Philadelphia /aɪ/-raising without rule insertion

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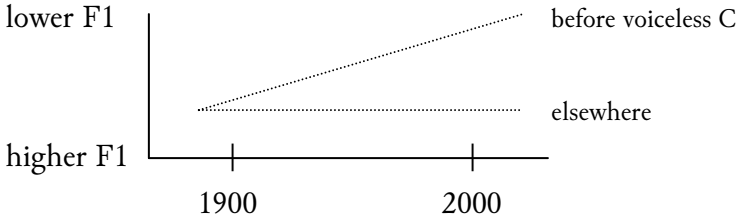
OVERVIEW

§1 *Philadelphia* /aɪ/*-raising* (Fruehwald 2013)

- /aɪ/ is raised to [ʌi] before voiceless obstruents:
  e.g. *ride* [ɹɑɪd] vs *write* [ɹʌit]
- Implemented in a phonetically gradient fashion during the 20th century:



- /t,d/-flapping already active before the inception of /aɪ/-raising:
  i.e. [ɾ] in both ***utt****er* and ***udd****er* already in the 19th century.
- Nonetheless, /aɪ/-raising is sensitive to underlying laryngeal specifications:

/d/-flap ► no raising	*rid**e**r*	/ɹaɪd-əɹ/	→	[ɹɑɪɾəɹ]
	*id**l**e*	/aɪdəl/	→	[ɑɪɾəl]
/t/-flap ► raising	*writ**e**r*	/ɹaɪt-əɹ/	→	[ɹʌiɾəɹ]
	*tit**l**e*	/taɪtəl/	→	[tʌiɾəl]

§2 *Puzzling evolution of output forms*

	rider	*writer*	*idle*	*title*
1900	[ɹɑɪɾəɹ]	[ɹɑɪɾəɹ]	[ɑɪɾəl]	[tɑɪɾəl]
2000	[ɹɑɪɾəɹ]	[ɹʌiɾəɹ]	[ɑɪɾəl]	[tʌiɾəl]

§3 *Fruehwald's (2013: 130) interpretation*

- Early stabilization
  /aɪ/ split into two discrete allophones at the onset of the change.
- Rule insertion
  The split was effected by a categorical context-sensitive rule of /aɪ/-raising inserted in the middle of the grammar, above /t,d/-flapping:

Context-sensitive raising $[+\text{lo}] \rightarrow [-\text{lo}] \; / \; \begin{bmatrix} \_\_\_ \\ +\text{bk} \\ -\text{rnd} \end{bmatrix} \text{ɪ}[-\text{voice}]$ (categorical, lexical)

§4 *Alternative proposal* (after Bermúdez-Otero 2004: §20–§23)

- 'Prefortis clipping' (Wells 1990) is a categorical phonological rule.
- Prefortis clipping applies lexically, and so is counterbled by /t,d/-flapping, which is postlexical.

i.e.	*rider*	*writer*	*idle*	*title*
clipping	ɹaɪdəɹ	ɹăɪtəɹ	aɪdəl	tăɪtəl
flapping	ɹaɪɾəɹ	ɹăɪɾəɹ	aɪɾəl	tăɪɾəl

- Philadelphia /aɪ/-raising started out as a phonetic enhancement of prefortis clipping:
  i.e. a phonetically gradient context-free process of raising
  targeting categorically clipped [ăɪ] in the output of the phonology.

Context-free raising ăɪ → ăi (gradient, phonetic)

§5 *Evolution of output forms under the proposed analysis* (cf. §2)

	rider	*writer*	*idle*	*title*
1900	[ɹɑɪɾəɹ]	[ɹăɪɾəɹ]	[ɑɪɾəl]	[tăɪɾəl]
2000	[ɹɑɪɾəɹ]	[ɹăiɾəɹ]	[ɑɪɾəl]	[tăiɾəl]

§6 *Implications* (cf. §3)

- <u>No early stabilization</u>
  Raising did not create two categories *ex nihilo*; the categorical distinction between clipped and unclipped allophones predated raising.
  Raising only altered the phonetic realization of a pre-existing category.
- <u>No rule insertion</u>
  Raising entered the grammar from below, as a gradient rule of phonetic implementation.
  Clipping overapplies before flapped /t/; but, at the outset, raising applied transparently to all and only categorically clipped allophones in the output of the phonology.

In this analysis, Philadelphia /aɪ/-raising complies fully with the life cycle of phonological processes (see refs in §11 below).

THEORETICAL BACKGROUND: THE DEBATE ON RULE INSERTION

Rule change in early generative phonology: anything goes

§7 *Early generative approaches to phonological change* (Halle 1962, Kiparsky 1965, King 1969)

These works claim that phonological rules can arise and evolve in a wide variety of ways over time:

- rule addition (at the end of the grammar),
- rule insertion (in the middle of the grammar),

- rule reordering,
- rule simplification or generalization (see also Vennemann 1972a),
- rule inversion (Vennemann 1972b),
- rule loss,

  etc.

§8 *Rule insertion*

A new phonological rule is inserted in the grammar directly above an older rule.
The new phonological process applies opaquely from its very inception.

Alleged examples:

- Lachmann's Law in Latin (Kiparsky 1965: 1-29ff);
- Latin rhotacism (Watkins 1970);
- other alleged cases in Halle (1962), Postal (1968: 253-60), etc.

§9 *Counterevidence*

The alleged examples of rule insertion in the early literature failed to stand up to scrutiny:

- for the general debate, see e.g. King (1973), Miranda (1983), Gress-Wright (2011);
- for the ongoing controversy on Lachmann's Law, see Roberts (2012: ch. 3);
- for Latin rhotacism, see Roberts (2011).

§10 *The underlying issue: the powers of the learner*

Early generative typologies of rule change presuppose an extremely powerful learner:

- an unspecified function of UG provides the learner with the set of all grammars compatible with the primary linguistic data,

and

- an evaluation measure (Chomsky 1957: ch .6) chooses the 'best' grammar from this set.

In this approach, rules are cheap
and opaque rule interactions are easily accessible
(even if relatively disfavoured by the evaluation measure).

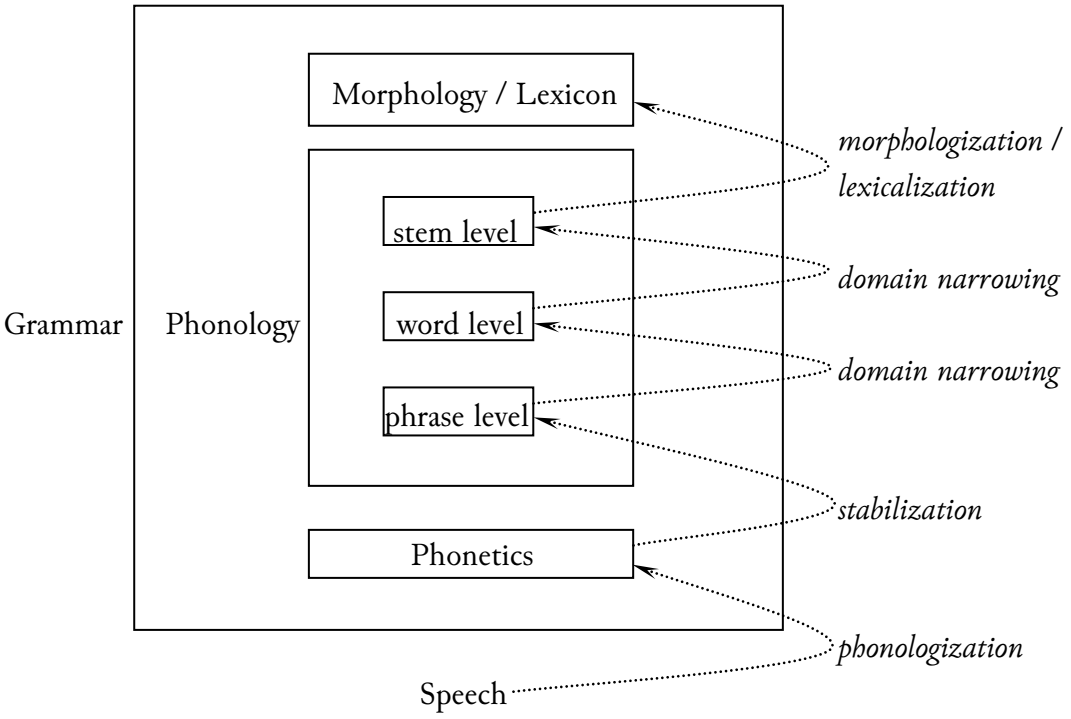
On the link betweeen rule insertion and the abstractness controversy, see King (1973).
On the limitations of the evaluation measure in curbing abstractness, see e.g. Kiparsky (1974).
For recent conceptual discussion of the evaluation measure, see Bermúdez-Otero (2012: 21-25).

Stratal models: the life cycle of phonological processes

§11 In contrast with early generative theories, stratal models support a considerably more restrictive approach to the diachronic evolution of phonological processes.

See e.g. Kiparsky (1988, 1995), Bermúdez-Otero (2007: 503ff; 2014), Bermúdez-Otero & Trousdale (2012: §2), Ramsammy (forthcoming).

The life cycle of phonological processes



(Bermúdez-Otero and Trousdale 2012: 700)

§12 *No rule insertion*

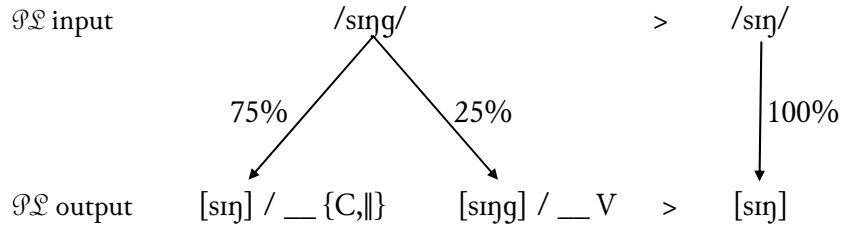
- New categorical rules enter the phonology through the stabilization of gradient processes of phonetic implementation.
- Like the phonetic processes from which they descend, newly stabilized phonological rules apply transparently across the board (in phrase-level domains).
- Opacity emerges through aging, as old rules undergo domain narrowing, and younger rules enter the phrase-level phonology through later rounds of stabilization.

§13 *A constrained learner* (cf. §10)

The model in §11 assumes that the main mechanism behind innovation is input restructuring:

- gradient coarticulatory effects are reanalysed as cues to categories on the surface representation;
- derived phonological properties at level *l* are reanalysed as features of the input to *l*.

e.g. [sɪŋ‖]~[sɪŋg ələʊd] > [sɪŋ‖]~[sɪŋ ələʊd]



(Bermúdez-Otero and Trousdale 2012: 698)

Grammar construction proceeds largely from the bottom up (Bermúdez-Otero 2003).

Cf. the notions of hierarchical constructive development (Quartz 1999: 54)
and sequenced bootstrap learning (Lappin and Shieber 2007: 424-25).

§14 *The empirical robustness of the life cycle*

Alleged instances of rule reordering identified in the literature yield to improved analyses compatible with the life cycle:

e.g. • *o*-lowering and Umlaut in Swiss German (Kiparsky 1965: 2-25ff),
reanalysed in Bermúdez-Otero (2014: §3.1) and Ramsammy (forthcoming), after Robinson (1976);
• glide hardening and continuant dissimilation in Cypriot Greek (Kaisse 1993),
reanalysed in Ramsammy (forthcoming).

The life cycle correctly predicts patterns of interaction between lenition processes:

e.g. in English dialects with separate processes of /l/-darkening and /l/-vocalization,
older darkening applies in narrower cyclic domains that younger vocalization
(Bermúdez-Otero and Trousdale 2012: 702-4; Bermúdez-Otero 2014: §3.2; Turton 2013).

SYNCHRONIC CONSIDERATIONS: /aɪ/-RAISING AND FLAPPING IN CANADIAN ENGLISH

Canadian raising and flapping: a well-behaved opacity effect

§15 Before tackling the diachronic question posed by Fruehwald's (2013) Philadelphia data, it will be useful to gain a deeper synchronic understanding of the opaque interaction between /aɪ/-raising and flapping.

The evidence from Canadian English is particularly helpful in this regard, as Canadian raising (Chambers 1973) is very similar to Philadelphia /aɪ/-raising but is

- categorical
- old already established in the late 19th century;
- sociolinguistically stable no significant difference in application between the 1970s and today,
aside from variation in respect of fronting of the nucleus;
remarkably uniform application across Canada.

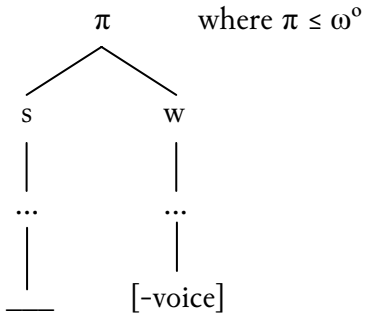
See Chambers (1989, 2006), Chambers and Hardwick (1986), Rosenfelder (2007), Thomas (1991).

§16 In a stratal model, the counterbleeding interaction between Canadian raising and flapping is perfectly well-behaved:

- Canadian raising applies at the stem level (Bermúdez-Otero 2003, 2004);
- flapping applies at the phrase level (e.g. Kaisse and Shaw 1985: 4).

Canadian raising is stem-level

§17 *The phonological environment for Canadian raising*



- Raising is triggered by a following voiceless consonant (C̥):

  e.g. *write* [ɹʌit] cf. *ride* [ɹɑɪd]
  knife [nʌif] cf. *knives* [nɑɪvz]

- Raising does not apply across prosodic word boundaries (ω):

  e.g. *high school* [ω′ [ω ˈhɑɪ] [ω ˌskuːl]] cf. univerbated [ω ˈhʌiˌskuːl]
  tie shop [ω′ [ω ˈtɑɪ] [ω ˌʃɑp]]

  Idsardi (2006: 26) reports that, in his idiolect, raised [ʌi] is acceptable in *Don't **lie** to me*. I have been unable to find another Canadian speaker who concurs with this introspective judgment.

- Within ω°, the trigger C̥ must be in a weak branch of the lowest prosodic node dominating both trigger and target:

i.e.	in the coda	*cite*	[sʌit]
	in the a onset of a following weak syllable	*cycle*	[ˈsʌi.kəl]
	in the onset of a following weaker foot	*nitrate*	[ω [Σ ˈnʌi] [Σ ˌtɹeɪt]]
but not	in the onset of a following stronger foot	*citation*	[ω [Σ ˌsɑɪ] [Σ ˈteɪʃən]]

§18 *Canadian raising overapplies before word-level suffixes* (Bermúdez-Otero 2003)

E.g. *eye-ful* [ˈɑɪfʊl], *[ˈʌifʊl] cf. *Eiffel* [ˈʌifəl]
Frau-ship [ˈfɹɑʊʃɪp], *[ˈfɹʌuʃɪp]

∴ Canadian raising is a stem-level process.

- Not an effect of secondary stress on the affix: cf. *nítràte* [ˈnʌiˌtɹeɪt].
- Not an effect of an ω-boundary between stem and affix: see Bermúdez-Otero (2011: §4).
  Cf. e.g. Szpyra (1989: 178-200), Hammond (1999: 322-329), Raffelsiefen (2005).
- For the absence of cyclic reapplication, see Bermúdez-Otero (2012: 31-40).

Flapping is phrase-level

§19 I assume Kiparsky's (1979: 437) analysis (see also Jensen 2000): *hit Ann*

i.e. /hɪt/

- at the word level, obstruents become [lax] if not foot-initial hɪt[lax]
- at the phrase level, lax [t] or [d] flap between in the environment {V,ɹ}__V hɪɾæn

Flapping must be phrase-level because its domain straddles word boundaries.

See e.g. Kaisse and Shaw (1985: 4), among many others.

Opacity explained: cyclic domains determine serial order

§20

		rider	*writer*	*idle*	*title*
☹	(raising)	ɹɑɪd	ɹʌɪt	ɑɪdəl	tʌɪtəl
☺		ɹɑɪdəɹ	ɹʌɪtəɹ	ɑɪdəl	tʌɪtəl
?	(flapping)	ɹɑɪɾəɹ	ɹʌɪɾəɹ	ɑɪɾəl	tʌɪɾəl

THE DIACHRONIC CHALLENGE: OPACITY REGARDLESS OF CHRONOLOGY

§21 Ordinarily, synchronic opacity reflects the inherently serial nature of historical innovation:

i.e. in an opaque interaction, the opacified process is usually older,
the opacifying process is usually younger (see §12).

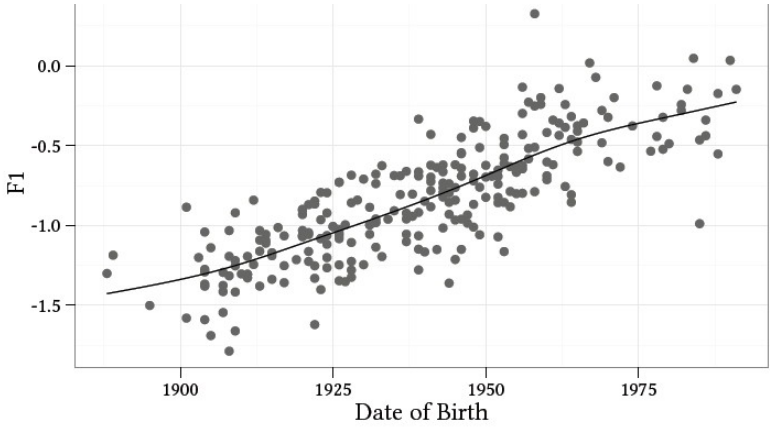
But /aɪ/-raising in English appears to challenge this neat picture:

/aɪ/-raising seems **always** to overapply before /t/-flaps...

- ...even in dialects where raising is younger than flapping!
- ...even at the stage when raising is being implemented by gradient neogrammarian change!!

Fruehwald (2013) on Philadelphia /aɪ/-raising

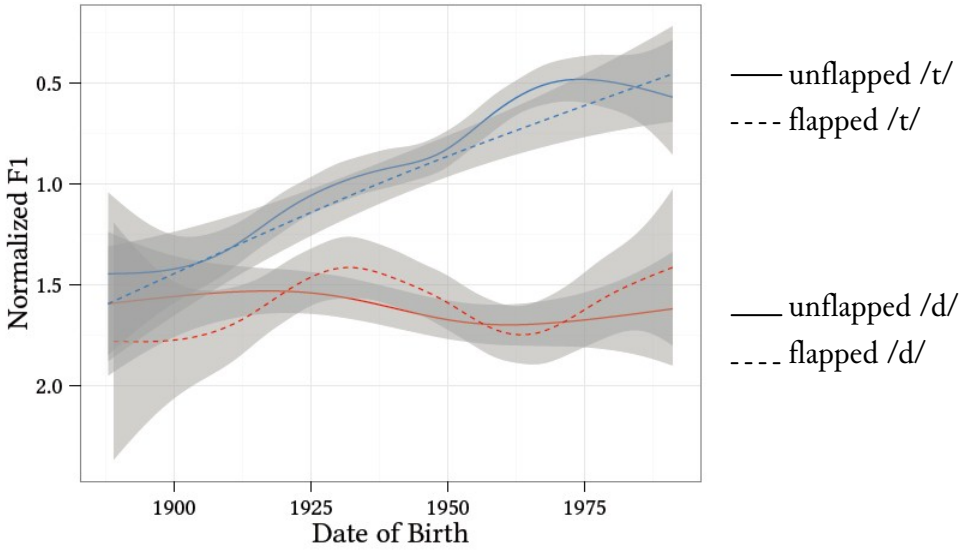
§22 *Philadelphia* /aɪ/*-raising implemented through gradient neogrammarian change during the 20th century*



(Fruehwald 2013: 34)

- Data from the Philadelphia Neighbourhood Corpus (Labov and Rosenfelder 2013): dots represent an individual speaker's mean F1 for the nucleus of /aɪ/ in canonical raising environments (see §17).
- In other environments, nucleus F1 remains roughly flat: see e.g. Fruehwald (2013: 112).

§23 */aɪ/ is raised before flapped /t/, but not before flapped /d/*



(Fruehwald 2013: 121)

§24 *Fruehwald's interpretation* (see §3)

	Stage 1		**Stage 2**		**Stage 3**	
environment	__Ç	__C̥	__Ç	__C̥	__Ç	__C̥
UR	/a$^{[+lo]}$ɪ/		/a$^{[+lo]}$ɪ/		/a$^{[+lo]}$ɪ/	
SR	a$^{[+lo]}$ɪ	a$^{[+lo]}$ɪ	a$^{[+lo]}$ɪ	a$^{[-lo]}$ɪ	a$^{[+lo]}$ɪ	a$^{[-lo]}$ɪ
phonetics	ɑɪ	ɑɪ	ɑɪ	ɑ̟ɪ̟	ɑɪ	ʌi

Stage 1: the system before the change

Stage 2: early stabilization by rule insertion

- A phonological rule of raising is inserted in the grammar above flapping.
- The rule is categorical and context-sensitive: it changes the feature specification of /aɪ/ in the raising environment.
- Phonetically, however, the realizations of raised and unraised allophones remain very close.

Stage 3: phonetic incrementation

After the new raised category has been created, the target assigned to it by the rules of phonetic implementation moves away gradually from the target for the unraised category.

Problem 1: the learner

§25 *Fruehwald's (2013: ch. 6) theoretical rationale for Stage 2*

- Learners are highly creative and only weakly stimulus-bound.
- As a result, categorical innovation is going on all the time.
- Change is rare only because most innovations fail to pass through the sociolinguistic filter.
  (Cf. Baker et al. 2011, Sóskuthy 2013.)

► A partial return to the powerful learners of early generative phonology (see §10 and §13 above).

§26 *An empirical argument for rife categorical innovation?*

Fruehwald adduces

> the proliferation of idiosyncratic idiolectal systems controlling the distribution of bunched and retroflex allophones of /r/ (e.g. Mielke et al. 2010).

Counterargument:

> What is special about this case is the acoustic equivalence of bunched and retroflex /r/.
> It is impossible to tell whether this special circumstance affects
> innovation (unleashing hypothesis formation in an otherwise stimulus-bound learner)
> or
> propagation (allowing idiosyncrasies to pass the sociolinguistic filter undetected).

Problem 2: the uniform behaviour of /aɪ/-raising across English dialects

§27 Fruehwald's account, as outlined in §24-§26, does not predict the following remarkable fact:

> In **all** English dialects that have /t,d/-flapping
> and /aɪ/-allophony conditioned by the voicing of the following consonant,
> /aɪ/ followed by a /t/-flap patterns with /aɪ/ followed by a voiceless consonant,
> regardless of whether /aɪ/-allophony is young or old in the dialect,
> or whether it is gradient or categorical.

§28 *Canadian English: the myth of dialect B*

- Joos (1942: 143-44):

  'dialect B' *write* [ɹʌit] ~ *writer* [ɹɑɪɾəɹ] (allegedly extant in Ontario in the 1940s)

  Further reports in Rudes (1976) and, indirectly, Picard (1977).

  Picked up as an argument for extrinsinc rule ordering by Chomsky (1964: 74), Chomsky and Halle (1968: 342), Bromberger and Halle (1989: 58-60), and Kenstowicz (1994: 6-7).

- But dialect B never existed!

  Chambers (1973: 122): no dialect-B speakers in the 1970s.
  Kaye (1990): if ever there were any, they all died young (transparency kills!)

§29 *More dialects like Philadelphia*

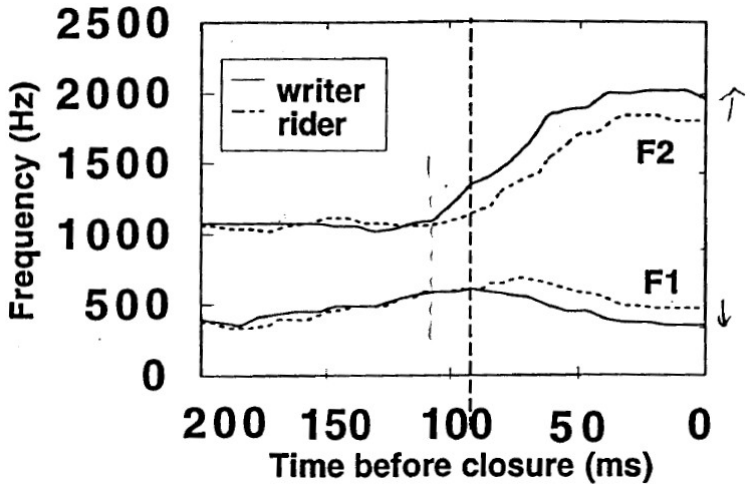
Raised [ʌi] before flapped /t/ in dialects where /aɪ/-raising is a mid or late 20th century innovation:

- 3 informants in Rochester (upstate New York) in 1975 (Vance 1987: 202)
- 30 natives of Ann Arbor (Michigan) in 1995 (Dailey-O'Cain 1997: 110-11)

Neither upstate New York nor Michigan had raising in the 19th century (Thomas 1991: §2-§3).

§30 *Gradient offglide peripheralization before flapped* /t/

- Offglide peripheralization is the phonetic precursor of nucleus raising.
  See Thomas (1991, 2000), Moreton (2004), Gussenhoven (2007), Moreton and Thomas (2007).
- Offglide peripheralization is highly pervasive: all dialects investigated show it to some degree.
  See Kwong and Stevens (1999), Thomas (1991: §4; 2000), Moreton (2004).
- Even in dialects where the nucleus has not yet been affected, there is offglide peripheralization before flapped /t/:



Time-normalized F1 and F2 trajectories for /aɪ/ in *writer* and *rider* uttered by a college-age American male. Note identical nuclei but peripheralized offglide in *writer*.
(Kwong and Stevens 1999: 8)

THE SOLUTION: /aɪ/-RAISING AS A PHONETIC ENHANCEMENT OF PREFORTIS CLIPPING

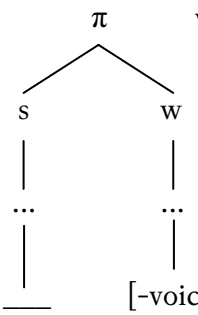
Key postulates (see §4 above)

§31 Prefortis clipping...
- is categorical,
- applies at the stem level,
- is therefore counterbled by /t/-flapping in dialects that have the latter.

§32 /aɪ/-raising...

- is a context-free process targeting categorically clipped allophones of /aɪ/,
- is therefore transparent (it is clipping that is opaque),
- starts out as a gradient enhancement, though it can be stabilized later (as happened already long ago in Ontario).

§33 Therefore, the correct statement of /aɪ/-raising is **not**



aɪ → ʌi / ___ [-voice] (stem level) see §17 above

but rather

ăɪ → ăi

Prefortis clipping is categorical

§34 *A long-standing question*

> "[W]hat is the status of vowel length before voiced sounds in English, *bead* [bi:d] versus *beat* [bit]? The difference is greater than observed in many other languages (Keating 1985), but does it count as phonological?"
>
> (Cohn 2006: 26)

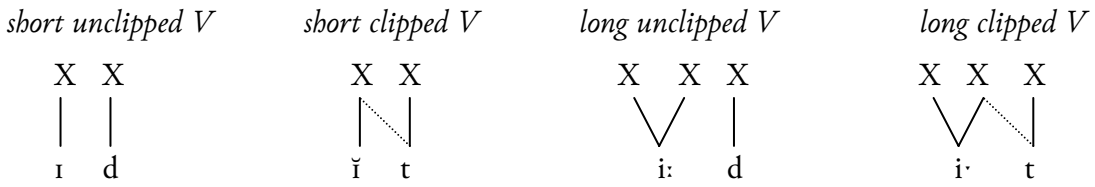
For discussion of the general approach to categoricity and gradience I adopt here, see Bermúdez-Otero and Trousdale (2012: 694-96) and Strycharczuk (2012: 45-7).

§35 *Key points*

- The magnitude of the durational difference between clipped and unclipped allophones in English is extreme
  (Chen 1970; see Sóskuthy 2013: 196-99 for a review of later literature).
- Prefortis clipping suffices to cue the laryngeal contrast by itself
  (Denes 1955, Klatt 1976, Port and Dalby 1982, among many others).
- Prefortis clipping is itself not sensitive to the magnitude of other phonetic cues to the laryngeal contrast:
  crucially, in English dialects with anticipatory assimilation in voicing/voicelessness, vowel duration remains unaffected by assimilation (Jansen 2004: 142).

§36 *If prefortis clipping is categorical, how is it represented in the phonology?*

A simple proposal: skeletal attachments iconically reflect durational trade-offs.



On durational trade-offs in prefortis clipping, see Kluender et al. (1988).

On 'mora sharing', see Maddieson (1993), Maddieson and Ladefoged (1993), Hubbard (1995a,b), and Broselow et al. (1997).

Prefortis clipping is stem-level

§37 *The testimony of Wells (1990, 2008)*

Instrumental studies of the effects of secondary stress and word-level suffixation on prefortis clipping are sadly lacking.

However, through the syllabification conventions of the *Longman pronunciation dictionary,* Wells (1990, 2008) reports (presumably instrospective) judgements on the incidence of prefortis clipping.

Strikingly, as first observed by Bermúdez-Otero (2004: §21),

the environment of prefortis clipping as reported by Wells

is exactly identical with

the environment of Canadian raising as reported by Chambers (see §17)!

• Clipping...	before coda Ç		*cite*	[sə̆ɪt]
	before onset Ç in an unstressed σ		*cýcle*	['sə̆ɪ.kəl]
	before onset Ç in a weaker stressed σ		*nítràte*	['nə̆ɪ.ˌtɹĕɪt]
• No clipping...	before onset Ç in a stronger stressed σ		*cìtátion*	[ˌsaɪ.'tĕɪ.ʃən]
	across ω-boundaries		*hígh schòol*	['haɪ.ˌskuːl]
	before word-level suffixes		*éyeful*	['aɪ.fʊl]
		but	*Éiffel*	['ə̆ɪ.fəl]

∴ By parity of reasoning with §18, prefortis clipping is stem-level.

Prefortis clipping and flapping

§38 If prefortis clipping is stem-level (§37), and flapping is phrase-level (§19), then the two must interact opaquely:

		rider	*writer*	*idle*	*title*
Ϭℒ	(clipping)	ɹaɪd	ɹə̆ɪt	aɪdəl	tə̆ɪtəl
Ϣℒ		ɹaɪdəɹ	ɹə̆ɪtəɹ	aɪdəl	tə̆ɪtəl
ϱℒ	(flapping)	ɹaɪɾəɹ	ɹə̆ɪɾəɹ	aɪɾəl	tə̆ɪɾəl

§39 The clipping contrast is nearly neutralized by a gradient phonetic process reducing the duration of vowels before flaps:

e.g. *median duration (ms) of* /aɪ/ *in Philadelphia (Fruehwald 2013: 117)*

before unflapped /d/	237	before unflapped /t/	144
before flapped /d/	156	before flapped /t/	111

The retention of a duration difference between *writer* and *rider* confirms that, in the output of the phonology, the two vowels belong to different categories.

This effect has been replicated in a large number of studies (Fox and Terbeek 1977, Zue and Laferriere 1979, Patterson and Connine 2001, Herd et al. 2010). It is observable both in real words and in nonce items (Braver 2011).

/aɪ/-raising an an enhancement of clipping

§40 *The phonetic origins of* /aɪ/*-raising*

- /aɪ/-raising is a knock-on effect of offglide peripheralization (see refs in §30).
- In turn, offglide peripheralization is an enhancement of clipping (Gussenhoven 2007):
  - learners observe that a peripheralized offglide creates a percept of reduced nucleus duration;
  - learners reanalyse offglide peripheralization as an acoustic cue realizing a clipped target.

§41 *Correct prediction 1*

Because offglide peripheralization and nucleus raising are phonetic enhancements of clipping, they track the **categorical status** of a vowel as clipped or unclipped, **not its duration**:

	writer	*write*	*rider*	*ride*
raising tracks.....surface category	[ăɪ]	[ăɪ]	[aɪ]	[aɪ]
not duration	111ms	144ms	156ms	237ms

§42 *Correct prediction 2*

In dialects where the clipped/unclipped distinction tracks a property P other than the obstruent laryngeal contrast, offglide peripheralization and nucleus raising track property P.

Strikingly, this is shown to be true by the Scottish Vowel Length Rule (SVLR):

[ɑɪ] unclipped by the SVLR	*sigh, dive, dire*
[ăi] clipped by the SVLR	*sign* (!), *side* (!), *life, sight*

- On the SVLR, see e.g. Aitken (1981), Agutter (1988), McMahon (1991), etc.
  Note that the SVLR is categorical and stem-level, like prefortis clipping in my analysis.
- Moreton and Thomas's (2007) approach to /aɪ/-allophony, the 'Spread-of-Activation hypothesis', fails to explain the Scottish facts, and so fails in its self-imposed goal of understanding English /aɪ/-allophony as a unitary phenomenon.

Conclusion

§43 This paper has argued that (i) prefortis clipping is a categorical lexical process
and (ii) /aɪ/-allophony begins as a phonetic enhancement of clipping.

This hypothesis explains two remarkable facts:

- in all English dialects,
  /aɪ/ before flapped /t/ patterns with /aɪ/ before voiceless consonants,
  and /aɪ/ before flapped /d/ patterns with /aɪ/ before voiced consonants,
  regardless of whether /aɪ/-allophony is young or old, and gradient or categorical;
- /aɪ/-allophony tracks clipping in non-Scottish dialects
  and the SVLR in Scottish dialects.

§44 *Pace* Fruehwald (2013), Philadelphia /aɪ/-raising provides evidence neither for early stabilization nor for rule insertion.

The historical developments in Philadelphia are consistent with
the life cycle of phonological processes
and the approach to phonetic and phonological learning that underpins the life cycle.

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