Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Using Speech Community Data as Phonological Evidence

Josef Fruehwald

University of Pennsylvania

September 16, 2011
Penn State, The Center for Language Science

Outline

Introduction   Phonology-Phonetic Interface   Identifying Phonological Processes   Conclusion

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Motivations

Phonological Context

"Classic" Evidence

- Alternations / Static Distributions.
- Drawn from introspection / Small number of informants.

LabPhon

- Experimental Measures (acoustic, articulatory, judgments).
- Drawn from standard pools of experimental subjects.
- Frequently expressing concerns about the validity of Classic phonological evidence.

Motivations
Sociolinguistic Context

Linguistic Theory

- Variable Rules
- Lexical Phonology (Guy, 1991a;b)
- Exemplar Theory (Bybee, 2002)

Variation Theory

- What is changing where, and how?
- What can influence variation?

Social Theory

- How does one construct and project their identity?

Motivations

Using Variation for Phonological Argument

Andries Coetzee

- $\sim$ Frequency biases in phonological variation, *NLLT* (w/ Shigeto Kawahara)
- $\sim$ The place of variation in phonological theory, *The Handbook of Phonological Theory. 2nd Edition* (w/ Joe Pater)
- $\sim$ ...

Ricardo Bermúdez-Otero

- $\sim$ Cycles and continua: on unidirectionality and gradualness in language change *Handbook on the history of English* (w/ Graeme Trousdale)
- 2007 Diachronic phonology *The Cambridge handbook of phonology*
- $\sim$ ...

Goals

- Identify how sociolinguistic data can be used for phonological theory building.

- Identify how sociolinguistic data can be used for identifying and specifying phonological phenomena.

- Identify the ways in which sociolinguistic data achieves these goals uniquely.

Data Sources

Philadelphia Corpus

Automatically extracted vowel measurements from 272 Philadelphia speakers interviewed between 1973 and 2010. Dates of birth ranging from 1888 to 1991.

Atlas of North American English

Acoustic vowel measurements from survey respondents in the Atlas of North American English.
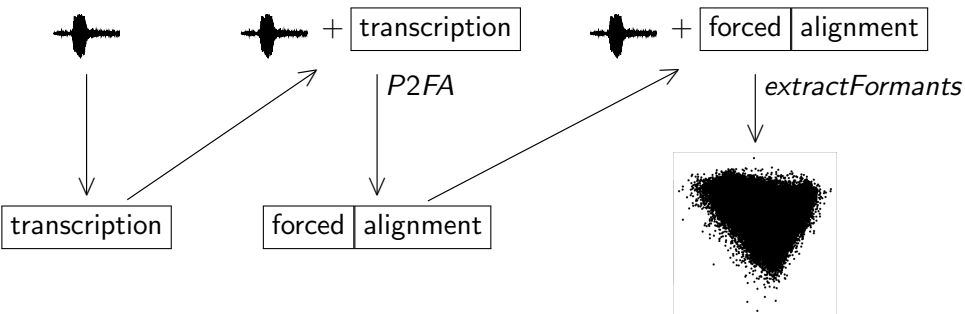
Sociolinguistic Literature

Various accounts of sound change in progress from the sociolinguistic literature.

Philadelphia Corpus
FAAV Project

Forced Alignment and Automatic Vowel analysis

Labov & Rosenfender (2011)
NSF# 921643

Outline

Introduction   Phonology-Phonetic Interface   Identifying Phonological Processes   Conclusion
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Phonology-Phonetic Interface

Options

- Universal Phonetic Implementation
- Langauge Specific Phonetic Implementation
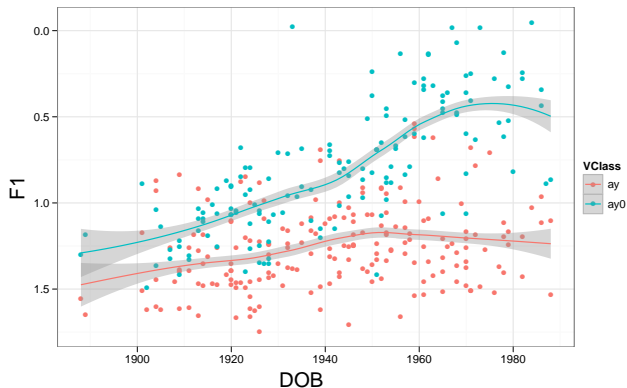- Exemplar Theory

Phonology-Phonetic Interface

Linking Hypothesis

All I have to work with is phonetic measurements, so settling on a
PH-interface model is crucial in order to make any connection to
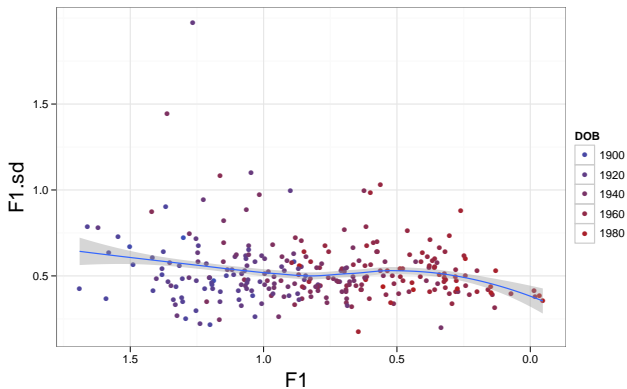phonological theory at all.

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Phonology-Phonetic Interface

Continuous Change

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Phonology-Phonetic Interface

Continuous Change

Phonology-Phonetic Interface

Options

- ~~Universal Phonetic Implementation~~
- Langauge Specific Phonetic Implementation
- Exemplar Theory

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Phonology-Phonetic Interface

Category Shifts

The parallel fronting of /uw/, /ow/ and /aw/ in North America,
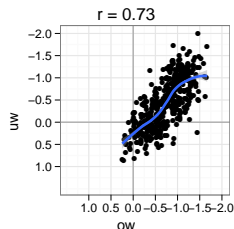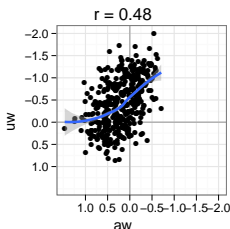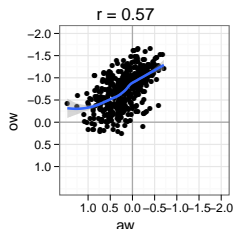
Labov, Ash & Boberg (2006)

Phonology-Phonetic Interface
Category Shifts

Canadian Shift

Boberg (2005)
Durian (2009)

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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

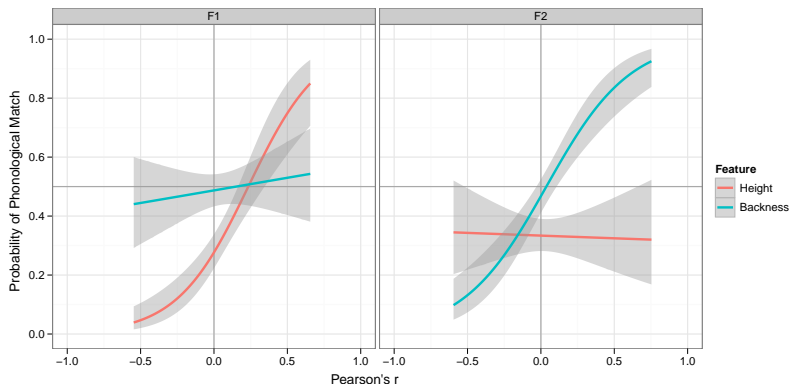# Phonology-Phonetic Interface
Category Correlation

Correlation of Philadelphia Vowels

- For the vowel means for each speaker, I calculated the correlations for every pairwise vowel comparison across speakers, once for F1, once for F2.

- For each pairwise comparison, I also coded for whether the two vowels also shared phonological specifications for height (3 degrees) or backness (2 degrees).
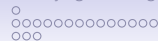
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Phonology-Phonetic Interface

Category Correlation

Phonology-Phonetic Interface
Category Correlation

Correlation of Philadelphia Vowels

- This result is suggestive that inter-speaker phonetic variation (due to change or any other reason) is relatable to phonological features, not just atomic phonemes.
- May also be used as a phonological diagnostic.
  - The above analysis categorized /ow/ and /uw/ as [−back], since they are undergoing a change of fronting.
  - What would it look like of they were categorized as [+back]?

Phonology-Phonetic Interface
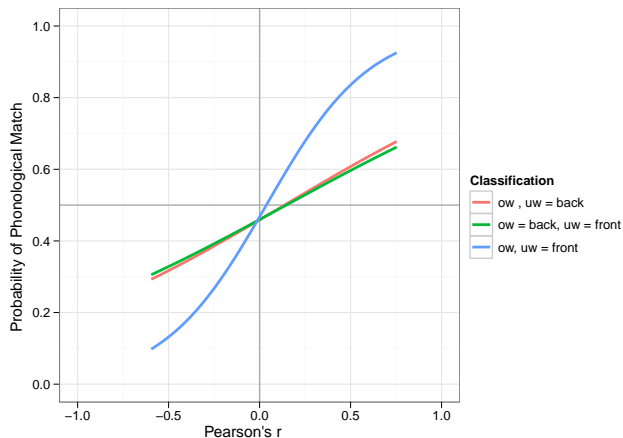
Category Correlation

Phonology-Phonetic Interface

Options

- ~~Universal Phonetic Implementation~~
- Langauge Specific Phonetic Implementation
- ~~Exemplar Theory~~

Phonology-Phonetic Interface

Phonology   uw → [+back]/___l

⟱

Language Specific Implementation   [+back] → 3 on F2

Kingston & Diehl, 1994; Boersma & Hamann, 2008

⟱

Phonetic Alignment   tũːn

Cohn, 1993; Zsiga, 2000

Phonology-Phonetic Interface

In phonetic change...

- The phonological representation remains stable (ish).
- The phonetic implementation of the phonological representation changes.

Outline

Identifying Phonological Processes

Follow

- Phonological Unity $\rightarrow$ Phonetic Unity
- ¬Phonetic Unity $\rightarrow$ ¬Phonological Unity

Don't follow (but likely)
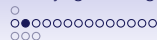
- * Phonetic Unity $\rightarrow$ Phonological Unity
- * ¬Phonological Unity $\rightarrow$ ¬Phonetic Unity

Philadelphia /ey/

Past description

- The peripheralization of /ey/ in non-word-final contexts was identified as a new and vigorous change in progress (Labov, 2001).
- The primary distinction that has been made is word final /ey/ versus other.
  - *pay* [pɛɪ]
  - *make* [mẹik]

Philadelphia /ey/

Past Description
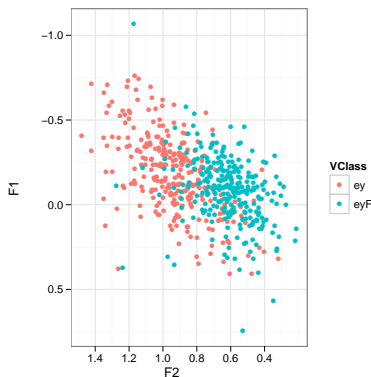
Questions

- Are any other syllabic structures relevant?
- Are there any other phonological effects?
- How does it interact with morphology? (i.e. How does *pays* behave?)

Philadelphia /ey/
Past Description
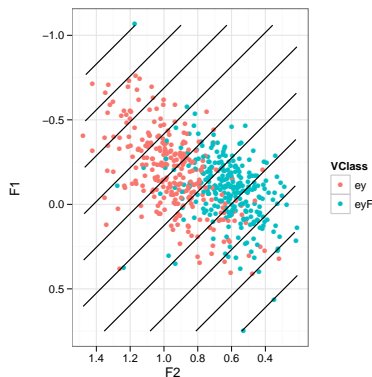
Questions

- Are any other syllabic structures relevant?
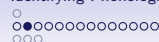- Are there any other phonological effects?
- How does it interact with morphology? (i.e. How does *pays* behave?)
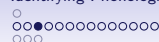
Philadelphia /ey/

Coding

- 4 syllable types
    1. Open
    2. Closed
    3. Final
    4. Hiatus
- Surface and "Underlying" Syllabification
- 5 Morphological Contexts
    1. Null *pay*
    2. Inflectional *pays*
    3. Derivational *payment*
    4. Compounding *paycheck*
    5. Contraction *they'd*

Philadelphia /ey/

		Underlying			
		Closed	Open	Hiatus	Final
	Closed	*came*	–	–	*days*
Surface	Open	*later*	*neighborhood*	–	*playground*
	Hiatus	–	–	*mayor*	*saying*
	Final	–	–	–	*they*

Introduction
○○○
○
○○

Phonology-Phonetic Interface
○○○
○○○○○○
○○○

Identifying Phonological Processes
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Conclusion

Philadelphia /ey/

Syllabic Context

First, only words with the same surface and "underlying" syllabification.

Introduction
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o
oo

Phonology-Phonetic Interface
ooo
oooooo
ooo

Identifying Phonological Processes
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ooooo●oooooo
ooo

Conclusion
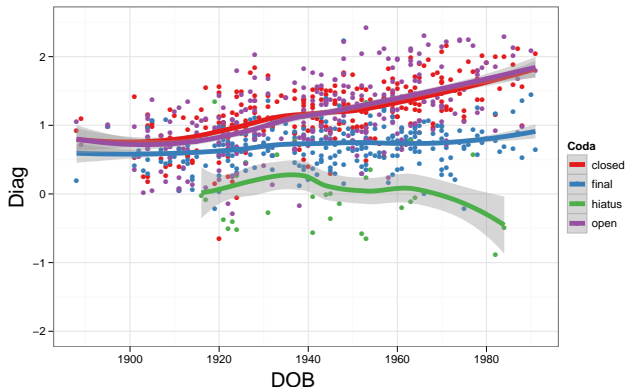
Philadelphia /ey/

Syllable Results

formula: `Diag ~ (DOB/10) * Syllable + (Syllable | Speaker)`

reference level: closed

	Estimate	t-value
Intercept	0.57	11.1
DOB	0.11	12.6
open	-0.14	-2.9
final	-0.04	-0.7
hiatus	-0.21	-0.6
DOB× open	0.02	2.9
DOB× final	-0.08	-9.1
DOB× hiatus	-0.16	-2.6

Slope Estimates

closed	0.11=0.11
open	0.13=(0.11 + 0.02)
final	0.03=(0.11 - 0.08)
hiatus	-0.05=(0.11 - 0.16)

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Phonology-Phonetic Interface
Segmental Context

Following segment for closed and open syllables.

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion
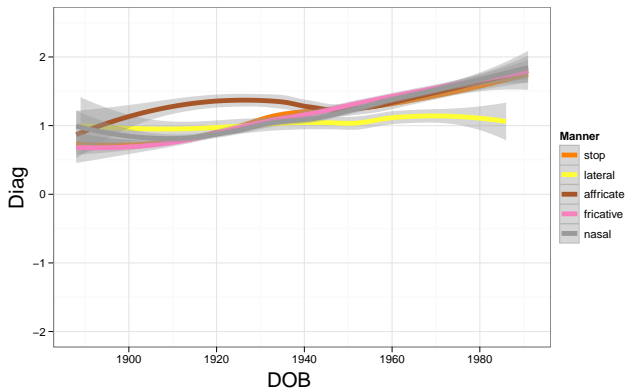
Philadelphia /ey/
Manner Results

formula: `Diag ~ (DOB/10) * Manner + (Manner | Speaker)`

reference level: stop

	Estimate	t-value
Intercept	0.56	10.9
DOB	0.11	13.2
fricative	-0.08	-1.3
nasal	-0.03	-0.5
lateral	0.38	2.8
DOB×fricative	0.02	1.5
DOB×nasal	0.00	0.2
DOB×lateral	-0.09	-3.8

Slope Estimates

stop	0.11=0.11
fricative	0.13=(0.11 + 0.02)
nasal	0.11=(0.11 + 0.00)
lateral	0.02=(0.11 - 0.09)

Philadelphia /ey/
Interim Description

Options

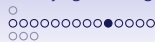| Non-undergoers	Undergoers
Word-final	Everything Else
Pre-hiatus	
Pre-/l/	

- Undergoers and Non-undergoers are phonemically distinct.

- There is an active phonological process which differentiates undergoes and non-undergoers.

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Philadelphia /ey/

Morphological Interaction

What effect does inflectional morphology have on otherwise word
final /ey/?
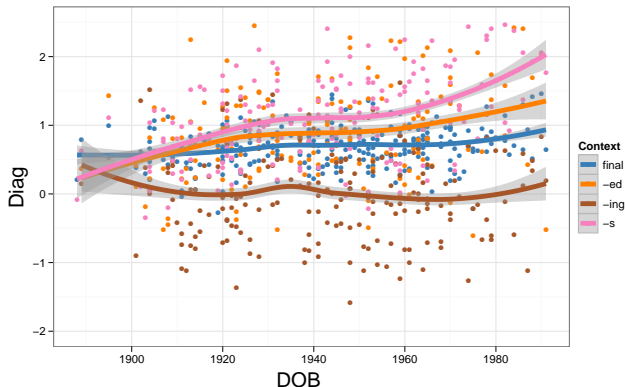
Philadelphia /ey/

Morphological Results

formula: Diag ~ (DOB/10) * Morphology + (Morphology | Speaker)

reference level: Null

	Estimate	t-value
Intercept	0.52	12.2
DOB	0.03	4.2
-ed	-0.09	-0.8
-s	-0.12	-1.3
-ing	-0.46	-3.7
DOB×-ed	0.05	2.7
DOB×-s	0.11	6.8
DOB×-ing	-0.04	-2.2

Slope Estimates
final	0.03=0.03
-ed	0.08=(0.03 + 0.05)
-s	0.15=(0.03 + 0.02)
-ing	-0.01=(0.03 - 0.04)

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Philadelphia /ey/
Final Pattern

All unaffixed, or affixed inflectional morphology in 4 contexts:
Word-final, Pre-hiatus, Pre-l, and elsewhere.
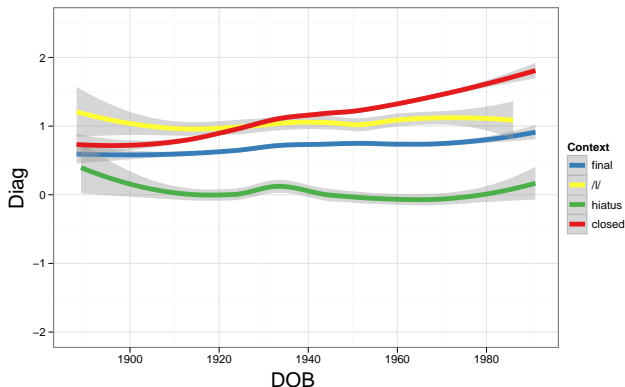
Philadelphia /ey/
Phonological Description

Phonological Process

$ey \rightarrow [+peripheral]/\underline{\quad}C\ldots]_{word}$

Phonetic Change

1. $ey_{+periph} \rightarrow 0.1$ peripherality
2. $ey_{+periph} \rightarrow 0.2$ peripherality
3. ...

Phonetic Alignment

- [eyl] $\rightarrow$ more peripheral
- [ey#] $\rightarrow$ less peripheral

Philadelphia /ey/
Phonological Description

Phonological Process

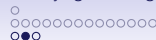ey $\rightarrow$ [+peripheral]/___C. . .]$_{word}$

/l/ is not a C?

- /l/ undergoes extreme vocalization in Philadelphia. (Ash, 1982)
    - Intervocalically (*balance*)
    - Initial Clusters (*floor*)
- Triggers offglide deletion in /aw/.
   - *Powel = pal*

The Unique View of Diachrony

Would a study without a view of the changing state of the speech community have come to the same conclusions?

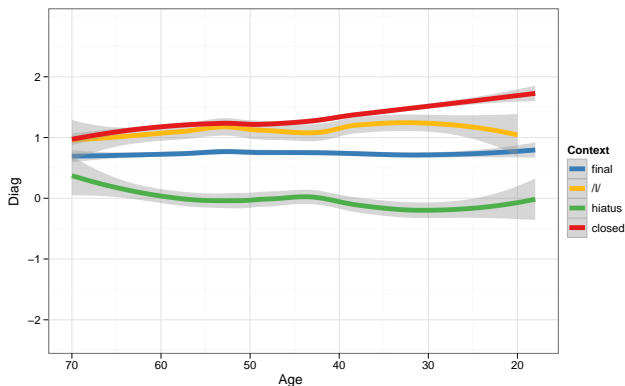# The Unique View of Diachrony

If you had done a study of college aged Philadelphians in 2002, this is what you would have seen.

Introduction
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○
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Phonology-Phonetic Interface
○○○
○○○○○○
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Identifying Phonological Processes
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Conclusion
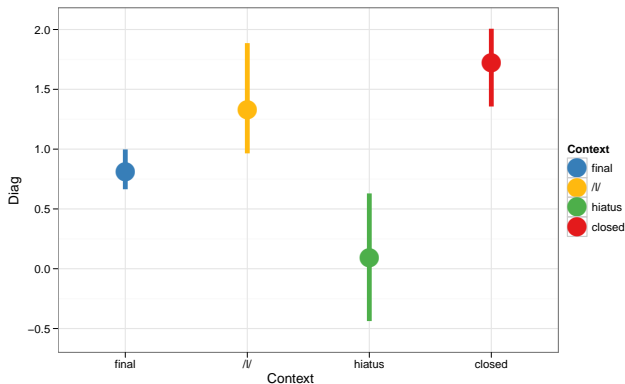
The Unique View of Diachrony

If you had done a study of Philadelphians aged 18 to 70 in 2002, this is what you would have seen.

Introduction
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Phonology-Phonetic Interface
ooo
oooooo
ooo

Identifying Phonological Processes
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Conclusion

Outline

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Conclusion

Details

- The data on phonetic variation and change support a model of language specific phonetic implementation along with fairly abstract phonological categories.

- There is a process of peripheralization of /ey/ in Philadelphia which is triggered by a following segment within the same word.

- /l/ does not act as a trigger to this process.

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Conclusions

- Sociolinguistic data can be used for phonological theory building.
- Sociolinguistic data can be used for identifying and specifying phonological phenomena.
- Sociolinguistic data can achieves these goals uniquely.

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

Thanks

Special thanks to. . .

William Labov, Ingrid Rosenfelder, Gene Buckley, Mark Liberman, Meredith Tamminga, Ricardo Bermúdez-Otero, Andries Coetzee, the denizens of the Upenn Sociolab, regular attendees of Splunch and the Common Ground seminars, and the audiences at NAPhC and MFM.

This work supported by. . .

Introduction
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Phonology-Phonetic Interface
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Identifying Phonological Processes
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Conclusion

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