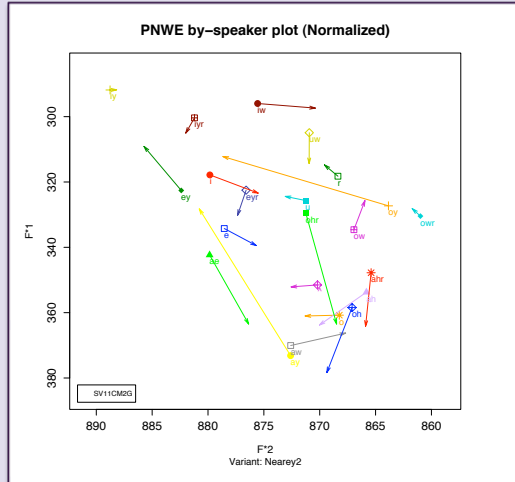


Results

Hyp 1c: raising and fronting of pre-velar /æ/ BAG found. (No NCS pre-nasal tensing and raising)

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- Yes. (ae) proximal to (e) (all contexts). A bivariate correlation on manner of articulation of following phone and F1 trajectory shows that  $\Delta F1$  for (aeN) is NOT significantly different from that of other (aeC). ( $F(3,971)=1.2$ ,  $p=.276$ , ns). This is a near-categorical pattern in the PNWE sample.

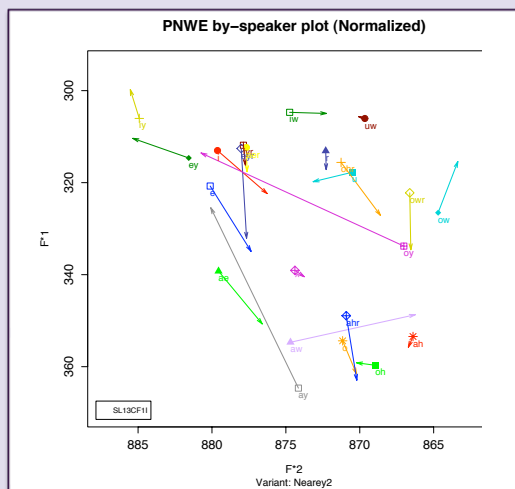


Results

Hyp II: Mainly females show overlap between /ε/ BEG and /e:/ BAKE

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- Yes (but only at midpoint). This pattern appears to be primarily associated with Gen1 female speakers. (Squizzero, 2009)
- However, trajectories appear to contribute to differentiation. Recall that these vectors are not truly diphthong-length. They do, however, proceed along the periphery in different directions.



## Measuring vowel overlap (VOIS3D)

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Normalized values (F1, F2, duration) are evaluated for overlap by the Spectral Overlap Assessment Metric (SOAM), and visualized using VOIS3D.

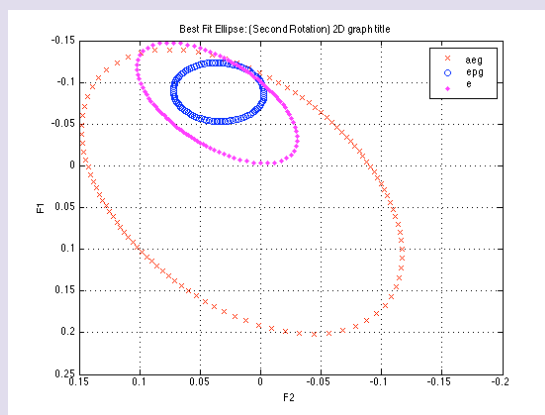
**Big idea:** Normalized scatter for two vowels distributions is modeled as two best-fit ellipses oriented at angles with respect to F1, F2 axes. The output of the metric is an *overlap fraction*. The overlap fraction represents the area of the region of overlap (the region shared by both best-fit ellipses).

**Procedure:**

- (1) Each observed vowel is plotted in a coordinate system where  $(x,y) = (\text{normF1}, \text{normF2})$
- (2) Center each vowel class' datapoints around its own origin.  $(0,0)$  is the center of each "system's" vowel space. Determine the geometric formula for each ellipse and define a principal axis for each.
- (3) Rotate each ellipse along its principal axis; determine the range of coordinates it occupies within its own 2D space.
- (4) Using area information, determine extent of overlap between areas of Vowel 1 & Vowel 2. The output of this procedure is referred to as the "**overlap fraction**", a real-number value between 0-100%. (Wassink 1999,2006)

## Some show spectral overlap between /æ/, /ε/ and /e:/ before /g/ centered around /e/ in Seattle English

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Males – Linguistic Tasks (Squizzero, 2009)  
 96 % Overlap across the three vowels  
 (BACON, BEG and BAG) in the 3<sup>rd</sup> most formal style (of five)

Results

Hyp IIIa: Both Females & Males show separation of V categories in formal styles, with overlap increasing in less-scripted styles.

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• In the casual styles, both males and females show a greater tendency to overlap vowel categories (at 20% , 50% and 80% in pairwise comparisons) than in formal styles.


Style:	(eG) BEG v. (æG) BAG			(eG) BEG vs (eyG) BACON			(eyG) BACON v. (æG) BAG		
	Formal	Casual		Formal	Casual		Formal	Casual	
	WL	LX	DEM	WL	LX	DEM	WL	LX	DEM
Female overlap fraction	97%	95%	99%	86%	73%	36%	9%	93%	31%
Male overlap fraction	75%	100%	94% <sup>1</sup>	33%	98%	100%	10%	91%	100%

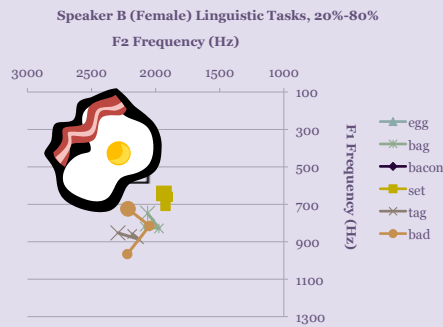
<sup>1</sup> Insufficient pre-velar tokens volunteered. All following phonetic environments were included (eC).

Summary

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• In the Pacific Northwest,

 BACON (eyg) and EGGS (eg) have merged



## Summary

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### • In the Pacific Northwest,



•BACON (eyg) and EGGS (eg) have merged

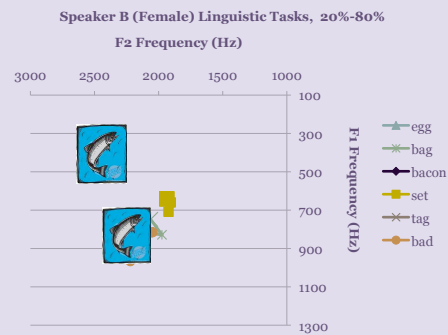


•BAG...er...SALMON-class words are jumping (from [æ] to [eɪ])



•Overlap increases the more casual the speech

•Females seem to prefer (merging) BACON and EGGS; males prefer EGGS and SALMON.



## Acknowledgements

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- National Science Foundation BCS#-0643374
- University of Washington, Special Collections Libraries





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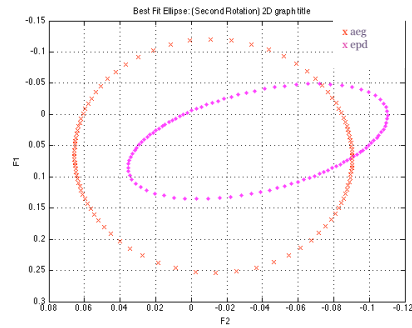
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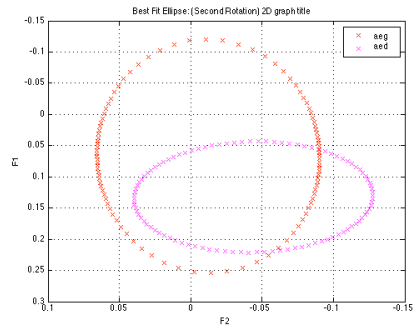
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## Males – All Styles

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93% Overlap



81% Overlap

/æ/ takes up the area of /æD/ and /ɛD/