

Acoustic analysis of California vowels

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Introduction

Two characteristics of the California vowel space:

- . The short vowels (KIT, DRESS, TRAP, LOT)
- . The vowel /oʊ/ (GOAT)

Background

California English (Labov et al 2006, Wells 1981):

- . LOT-THOUGHT merger (low back merger)
- . advanced /uʷ/ (GOOSE) → [ɨʊ]
- . **conservative /ow/ (GOAT)**
- . **conservative re: Canadian Shift**

Innovations

(Eckert 2004, Hinton et al 1987, Gordon 2006, Luthin 1987)

The California Shift:

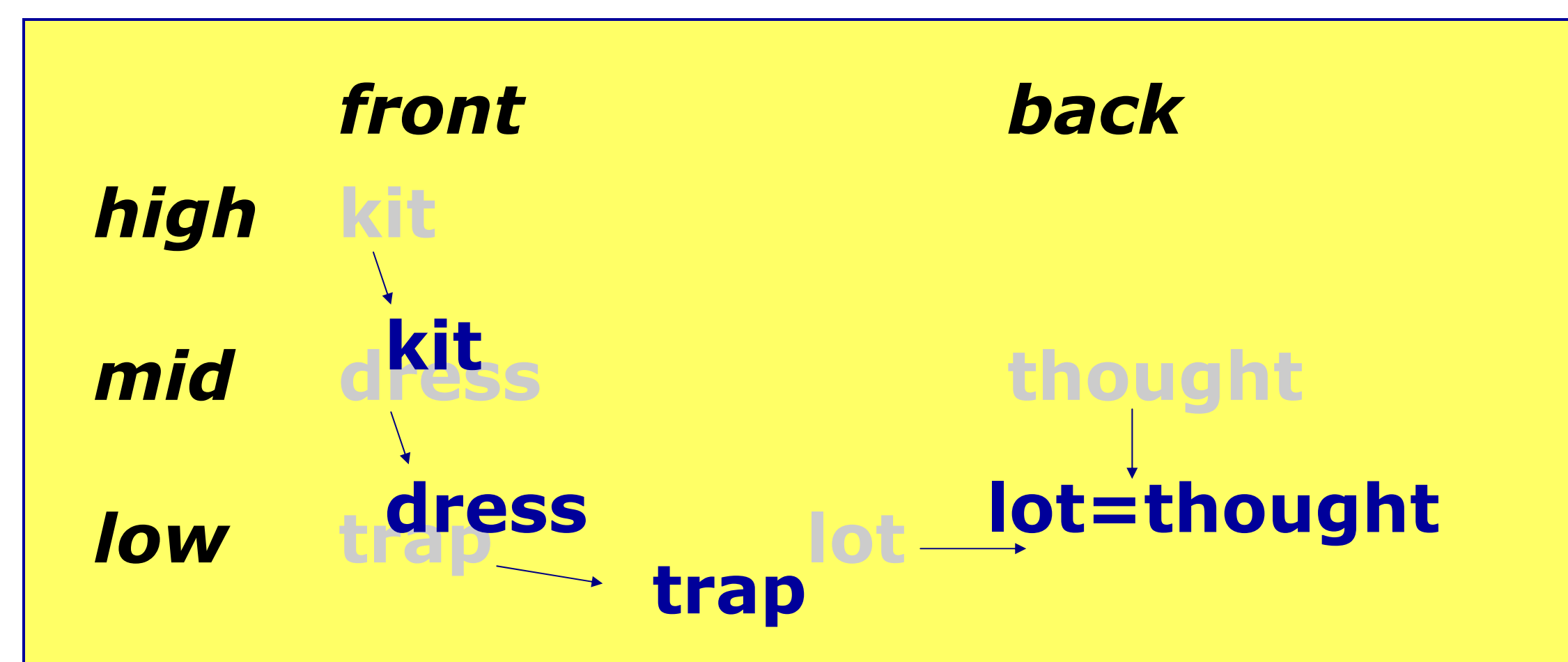
A pull-chain, parallel to Canadian Shift (Boberg 2008)

- . merger of LOT-THOUGHT vowel (i.e. a ; /o/ in ANAE)
- . retraction of LOT-THOUGHT to [ɑ].
- . retraction of TRAP (i.e. æ, /a/ in ANAE)
- . lowering of DRESS (i.e. /eh/)

/ow/ fronting

- . Central nucleus for GOAT, i.e. /ow/ → [ʌʊ]

Figure 1
California
shift



Previous phonetic research

(Hagiwara 1997, 2005; Ladefoged 2001)

- . lowering of KIT, DRESS, TRAP relative to long vowels
- . F2: analog of vowel frontness
- . F1: inverse analog of height

Symbol key:

	KIT	DRESS	TRAP	LOT	THOUGHT	GOAT	FLEECE	FACE	GOOSE
Wells	i	e	æ	o	oh	ow	iy	ey	uw
ANAE	i	e	æ	o	oh	ow	iy	ey	uw
Us	ih	eh	ae	a	a	ow	iy	ey	uw

Hypotheses

California shift = Canadian Shift

Canadian Shift, quantitatively (Labov et al. 2006):

- . F1 of DRESS greater than 650 Hz
- . F2 of TRAP less than 1825 Hz
- . F2 of LOT less than 1275 Hz

California /ow/ fronting

- . F2 of GOAT greater than 1278 Hz

Method

Procedure

- subjects: 13 adult California English speakers
snowball sample
- items: **KIT, DRESS, TRAP, LOT, GOAT**
FLEECE, FACE, GOOSE
- elicitation: survey (Labov et al 2006)
Rainbow passage (Fairbanks 1960)
headphones w/ ambient noise
interview

Measurement

Formants

- . Spectrograms obtained in Praat
- . F1, F2 measured at 1st quarter of vowel duration
- . between offset and onset of surrounding transitions

Normalization

- . log-mean normalization (Nearey 1978)

Plotting

- . averages of normalized vowels within subjects

Analysis

Overall

Two-way ANOVA:

- . F1 and F2 differ significantly across 8 vowels
- . F1: $F(7, 519) = 355.9, p > 0.0001$
- . F2: $F(7, 519) = 311.58, p > 0.0001$

Tukey post-hoc test:

- . all vowels differ significantly in both dimensions *except*:
- . F1 for **KIT** and **FACE**
- . F2 for **GOOSE** and **TRAP**
- . F2 for **GOOSE** and **DRESS**

Results

The California Shift

relative space:

- . **KIT DRESS TRAP LOT** different in both F1 and F2
- . **KIT** no higher than **FACE**

absolute space:

- . F1 of **DRESS** greater than 650 Hz (lowered)
- . F2 of **TRAP** less than 1825 Hz (retracted, for almost all)
- . F2 of **LOT** less than 1275 Hz (retracted, **only for some**)

/ow/ fronting

relative space:

- . **GOAT** fronter (higher F2) than **LOT**

absolute space:

- . Some subjects: F2 of **GOAT** >1278 (advanced)

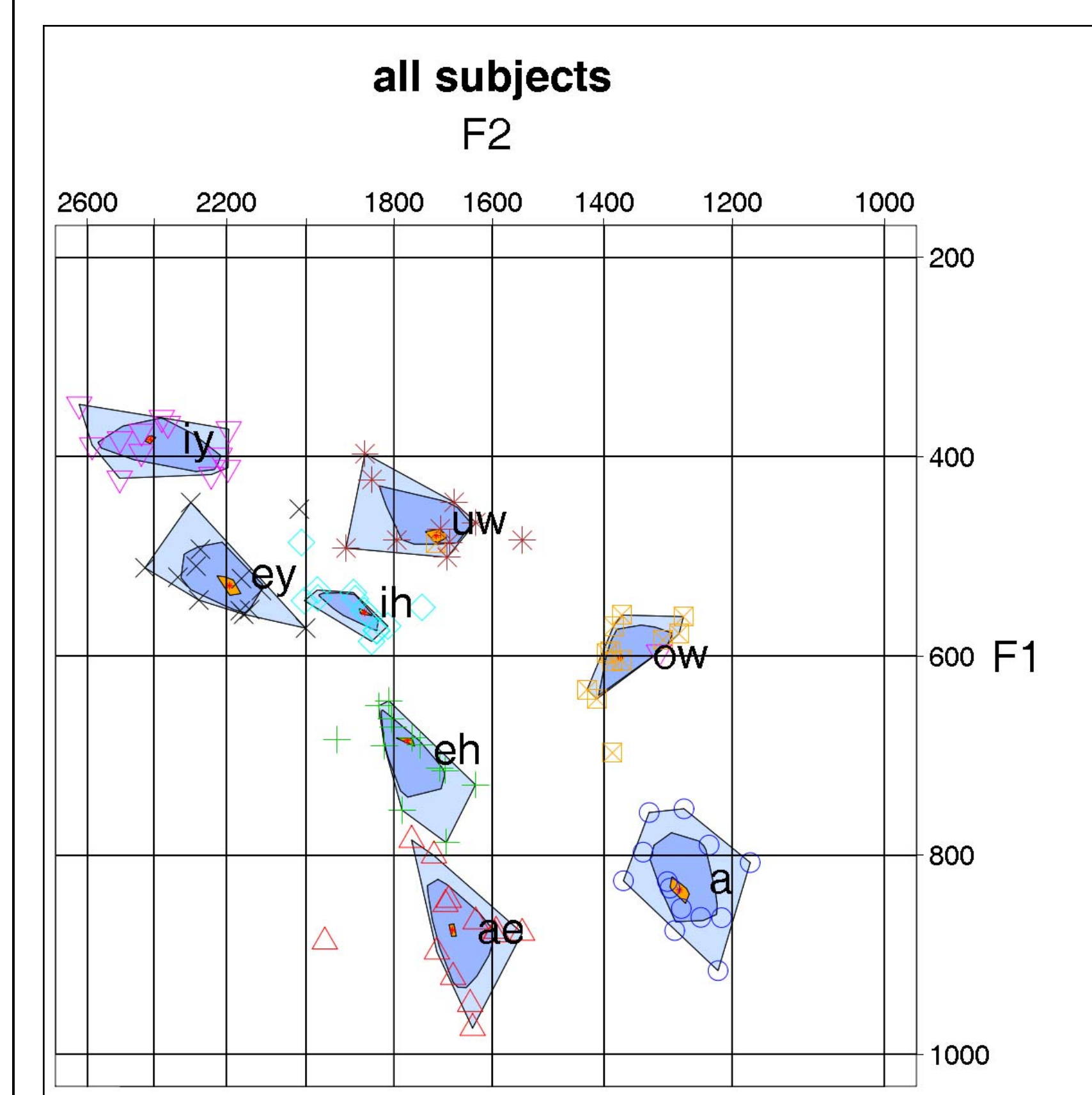


Figure 2: Normalized F1-F2 plots. Each point is a subject's average for that vowel.

- . **iy** = FLEECE = [i:]
- . **uw** = GOOSE = [ɨʊ]
- . **ey** = FACE = [eɪ]
- . **ih** = KIT = [ɛ]
- . **ow** = GOAT = [ʌʊ]
- . **eh** = DRESS = [æ]
- . **ae** = TRAP = [æ ~ a]
- . **a** = LOT-THOUGHT = [a ~ ɑ]

Summary

Quantitative results

- . reflect Eckert (2004), Gordon (2006)
- . **KIT DRESS TRAP**: meet ANAE benchmarks for Canadian Shift, but **LOT** does not quite

Relative F1, F2 of short vowels

- . matches Hagiwara (2005), Ladefoged (2001)
- . **KIT DRESS TRAP LOT**: clearly chain-shifted

F2 of GOAT: centralized nucleus

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