EGG School, Banja Luka
July/August 2018

Does word frequency affect phonology? Reasons to be cautious... 3

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The contents of this session

1. How do things stand in terms of the full balance of predictions...?
2. Do the examples hold up to scrutiny?
3. Are frequency effects omnipresent?

How do things stand in terms of the full balance of predictions...?

Let's see... the interesting ones are where they disagree...

1. Low frequency ('frequency conserving') effects should exist
- UBP – yes ✓
- FP – yes ✓

2. High frequency effects should exist
- UBP – yes
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3. High frequency effects should *always* exist in 'natural' changes/rules
- UBP – yes
- FP – no

4. Frequency effects, like all phonological generalisations, should always be gradient
- UBP – yes
- FP – no

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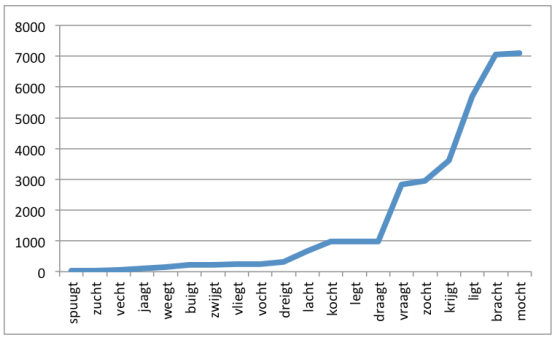
The type of frequency effects that are really problematic for formal phonology are synchronic frequency effects
- the kind of variation that is observed in connection with 'change in progress' is implemented by speakers synchronically
- in a formal approach, this would involve a rule-based statement
  - such rules should not show lexical effects on the FP assumptions that we have considered

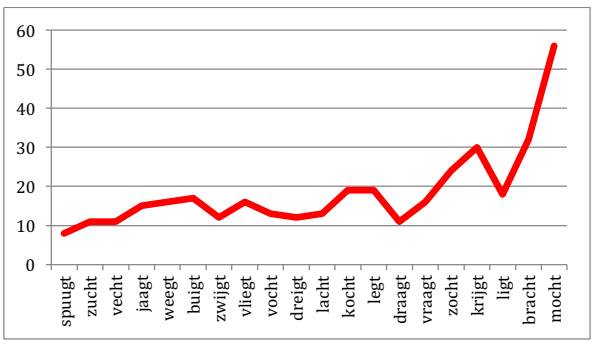
Do the examples hold up to scrutiny? Do synchronic high frequency effects exist?

Reasons to be cautious...

Coronal Stop Deletion

Let's return to the graphs summarising the Dutch case of t → Ø / s,x__#
- they seem to make a strong case for the existence of a high frequency effect

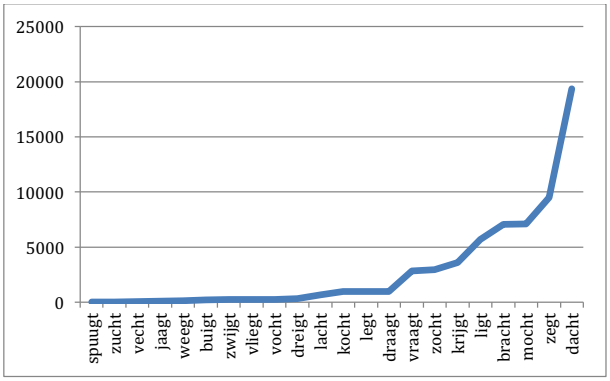


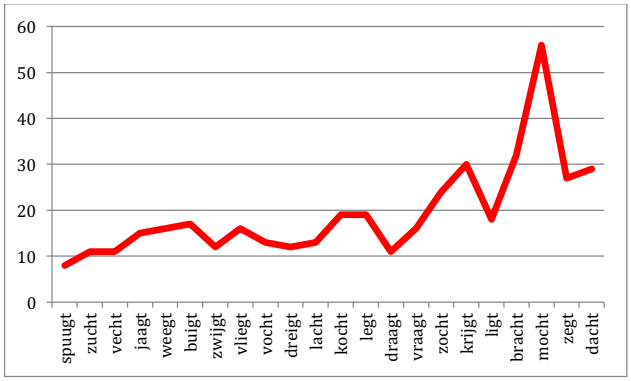


Frequency of use and likelihood of deletion increase in a highly similar way
- given the interpretation of numbers in such situations, we cannot expect a perfect fit
  - however, others interpreting results like this have complained that, to be persuasive, the numbers need to be shown to be statistically significant

And, actually, I slightly overplayed the Dutch case in the graphs by including only the first 20 words

- if we add in all the words that Phillips gives numbers for, the situation may be different





It's not completely sure what the likelihood of deletion graph is showing

- there is a peak for *mocht*, and lots of variation between 10% and 30%
  - is it clear that the variation is significantly related to frequency?

What about the case of English: t,d → Ø / C_# ?

Phonetic environment	Verb	% Deletion	*CELEX* – raw word form frequency	
			More susceptible to deletion	Less susceptible to deletion
-ld	told	68	1763	
	held	0		765
-lt	felt	55	1449	
	built	0		456
-nt	sent	25	551	
	meant	0		515
	lent	0		25
-pt	kept	66	750	
	slept	50		120
-ft/st	left	25	1503	
	lost	0		759

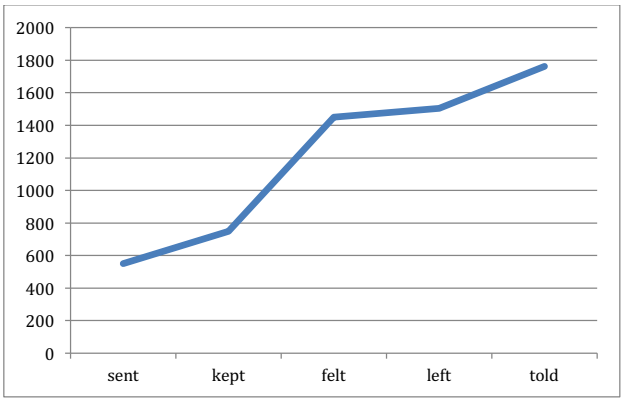
The claim is that:

- once phonological environment is considered – there is a frequency effect

But, is it right to place so much weight on the differences in phonological environment?

- would we expect deletion to pattern differently in [_lt] and [_nt]? or [_pt] and [_ft]?
  - a case needs to be made why that should be the case

If we simply rank the high-frequency words in terms of their frequency, the correlation with deletion is not impressive...



It may also be relevant to consider that, as Abramowicz (2007) points out:

- t,d-deletion in varieties of English is generally regarded as stable variation
  - while there may be a frequency effect to be seen here, it is not a diachronic fact
  - it could be that that implementation of frequency effects in variation is due to a different mechanism to that which drives phonological change

"*time* and *thyme* are not homophones"

The work reported here is statistically sophisticated

- however, the case is less clear that Gahl argues – the full citation is as follows:

> Crucially for the current study, the log frequency of a word was a significant predictor of word duration when all other factors were controlled for: as frequency increases, word duration decreases, when other factors are held constant. This effect, while small, is similar in size to other theoretically important effects on word duration reported in the literature, such as effects of repetition, associative priming, and contextual predictability (e.g. Bell et al. 2003, Shields & Balota 1991), and to the effects of the other factors in the model.

The effect is small – is it robust?

- small statistic effects need some caution in interpretation
  - an effect of this kind has been replicated in some other studies, so it is likely robust

However…

The experimental record on this question is mixed. A majority of studies of homophone durations have so far failed to find differences in the durations of homophone pairs as a function of frequency. Other studies, however, found duration differences in some experiments, apparently varying with presentation order and context. Whalen (1991, 1996) found duration differences when homophones were presented in word lists with the words grouped by frequency, but not when the same words were presented in mixed-frequency lists. Similarly, Guion (1995) found that pairs of homophones differed in duration when the words were embedded in constructed sentence pairs (such as *We'll* ***need*** *the watch for a few hours*, *We'll* ***knead*** *the dough for five minutes*). When the same words were read in generic carrier phrases (*Say . . . to me again*), however, there was no significant difference in duration. Another study that did not report any significant durational differences between homophone pairs is Cohn et al. 2005a,b, which tested words in lists, as well as in constructed sentences, some of which were the same as in Guion's study.

And

A small number of studies have examined homophone durations in corpora of speech in naturalistic settings. Lavoie 2002 examined the pronunciation of the words *four* and *for* in read speech and in spontaneous speech. Although Lavoie reported shorter durations for the more frequent *for* than for the less frequent *four*, those differences may be related to the prosodic environments of the two items in question, which affects the contextual speaking rate. Indeed, Lavoie's interpretation of the durational differences is that they reflected effects of articulation in context, rather than differences in the representation associated with each word.

And

Jurafsky et al. 2002 examined the durations of four ambiguous function words (*to*, *that*, *of*, and *you*) in a subset of the Switchboard corpus of American English telephone conversations. A subsequent study (Bell et al. 2003) examined the ten most frequent English function words. Using multiple regression, Bell and colleagues controlled for factors known to affect duration, such as speaking rate, segmental context, pitch accent, and contextual predictability. Once these factors were controlled for, the frequency of the preposition *to* vs. the infinitival marker *to*, for example, was no longer a significant predictor of word durations.

The balance on imperceptible phonetic effects in reduction is:

- the issue is unproven, but certainly possible
  - however, it is not completely clear that all other potentially confounding factors could be accounted for in a corpus study
  - and, however, a reasonable question is: is this a phonological effect?
- it may well be that phonology does not need to account for such effects
  - but that doesn't let FP completely off the hook...
  - something in a model of language-and-speech will need to be able to account for it

Syncope in English

This does look phonological – the summary is:

There is a process of syncope in English, which is spreading through the lexicon, and is "more advanced in words of higher frequency (such as those just named) than in words of lower frequency" (Bybee 2001, 11)

High frequency word:	*every*	[∅]
Mid frequency word:	*memory*	[∅ ~ ə]
Low frequency word:	*mammary*	[ə]

There are several reasons to be cautious about this...

- certainly, syncope in English is more complicated that this makes out
  - there is a major debate as to whether syncope is actually a synchronic phonological process in English

It certainly does not just involve the post-tonic cases that are typically discussed in connection with frequency

High frequency word:	*every*	[∅]
Mid frequency word:	*memory*	[∅ ~ ə]
Low frequency word:	*mammary*	[ə]

Harris (2011), though Balogné Bérces (2011)

> Syncope in English, which is both lexically and phonetically variable, targets unstressed syllables in two environments […] (a) a word-initial unfooted syllable […] and (b) between a stressed and an unstressed syllable where the consonant following the targeted vowel is a sonorant and more sonorous than the consonant preceding […] The effect of the second pattern is to contract a trisyllabic sequence into a bisyllabic trochaic foot.

Balogné Bérces, Huber & Turcsán (2011)

post-stress syncope	**pre-stress syncope**
strict sonority constraint[1] Hooper: not before obstruents, not even in *sC* clusters[2]	phonotactically unconstrained (Zwicky), or: less constrained, on a relative scale (Hooper[3])
e.g., *camera*, *family*, *different*, *separate* (adj), etc.	e.g., *terrain*, *police*; also in *suppose*, *suffice*, *potato*, etc.
lexicalized cases	only attested in very fast and casual speech

Is English syncope phonological?

- if so, it creates all different kinds of opacity

Balogné Bérces, Huber & Turcsán (2011)

Aspiration[7]	Tapping[8]	Voicing	Gemination
sU[p^h]osed [k^h]Onnections [k^h]Ollected	li[ɾ]Erature ca[ɾ]Alog ca[ɾ]Ering	po[z]Itive	pro[bb]ly ('probably') lib[rr]y ('library')
- no aspiration after [s] morpheme-internally - no aspiration bef. C	no tapping before C	no voiced fricatives before fortis obstruents morpheme-int-ly	no lexical geminates

Any consideration of syncope needs to consider these facts!

Kiparsky (2016) is scathing...

> It has been claimed that the syncope of unstressed medial vowels between a consonant and a sonorant is a sound change in English that spreads through the lexicon, frequent words first. According to Bybee (2007), the high-frequency word *every* has undergone it, the low frequency word *mammary* has not, and the medium frequency word *memory* is in the process of changing. Phillips (2006: 97–98) likewise argues that syncopation depends on word frequency, so that *opera*, *salary*, *camera*, *cabinet*, *memory*, *history* tend to syncopate more often than the relatively less frequent *broccoli*, *gasoline*, *grocery*, *buffalo*, *surgery*, *chocolate*. Her figures show at best a tenuous correlation to frequency (she does not test for statistical significance). But the more important point is that these data are completely irrelevant, because syncope took place in Old English, and one cannot document the conditions of an Old English sound change with modern English vocabulary. None of the words cited by Bybee and Phillips actually underwent the sound change. *Every* is from OE *æfre ylc*, not **æfere ylc*, and the others were not yet in the language: *memory* is a 13th century borrowing from Anglo-Norman, *mammary* is a 17th century learned borrowing from Latin, and there was no *broccoli*, *gasoline* or *chocolate* in Old English. The Old English sound change was phonologically conditioned by stress and syllable weight, and conformed perfectly to the regularity hypothesis (Sievers-Brunner 1965: §158–159; Campbell 1983). It left the language with a productive variable synchronic syncope process, which has existed in the grammar, in a modified form, for a millennium down to the present.

Synchronic syncope is a variable rule whose frequency of application depends on a number of factors besides word frequency. The principal phonological inhibitor is the avoidance of stress clash, e.g. *gén'rative* vs. *géneràtion*. Phonotactics also appears to play a role: sequences like *-nm-* that involve gestural overlap (Blevins and Garrett 1998, 2004) are avoided, as in *enemy*, *economy* vs. *emery*, *refectory* (trumping frequency). There is less syncope before word-level suffixes than before stem-level suffixes, e.g. *hindering* vs. *hindrance*. Opaque forms such as *parchment*, *poultry*, *butler*, *chaplain*, *apron*, *dropsy*, *chimney*, *remnant*, *damsel*, *partner*, *marshal*, *captain*, *laundry* have been entirely reanalyzed in their syncopated form, as have *fancy* and *curtsy* from *fantasy* and *courtesy*, whereas transparently derived words like *cursory*, *operative*, *summary*, *temporal*, *cidery*, *buttery*, *cobblery*, *clownery*, *cookery* can retain the trisyllabic underlying form and remain subject to variable syncope indefinitely as long as their morphology stays transparent, because their trisyllabic pronunciation can be acquired ('analogically restored') even by speakers who have only heard them syncopated.

Are any high frequency effects robust...?

- it seems likely so, but the case is far less robust than UBP theorist contend

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As a reminder...

- Tamminga (2014) explains how Pierrehumbert (2002) sets this out:

> Pierrehumbert explicitly extends the claim that frequent words lead sound change to any kind of gradient phonetic change, stating that "any systematic bias on the allophonic outcome would incrementally impact high frequency words at a greater rate than low frequency words" (2002:118). Just as frequent words that undergo reduction in speech should end up being more reduced in the phonetics inherent to their representation, frequent words that are undergoing non-reductive sound change (for example, the raising of /ey/ along the front diagonal in Philadelphia (Labov et al., 2013)) should accumulate advanced tokens more quickly than their less-frequent counterparts.

In order to understand this, the study of contemporary variation ('change in progress' or 'stable variation') is crucial, and – luckily – this has been investigated in detail

Labov (2006) explains that the large majority of changes described as being in progress across the United States in Labov, Ash, & Boberg (2006) show no frequency effect at all

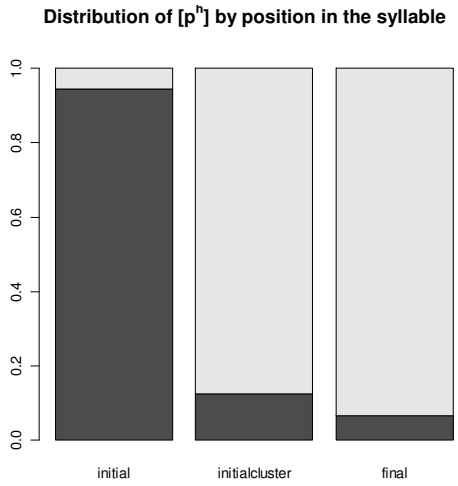
- Labov, Ash, & Boberg (2006) *The Atlas of North American English: Phonetics, phonology and sound change* is the largest ever investigation into phonological variation (both synchronic and diachronic) in American English

Labov (ms) writes that

- "the study of a century of sound change in Philadelphia has found no evidence of lexical irregularity in the fronting of /aw/, /ow/ and /uw/, the raising of /ahr/ and /ohr/, the raising of /oh/or the backing of /e/, as well as the raising of /eyC/"

Pharao (2010) investigated the lenition of /p, b, k, g/ (and other phenomena) in Copenhagen Danish in real detail

- there is massive, variable lenition in Danish – exactly the kind of things that 'should' show a high frequency effect on UBP predictions



Pharao found that

- "[f]or the variables (ɒw), (p), (b), (k) and (g), word form (log) frequency does not emerge as significant"

- tokens of |p| which are expected to be realized as [b̥] in distinct, casual speech:

Variant	b̥	β	pʰ	deleted	ɸ	f
Number	408	71	37	15	7	1
Percentage	76 %	13 %	7 %	3 %	.9 %	.1 %

Tamminga (2014) shows that the several types of the word *like* with considerably different frequencies behave in a way which goes against the predictions of UBP in terms of the introduction of aɪ-raising in Philadelphia English.

like has several different lexical entries, all with the same phonological form /laɪk/

- these have massively different frequencies of occurrence

Function	Example
Lexical verb	*I don't LIKE the taste of beer anyways*
Preposition	*The tripe itself is almost bland as such, LIKE eating Jello.*
Conjunction	*But uh they didn't go up together LIKE they used to.*
Adjective	*I don't know if he's exactly LIKE his father.*
Quotative	*And she's LIKE, "Let's go to this fortune teller."*
Discourse marker	*Um LIKE we used to play a lot of running games you know.*

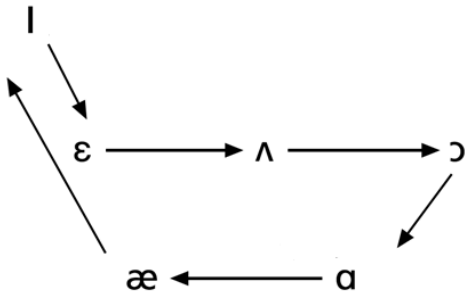
Function	Count
Lexical verb	213
Preposition	274
Conjunction	129
Adjective	138
Discourse marker	1149

Within-dataset frequency of the LIKE functions

Tamminga concludes: "The adjective, conjunction, discourse marker, and preposition forms of LIKE are in lockstep throughout the entire course of the change, despite order-of-magnitude differences in their within-dataset frequencies."

Dinkin (2008) conducted a detailed consideration of a change which is in progress in US English: the Northern Cities Shift, which can affect /ɪ, ɛ, æ, ʌ/, and other vowels, at its most extreme, analysing measurements of a large number of tokens of vowels involved.

- one representation of aspects of the NCS is as follows:



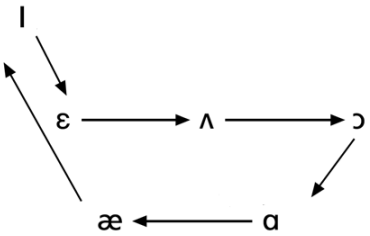
A view of the Northern Cities Shift
(based on Labov 2010:15)

Dinkin finds that some small high frequency effect seems to exist for /ɪ, ɛ/

- words which contain these vowels move a little more in the direction of the shift than infrequent words
- however: the opposite effect exists for /æ, ʌ/ (and also /ʊ/ which is not involved in the NCS) as words which contain /æ, ʌ/ move a little less in the direction of the shift than infrequent words

This seems paradoxical, but Dinkin shows that it is understandable along the following lines:

- the NCS changes that affect /ɪ, ɛ/ involve centralisation
- the NCS changes that affect /æ, ʌ/ involve movements away from the centre



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- the actual frequency effects that Dinkin observes have nothing to do with the Northern Cities Shift changes
  - the frequency effects are all just a slight synchronic centralisation effect of all segments in frequent words
  - this looks like the same kind of thing as the 'time-thyme' imperceptible phonetic effect of 'word reduction'

Dinkin (2008, 9) "it is certainly not sound change in progress *in general* that is led by more frequent words" – again, conflicting with the predictions of UBP.

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- UBP – yes
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- will it make all the difference...?