Phonological Involvement in Phonetic Change

Josef Fruehwald

University of Pennsylvania

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Outline

Introduction
- Phonetic change...
- Phonology and phonetic change

Phonological Influence
- Early
  - Pre-Voiceless /ay/
  - Consequences & Moving Forward
- Continuing
  - Parallel Phonetic Shifts
  - Consequences & Moving Forward

Theoretical Implications

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Background

"In the almost total absence of large-scale, questionnaire-supported observations which would have to be extended or repeated over generations of speakers in a community, such a picture can be only guesswork."
Hoenigswald (1960)
Ch 8. §Alleged Gradual Character of Phonetic Alteration

"It could be observed only by means of an enormous mass of mechanical records, reaching through several generations of speakers."
Bloomfield (1933)

Introduction

My proposed dissertation is about the relationship between phonetics and phonology, specifically in cases of phonetic change.

Goals

- Establish some facts regarding how phonetic changes progress with relation to phonological patterns.
- Establish some principles regarding how phonology affects phonetic change, and vice versa.

What is unique about this work

The Philadelphia Neighborhood Corpus

- *Big*
  Allows for very detailed study of contextual effects on sound change.
- *Long*
  A century of acoustic data allows us to see sound changes throughout a long period of their lifespan.
- *Detailed*
  Compared to other large speech corpora, it's narrowly focused on one speech community, and has important demographic data.
- *Expandible*
  Additional interviews that I conduct, or other sources of speech are easily added to the corpus thanks to the FAVE suite.

What is unique about this work

Contemporary

I'm looking primarily at contemporary, fully observed sound changes in progress.

Real

The data is real, not primarily simulation based.

Diachronic

The data is primarily diachronic, not results from synchronic perception studies.

Quantitative

I intend to break new (to the study of sound change) quantitative ground.

Phonetic Change is Special

"Had Paul been interested in the problem of discreteness versus continuity as a feature of language design, he might have both enlarged on the parallelisms between **phonetic and semantic change**, and realized that **they are jointly not representative of the rest of language change.**"
Weinreich, Labov & Herzog (1968)

What phonetic change is *not*.

Not Competitive

Phonetic change does not progress as competitive use of categorical variants.

What phonetic change is *not*.

What phonetic change is *not*.

What phonetic change *is*.

What phonetic change is *not*.

Not competitive.

I have done a number of simulations trying to model phonetic change as competition between two categorical variants, and they have been unsuccessful.

What phonetic change *is*

Language specific phonetics.

A shift in the target of phonetic implementation for a relatively stable phonological representation.

Immediate questions:

1. When does phonological reanalysis take place?
2. How does phonology interact with phonetic change at any point in time during the change?

When does phonology matter?

Never?

- *Lexical Diffusion*
  Mediated by "analogy," not necessarily phonological generalizations.
- *Neogrammarian Sound Change*
  Sound change is generalized, *phonetically* conditioned.
- *Exemplar Theory*
  Generalizations are momentary, "on the fly."

When does phonology matter?

Error Accumulation

Listener Corrects

	Speaker		*Listener*	
Representation	/ayt/; /ayd/		/ayt/; /ayd/	*Representation*
	↓		↑	
Production	[ɐit]; [aɪd]	⟶	[ɐit]; [aɪd]	*Perception*

Listener Hypocorrects

	Speaker		*Listener*	
Representation	/ayt/; /ayd/		/ɐyt/; /ayd/	*Representation*
	↓		↑	
Production	[ɐit]; [aɪd]	⟶	[ɐit]; [aɪd]	*Perception*

When does phonology matter?

Error Accumulation

Proponents/Exponents

- Ohala (1981, *et seq*)
- Exemplar Theoretic change (Bybee, 2002)
- Evolutionary Phonology (Blevins 2004)
- Early stages of the Lifecycle of Phonological Change (Bermúdez-Otero, 2007)

When does phonology matter?

Big Bang Model

A brief period of pure phonetic conditioning is rapidly followed by reanalysis as phonological conditioning.

Proponents/Exponents

- Janda & Joseph (2001)
- Baker, Archangeli & Mielke (2011)

When does phonology matter?

Consensus/Synthesis

Phonetic change begins as pure phonetic conditioning, driven by the natural acoustic and articulatory properties of speech. This period of pure phonetic conditioning persists either

- throughout the lifespan of the change, or
- until the magnitude of the conditioning increases to the point that it becomes reanalyzed as phonological.

The influence of phonology.

I am proposing that the influence of phonology is:

Early

Phonological generalization occurs early, perhaps synchronously with a phonetic change.

Continuing

Throughout the course of a phonetic change, it is guided and affected by phonology.

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Conditioned Sound Changes

To make the case for early phonological influence/reanalysis, I'll be focusing on conditioned sound changes.

2 kinds of conditioning

1. "Phonetic" (e.g., Nasals on /aw/)
2. Absolute (e.g., Following voiceless segment on /ay/)

Conditioned Changes

Phonetic Conditioning

Nasals on /aw/

Conditioned Changes

Phonetic Conditioning

Nasals on /aw/

Conditioned Changes

Absolute Conditioning

Pre-voiceless /ay/

Conditioned Changes

Absolute Conditioning

Pre-voiceless /ay/

Conditioned Changes

Consensus view on conditioned changes

- Either phonetic conditioning (like that of nasals on /aw/) is a historical precursor to absolute conditioning,
- or phonetic and absolute conditioning differ only in degree.

Pre-Voiceless /ay/

Background

- Pre-voiceless /ay/ raising was identified as a new and vigorous sound change in progress in the 1970s. (Labov, 2001)
- It is the most vigorous change in the PNC.

Pre-voiceless /ay/

Possible Phonetic Precursors

- Pre-voiceless shortening leads to undershoot. (Joos, 1942; Chambers, 1973)
- Pre-voiceless glide peripheralization leads to undershoot (Moreton and Thomas, 2004)

Pre-voiceless /ay/

Contemporary Phonetic Unnaturalness

	write	*ride*	*writer*	*rider*
UR	rait	raid	raitɚ	raidɚ
RAISING	rʌit	–	rʌitɚ	–
FLAPPING	–	–	rʌirɚ	rairɚ
SR	rʌit	raid	rʌirɚ	rairɚ

Pre-voiceless /ay/

Questions to ask

- Was the conditioning of /ay/ raising ever purely phonetically conditioned?
- If not, can the patterns still be explained in a way which does not involve phonological generalization?

Pre-voiceless /ay/

Data prep

Non-flapping context

- /ay/ followed by /t/ or /d/,
- if /t/ or /d/ are within the same word,
- and are then followed by a pause.

Flapping context

- /ay/ followed by /t/ or /d/,
- if /t/ and /d/ are followed by an unstressed vowel,
- and that vowel is within the same word.

Pre-voiceless /ay/

Duration

Pre-voiceless /ay/

Glide Peripheralization

Unavailable so far in PNC. Reported for Victoria B.C. in Rosenfelder (2005).

Pre-voiceless /ay/

Patterning According to Phonetic Precursors

Duration	Glide Peripherality
{ t }	{ t }
{ r⁻, r⁺ }	{ r⁻, (r⁺), d }
{ d }	

Pre-voiceless /ay/

Flaps and Raising

Pre-voiceless /ay/

GAMMs

- Generalized Additive Mixed-effects Models
- Date of birth smoothed via cubic regression spline
- Random intercepts for Speaker and Word
- 3 models each for /t/ and /d/
  - M1 Flaps and non-flaps have different curves.
  - M2 Flaps and non-flaps have the same curves, but transposed.
  - M3 There is no difference at all between flaps and non-flaps

Pre-voiceless /ay/

Model Comparisons

	/t/		/d/	
Model	AIC	BIC	AIC	BIC
M1: Different Curves	2475.5	2512.4	**1484.3**	1518.2
M2: Same Curves	2467.7	2499.3	1485.6	1514.7
M3: No Effect of Context	**2465.7**	**2492**	1485.1	**1509.4**

Pre-Voiceless /ay/

GAMM fits

Pre-voiceless /ay/

Phonetic Precursors		Raising
Duration	Glide Peripherality	
t	t	t
ɾ⁻	ɾ⁻	ɾ⁻
ɾ⁺	(ɾ⁺)	ɾ⁺
d	d	d

It appears as if /ay/ has always patterned according to the phonological voicing of the following segment *not* according to the phonetic properties of the following segment.

Pre-voiceless /ay/

Alternative Analyses

Just generalized to flaps?

- No, underlyingly voiced flaps didn't undergo raising.
- It doesn't appear as if lexical diffusion of *spider* and *Snyder* type words happened till much later.

Pre-voiceless /ay/

Lexical Diffusion

Pre-voiceless /ay/

Alternative Analyses

Analogy?

Most of the pre-voiceless flap cases are derived forms (e.g., *fighting*).

- Is the raising in *fighting* analogy from *fight*?
- As an expedient, I'll be looking at /Cayt/ frames and seeing
  - Does the frequency with which the /t/ surfaces as [t] affect the degree to which /ay/ raises when it surfaces as [ɾ]
  - For the frame [Caɪɾ], does the frequency with which the flap corresponds to /d/ affect the degree to which /ay/ raises when it corresponds to /t/?

Analogy

For a /Cayt/ frame, how much more frequently does the /t/ surface as voiceless?

Analogy

For a Cayr frame, does the [r] correspond more to /t/?

Pre-voiceless /ay/

Conclusions

- /ay/ raising applied opaquely (before underlyingly voiceless flaps) from its outset.
- The phonetic properties of the context are not commensurate with the degree of /ay/ raising.
- The *phonetic* raising of /ay/ was always conditioned by the *phonological* voicing of the following segment.
- Alternative analyses are unlikely to find support in the data.

Pre-voiceless /ay/

Conclusions

Sequence of events

1. A new phonological rule entered the grammars of Philadelphians.
   ay $\rightarrow$ ay^{+}/ ___ $-$voice $]_{\omega}$
2. The phonetic difference between [ay] and [ay^{+}] was small at first.
3. The phonetic difference grew as [ay^{+}] raised phonetically.

Consequences & Unresolved Issues

- Requires revisiting the notion that rule insertion is not a possible language change.
- Phonetically *unnatural* changes are rare/unattested.
- If there was a phonological change (the introduction of the rule) which corresponded to a small phonetic difference, there should be some evidence of it in the early data.

Moving Forward

- Add more case studies of conditioned changes.
  - /eyC/, /eyV/ split.
  - /Tuw/, /uw/ split.
  - /uwl/ and /owl/
- Determine how these results generalize or don't to phonologically unconditioned phonetic change.
- Figure out the plausibility of children acquiring an absolute phonological distinction which corresponds to a small phonetic difference.
- Figure out the dynamics driving both the ubiquity of the phonological rule, and the subsequent phonetic raising of /ay/.

Continuing Influence

Phonology has an early influence on phonetic change. Does that influence persist throughout the change?

Parallel Phonetic Shifts

To address this question, I'll be focusing on parallel phonetic shifts.

Parallel Phonetic Shifts

Multi-phoneme phonetic shifts are frequenty described as chain shifts.

Canadian Chain Shift

$$\begin{array}{ccc} ɪ & & \\ \downarrow & & \\ ɛ & & \\ \downarrow & & (ɔ,ɑ) \\ æ & \rightarrow & \end{array}$$

Clarke, Elms, and Youssef(1995)
Labov, Ash, and Boberg (2006)

Parallel Phonetic Shifts

Segments can also shift in parallel in a way not characterized by phonetic gap creation and filling

Canadian Parallel Shift

ɪ →

ɛ →

(ɔ,ɑ)

æ →

Boberg (2005)
Durian (2009)

Parallel Shifts

Parallel Shifts in the PNC

- Vw (back, upgliding diphthongs) fronting.
- VyC raising?

Parallel Shifts

Vw fronting

Parallel Shifts

	/aw/∼/ow/	/ow/∼/uw/	/aw/∼/uw/
Spearman's ρ	0.48	0.52	0.37
95% Bootstrap CI	0.39–0.57	0.42–0.6	0.26–0.47

Parallel Shifts

Parallel Shifts

	/ay/∼/ey/
Spearman's ρ	0.51
95% Bootstrap CI	0.41 – 0.59

Parallel Shifts

Analysis

- Some phonetic changes can target natural classes (front short vowels, back upgliding diphthongs, front upgliding diphthongs)
- Natural class behavior is typically best described in terms of phonological features.
- The target of some phonetic changes are phonological features.

Parallel Shifts

Analysis

Canadian Shift

- Phonetic Implementation
  - short -back $\rightarrowtail$ Slightly backer

Back Vowel Fronting

- Phonetic Implementation
  - Vw $\rightarrowtail$ Slightly fronter

Parallel Shifts

Analysis

Vy Raising

- Phonology
  - $ay \rightarrow ay^{+}/___ \begin{matrix} C \\ -voice \end{matrix}]_{\omega}$
  - $ey \rightarrow ey^{+}/___ C]_{\omega}$
- Phonetic Implementation
  - $Vy^{+} \rightarrowtail$ Slightly higher

Consequences

By describing phonetic change in terms of the phonetic implementation of phonological features, we can

- bring evidence about phonological representation, and phonetic implementation directly to bear on the study of phonetic change,
- vice versa.

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Theoretical Implications

Phonology Phonetics Interface

Phonology Phonetics Interface

Objects of Implementation

If phonetic change is a change in the phonetic implementation of phonological objects, then

- the objects of phonetic implementation are possible targets of phonetic change (e.g., features)
- the targets of phonetic change are necessarily objects of phonetic implementation.

This second point should motivate recasting more phonetic changes as targeting natural classes if, for example, we don't want phonemes as atoms, or wholistic entities to be objects of phonetic implementation.

Phonology

Phonological Inference

- Phonological Identity $\rightarrow$ Phonetic Identity
- Phonetic Divergence $\rightarrow$ Phonological Divergence

Phonology

0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−F1
1900
1920
1940
1960
1980
Date of Birth
Voice
voiceless
voiced

Conclusions

By expanding the analysis of early and continuing phonological involvement on phonetic change, I will both be able to establish some new facts and principles regarding phonetic change in particular, and the phonology-phonetics interface more broadly.

Thanks!