24.910 Topics in Linguistic Theory: Laboratory Phonology
Spring 2007

Phonetics and phonology of accent variation

Accents and Dialects

Dialects of English can differ in all aspects of grammar

- Lexicon
  - soda, coke, pop
- Syntax
  - I might do   vs.   I might
  - The house needs painted   (W. PA, E. Ohio, Scots)
  - The house needs painting
- Phonology
- Phonetics

- 'Accent' refers to phonetics and phonology only.

Accents of English

Accents can differ in all aspects of phonology/phonetics

- Phoneme inventory - differences in the number and arrangement of phonemes.

- Phonological rules/phonotactics

- Phonetic realization - differences in the detailed realization of phonemes.

Differences in phoneme inventory

- Contrast /ɑ ɔ/, e.g. Inland North, Atlantic States
- Only /ɑ/, West, NE New England
  – Homophones: *cot-caught, Don-dawn, hock-hawk*
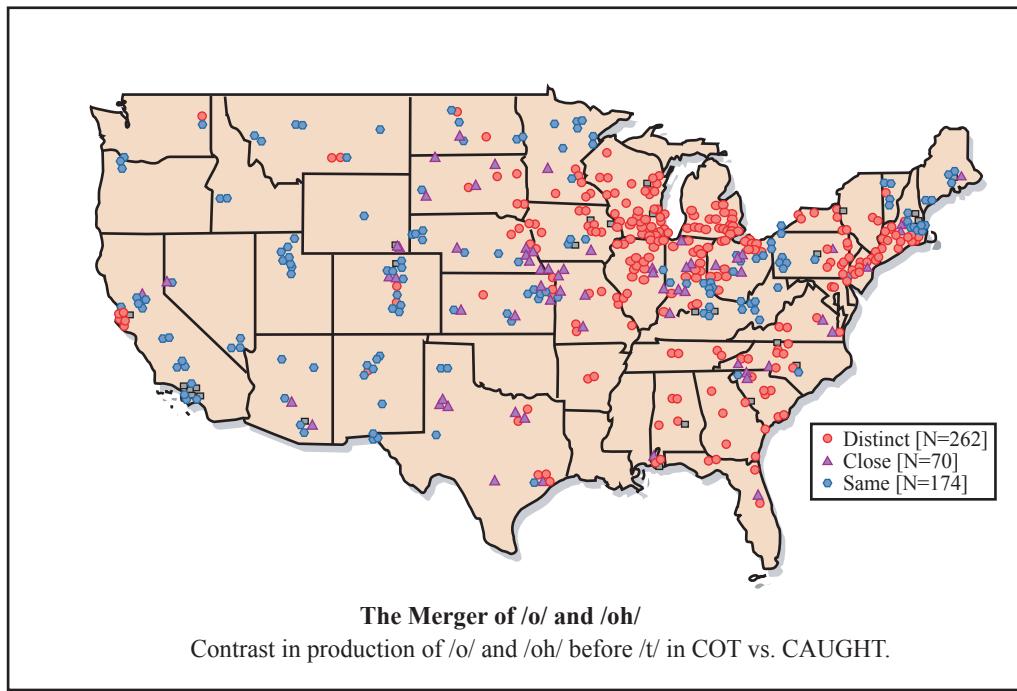
The Merger of /o/ and /oh/
Contrast in production of /o/ and /oh/ before /t/ in COT vs. CAUGHT.

Legend:
- Distinct [N=262]
- Close [N=70]
- Same [N=174]

Figure by MIT OpenCourseWare. Adapted from the Linguistics Laboratory of the University of Pennsylvania.

Differences in distribution of contrasts

- All accents contrast /ɪ, ɛ/.
- In some accents (e.g. South) this contrast is neutralized before nasals.

  pʰɪn   'pin, pen'
  hɪm   'him, hem'
  mɪni   'many, mini'
  lɪŋkθ   'length'

Differences in distribution of contrasts
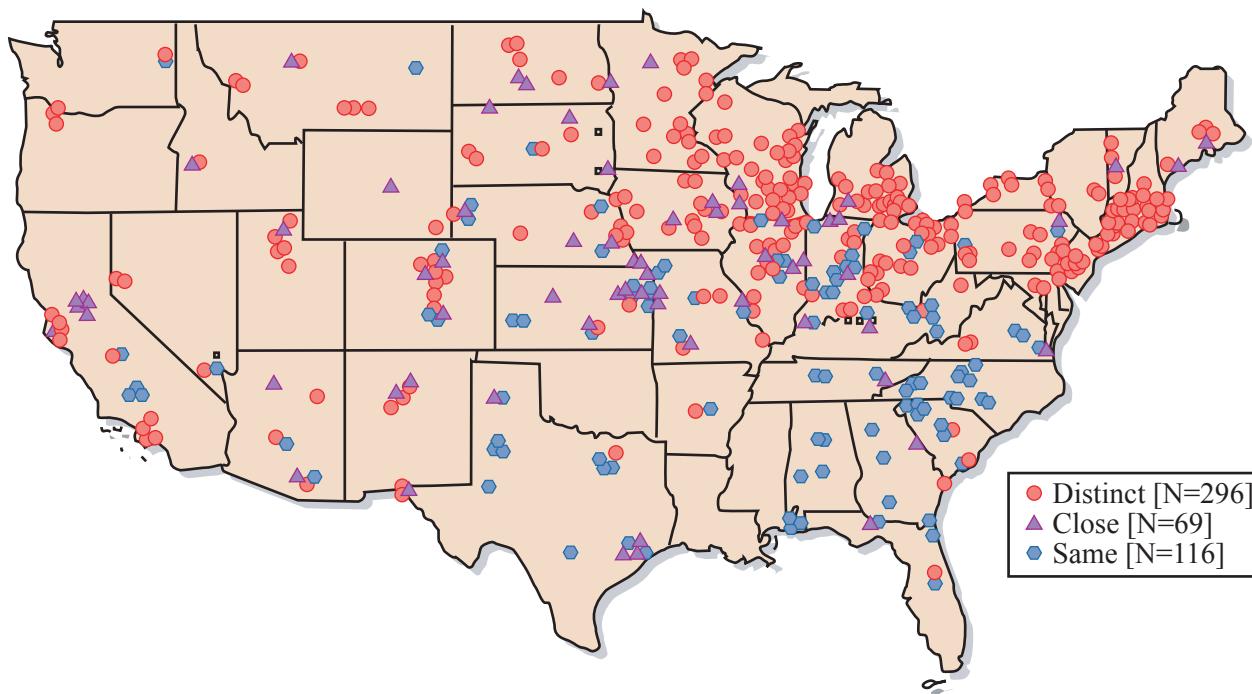
The PIN/PEN merger
Contrast in speech production of /l/ and /e/ before nasals in PIN and PEN, HIM and HEM.

Figure by MIT OpenCourseWare. Adapted from the Linguistics Laboratory of the University of Pennsylvania.

Differences in allophonic rules

- California English /æ/ → [ɪæ]/ _ [+nasal]

  had   stand

[Audio clip removed due to copyright restrictions]

Listen:
http://www.stanford.edu/~eckert/sounds/stand.wav
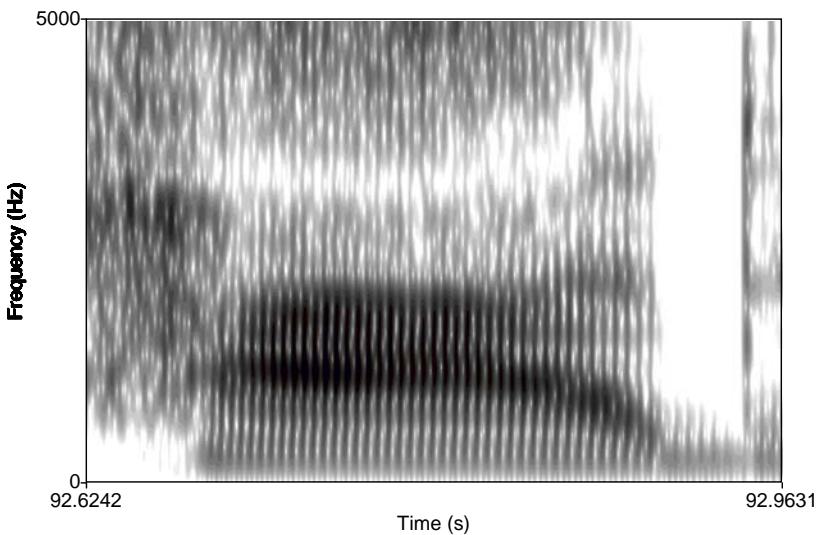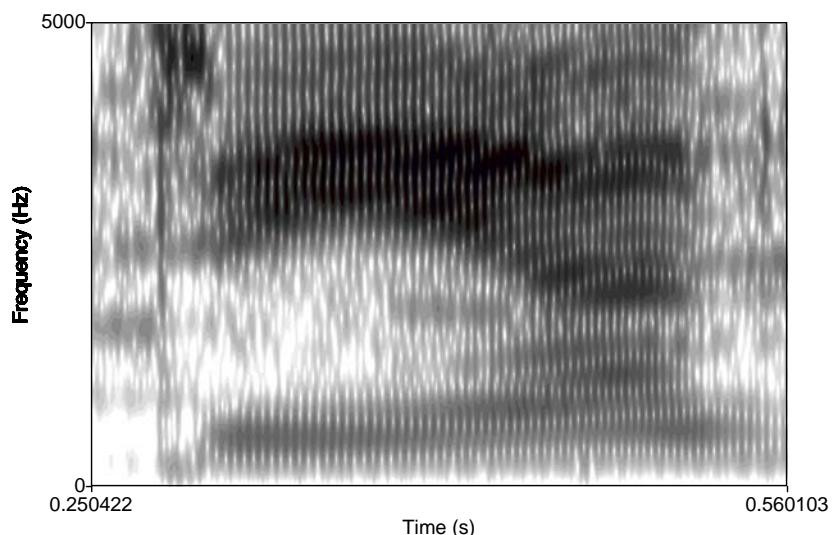
Differences in realizations of phonemes
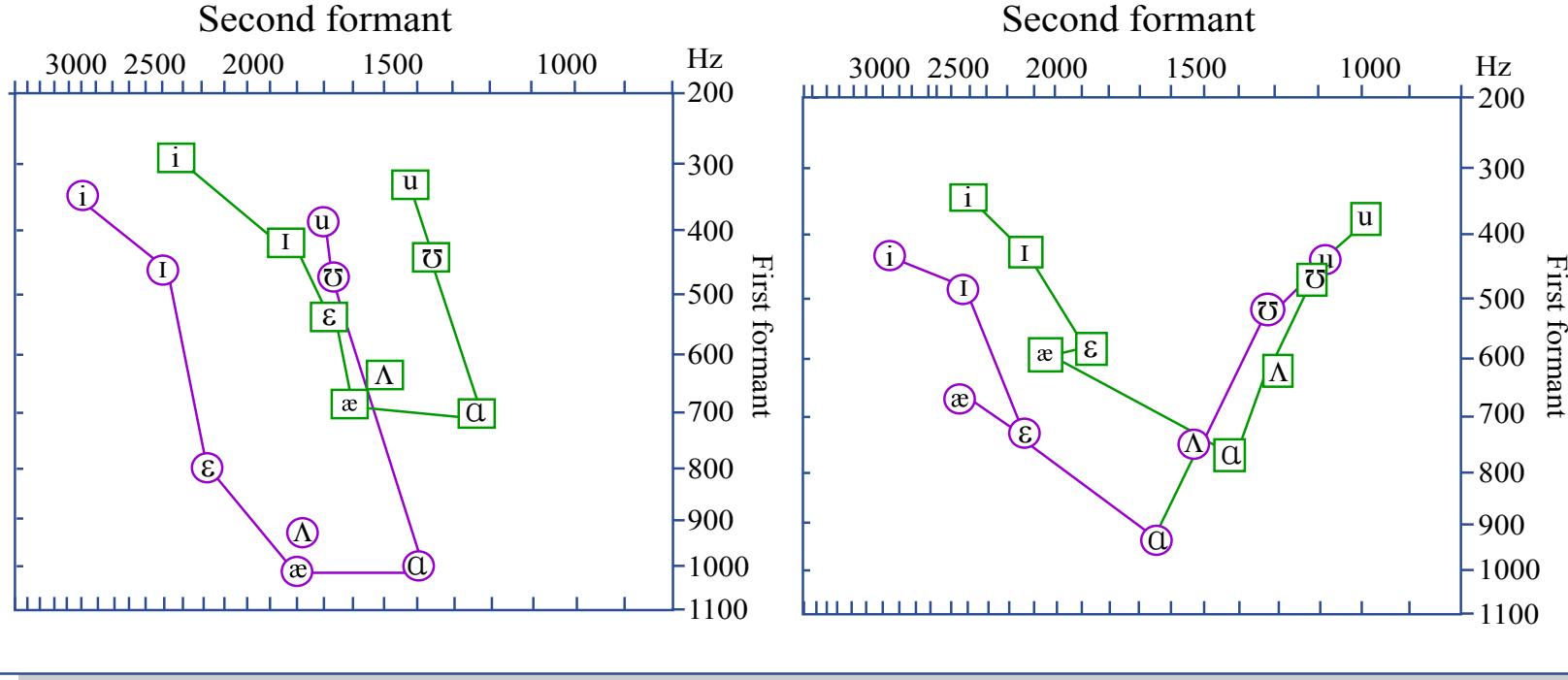
Figures by MIT OpenCourseWare.

- Californian speakers (M open, F closed) (Hagiwara 1997).

- /ʉ/ [Listen: http://www.stanford.edu/~eckert/sounds/move.wav]

- /ʌ/ [Audio clip removed due to copyright restrictions]

- N. Midwest speakers (M open, F closed) (Hillenbrand et al 1995).

- [ʌ₎] [Listen: http://www.stanford.edu/~eckert/sounds/fund.wav]

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Describing English Accents

- Northern /ʊ/ and California /ʉ/ are corresponding phonemes in the two accents because they generally occur in the same words.

  - where Northern has /ʊ/ Californian has /ʉ/.

- So a convenient way to refer to vowel phonemes in describing accents is in terms of the words in which they appear.

- Wells (1982) proposes a set of keywords for referring to classes of words that (generally) share a vowel phoneme, e.g.

  - KIT, DRESS, TRAP, LOT, STRUT, etc.

Describing English accents - an historical approach

- The 'keyword' approach works because of the approximate correctness of two assumptions:
    - All accents of English are descended from the same language via sound change.
    - Sound change is regular ('Neogrammarian') - exceptionless and phonetically conditioned.
- Labov takes an explicitly historical approach to description of accents.
    - accents are described in terms of changes from an 'initial position' - 'our best estimation of the common base for American English dialects which resulted from the mixing of various English dialects in the 16th and 17th centuries'

Some differences between English and US accents

- To a first approximation, the differences between English and US accents are the result of independent sound changes in one region or the other.

- E.g. a Southern English innovation: loss of post-vocalic /ɹ/

  stɑɹ   > stɑ   'star'

  fɔɹ   > fɔ   'for'

  stɑɹɪŋ > stɑɹɪŋ   'star'

  – ɹ > Ø / _ {C, #}

LOT-PALM merger

- A US innovation   ɒ > ɑ ː

R.P.	most US	
lɒt	lɑt	'lot'
pʰɑm	pʰɑm	'palm'
bɒðə	bɑðə˞	'bother'
fɑðə	bɑðə˞	'bother'

  /ɑ, ɒ/   /ɑ/

US innovation: j-deletion

R.P.	most US		RP/US		RP/US		RP/US	
tʰjun	tʰun	'tune'	tʰul	'tool'	pjuni	'puny'	kjut	'cute'
dju	du	'dew'	du	'do'	bjuti	'beauty'	hju	'hue'
sjut	sut	'suit'	sun	'soon'	fju	'few'		
zjus	zus	'Zeus'	zu	'zoo'	vju	'view'		
njuz	nuz	'news'	nus	'noose	mjuz	'muse'		

- j > Ø / [+coronal] _
- ˈvaljəm, ˈʌnjən
- synchronic process also.

j-deletion

- Actually deletion of [j] started earlier, applying in some environments in both English and US accents:

  – ɪʊ > ju

  – j > Ø / palato-alveolars, Cl, ɹ _ (or ɪʊ > u)

17thC	Most modern	
tʃɹuz	tʃuz	'chews'
tʃuz	tʃuz	'choose'
θɹɪu	θɹu	'threw'
θɹu	θɹu	'through'
flɪu	flu	'flew'
flu	flu	'through'

- In many English accents j-deletion has since applied after [l], *e.g. lewd*

An irregular sound change

- Regular sound change applies to all words that contain the relevant sound in the relevant context.

- Some sound changes appear to apply to a subset of words giving rise to complicated differences in lexical distribution.

- US/UK Englishes both have /æ, ɑ/ but in different words

  - *staff, bath, pass, grasp*

  - *dance, answer, demand, grant, example*

  - UK: æ > ɑ/ _ voiceless fricative, NC

  - but: *gas, asp, passage, chaff, (plastic),…*

  - but: *romance, hand, band, ant, ample,…*

Regional Accents in the USA

- Traditional dialectology divides the USA into four major dialect areas based primarily on vocabulary (soda vs. pop, etc)
  - North, Midlands, South, West
- Labov and colleagues (2006) have divided the USA into similar areas based purely in pronunciation
  - Areas are grouped by distinctive combinations of shared sound changes - often sound changes in progress.

Labov et al (1997)

The North
North Central: Conservative long high and mid vowels
☐ F2 of checked /ow/ < 1100 Hz
The Inland North: The Northern Cities Shift
⬡ F2 of /e/ - F2 of /o/ < 375 Hz
Boston and E.N.E.: /r/ vocalization and low back merger
▲ /o/ = /oh/, vocalization of postvocalic /r/
New York City: /I/ vocalization and raising of /Qh/, /oh/

The Midland and the West
The North Midland: Approximates the initial position
• Absence of any marked features on Map 1
    Pittsburgh: localized monophthongization of /aw/
    ▼ /o/ = /oh/, /aw/ ⟶ [a:]
    St. Louis: Localized merger of /ahr/ and /ohr/
    △ Distance of /ohr/ from /ahr/ < 125
The South Midland: fronting of checked /ow/
★ F2 of /ow/ > 1350 Hz
    Philadelphia: Northernmost extension of Southern Shift
    ● Distance of /o/ from /oh/ > 400. F2 of checked /ow/ > 1275 Hz
The West: The low back merger and fronting of /uw/
● /o/ = /oh/ before /t/: F2 of /uw/ > 1850 Hz

The South
The South: The Southern Shift
✕ Monophthongization of /ay/
The Coastal Southeast: Charleston and Savannah
retention of tense high and mid long vowels
✳ F2 of checked /ey/ > 2050 Hz

The urban dialect areas of the United States based on the
acoustic analysis of the vowel systems of 240 Telsur informants

Figure by MIT OpenCourseWare. Adapted from the Linguistics Laboratory of the University of Pennsylvania.

The West

The West is primarily characterized by a combination of two developments:

- *Cot-caught* merger: /ɑ/, no /ɔ/

  - Spreading East through the midlands.

- Fronting of GOOSE vowel to [ʉ] (similar change in the South and elsewhere. Not in North)
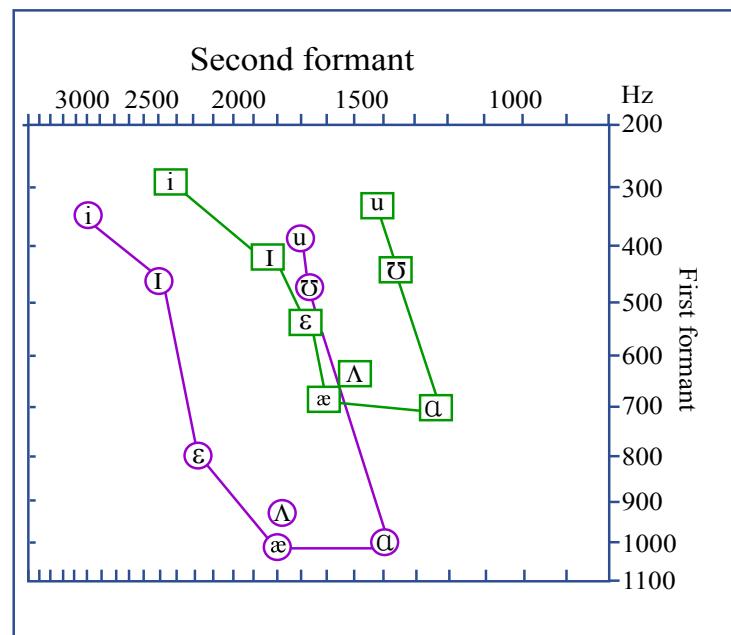
Figure by MIT OpenCourseWare.

The North

- Generally retains 'conservative' long /i, eɪ, u, oʊ/

- Inland North characterized by a **chain shift**, primarily involving historically lax vowels - Northern Cities Shift.

  – Change in progress, most advanced in major cities (Buffalo, Rochester, Cleveland, Detroit, Chicago, Madison etc).
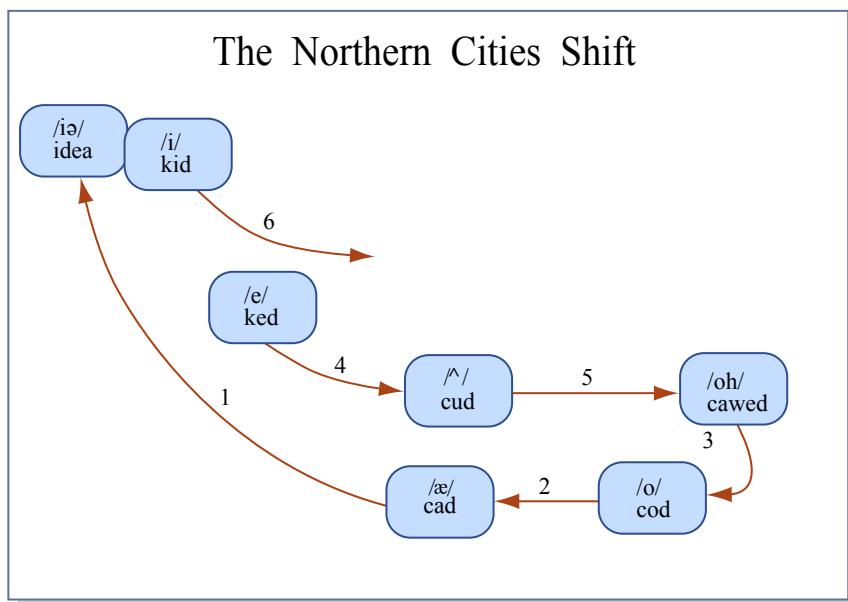
Figure by MIT OpenCourseWare.
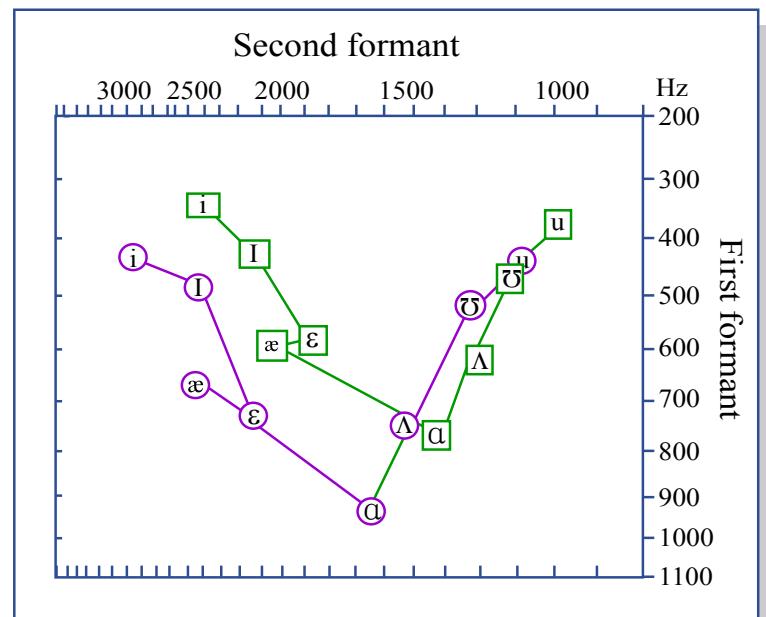
Figure by MIT OpenCourseWare.

Northern Cities Shift

- Chain shift: a series of connected sound changes. Can result in wholesale rotations of portions of the vowel system.

- Earliest stages:
  - fronting of LOT/PALM ɑ > a
    Buffalo   Chicago   Kenosha
  - 'tensing' of TRAP æ > eæ/ɪɛ
    Buffalo   Chicago   Detroit
- Less advanced:
  - THOUGHT lowering/unrounding
    - ɔ > ɑ
      Rochester
  - STRUT/ʌ/ backing   Detroit
  - HEAD/ɛ/ backing   Detroit

The Northern Cities Shift

/iə/ idea   /i/ kid

/e/ ked

/ʌ/ cud   /oh/ cawed

/æ/ cad   /o/ cod

6
4
5
3
2
1
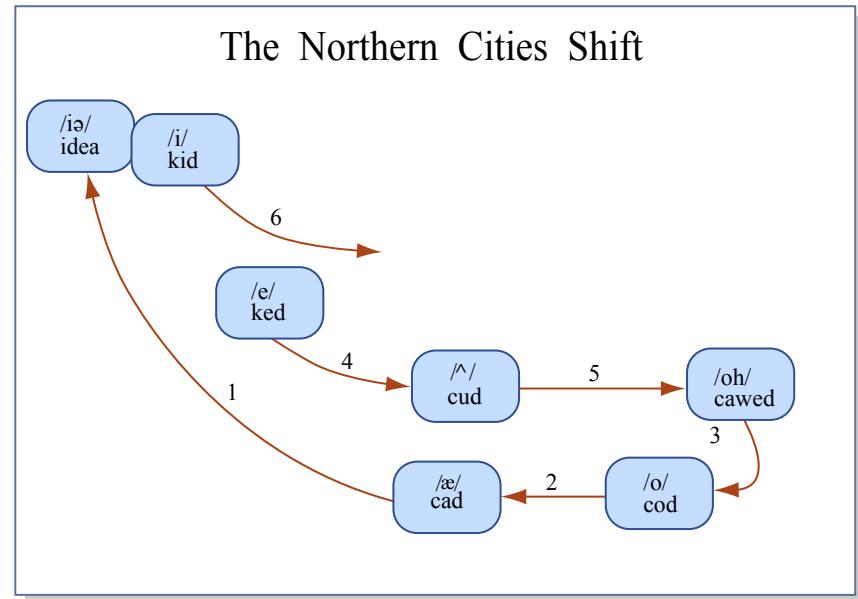
Figure by MIT OpenCourseWare.

The North

- Much of the North is also characterized by 'Canadian Raising'
- Usually written: /aɪ/ → ʌɪ /_ [-voice]
                        /aʊ/ → ʌʊ/_ [-voice]

Listen to sound files <u>here</u>
- "knife, knives"
- "lout, loud"

The South

- The South is characterized by another series of vowel shifts,
  - referred to as 'the Southern Shift', but it's not clear to me why all the changes should be regarded as part of a single 'chain'.


The Northern Cities Shift
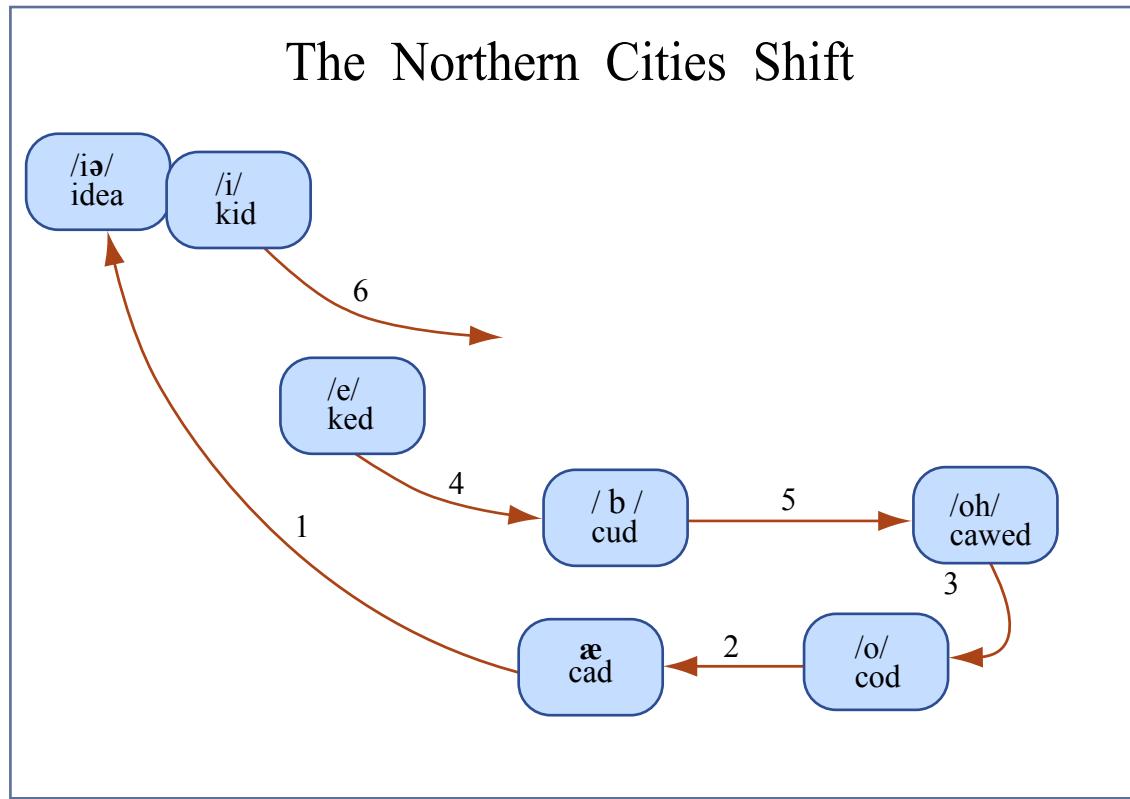
Figure by MIT OpenCourseware.

The South

- One of the oldest Southern developments is PRICE monophthongization
  - aɪ > aː (/_[-voice])
- GOOSE /u/ fronting   Texas
- THOUGHT /ɔ/ raising/diphthongization   Texas
- GOAT /oʊ/ > [əʊ]   Texas
- Variably rhotic   Texas

Audio files removed due to copyright restrictions.

The Midlands

- Not very uniform. Primarily characterized by Labov as not participating in Northern Cities or Souther shifts.

- Some Southern features, e.g. unrounding of GOAT nucleus [əʊ].

- This is obviously a very broad characterization
    - many small areas have distinctive accents that do not fit this classification (New York City, Philadelphia, Eastern New England etc).
    - Does not incorporate cultural variation within regions, e.g. African American Vernacular English.

Eastern Massachusetts

- The 'Boston' accent.

- Non-rhotic

Listen:
11_car.wav
11_spa.wav
11_floor.wav

Eastern Massachusetts

- The 'Boston' accent.
- Non-rhotic

  Listen:
  11_car.wav
  11_spa.wav
  11_floor.wav

- Non-rhotic and variably rhotic accents are primarily found in E. New England, NYC, coastal plain of the South.
  - But these areas also contain pockets of continuous rhoticity.
- This patterns seems to have resulted because r-loss spread from Southern England along trade routes to major ports of the Eastern seaboard, and then to surrounding areas.
- Non-rhotic accents used to be locally prestigious, but have largely lost their prestige and are in retreat.

Eastern Massachusetts

- Post-vocalic /ɹ/ in many contexts is better thought of as vocalized ('de-rhotacized') rather than simply deleted.

- Many historical vowel-r sequences are now diphthongs.
  - floor [ɔa] (=/ɒa/?)   horse
  - hoarse [ʊə]
    - This contrast has been lost in many UK and US accents.
  - NEAR [iə]
  - SQUARE [eə]

Eastern Massachusetts

Some unusual features

- Neutralization of LOT/ɒ/-THOUGHT/ɔ/ to /ɒɑ/
  - Boston 🔊 cot 🔊 caught 🔊 hot 🔊

- PALM/ɑ/ remains distinct, but fronted /a/
  - car 🔊   spa 🔊

- Contrast between three front lax vowels before /ɹ/
  - *Mary-merry-marry*

Mary	ɪɛ eɛ (fairy, hairy vs. Carey)
merry	ɛ eɛ
marry	æ ɛæ (carry, Harold vs. marry, Barry)

Table by MIT OpenCourseWare.

Cross-dialect Communication

- Labov points out that advanced Northern Cities pronunciations could result in apparent word changes for speakers of other accents.
  - on > Ann > Ian
  - block > black
- Accent differences can lead to confusion, but we regular communicate across accents, and adapt quickly to new accents. How?
- Two experiments:
  - Evidence that we can take accent into account in interpreting vowels.
  - Evidence of a mechanism for rapid adaptation to new patterns of pronunciation.

Speaker normalization

- Dealing with dialect variation is conceptually similar to dealing with (within dialect) speaker variation, e.g. due to vocal tract size.
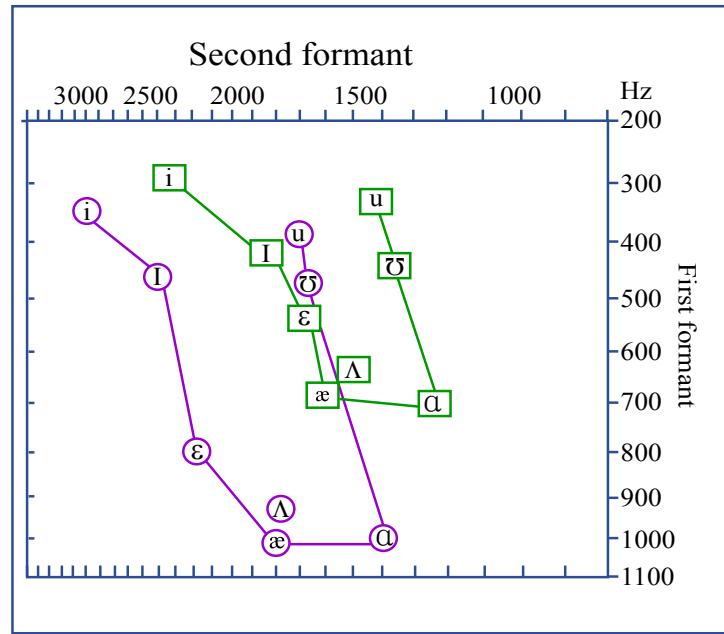

Figure by MIT OpenCourseWare.

- [Ladefoged/Broadbent](#)

Cross-dialect Communication

- Rakerd and Plichta (2003) adapted Ladefoged and Broadbent's experimental method to show that perception of vowels is influenced by dialect information in the preceding context.
- Synthetic [æ-ɑ] continuum (hat-hot, sack-sock)
- Speakers and subjects from Detroit and Michigan Upper Peninsula.
- Detroit accent is characterized by fronting of /ɑ/ and diphthongization of /æ/ (Northern Cities Shift).
- Synthetic words were placed at the end of carrier phrases from Detroit and UP speakers.

Cross-dialect speech perception

- For Detroit listeners identification of continuum shifted as a function of carrier phrase.

Detroit (LM) carrier   UP carrier

LM-LMP
UP-LMP
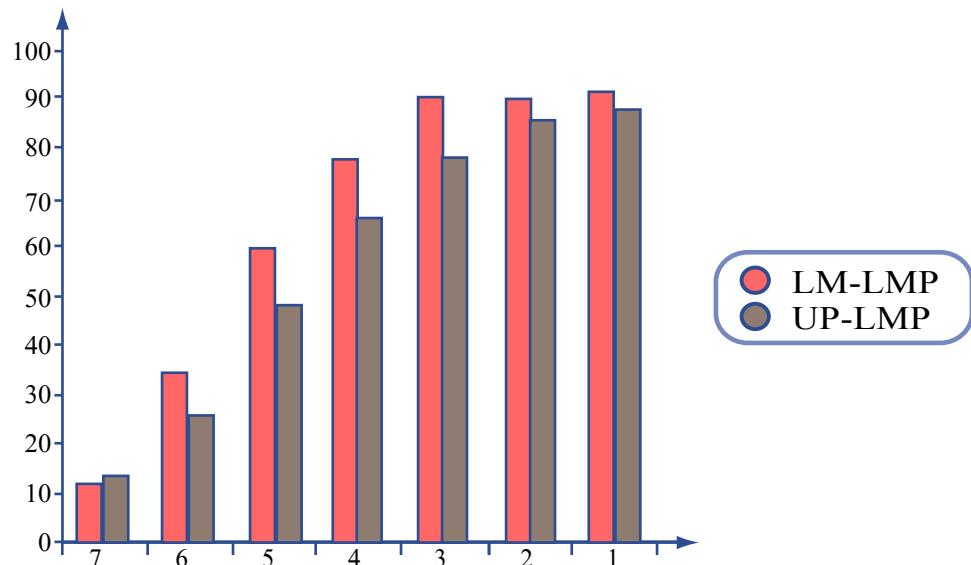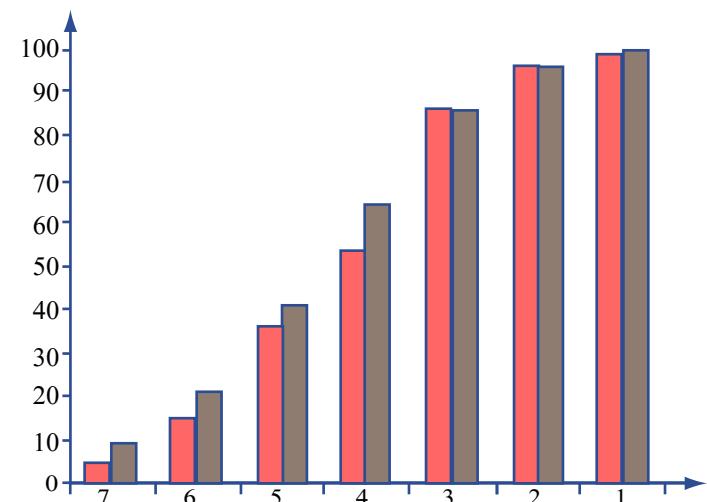
Figures by MIT OpenCourseWare.

Detroit (LM) carrier   UP carrier

Cross-dialect speech perception

- Evidence for 'accent normalization' is interesting because it cannot be achieved on the basis of the signal.

- For speaker-normalization, it has often been suggested that signals can be mapped onto a speaker-independent representation by a low-level transformation of the signal (e.g. formant ratios in place of formants).

- On the other hand, it has also been argued that speaker normalization requires that the signal be interpreted in relation to a model of the speaker that is constructed based on a variety of sources of information.

- Accent normalization fits into the second approach to normalization.

Norris, McQueen & Cutler (2003)

- Evidence for rapid adaptation to a new pattern of pronunciation.
- Lexical decision task in Dutch.
- Some words contain a final sound [?] that is ambiguous between [f] and [s], created by averaging [f] and [s] waveforms.
  - pretest to ensure ambiguity.
- Three conditions:
  1. Words are meaningful if [?] is interpreted as [s].
     - E.g [witlo?] - *witlof* 'chicory', *witlos* is not a word.
  2. Words are meaningful if [?] is interpreted as [f].
     - E.g [na:ldbo?] - *naaldbos* 'pine forest', *naaldbof* is not a word.
  3. Non-word if [?] is interpreted as either [f] or [s].
- Subjects in each condition hear 20 target words + the other 10 targets unedited + fillers.
- Subjects in (1) and (2) accepted edited words as corresponding word.

Norris, McQueen & Cutler (2003)

- After lexical decision task, subjects categorized stimuli from an [εf-εs] continuum (same speaker).
- Boundary differed depending on condition in part 1:
  1. [?] = [s], more stimuli categorized as [s].
  2. [?] = [f], more stimuli categorized as [f].
 3. Non-word group did not differ from (1) or (2).
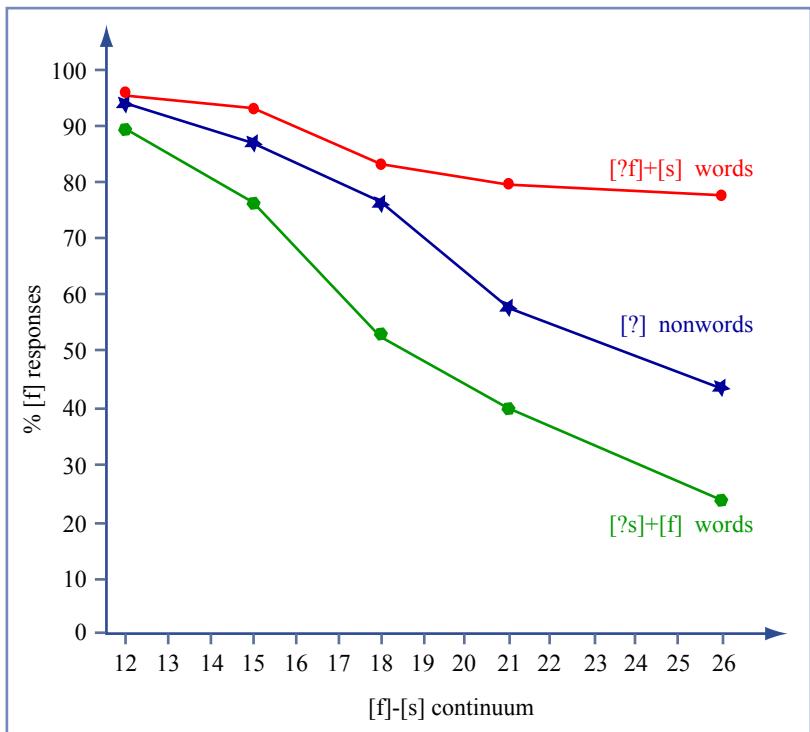
Figure by MIT OpenCourseWare.

Norris, McQueen & Cutler (2003)

- Interpretation: subjects have learned that speaker has an unusual /s/ or /f/ on the basis of hearing this rendition in 20 words.

- This knowledge affects perceptual boundary between /f/ and /s/ for that speaker.
  - i.e. subjects made a generalization about pronunciation of that sound.

- A follow-up study (Cutler et al 2005) followed the training phase with a cross-modal priming task (visual lexical decision following an auditory prime).
  - Priming effect of modified words depended upon the interpretation of [?] learned in the training phase.
  - Crucial words had not been heard in the training phase.

Adaptation to a new accent

- The Norris et al experiment shows that listeners are capable of rapid adaptation to a novel accent (novel in one respect).

- Presumably involves:
  - Ability to interpret ambiguous stimuli as words, given context.
  - Ability to generalize based on segments.
    - How broad is the generalization?
      - All s/f? Word-final s/f? Coda s/f? Word-final s/f after certain vowels?

- Value of decomposing words into segments: facilitates rapid generalization to new speakers
  - Given that variation tends to affect segments in context, rather than e.g. individual words. Cf. Regularity of sound change.