Semantically opaque prefixes in English phonology

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SEMANTICALLY OPAQUE PREFIXES AND ENGLISH PHONOLOGY

Claim: English words such as *begin, contain, destruct, expel, forget, include, respect, submit* should be analysed as complex and not as simple words.

1. OPAQUE PREFIXED WORDS: HISTORY AND ISSUES

1.1. *The = boundary in early generative phonology*

Early generative phonology (Chomsky & Halle 1968: 94; Halle & Keyser 1971: 37; Liberman & Prince 1977) used the = boundary (as opposed to +) for "complex verbs", i.e. verbs which are "morphologically analyzable into one of the prefixes *trans-*, *per-*, *con-*, etc. followed by a stem such as *-fer, -mit, -cede, -curn* or *-pel*" (Chomsky & Halle 1968: 94).

The difference between = and + was often interpreted as an etymological difference: = would be for Latinate words and + for "default" words (McMahon 2000: 69; Scheer 2011: 72; Siegel 1974: 114, 1980).

This seems to be a misinterpretation of the fact that SPE's list of formatives are all Latinate. SPE's authors never claim that = should be restricted to Latinate words, but it is true they never use examples containing Germanic prefixes (e.g. *be-*, *for-*).

In SPE, the = boundary was used to account for specificities in the stress patterns of verbs. In general, they claimed that:

- verbs have final stress when their final syllable contains a strong cluster (i.e. when the final syllable is heavy; e.g. *cajóle, eráse, collápse, cavórt*)
- they have penultimate stress when it does not (e.g. *astónish, édit, imágine*).
- verbs of three or more syllables undergo the Alternating Stress Rule (hereafter ASR; SPE: 77), which retracts final primary stress to the antepenult (e.g. *víolàte, extrápolàte, expérimènt*).

The = boundary was used to account for the stress pattern of dissyllabic verbs with a stressed light ultima (1a) and longer verbs which do not follow the ASR (1b).

(1) a. *permít, concúr, compél, detér, transfér*
b. *còmprehénd, ìntersect, còntradíct*

This boundary ensured that stress would be assigned to the final syllable even though it was light and to block the retraction of stress to the antepenult if the final syllable is immediately preceded by =.

1.2. *Siegel's rejection of the = boundary*

Siegel (1974, 1980) rejects the = boundary and comes up with the now commonplace "Class I" and "Class II" classification of English affixes.

She modifies the ASR to restrict stress retraction to verbs which end with a suffix. The stress difference between *désignàte* and *ìntersect* is therefore accounted for without any reference to =.[1]

She mentions examples such as those in (1a) in her presentation of SPE's analysis but does not mention them in her own analysis, which they directly contradict:

- If the = boundary is rejected then these words have to be treated as exceptions because they contradict the weight-based generalisation.

Therefore, abandoning the = boundary was done on questionable grounds. After her work, "Latinate prefixes" have only been referred to for their particular reduction behaviour (see §2.1).

1.3. *The problem*

Historically prefixed words in English are a well-known issue in morphological theory (Anderson 1992: 55; Aronoff 1976: 12-15; Bauer *et al.* 2013: 15-16; Katamba & Stonham 2006: 23; Mudgan 2015; Plag 2003: 30-33) as their constituents are recurring forms with no clearly identifiable meaning and therefore constitute a challenge to the standard definition of the morpheme as the minimal meaningful unit.[2]

Let us leave aside the question of how such opaque constituents should be called ("pseudo-morphemes", "formatives") and ask whether semantically opaque prefixed words should be analysed as complex or not.

Four questions:

1. Are there phonological phenomena which seem to be sensitive to the presence of opaque prefixes?
2. Is there psycholinguistic evidence showing that speakers store forms such as *contain* or *submit* as complex words?

[1] Siegel's criticism is based on dubious examples that she describes as "the ones I have been able to find" (without mentioning how the search had been conducted) such as *bicuspid, inhibit, prohibit, inhabit, evanesce, immature, premature* or *determine.* She claims that SPE predicts that these verbs would receive stress on their prefix. This seems clearly wrong: SPE predicts stress retraction only in the case where the verbs receive final stress. Apart from *immature* and *premature*, all of these verbs have a light ultima and are correctly predicted to receive penultimate stress. Moreover, *bicuspid, immature* and *premature* all have semantically transparent prefixes and should be described using + and not =.

[2] Note that zero morphemes, cranberry morphemes and theme vowels also contradict that definition.

If the first two questions are answered positively:

3. What mechanisms can English speakers use in order to recognise these structures in the absence of clear semantic information?
4. What are the limits of this recognition?

2. PHONOLOGICAL PHENOMENA SENSITIVE TO OPAQUE PREFIXATION

2.1. Vowel reduction

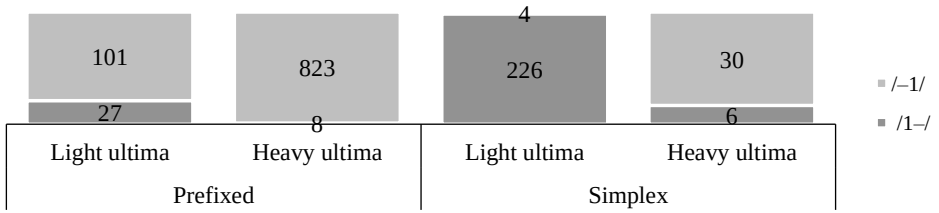
Virtually all major works on the phonology of English recognise that "Latinate" prefixes[3] have a specific reduction behaviour (SPE: 118; Halle & Keyser 1971: 37; Liberman & Prince 1977: 284-285; Guierre 1979: 253; Selkirk, 1980; Hayes 1982; Halle & Vergnaud 1987: 239; Pater 2000; Hammond 2003; Collie 2007: 129, 215, 318-319).

Initial pretonic closed syllables normally do not undergo vowel reduction (e.g. *l*[æ]*mpóon, p*[ɒ]*ntíficate, t*[e]*chníque*) whereas prefixes in that position almost always reduce (e.g. [ə]*dvánce, c*[ə]*ndénse, s*[ə]*btráct*).[4]

To my knowledge, the only proposed explanation for this particular behaviour is given by Hammond (2003), building on previous work by Fidelholtz (1975), who suggests that high frequency items tend to reduce.

2.2. The stress pattern of verbs

Preliminary data from Dabouis & Fournier (in preparation) on dissyllabic verbs shows that prefixation does have an effect on the position of stress, independently of syllable weight.[5]



Examples:

/1–/ : *conjure, suffer*	/1–/ : *contact, injure*	/1–/ : *bother, vomit*	/1–/ : *calcine, foray*
/–1/ : *begin, commit*	/–1/ : *betray, consult*	/–1/ : *caress, possess*	/–1/ : *cajole, molest*

- A purely weight-based account misses the 101 verbs with stressed light ultimas (the ones Siegel does not evoke in her new analysis; see §1.2).
- Many of these verbs are common words: *admit, become, discuss, forget, permit…*

2.3. Secondary stress

Dabouis (2016): large investigation on ≈ 6,000 words containing a secondary stress mark in Wells (2008). Some of the results showed an influence of historic prefixation.[6]

2.3.1. Non-derived words

The data contained 55 non-derived words (i.e. monomorphemic or bound bases) with at least three pretonic syllables.

	Non-prefixed	Prefixed
/20-/	35 (83%) e.g. *abracadabra, catamaran, prestidigitation, rodomontade*	0
/02-/ or variation	7 (13%) e.g. *aperitif, egalitarian, taramasalata*	13 (100%) e.g. *amanuensis, divertimento, inamorata, repetiteur*

- Problem: many of the historically prefixed words are rare and seem very difficult to analyse synchronically as prefixed:

amanuensis "One who copies or writes from the dictation of another."

→ *manu* < *manual, manufacture, manumit, manuscript*?

inamorata " A female lover, mistress, sweetheart."

→ *amor* < *enamor* "to fill/inflame with love" + knowledge of Italian *amore*?

…

[3] As mentioned in §1.1, this restriction is most likely an overinterpretation of the fact that SPE never uses examples containing Germanic prefixes. Guierre (1979) notes that Germanic prefixes have the same behaviour (e.g. *b*[i~ə]*spéak, b*[i~ə]*stów, b*[i~ə]*stríde*).

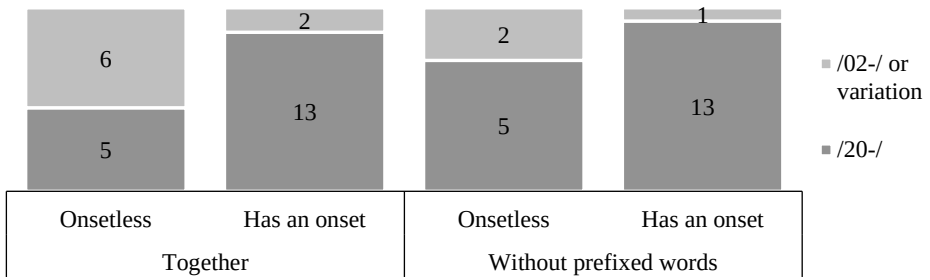
[4] Raffelsiefen (2007) proposes an alternative analysis. She claims that vowel reduction in closed initial syllables is specific to verbs. However, she contrasts only prefixed verbs (e.g. *contain, obsess, suspect*) to non-prefixed nouns (e.g. *canteen, pontoon, sestet*). There are almost no dissyllabic non-prefixed verbs with a closed initial syllable but they all have full vowels (e.g. *bl*[æ]*sphéme, fr*[æ]*gmént, st*[æ]*mpéde*). However, some of them may be unreliable because of the existence of related nouns with initial stress (e.g. *fragment, segment*) or because of the pronunciation of a related word (*st*[æ]*mpede* < *stamp*). Likewise, prefixed nouns are scarce but all have reduced vowels (e.g. *c*[ə]*nstráint, c*[ə]*ntémpt, s*[ə]*spénse*) but that behaviour can be attributed to the corresponding verbs (*constrain, contempt, suspend*).

[5] In the rest of this presentation /1/ stands for primary stress, /2/ for secondary stress and /0/ for no stress.

[6] The study does not take into account proper names such as *Monongahela* or *Ticonderoga* or compounds.

Alternative explanation: Halle & Kenstowicz (1991) note that #LL words stressed /02-/ are often onsetless. Many prefixed words are onsetless → could explain their different stress.

If we keep only #LL words, we get:



Difference: Significant (Fisher's exact test: $p < 0.04$) Non-significant (Fisher's exact test: $p = 0.52$)

- Small effect of onsetlessness.
- That effect disappears if we factor out prefixed words.
- We are still to explain how these prefixes are recognised.

2.3.2. Derived words

Study of 250 derivatives with a trisyllabic pretonic sequence and base stressed /01(-)/ only.

Goal: to determine what parameters can explain occasional stress preservation failures (e.g. *antícipate → antìcipátion ~ ànticipátion*).

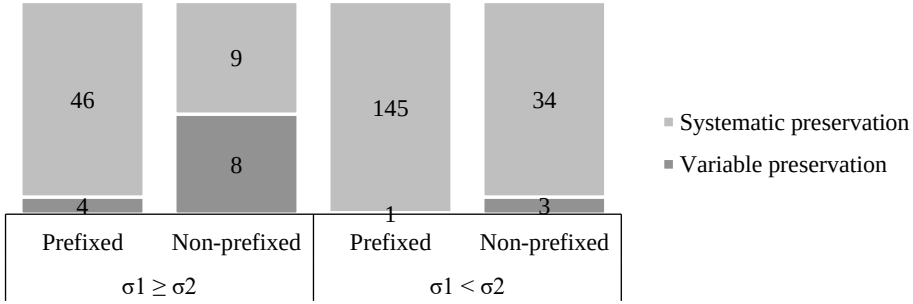
A number of variables were evaluated in a binary logistic regression (relative/absolute frequency, relative prominence, morphology…).

- Only two variables turned out to have a significant correlation with preservation failure: morphology (presence of an opaque monosyllabic prefix) and relative prominence (using mora counts proposed by Hammond (1999: 145)).[7]

	95% C.I.			p-value
	Inf	OR	Sup	
MORPH-PREF	0,030	0,109	0,355	0,000336
S1<S2-YES	0,031	0,124	0,412	0,001173

[7] This contradicts Collie's (2007, 2008) findings: she reports an effect of relative frequency of the base and the derivative. In her data (which presents biases discussed in Dabouis (2016: §8.4.2.1)), preservation failure is more likely to occur if a derivative is more frequent than its base.

The data is distributed as follows:



- Variable preservation is facilitated by a higher prominence of the first syllable relative to the second syllable.
- Preservation on the second syllable is almost systematic in prefixed words (e.g. *communication, denunciation, evacuation, intoxication, perceptibility*).

This second finding is consistent with analyses which describe opaque prefixes as "stress-repellent" (see Fudge (1984: §6.2)).

2.4. "Final Nucleus Enhancement"

Raffelsiefen (2007: §3.1.2) notes that tensing/lengthening of the prefix vowel (e.g. *b*[iː]*witch, d*[iː]*cease, pr*[iː]*scribe*) is possible for certain prefixes which are either mildly productive (*be-*) or have evolved into modifying prefixes (*de-*, *pre-*, *re-*) but not in prefixes such as *e-*, *se-* or *neg-* (in *elect, select, neglect*).

- She interprets this as a boundary signal indicating prefix recognition.

Problem: according to Wells (2008), Final Nucleus Enhancement (marked [i] in the dictionary) is actually possible for *e-* (e.g. *eject, emend, emerge, emit, eruct, evoke, evolve*) but also for non-prefixed words (e.g. *echidna, echoic, economy, egalitarian, elastic*)

- More extensive empirical work on the issue needs to be conducted before we can be sure this phenomenon is indeed a manifestation of prefix recognition.

3. PSYCHOLINGUISTIC EVIDENCE

A number of psycholinguistic studies report that morphological structure, even opaque, has an influence on visual morphological processing.

Overall they conclude that *"morphological decomposition is a process that is applied to all morphologically structured stimuli, irrespective of their lexical, semantic or syntactic characteristics"* (Rastle & Davis 2008, in a review on the issue).

This morpho-orthographic decomposition would appear to take place in the early stages of the recognition process, independently of semantics[8] (see Marslen-Wilson *et al.* (2008) and references therein).

Lexical decision studies which have focused on prefixed words with bound roots and report facilitation with primes which share their root with the target. Here are some of their results:

- Taft & Forster (1975) (later replicated with more thoroughly controlled materials in Taft (1994)) found that, in a lexical decision task, participants took longer to reject prefixed nonwords which contained a bound stem (e.g. *devive*, with *-vive* from *revive, survive*) than those which did not (e.g. *delish*, with *-lish* from *relish*).
- Taft *et al.* (1986) also found that nonwords with non-prefix initial elements (e.g. *tejoice, asiwhelm, lanlediate, asiwhast*), even if they contained bound stems, were rejected faster than those with initial prefixes (e.g. *dejoice, uniwhelm, dejouse, conlediate*).
- Forster & Azuma (2000) and Pastizzo & Feldman (2004) conducted lexical decision tasks with masked priming with prefixed words containing bound stems (e.g. *explore*) or free stems (e.g. *distrust*) and found the same amount of priming facilitation for both structures (independently of orthographic factors).

See also Emmorey (1989 and Stanners *et al.* (1979)

4. POSSIBLE MECHANISMS OF RECOGNITION

4.1. Distributional recurrence

4.1.1. Between prefixed forms

Prefixes and roots often alternate with each other, which is likely to be the main mechanism allowing their identification (Fournier 1996, 2012; Taft 1994).

Root / Prefix	*-ceive*	*-clude*	*-duce*	*-fer*	*-mit*	*-press*	*-spect*	*-tain*
a-/ab-/ad-			*adduce*		*admit*		*aspect*	*attain*
con-/com-	*conceive*	*conclude*	*conduce*	*confer*	*commit*	*compress*		*contain*
de-	*deceive*		*deduce*	*defer*		*depress*		*detain*
ex-		*exclude*				*express*	*expect*	
in-		*include*	*induce*	*infer*		*impress*	*inspect*	
per-	*perceive*				*permit*			*pertain*
pre-		*preclude*		*prefer*				
pro-			*produce*				*prospect*	
sub-				*suffer*	*submit*	*suppress*	*suspect*	*sustain*

This could even apply to a completely unproductive, obscure and rarely occurring prefix such as *se-*:[9]

(2)

secede	*accede, concede, precede, recede*
seclude	*conclude, exclude, include, occlude, preclude, reclude*
secrete	*concrete, discrete, excrete*
secure	*procure, obscure*
seduce	*adduce, conduce, deduce, induce, produce, reduce, traduce*
select	*collect, elect*

- Forster & Azuma (2000) and Pastizzo & Feldman (2004) find greater priming effects with roots which are found in many words (e.g. *mit* is found in more words than *vive*).

4.1.2. Between prefixed forms and suffixed forms

The recurrence of the root in suffixed forms can also contribute to its identification, even more so when there can be semantic similarities.

(3)

rect	< *rectify, rectilinear*	"rightness, straightness"
spect	< *spectate, spectacle*	"looking, sight"
rupt	< *rupture, bankrupt*	"breaking"
venge	< *vengeance, vengeful*	"avenging"
vive	< *vivace, vivid, vivify*	"life"

[8] Feldman *et al.* (2009) do not challenge the claim of early morpho-orthographic decomposition but they argue that semantic similarity can influence early morphological processing.

[9] Guierre (1979: 362) also suggests that, even though *severe* is not historically prefixed, it could be reinterpreted as such on the model of *secede* and *revere* and that this could explain why *severe* has final stress.

- Taft & Kougious (2004) suggest that lexical decision may be influenced by the degree of semantic transparency of the root (*venge* would take longer to reject than *ceive* in experiments such as those conducted by Taft & Forster (1975)).

4.1.3. Between prefixed forms and productive prefixes or free forms

The existence of productive prefixes (4) or free forms (5) with related semantics or maybe even without any semantic relatedness (homophones/homographs) could facilitate recognition.

(4)

de-	>	*deceive, decide, defend, develop*
pre-	>	*precede, prepare, prescribe, pretend*
pro-	>	*proceed, produce, profess, project*
re-	>	*receive, recur, refer, remand*
sub-	>	*subduct, subject, submit, subscribe*

(5)

form	>	*conform, inform, perform, reform*
loud	>	*aloud*
low	>	*below*
press	>	*compress, depress, express, impress*
stand	>	*understand, withstand*

4.2. Semantics

In instances of (3) or (5) where the semantic connection is clear, decomposition is most likely facilitated.

Likewise, in constructions with bound roots (or stems?) where prefixes are semantically transparent, decomposition must operate.[10] This is probably the case in isolated constructions (6) and in series of words whose semantic opposition is based on that of their prefixes (7).

(6)

a*cephalous*	"**lacking** a head"
circum*scribe*	"to draw a line **round**; to encompass; to **encircle**"
co*habit*	"to live **together** as husband and wife"
de*toxify*	"to **deprive** of poisonous qualities"
re*capitulate*	"to go through or repeat **again**; to summarise"

(7)

deflate	↔	*inflate*	↔	*reflate*
exhale	↔	*inhale*		
export	↔	*import*	↔	*deport*

Decomposition in a construction with a semantically transparent prefix could in turn facilitate decomposition in a related construction with an opaque prefix (8).

(8)

decelerate	>	*accelerate*
decrease	>	*increase*
demote	>	*promote*
dissimilate	>	*assimilate*
regress	>	*progress*
subjacent	>	*adjacent*

4.3. Root allomorphy

Aronoff (1976: 13, 102-110) notes that root allomorphy with *-ion* suffixation is consistent across prefixed constructions sharing the same root (9).

(9)

ad, e, com, per, sub, trans } *mit* + *-ion* → *ad, e, com, per, sub, trans* } *mission* (≠ *limitation*)

con, de, per, re } *ceive* + *-ion* → *con, de, per, re* } *ception*

as, con, re, sub } *sume* + *-ion* → *as, con, re, sub* } *sumption* (≠ *exhumation*)

He also observes a similar phenomenon for verbs which share the same irregular inflection even in the absence of semantic similarity (Aronoff 1976: 14).

[10] This is necessary because these words often have a phonological behaviour comparable to that of constructions with free stems (e.g. *deconstruct*, *re-do*, *unknown*): prefixes can be stressed even if the base has initial stress (e.g. *dèmóte, prèpénse, rèjùvenéscence*), vowel-final prefixes have long vowels when stressed (e.g. d[iː]*glutítion, pr*[iː]*mónitory, r*[iː]*fláte*) and constructions with consonant-final prefixes may show gemination (e.g. *di*[ss]*ìmilátion, i*[nn]*áte*) (see Dabouis (2016), Raffelsiefen (1993)). In Prosodic Phonology, this is commonly analysed as evidence that the prefixes have their own prosodic words (Booij & Rubach 1984; Raffelsiefen 1993, 1999, 2007; Szpyra 1989; Wennerstrom 1993).

Infinitive	Simple past	Past participle
come *– be**come***	***came*** *– be**came***	***come*** *– be**come***
get *– be**get*** *– for**get***	***got*** *– be**got*** *– for**got***	***gotten*** *– be**gotten*** *– for**gotten***
give *– for**give***	***gave*** *– for**gave***	***given*** *– for**given***
stand *– under**stand*** *– with**stand***	***stood*** *– under**stood*** *– with**stood***	***stood*** *– under**stood*** *– with**stood***
take *– mis**take*** *– par**take*** *– under**take***	***took*** *– mis**took*** *– par**took*** *– under**took***	***taken*** *– mis**taken*** *– par**taken*** *– under**taken***
wake - a**wake	***waked ~ woke - a**waked ~ a**woke***	***waked ~ woken - a**waked ~ a**woken***

4.4. Phonotactics

Guierre (1990) and Hammond's (1999: §3.3) report that certain medial consonant clusters not found in simplex words do occur in prefixed words, such as:

- voicing disagreements involving voiceless fricatives (e.g. [bs] *abcess, absence, subsidy*, [bf] *obfuscate*)
- certain clusters containing a voiced stops followed by a sonorant (e.g. [bm] *submerse*, [dm] *admire*, [bn] *obnoxious*)
- most clusters containing a voiced stop followed by a voiced fricative or affricate (e.g. [bv] *obvious*, [bz] *absolve*, [dv] *advantage*, [bdʒ] *object*, [gdʒ] *suggest*)
- [dh] in *adhere*, a cluster normally only created by concatenation (e.g. *childhood, madhouse*).

Therefore, it can be argued that these clusters function as "boundary signals" and can favour the recognition of a structure in these words.[11]

4.5. The frequency of the root

Taft (1979): *proach* in *approach* and *reproach* has a higher frequency than *suade* in *persuade* and *dissuade* → lexical decision latencies are reported to be faster for *reproach* than for *dissuade* even though these words have equivalent printed frequencies

4.6. Towards a model of prefix recognition?

All these clues of internal structure probably conspire together:

[11] However, Raffelsiefen (2007) claims that such "unusual clusters" do not indicate morphological complexity because "all relevant segments are easily parsed into pword-internal prosodic constituents".

	Recurrence of the root	Semantics	Allomorphy	Phonotactics
absolve	✓	×	✓	✓
adhere	✓	×	✓	✓
destroy	×	? (prefix)	✓	×
export	✓	✓	×	✓
seduce	✓	×	✓	×
subjacent	✓	✓	×	✓

We need a model taking into consideration all of these which should be able to:

- determine the relative importance of each parameter;
- identify historically prefixed words which seem difficult to analyse as synchronically prefixed (e.g. *edit, enter, exit, index, summon*);
- give an index of decomposability (e.g. *edit* would have a low decomposability index and *export* would have a high decomposability index) which should (hopefully) be correlated with differences in phonological behaviour (cf. the phenomena of §2).

5. CONCLUSION

- Siegel's rejection of the = boundary (among other things) has led to monomorphemic analyses of words like *contain, resist* and *submit*.
- We need the phonology to be able to refer to these words' structure to account for:
  - vowel reduction in initial pretonic closed syllables
  - primary stress placement in verbs
  - secondary stress placement in derived and non-derived words

  (+ possibly Final Nucleus Enhancement if empirically confirmed)
- There is a large body of psycholinguistic evidence supporting the decomposition of such forms, even in the absence of strong semantic support.
- A variety of mechanisms can be posited for morphological recognition:
  - distributional recurrence
  - semantics (in a given construction or between constructions)
  - root allomorphy
  - phonotactics
  - frequency of the root
- We need a proper evaluation of these mechanisms and a model of their interactions.

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