

Flapometry and palatography: An argument for surface identity between derived forms?

1 Introduction

(1) Bermúdez-Otero (2008): the *swingometer* conundrum

- Learned affixes such as *-ometer*, *-ology*, *-ograph*, *-ocrat*, *-ectom(y)* (etc.) behave in most respects like “classic” level 1 affixes
 - Attach to bound bases: *thermómeter*, *hydrómeter*
 - Occur inside other level 1 affixes *-ic*, *-y*: *phòtographíc*, *photógraphy*
 - Attract main stress: *speedómeter*, *oscíllograph*, *photógraphy*
 - Can condition stress-induced segmental changes to realization of stem:

<i>speed</i> [spi:d]	~	<i>speedómeter</i> [spəd] (Am.Eng.)
<i>phóto</i> [ˈfourou]	~	<i>photógraphy</i> [fəˈtʰɑ]
cf. <i>átom</i> [ˈæɾəm]	~	<i>atómic</i> [əˈtʰam]
<i>compúte</i> [kʰəmpʰju:t]	~	<i>còmputátion</i> [kʰəmpjətʰ]

- However, unlike other stress-shifting affixes, they trigger nasal cluster simplification
 - Usual case: *íá[mb]ic*, *diphthó[ŋg]al*, *elo[ŋg]átion*
 - But compare: (nonce) *swi[ŋ]ómeter*, *diphtho[ŋ]ómeter*¹
- Such affixes show mixed behavior with respect to stem alternations

	Attract stress	Preserve clusters
Level 1	✓	✓
<i>-ometer</i>	✓	*
Level 2	*	*

- These affixes “count” for (at least some aspects of) stress assignment, but seem to be invisible for purposes of cluster simplification

(2) Why can't *-ómeter* save the /g/?

- Morphological difference
 - Bermúdez-Otero: root- vs. stem-level affixation, with stem-final simplification

Stem-level: [e-[log]Root-ate]_{Stem}, [[lond₃]Root-itude]_{Stem}

Word-level: [[[log]Root]_{Stem}-ócracy]_{Stem}
 - Stem-final cluster simplification occurs in first cycle, and is carried forward to subsequent cycles
- Closely related idea: syntactic difference (Marvin 2003; Marantz, to appear)
 - Structure of *-ómeter* words is such that some (but not all) phonological evaluation applies cyclically to inner constituent, without *-ometer*

¹Some English dialects retain surface [ŋg] in some or all positions, at least optionally. The discussion here concerns only those dialects in which *swing* is obligatorily pronounced [swɪŋ].

- Prosodic difference (Raffelsiefen 2005)
 - Affixes like *-ómeter* involve a different prosodic structure (e.g., something like a compound boundary?), which conditions post-nasal deletion
- Output-output correspondence (Burzio 1996; Kenstowicz 1997; Benua 1997; and many others)
 - Affixes like *-ómeter* invoke high-ranking OO-DEP
 - Causes overapplication of deletion, but allows stress shift, reduction, aspiration, etc.

Base:	s	w	ɪ	ŋ	∅
Derived:	s	w	ɪ	ŋ	*g 'amərɪ

(3) Testing these approaches, part 1: empirical adequacy

- A desirable goal: reduce phonological differences between affixes to other independently motivated differences
 - Affixation creates limited set of syntactic, morphological, or prosodic structures
 - Parsimonious/satisfying if uniformity effects can be derived from these
- Output-output correspondence provides many more degrees of freedom
 - In principle, Base-IDENT(stress), Base-IDENT(±back), etc., can be ranked separately with respect to markedness constraints on stress, vowel reduction, etc. (Benua 1997; Raffelsiefen 1999)
 - No inherent mechanism for relating to the meaning or function of the affix (though see Burzio 2005)

(4) Testing these approaches, part 2: predictions for learnability

- If behavior of affix follows from independent syntactic/morphological classification, then learning = recovering hidden structure
 - In principle, multiple sources of evidence (meaning, affix ordering, interaction with other phonological processes)
 - Learning challenges: figure out set of available structures, figure out any differences in how phonology applies to different structures
 - Lacking decisive evidence about a particular affix, assign a default structure (?)
- If alternations must be learned independently, on an affix-by-affix basis, then learning = observing surface alternations
 - Initial state: OO constraints ranked high, learners assume that derived forms must preserve all base properties (McCarthy 1998)
 - Positive evidence from alternating pairs (e.g., *phóto* ~ *photógraphy*) compels learner to demote OO- \mathcal{F} constraints for the relevant affix
 - In absence of evidence, speakers assume that uniformity holds

(5) Goals of this paper

- Compare these approaches on their predictions for realization of stops before affixes like *-ómeter*, *-ógrapher*

- Claim: lack of [g] in *swi[ŋ(*g)]ómeter* is part of a broader range of unexpected phonology surrounding these affixes, at least in some varieties of American English
- Surprising segment-by-segment, affix-by-affix, and speaker-by-speaker differences
 - Difficult to derive from any independently motivated structural difference
 - Correspond fairly well with set of forms available to the average learner
- Data appear to require surface conditions on base-derivative identity

2 Diphthongometry, flapology and palatography

The data: many cyclic effects

(6) Overapplication of nasal cluster simplification before “-ómeter affixes”

- As noted by Bermúdez-Otero (2008), affixes like *-ómeter*, *-ography*, *-ology* regularly condition nasal cluster simplification

Base		Root affixation (with cluster)		Nonce <i>-ómeter</i> affixation	
<i>diphthong</i>	[dɪpθɔŋ]	<i>diphthóngal</i>	[dɪpθɔŋgəl]	<i>diphthongómeter</i>	[dɪpθɔŋ(*g)əmɔɾɪ]
<i>bomb</i>	[bɑm]	<i>bombárd</i>	[bəmbɑrd]	<i>bombólogy</i>	[bɑm(*b)əlɔdʒɪ]
<i>thumb</i>	[θʌm]	(<i>thimble</i> ??)	[θɪmbɪ]	<i>thumbéctomy</i>	[θʌm(*b)ɛktəmi]

- This is unexpected, given that English normally bans medial VɪV, except at level 2 affix and word boundaries: *singer* [ˈsɪŋɔɾɪ]; *sing out* [sɪŋˈaʊt]²

(7) Underapplication of vowel reduction, and misapplication of stress

- As with level 1 affixes, vowel reduction may be blocked in low-frequency *-ómeter* derivations
 - Classic example: *cond[é]nse ~ cònd[ɛ]nsátion* (full vowel in unstressed syllable)
 - With *-ómeter*: *p[ɛ]dómeter*, *t[æ]chómeter*
- In other cases, it's not clear whether secondary stress remains behind, or whether residual vowel quality leads speakers to mark secondary stress

Base	Derived	Merriam-Webster Ninth New Collegiate
<i>refléct</i>	<i>reflectómeter</i>	[rɪflɛktámɔɾɪ]
<i>refráct</i>	<i>refractómeter</i>	[rɪfræktámɔɾɪ]

- In productive formations, my intuition is clear that there must be secondary stress with clash
 - *rèd-ómeter*: “I can’t pull out a **redometer** and say it has 14 militomatoes of redness”³
 - *obscène-ómeter*: “You can’t point an **obscenometer** at a movie and say ‘oh this has 50 chambers of obscenity...’”⁴

²There are a few lexical exceptions, such as *hangar*, *dinghy*, *gingham*; these are, in fact, the focus of Bermúdez-Otero’s paper.

³<http://www.rantsnraives.org/archive/index.php/t-3942.html> (Accessed 6/16/08)

⁴<http://www.theroc.org/roc-mag/textarch/roc-08/roc08-20.htm> (Accessed 6/16/08)

2.1 Stops before *-ometer*

(8) Realization of voiceless stops before *-ometer*

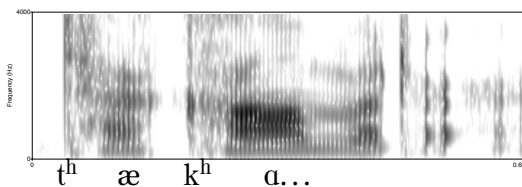
- For a small set of existing words, one finds the normally expected realization of voiceless stops before *-ometer*: aspiration in the onset of the main stressed syllable (individual intuitions may vary)
 - *tachómeter* [t^hæk^haməɾəɪ], *magnetómeter* [mægnət^haməɾəɪ], *palatómeter* [pælət^haməɾəɪ]
- Aspiration is also the norm after bound roots
 - *pho*[t^h]*ómeter*, *sensi*[t^h]*ómeter*, *spec*[t^h]*rómeter*
- Free-standing stems ending in labials and stops: clear intuition that unaspirated stops are preferable
 - *tri*[p(*^h)]*ómeter*, *fla*[p(*^h)]*ómeter*
 - *lea*[k(*^h)]*ómeter*, *ya*[k(*^h)]*ómeter*
- *-ometer* can't be just a stem-level affix (assuming aspiration is a word-level process)

(9) Verifying this difference

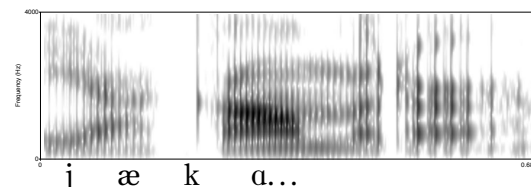
- Although the contrast between *tachómeter* and *yakómeter* is quite clear for many speakers, it is also subtle and not shared by all
- Therefore, a small phonetic pilot study was carried out
- Two speakers were asked to read a series of sentences, designed to elicit forms in *-ometer*, *-ography*, and *-ology*
 - Written prompt: *What would you call a device that measures yaks?*
 - Response: "A device that measures yaks is a yakometer."
- Nonce forms with various affixes were elicited in random order
 - 36 base words ending in stops, × 3 affixes
 - 24 filler items per affix, ending in sonorants or vowels
 - Most base nouns were names of animals

(10) Aspiration in non-coronals: bound *tachómeter* vs. free-standing *yakómeter*

a. *ta*[k^h]*ómeter*



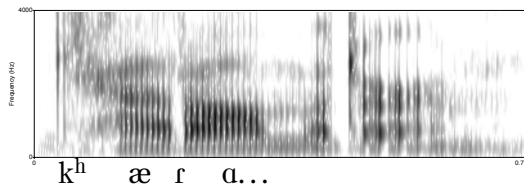
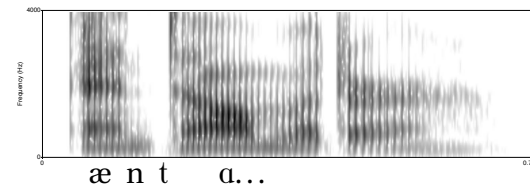
b. *ya*[k]*ómeter*



(11) Free-standing stems ending in coronals

- Monosyllabic CVt bases: all candidates are awkward, but flapping is least awkward
 - ?*ca*[ɾ]*ómeter* / ?**ca*[t̚]*ómeter* / **ca*[t^h]*ómeter* / ***ca*[t]*ómeter*
 - ?*goa*[ɾ]*ómeter* / /?**goa*[t̚]*ómeter* / **goa*[t^h]*ómeter* / ***goa*[t]*ómeter*
- Polysyllabic σCVt bases: flapping is perfectly acceptable
 - *pivo*[ɾ]*ómeter*, *rabbi*[ɾ]*ómeter*, *carro*[ɾ]*ómeter*
- Bases ending in /nt/, /lt/ clusters: unaspirated [t] is preferred, though aspiration perhaps also possible (and some between-speaker variability?)
 - *curren*[t]*ómeter* / ?*curren*[t^h]*ómeter*, *faul*[t]*ómeter* / ?*faul*[t^h]*ómeter*

(12) Flapped vs. unaspirated coronals

a. *ca[r]ómeter*b. *an[t]ómeter*

2.2 A structure-based analysis?

(13) Making sense of all these realizations

- The fact that bound stems in lexicalized forms behave differently from free stems in productively derived forms is reminiscent of “root” vs. “stem” derivation
 - Same affix, different attachment sites: lower (more cohering) vs. higher (less cohering) (Marvin 2003; Arad 2003; Marantz 2006; Michaels 2007)
 - Not obvious that this distinction is independently motivated in this case by semantic transparency, but perhaps two different argument structures involved
 - *sensitometer*: measures sensitivity of something
 - *rabbitometer*: measures something about rabbits
- Phonologically, derivatives from bound stems behave like ordinary words⁵
 - Aspiration in onset of stressed syllable, but not much else to uniquely diagnose internal structure
- But what is the structure of productive formations?
 - Word-internally, unaspirated stops and flaps practically never occur before stressed vowels in English⁶
 - They are characteristic of word boundaries, however
 - *tri*[p^(*h)] *úp*, *lea*[k^(*h)] *óut*
 - *scallo*[p] *ómelette*, *carro*[r] *ómelette*, *haddo*[k] *ómelette*
 - Perhaps productive *-ómeter* forms involve a word boundary?

(14) Comparing *-ómeter* forms with compounds

- Stress clash, lack of aspiration, and flapping before a stressed vowel are all typical at word boundaries in American English
- However, other processes that occur at word boundaries do not occur with *-ómeter*
 - “Nasal flapping”⁷: (optional)
 - *elepha*[r̥] *entourage*, *infa*[r̥] *activism*
 - **elepha*[r̥] *ometer*, **infa*[r̥] *ometer*
 - Glottalization: (optional)
 - *crow*[ʔ] *omelette*, *chickadee*[ʔ] *omnibus*, *elephan*[ʔ] *entourage*, *ca*[ʔ] *obelisk*
 - **crow*[ʔ] *ometer*, **chickadee*[ʔ] *ometer*, **elephan*[ʔ] *ometer*, **ca*[ʔ] *ometer*

⁵I leave aside the issue of incomplete vowel reduction in *tachometer*, *photometer*

⁶One exception, which we can return to, is before suffixes like *-ée*, *-ése*, and *-éte*.

⁷This is sometimes simply referred to as /t/-deletion

- An inexact match

	-ation	-ometer	# \check{V}
/p/, /k/	p ^h , k ^h	p, k	p, k
/t/ Vt (monosyl)	t ^h	?? _r	r/?
Vt (polysyl)	t ^h	r	r/?
nt	t ^h	nt ^(h)	ĩ/nt

- The upshot
 - Although alternations induced by *-ometer* overlap in part with alternations at word boundaries, this does not explain lack of nasal flapping, lack of glottalization, and awkwardness of coronals in monosyllabic forms

2.3 A uniformity-based analysis

- (15) Compare realization of stems in isolation and with *-ometer*


Segment	Example	Utterance-final	/__ ómeter
/p/, /k/	<i>scallop, haddock</i>	p, k (unaspirated)	p, k
/t/ Monosyl	<i>cat</i>	?/t [?] (glottalized, reduced)	? _r
Polysyl	<i>rabbit</i>	?/t [?] (glottalized, very reduced)	r
/nt/ cluster	<i>ant, elephant</i>	nt (strong release)	nt ^(h)

- Unaspirated [p], [k] correspond closely to realization in final position, which is (at least optionally) released, but not aspirated
- Flap differs from final /t/ in presence of glottalization, but ability to flap correlates with degree of articulatory reduction
 - Greater reduction of coronal gestures in word-final position (Browman and Goldstein 1992, p. 231; de Jong 1998; Fukaya and Byrd 2005)
 - Greater reduction in stressless syllables than in stressed monosyllables
- Marginal possibility of aspiration in nasal clusters (esp. after stressed syllables) corresponds to strong final releases after clusters: $\approx ant^{[h]}$
- Faithfulness to properties of (phonetically realized) surface form
 - BASE-IDENT(release noise): aspiration, or frication noise at point of articulation
 - BASE-IDENT(gestural strength): strong in onsets and stressed syllables, weak in codas and stressless syllables

(Similar in spirit to an account of vowel length effects considered and rejected by Raffelsiefen 2005)

- (16) Deriving the observed differences by place and context

- a. Bound stems: no base to demand faithfulness⁸

/tach-ómeter/	IDENT(release noise)	IDENT(gest. strength)	*C _[-asp] \check{V}
a. tækaməɾɪ			*!
 b. tæk ^h aməɾɪ			

⁸Or, in the case of *sensi*[t^h]*ómeter*, a base with an aspirated stop: *sensi*[t^h]*ivity*.

b. Free stems: faithfulness to base prefers unaspirated

/yak-ómeter/	IDENT(rel. noise)	IDENT(gest. strength)	*C _[-asp] Ŷ
☞ a. jækamərɪ			*
b. jæk ^h amərɪ	*!		

- Sufficiently familiar or semantically distant forms may escape effects of base identity (e.g., *palatómeter*)

c. Possibility of flapping depends on degree of gestural reduction in base form

/cat-ómeter/	IDENT(rel. noise)	IDENT(gest. strength)	*rŶ
☞ a. kærámərɪ		?	*
☞ a.' kæt ^(ʔ) ámərɪ		?	*
b. kæt ^h ámərɪ	*!	?	

/rabbit-ómeter/	IDENT(rel. noise)	IDENT(gest. strength)	*rŶ
☞ a. ræbɪrámərɪ			*
b. ræbrɪ ^h ámərɪ	*!	*	

d. Marginal possibility of aspiration in clusters, based on forcefulness of release in isolation form

/ant-ómeter/	IDENT(rel. noise)	IDENT(gest. strength)	*C _[-asp] Ŷ
☞ a. æntámərɪ	?		*
(☞) b. ænt ^h ámərɪ	?	?	

(Note that OT formulation here, with constraints on phonetic correspondence stated as features, with categorical violations and question marks, is just shorthand for some more sensible way of talking about degrees of deviation from the base form)

(17) Explaining this ranking

- Few English affixes demand such slavish faithfulness to their bases; why *-ómeter*?
- Claim: this is in fact the natural initial state for all affixes
 - Initial state: OO-Faith \gg Markedness \gg IO-Faith (McCarthy 1998)
 - Ability to trigger alternations and repairs must be learned
 - Perhaps even on an affix-by-affix basis (see also Raffelsiefen)
- The fact that *-ómeter* remains in this state is related to the fact that it's rare and learned, and practically never occurs with the relevant types of bases

(18) Attested *-ómeter* words: very few in CELEX (Baayen, Piepenbrock, and van Rijn 1993)

- Lemmas with frequency > 0 (i.e., actually attested)

Reduction/No clash		Clash	
<i>thermometer</i>	[θɪmámərɪ] 102	<i>mileometer</i>	[màɪlámərɪ] 9
<i>speedometer</i>	[spədámərɪ] 15	<i>gasometer</i>	[gæsámərɪ] 6
<i>barometer</i>	[b(ə)ɹámərɪ] 14	<i>pedometer</i>	[pèdámərɪ] 1
<i>chronometer</i>	[krɔnámərɪ] 3	(<i>micrometer</i>)	[màɪkrámərɪ] 1
(<i>kilometer</i>)	[kəlámərɪ] 497		

- Crucially, none with voiceless stops
 - Speakers may be familiar with sporadic examples: *magnetometer*, *palatometer*
 - Plausibly not abundant, frequent, or familiar enough to prompt reranking of base-derivative faithfulness

(19) Local summary

- Surface correspondence to phonetic properties of base form in isolation corresponds well with range of realizations (and uncertainties or optionality) surrounding realization of voiceless stops before *-ómeter*
- Difference between *-ómeter* more “standard” level 1 affixes (like *-átion*) follows from learning account in which lack of data concerning voiceless stops before *-ómeter* leaves speakers with high-ranking OO-Faith

3 A revealing comparison: *-ography*

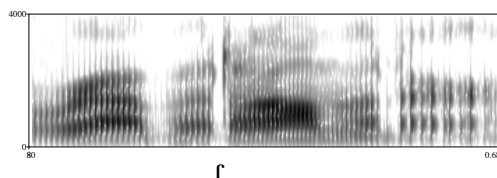
(20) Similarities between *-ómeter* and *-ógraphy*

- Overapplication of cluster simplification: *diphtho[ŋ]ography*⁹
- Aspiration in known forms: *lexi[k^h]ógraphy*, *ty[p^h]ógraphy*
- Unaspirated labials and dorsals in productive derivations: *sni[p]e-ography*, *sna[k]e-ography*, *ya[k]-ography*

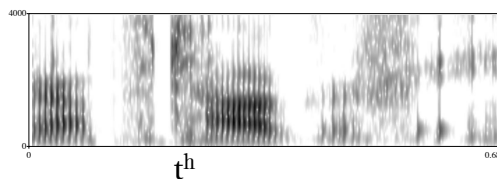
(21) But a surprising difference: aspiration of /t/

a.	<i>rabbit</i>	<i>rabbi[r]ómeter</i>	<i>rabbi[t^h]ógraphy</i>
	<i>ferret</i>	<i>ferre[r]ómeter</i>	<i>ferre[t^h]ógraphy</i>
	<i>hornet</i>	<i>horne[r]ómeter</i>	<i>horne[t^h]ógraphy</i>
b.	<i>cat</i>	? <i>ca[r]ómeter</i>	? <i>ca[t^h]ógraphy</i>
	<i>goat</i>	? <i>goa[r]ómeter</i>	? <i>goa[t^h]ógraphy</i>
	<i>stoat</i>	? <i>stoa[r]ómeter</i>	? <i>stoa[t^h]ógraphy</i>
c.	<i>elephant</i>	<i>elephan[t^(?h)]ómeter</i>	<i>elephan[t^h]ógraphy</i>
	<i>infant</i>	<i>infan[t^(?h)]ómeter</i>	<i>infan[t^h]ógraphy</i>
	<i>cormorant</i>	<i>cormoran[t^(?h)]ómeter</i>	<i>cormoran[t^h]ógraphy</i>

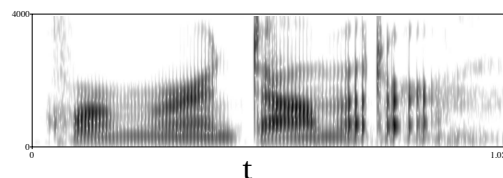
rabbi[r]ómeter



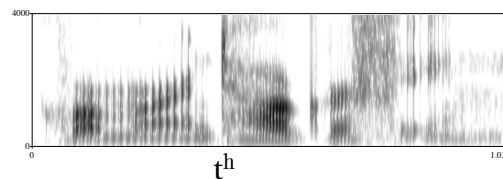
rabbi[t^h]ógraphy



cormoran[t]ómeter



cormoran[t^h]ógraphy



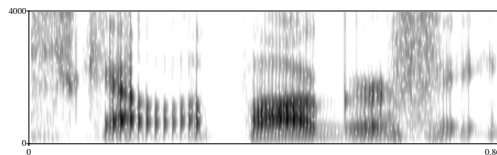
- Flapping/aspiration difference seen remarkably consistently across speakers

(22) A puzzling discrepancy

- Aspiration of /t/, but not of /p/ or /k/
- This does not correspond to the allophonic distribution found at any other prosodic or morphological boundary

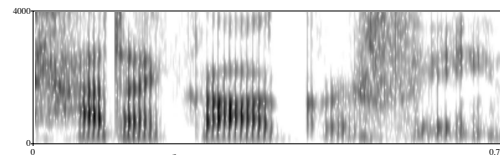
⁹The OED lists at least one exception, which I set aside as a learned formation: *iambographer* [aɪəmbəgrəfə(ɪ)]

scallo[p]ógraphy



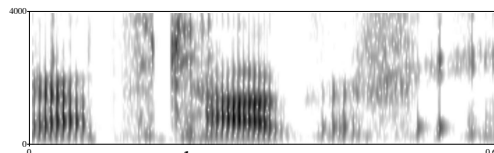
p

haddoc[k]ógraphy



k

rabbi[t^h]ógraphy



t^h

- Appears to preclude any analysis based on independently motivated structural representations, since no independent reason to think of aspiration as distinct processes for coronals vs. non-coronals

(23) Attested *-ógraphy/ -ógrapher* words (CELEX; ‘*’ = voiceless stop)

	<i>-ógrapher</i>	Freq	<i>-ógraphy</i>	Freq	Total
*	<i>photographer</i>	159	<i>photography</i>	98	257
	<i>geographer</i>	4	<i>geography</i>	218	222
	<i>biographer</i>	27	<i>biography</i>	103	130
	<i>autobiographer</i>	0	<i>autobiography</i>	126	126
	<i>pornographer</i>	2	<i>pornography</i>	76	78
	<i>bibliographer</i>	0	<i>bibliography</i>	34	34
	<i>choreographer</i>	6	<i>choreography</i>	6	12
*	<i>topographer</i>	0	<i>topography</i>	12	12
	<i>demographer</i>	1	<i>demography</i>	7	8
	<i>radiographer</i>	2	<i>radiography</i>	4	6
	<i>stenographer</i>	6	<i>stenography</i>	0	6
*	<i>cartographer</i>	2	<i>cartography</i>	2	4
	<i>oceanographer</i>	3	<i>oceanography</i>	1	4
*	<i>typographer</i>	0	<i>typography</i>	4	4
*	<i>cryptographer</i>	1	<i>cryptography</i>	2	3
	<i>ethnographer</i>	0	<i>ethnography</i>	3	3
	<i>orthographer</i>	0	<i>orthography</i>	3	3
*	<i>lexicographer</i>	2	<i>lexicography</i>	0	2
	<i>lithographer</i>	0	<i>lithography</i>	2	2
*	<i>cinematographer</i>	0	<i>cinematography</i>	1	1
	<i>hagiographer</i>	0	<i>hagiography</i>	1	1

- A number of attested examples with voiceless stops (and aspiration)
- CELEX frequencies may not correspond exactly to relative spoken frequencies?
 - My subjective intuition is that *cryptography*, *cinematography* are more frequent than, say, *demography* or *radiography* (mirrored also by Google counts)
- Several familiar /t-ography/ examples
 - *photography*, *cryptography*, *cinematography*

- Relatively fewer familiar /p-ography/, /k-ography/ examples
 - Some are bound, no clear base (*topography*, *typology*)
 - Others already have aspirated stop in base (*lexi*[k^h]*on* ~ *lexi*[k^h]*ography*)
 - So, no clear evidence of aspiration alternations for non-coronal stops before *-ógraphy*; no need to demote BASE-IDENT(release noise)

(24) Proposal:

- Early, widespread exposure to the word *photography* (possibly helped by words like *cryptography* or *cinematography*) helps demote BASE-IDENT(release noise) and BASE-IDENT(gestural strength) below *r^h
- This allows aspiration of /t/ to satisfy the otherwise very strong phonotactic requirement for aspiration in onset of stressed syllables

/rabbit-ógraphy/	*r ^h	IDENT(rel. noise) (-ógraphy)	IDENT(gest. strength) (-ógraphy)
a. ræbɪrɑgrəfi	*!		
b. ræbɪ ^h ɑgrəfi		*	*

- Lack of parallel evidence for /p/, /k/ leaves BASE-IDENT(rel noise) in its initial state, ranked above *C_[-asp]^h
 - No aspiration of /p/, and /k/: *scallo*[p]*ography*, *haddoc*[k]*ography*

(25) Conclusion from *-ógraphy*

- Though non-coronal stops behave the same as with *-ólogy*, a striking difference is seen between *rabbi*[r]*ómeter* and *rabbi*[t^h]*ógraphy*
- I know of now independently motivated structure or mechanism whereby aspiration of /t/ would be enforced separately from aspiration of /p/, /k/
- As a result, it's hard to imagine what structural difference one could posit between the two affixes in order to derive this difference
- Difference in ability to aspirate correlates suggestively with difference in set of attested forms, however
 - More /*t-ographer*/ than /*t-ometer*/ words
 - More /*t-ographer*/ than /*p-ographer*/ words
- Easily encoded with constraints on surface identity to base form, reranked in response to available data

4 Epilogue: *-ólogy*

(26) How many different affix types are there?

- If account of *-ómeter*/*-ógraphy* difference sketched above is on the right track, then in principle, we expect many different affix types
- For example, if an affix happened to occur often after voiceless stops, it might have the opportunity to condition aspiration for /p/ and /k/ as well as /t/
- Also, if different learners were exposed to different sets of words, they might reach rather different conclusions
- A possible test case: *-ólogy*

(27) Attested *-ólogy* forms in CELEX

- Compared with *-ómeter* and *-ógraphy*, there are relatively more familiar *-ólogy* forms (62 with frequency > 0 in CELEX)
- A few of these show clear data in support of alternations
 - *toxi[k^h]ology, clima[t^h]ology*
- However, most of them have no clearly related base form
 - *apology, anthropology, paleontology, tautology, ecology, gynecology*
- Using same logic as above, one would expect a preference for unaspirated stops and flaps, as with *ómeter*
 - This is indeed my intuition: *sni[p^(*h)]e-ology, sna[k^(*h)]e-ology, rabbi[r]ólogy*
 - It is also the systematic preference of one of the two speakers recorded in the phonetic pilot study
- However, the second speaker shows a different pattern
 - Variable aspiration after /p/, /k/ (6 out of 20 items)
 - Categorical aspiration of /t/ (13/13 items)

☞ Why do speakers differ before *-ólogy*?

(28) A boring possibility: depends on how many *-ólogy* words you know

- Large stock of low frequency/learned words in *-ólogy*, with free-standing base forms
- A few with /p/, /k/: *musicology, lexicology, hippology*
- Lots with /t/: *dialectology, insectology, planetology, parasitology, Egyptology, skeletology, symptomatology, etc.*
- Maybe the second speaker is more familiar with these?

(29) A more interesting possibility: faithfulness conditions vs. surface conditions

- Words like *toxi[k^h]ology* and *musi[k^h]ology* provide clear evidence that /k/ can alternate between related forms
 - *toxi[k] ~ toxi[k^h]ology*
- However, even without a clear base form, words like *psychology, ecology, typology, tautology, dermatology, gerontology, etc.*, provide a different kind of data
 - “*-ólogy* is often preceded by aspirated stops”
 - “*-ólogy* is **very** often preceded by aspirated [t^h]”
- Perhaps speaker 2 was employing lexically informed surface constraints?

(30) A small piece of evidence that this might be true

- Speaker 2 also differed from speaker 1 (and my intuitions, along with others who I've consulted) in one other interesting respect: frequent truncation before *-ómeter*

<i>badger</i>	<i>badgeometer</i>	[bædʒámɛr.ɪ]
<i>salmon</i>	<i>salmometer</i>	[sæmənámɛr.ɪ]
<i>chicken</i>	<i>chickometer</i>	[tʃíkámɛr.ɪ]
<i>bison</i>	<i>bisometer</i>	[baɪsənámɛr.ɪ]
<i>bishop</i>	<i>bishometer</i>	[bɪʃámɛr.ɪ]

- Sporadic effect; not every polysyllabic base was truncated
- Truncation never employed for any affix other than *-ómeter*

- Why truncate?
 - Note that truncated forms are actually prosodically worse than their non-truncated counterparts: *bàdgerómeter* avoids clash incurred by *bàdgeoómeter*
 - Looking back at set of attested *-ómeter* forms, however, we see that they all involve monosyllabic bases
 - Also an effect of enforcing surface constraint on output of affixation?

(31) Local summary

- More data is clearly needed, but segment-by-segment and affix-by-affix differences go beyond what is predicted by independently motivated syntactic and prosodic structures
 - Data presented here is modest, but remarkably consistent in many respects
- Currently available data suggests mix of effects
 - Faithfulness to realization of base form in isolation
 - Surface conditions on prosodic and segmental content of derived forms

5 Conclusion

(32) The “bad news”: data concerning realization of consonants before *-ómeter*, *-ógraphy*, *-ólogy* in American English do not appear to line up with a theory that makes use of a small number of independently motivated structural differences

- Differences between affixes in aspiration, but not in stress, etc.
 - *rabbi[r]ometer* vs. *rabbi[t^h]ography*
 - Also similar but not quite identical to effects before *-ée*, *-ése*
- Differences within affixes in aspiration/flapping, depending on place of articulation
 - *scallo[p]ography* vs. *rabbi[t^h]ography*
- These differences are particularly surprising, given the relative lack of data that speakers have about these affixes
- I have so far not seen any way to delimit the relevant processes in a way that makes them apply for just certain segments or affixes in this way
 - (If you have a way to predict them, your chance to speak is coming soon)

(33) The “good news”: these differences make sense, when two principles are applied

- Surface identity to base forms
- Possibility of alternations depends on attested data, on an affix by affix basis

(34) Barbarisms of this analysis

- Few implicational relations between alternations (Bermúdez-Otero 2007, OCP4)
 - “Alternation X in context A → alternation Y in context A”
 - “Alternation X in context A → alternation X in context B”
- Little generalization across segments, or across affixes

(35) Implicational relations across contexts and segments

- I do not wish to preclude the possibility that learners do, in fact, use data from one affixal or segmental context to generalize to other contexts
- Several natural mechanisms
 - Granularity of phonological constraints: *C_[-asp] V penalizes all places of articulation equally, so can't get aspiration on /p/ without /k/
 - Granularity of affix-by-affix differences (BASE-IDENT for *-ometer*, or for some larger set of affixes?)
 - Strength of affix-by-affix faithfulness: greater semantic or structural overlap → greater base identity
- I suspect that affix-by-affix caution here may be encouraged by the fact that these affixes are rare and occur in rather different segmental and prosodic contexts
- More (and more detailed) data is needed to investigate the full extent to which affixes-by-affix preferences may be encoded separately, and what kinds of data lead to generalization across affixes

References

- Baayen, R. H., R. Piepenbrock, and H. van Rijn (1993). *The CELEX lexical data base on CD-ROM*. Philadelphia, PA: Linguistic Data Consortium.
- Benua, L. (1997). *Transderivational Identity: Phonological Relations Between Words*. Ph. D. thesis, University of Massachusetts, Amherst.
- Bermúdez-Otero, R. (2008). [ðə swɪŋ'ɒmɪtə tʰɪnd ə'genst sə 'mɪŋɪs 'kæmbəl]: Evidence for Chung's generalization. Paper presented at the 16th Manchester Phonology Meeting, 24 May 2008.
- Browman, C. P. and L. Goldstein (1992). Response to commentaries. *Phonetica* 49, 222–234.
- Burzio, L. (1996). Surface constraints versus underlying representations. In J. Durand and B. Laks (Eds.), *Current trends in phonology: Models and methods*, pp. 97–122. CNRS, Paris, and University of Salford: University of Salford Publications.
- Burzio, L. (2005). Sources of paradigm uniformity. In L. J. Downing, T. A. Hall, and R. Raffelsiefen (Eds.), *Paradigms in Phonological Theory*, pp. 65–106. Oxford University Press.
- de Jong, K. (1998). Stress-related variation in the articulation of coda alveolar stops: Flapping revisited. *Journal of Phonetics* 26, 283–310.
- Fukaya, T. and D. Byrd (2005). An articulatory examination of word-final flapping at phrase edges and interiors. *Journal of the International Phonetics Association* 35, 45–58.
- Kenstowicz, M. (1997). Base identity and uniform exponence: Alternatives to cyclicity. In J. Durand and B. Laks (Eds.), *Current Trends in Phonology: Models and Methods*, pp. 363–394. Salford: University of Salford.
- Marantz, A. (to appear). Phases and words.
- Marvin, T. (2002). *Topics in stress and the syntax of words*. Ph. D. thesis, MIT.
- McCarthy, J. (1998). Morpheme structure constraints and paradigm occultation. In M. C. Gruber, D. Higgins, K. Olson, and T. Wysocki (Eds.), *CLS 32, vol. II: The Panels*. Chicago Linguistic Society.
- Michaels, J. (2007). Syntactically conditioned phonology: Causatives in Malayalam. MIT ms.
- Raffelsiefen, R. (1999). Phonological constraints on English word formation. In G. Booij and J. van Marle (Eds.), *Yearbook of Morphology 1998*, pp. 225–287. Dordrecht: Kluwer.
- Raffelsiefen, R. (2005). Paradigm uniformity effects versus boundary effects. In L. J. Downing, T. A. Hall, and R. Raffelsiefen (Eds.), *Paradigms in Phonological Theory*, pp. 211–262. Oxford University Press.