



The Stress Pattern of English Verbs

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Outline

- Our past work
- The literature
- Methodology
- Results
- Discussion

Our past work

We have been working on English verbs for a while, and have presented our results at PAC conferences many times:

- **PAC 2010** *Structure, variation, usage & corpora: the case of word stress assignment in disyllabic verbs*
- **PAC 2012** *Multicategorial Prefixed Words Stress Behaviour: Variation and Frequency*
- **PAC 2015** *Disyllables and Syllable Weight*

After many exchanges with colleagues and a lot of refining work, we are in the capacity to present a detailed descriptive account of stress in English verbs.

The literature

In SPE, verbs are claimed to normally follow the following pattern:

- Final stress when their final syllable is heavy; e.g. *cajóle, eráse, colláapse, cavórt*
- Penultimate stress when it is not (e.g. *astónish, édit, imáagine*).
- Verbs of three syllables or more undergo the Alternating Stress Rule which retracts final primary stress to the antepenult (e.g. *violàte, extrápolàte, expérimènt*).

The literature

The = boundary was used to account for the fact that prefixed verbs do not comply with the previous generalisations.

- Final stress even with a light ultima (*per**mít**, conc**úr**, comp**él**, det**ér***)
- No retraction of stress in longer words (*c**ò**m**prehénd**, ì**nterséct**, c**ò**n**tradíct***)

This boundary was rejected by Siegel (1974, 1980) and was replaced by the now commonplace “Class-I” and “Class-II” classification of English affixes.

The literature

The two generalisations on the stress pattern of English verbs have known different fates in the literature:

- Generative phonology after Siegel's work:
 - Weight-based generalisation only
 - No reference to opaque prefixation

- The Guierrian School:
 - Focus on the morphology-based generalisation
 - Little or no reference to the weight-based generalisation

Research question

Do verbs with opaque morphology such as *devélop*, *concúr*, *compél* or *intermít* have a behaviour which is distinct from verbs with no internal structure?

Methodology

Using the LLL's Dictionary Database, we extracted all 4916 verbs listed in Jones (2006, EPD).

Only the main pronunciation for British English was extracted.

The category “verb” came from the Macquarie Dictionary (MCQ).

Words which were marked as “rare”, “obsolete”, as belonging to another dialect of English (AmE, AusE...) or which had no entry as verbs in the online *Oxford English Dictionary* (OED) were left out.

Methodology

Conversion

Many words marked as verbs in dictionaries are in fact converted nouns or (more marginally) adjectives.

We used the OED to cross the dates of first appearance, the relative frequencies and the semantics of the verbs, nouns or adjectives to determine whether a verb should be treated as converted.

1255 conversions were identified (e.g. *author, baby, catalogue, engineer, input, invalid, opaque, patent, ready, signature, silence, tapestry...*).

The final dataset contains 3397 words.

Methodology

Morphological analysis

We treated as potentially morphologically complex words for which the OED indicates an affix in their history, except when the prefix vowel has been lost.

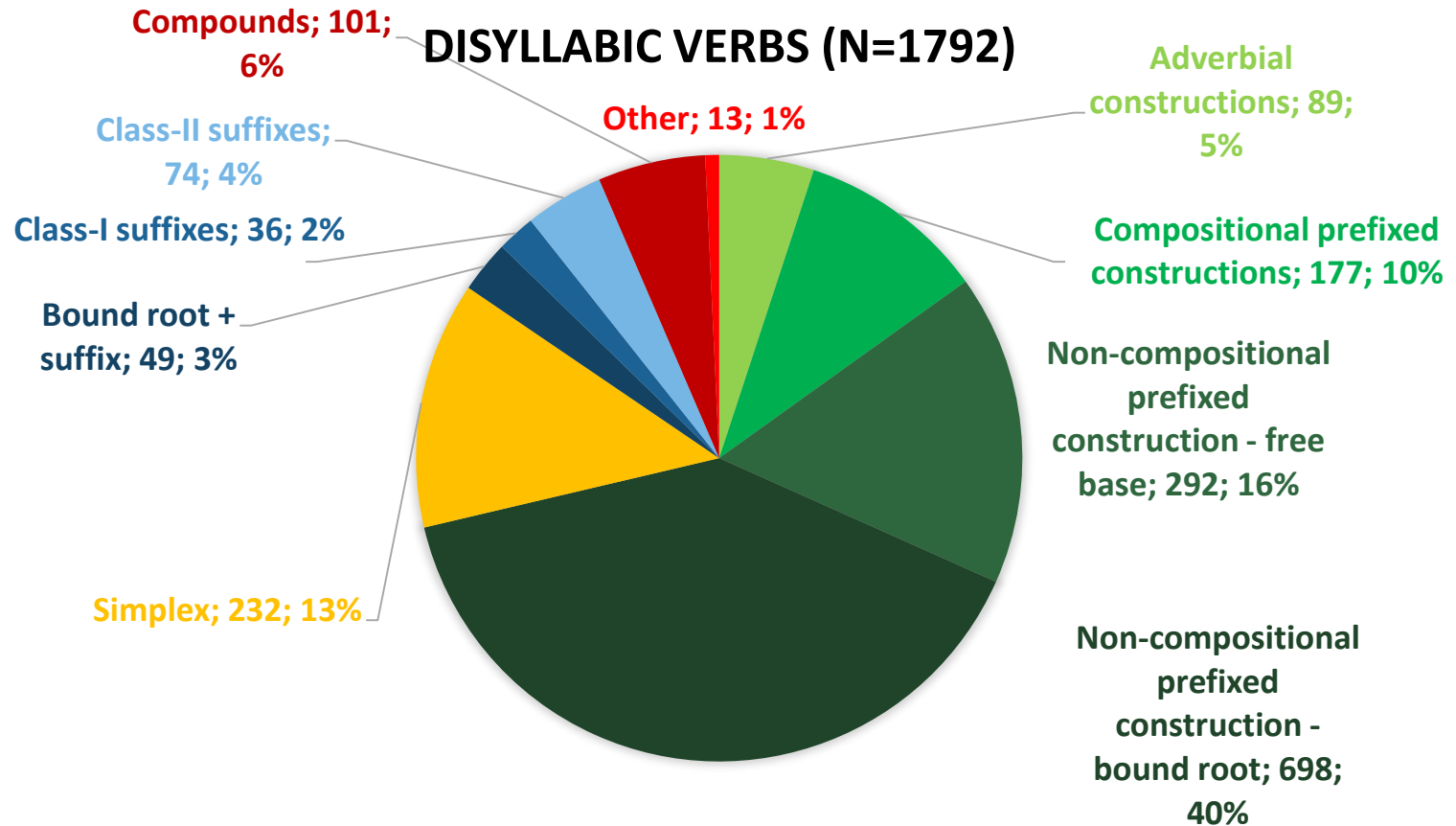
cóver < OF *c(o)uvrir* < Lat. *co-* + *operīre*

rálly < Fr. *rallier* = *re-* + *allier*

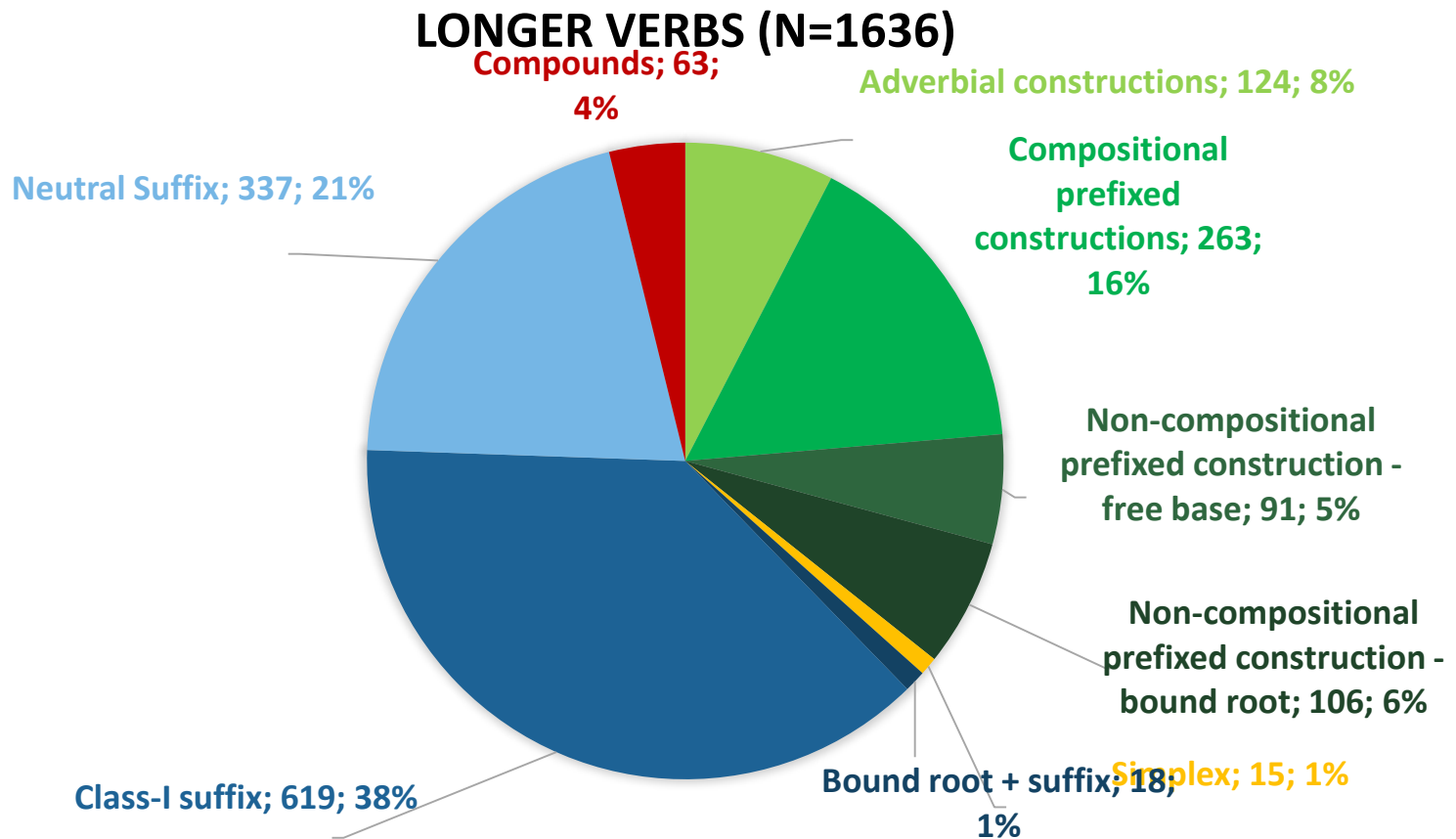
trépass < OF *trespasser* < Lat. *trans-* + *passare*

sójourn < OF *surjurner, sorjorner* < Lat. *subjornare, subjurnare*

Results: Morphological distribution



Results: Morphological distribution



Results: Syntactic constructions (n=653)

Semantically compositional constructions whose leftmost formative is a prefix or an adverbial particle tend to behave as two distinct phonological domains, as evidenced by stress clashes (e.g. *dèprógram, rèwíte, òutbáalance*) or morphological geminates (e.g. *di[ss]atisfy, mi[ss]pell*).

Primary stress is always on the word.

11 exceptions (<2%): *báckcomb, báckfill, báckslide, báckwash, cóuntercharge, cóunterpoise, cóuntersign, cóuntersink, fórecast, óutcry, óutbox, óutsource, óversew*

Results: Class-I suffixes (n=655)

Certain suffixes determine the position of primary stress in vast parts of the data:

➤ **-ate (n=537)**

- /01/ in disyllables (33/36 words): *dictáte, negáte, gradáte*; exc: *cúrate, fúrcate, stríate*
- /(-)100/ in longer verbs (495/501 words): *démonstrate, originate, maturate*; exc: *detrúncate, èquilibráte, inspíssate, óxygenate, péregrinate, térgiversate*

+ Analogical (?) extension in **n=14** words in *-ute/-ite* (e.g. *cónstitute, éxpédite, pérsecute*)

Results: Class-I suffixes (n=655)

Certain suffixes determine the position of primary stress in vast parts of the data:

➤ **-ify (n=89)**

- all stressed /-100/ (e.g. *divérsify, glórfify, rárefy, solémnify, vílify*)

➤ **-esce (n=9)**

- all stressed /-1/ (e.g. *àcquiésce, èfflorésce, lùminésce*) + *rèminísce*

➤ **Other (n=6):**

- *bùccanéer, cashíer, elèctionéer, appórtion, dìsillúsió, envísió*

Results: Class-II suffixes (n=411)

Apart from a few exceptions, no stress shifts are observed.

➤ **-ize (n=335)**

- 324 words with no stress shift (e.g. *cánon* > *cánonize*, *cháacter* > *cháacterize*, *pròpagánda* > *pròpagándize*, *stýle* > *stýlize*).
- 11 exceptions with stress shifts (e.g. *advért* > *áadvertize*, *épilogue* > *epílogize*, *gélatin* > *gelátinize*)

➤ **-en (n=58)**

- no stress shifts (e.g. *awáke* > *awáken*, *fát* > *fátten*, *short* > *shorten*)

➤ **Other (n=18)**

- *attaint, banish, blandish, bombard, bumper, burnish, flitter, jigger, moulder, mullock, multiply, notice, pester, prophesy, putter, skitter, whimper*
- One exceptional stress shift: *ímage* > *imáagine* (but semantic drift?)

Results: Compounds (n=164)

This inventory includes both “normal” compounds and more obscure constructions and neoclassical compounds (e.g. *antágonize, flábbergast, psýcho-áanalyse, túrbocharge*)

Weak tendency towards stress on the first element (68%).

e.g. *áir-condition, blíndfold, hándcraft, kídnáp, skýjack, wíndow-shop*

A significant number of words have primary stress on the second element.

e.g. *cròss-exámine, dèep-frý, hànd-píck, stàge-mánage*

→ This stress distribution is not of any significance because of the heterogeneity of the inventory.

Results: Opaque prefixation

We treated as “opaque” any construction in which the meaning of the construction is not compositional.

e.g. *exact* ≠ *ex-* + *act*

proclaim ≠ *pro-* + *claim*

This includes cases for which the base is not a verb.

e.g. *debug*, *de-ice*, *derail*, *enchain*, *enlist*, *ensnare*, *dismast*

Results: Opaque prefixation with a free base (n=383)

Primary stress is on the base.

e.g. *accústom, accóunt, becóme, besprínkle, defáult, eláipse, emblázon, expórt, preóccupy, rècolléct, redréss, ùnderstánd*

This includes 4 parasynthetic formations: *aggrándize, acclímatize, embólden, enlíven*

Two exceptions: *ínfix, rétrograde*.

Results: Opaque prefixation with a bound root (n=804)

In 96% of cases, stress is on the first syllable of the root.

e.g. *abhór, commít, distráct, ejéct, obtáin, persíst, référ, survíve*
còntradíct, intercèpt, intermít, rètrogréss
amórtize, contínue, demólish, elícit, inhábit, remémber

The exception rate is higher in long verbs (12%) than in disyllables (3%).

Exceptions:

- Disyllables: *ábseil, cómbat, cómfort, cómpass, cónjure, cónquer, déstine, díffer, édit, énter, ínjure, óffer, pérjure, próffer, próssper, rélay, rével, séver, súffer, súmmon*
- Long verbs: *círcumcise, círcumscribe, cómpliment, discómfít, éxorcize, ímplement, ìmportúne, ímprovise, intérpret, óccupy, récognize, réconcile, súpervise*

Results: Bound root + suffix (n=67)

In disyllables, stress is initial in 42/49 words (86%).

e.g. *brándish, glísten, héarken, mánage, pótter*

Exceptions: *chastíse, divíne, fréquént, igníte, levánt, rampáge, uníte*

In longer verbs, 17/18 (94%) are stressed /(-)100/.

➤ *mónitor*

➤ 16 words in *-ize*; e.g. *fráternize, órganize, sánitize*

Exception: *etérnize*

Results: Simplex verbs (n=247)

In disyllables, stress is initial in 204/233 words (88%).

e.g. *árgue, bárter, cáncel, cópy, fóllo, góvern, hállow, lísten, ópen, rénder, scúrry, swállow, vómit*

Exceptions: *augmént, cajóle, caréen, caréss, caróuse, cashíer, cavórt, coquét, curtáil, equíp, fermént, fomént, gazúmp, halál, lamént, liáise, maráud, molést, opíne, ordáin, patról, piáffe, pollúte, posséss, salúte, shampóo, tormént, usúrp*

Results: Simplex verbs (n=247)

In longer verbs, we have:

- 8 stressed /(-)10/: *bamboozle, canoodle, finagle, malingering, manoeuvre, sequester, skedaddle, solicit*
- 7 stressed /(-)100/: *damascene, gallivant, manacle, manifest, massacre, minister, orient*

(some of these are arguably not simplex, but their structure is particularly opaque)

→ We have no explanation for the ones stressed /(-)10/.

Opaque prefixation and syllable weight

We kept only the relevant parts of the corpus to test the role of opaque prefixation and syllable weight:

- Opaque prefixed constructions with bound roots
- Bound roots + suffix
- Simplex verbs

The weight of their final syllable was coded using the mora counts proposed in Hammond (1999).

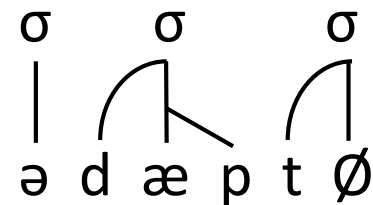
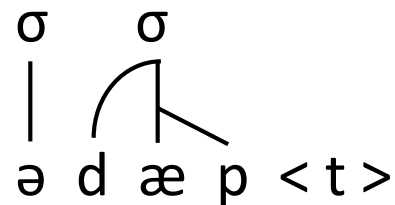
Opaque prefixation and syllable weight

In the literature, the final consonant of verbs is often excluded from the computation of stress. Two analyses can be found:

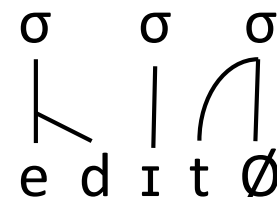
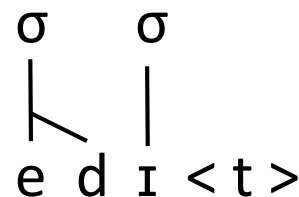
extrametricality

catalexis

adapt



edit



Opaque prefixation and syllable weight

Following these proposals, we treated the final consonant as morales.

Then:

➤ -CC# → 1μ

➤ -V(C₀)* → 1μ ([ɪ] was treated a short vowel)

➤ -VV(C₀) → 2μ

A syllable was treated as heavy (H) when it is at least bimoraic. Otherwise, it was treated as light (L).

Opaque prefixation and syllable weight: Trisyllables

Reminder: Only 13 words (12%) do not have primary stress on the root: *círcumcise*, *círcumscribe*, *cómpliment*, *discómfít*, *éxorcize*, *íimplement*, *ìimportúne*, *íimprovise*, *intérrpret*, *óccupy*, *récognize*, *réconcile*, *súpervise*

A weight-based approach would not only fail to account for these cases except *discómfít*, *ìimportúne* and *intérrpret*, but also *ìntermít*, *ìntromít*, *prètermít*, *amórtize*, *impóverish* and *rètrogréss* (which do have stress on the root).

→ No strong evidence in favour of either approach.

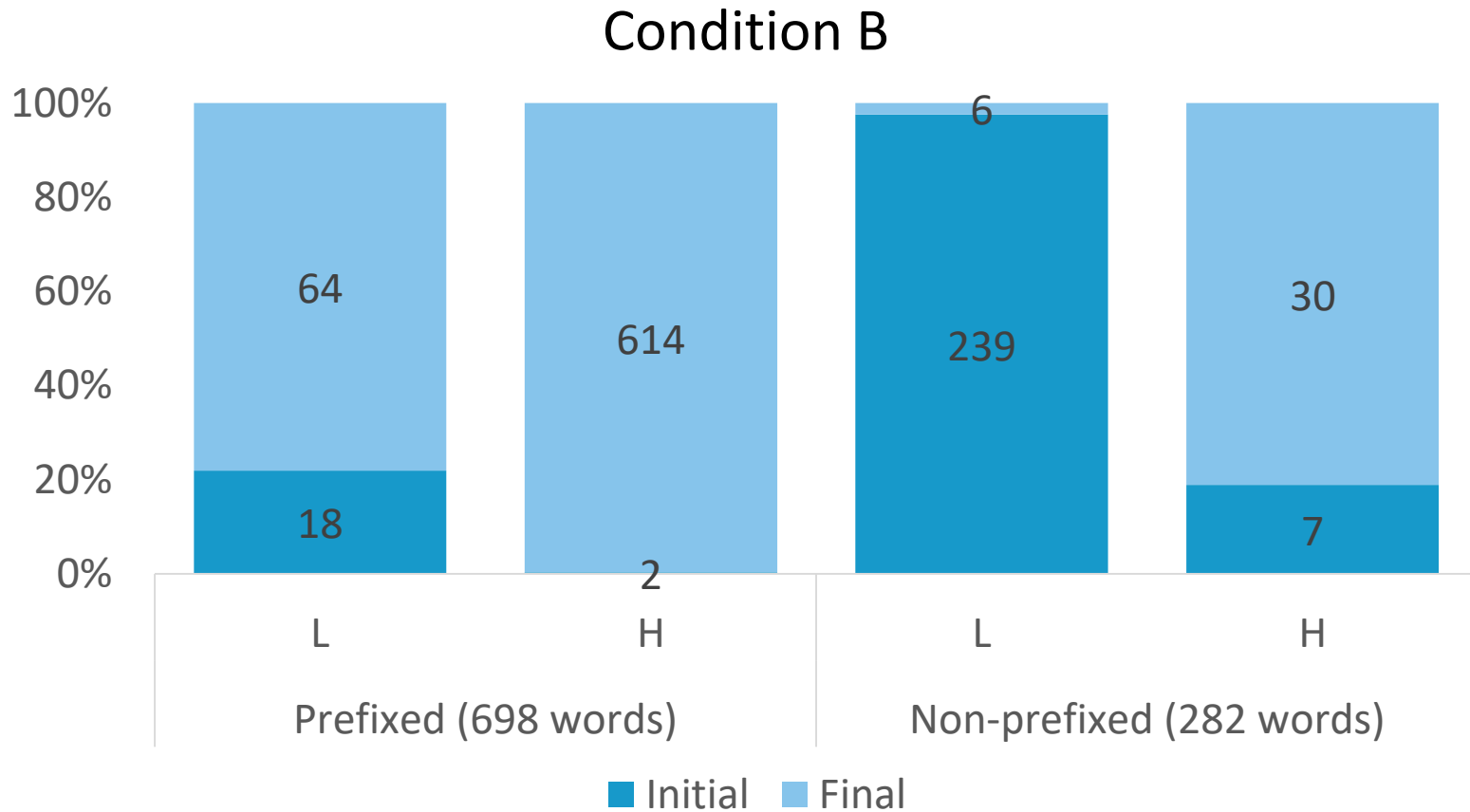
Opaque prefixation and syllable weight: Disyllables

For disyllables, we tested for weight in four conditions:

	Schwa	Final [əʊ]
Condition A	0μ	2μ
Condition B	0μ	1μ
Condition C	1μ	2μ
Condition D	1μ	1μ

→ Condition B is the most efficient.

Opaque prefixation and syllable weight: Disyllables



Opaque prefixation and syllable weight: Disyllables

Syllable weight is mostly inoperant in prefixed verbs, which always have stress on their base regardless of the weight of the final syllable.

Crucially, the weight hypothesis is contradicted by 88% of prefixed verbs with a light final syllable which have final stress.

Examples: *abash, assess, condemn, detach, emit, propel, obsess, succumb*

A clearer effect of syllable weight can be observed in non-prefixed verbs but there are few verbs with that structure and many are not very common.

Examples of final-stressed non-prefixed verbs with a heavy final: *carouse, cavort, gazump, maraud, molest, patrol, torment, usurp*

Opaque prefixation and syllable weight

The two approaches make comparable predictions in the large majority of relevant cases.

The morphology-based approach makes slightly better predictions than the weight-based approach.

However, let us remind what the weight-based approach has to assume:

- Final [əʊ] is underlyingly short
- The final consonant of verbs is invisible to the stress-assigning mechanism
- Schwa is lexical (which opens the door to circularity)

Opaque prefixation and syllable weight

All we have to assume is that the morphological structure in opaque prefixed constructions is accessed by speakers.

Accessing opaque prefixation?

Our results strongly suggest that opaque prefixation should not be left out of the parameters determining the position of primary stress in English.

This raises some questions:

- Are there other phonological phenomena sensitive to opaque prefixation?
- Is there evidence that speakers analyse opaque prefixed constructions as morphologically complex?
- If there is, then what structural properties of opaque prefixed constructions can be assumed to allow for morphological decomposition, if it isn't semantics?

Phonological phenomena sensitive to opaque prefixation

Vowel reduction

All major works on the phonology of English recognise that prefixes have a specific reduction behaviour.

Their vowel reduces in initial pretonic closed syllables (e.g. [ə]*dvá*nce, c[ə]*ndé*nse, s[ə]*btrá*ct), where vowels do not normally reduce (e.g. l[æ]*mpó*on, p[ɒ]*ntíf*icate, t[e]*chní*que).

Phonological phenomena sensitive to opaque prefixation

Secondary stress

The presence of an opaque prefix also influences the placement of secondary stress in monomorphemic words or words containing a bound root and in derivatives (see Dabouis 2016, 2017).

Phonological phenomena sensitive to opaque prefixation

“Final Nucleus Enhancement”

Raffelsiefen (2007) notes that tensing of the prefix vowel (e.g. *b[i:]wítch*, *d[i:]céase*, *pr[i:]scríbe*) is possible for certain prefixes:

- mildly productive (*be-*)
- have evolved into modifying prefixes (*de-*, *pre-*, *re-*)

But not prefixes such as *e-*, *se-*, *neg-*.

This is interpreted as a boundary signal indicating prefix recognition.

Phonological phenomena sensitive to opaque prefixation

“Final Nucleus Enhancement”

Problem: in Wells (2008) this phenomenon does occur for *e-* (e.g. *eject*, *emerge*, *emit*) but also for non-prefixed words (e.g. *economy*, *egalitarian*, *elastic*).

- More empirical work needed to determine the extent of the phenomenon and make sure it is a manifestation of prefix recognition.

Psycholinguistic evidence

Many reports of an influence of morphological structure, even opaque, on visual morphological processing.

Morphological analysis would apply in the early stages of the recognition process to all morphologically structured stimuli, independently of semantics.

Psycholinguistic evidence

A few examples:

- Taft & Forster (1975) – later replicated in Taft (1994)

Lexical decision task: participants took longer to reject prefixed non-words which contained a bound root (e.g. *devive*) than those which did not (e.g. *delish*)

- Forster & Azuma (2000) and Pastizzo & Feldman (2004)

Lexical decision task with masked priming: same amount of priming for bound roots (e.g. *explore*) or free stems (e.g. *distrust*), independently of orthographic factors.

Possible mechanisms of recognition

Distributional recurrence: between prefixed forms

Alternation of prefixes and roots with each other: probably the main mechanism of recognition.

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

Possible mechanisms of recognition

Distributional recurrence: between prefixed and other forms

Recurrence of the root in suffixed forms and prefixed forms:

<i>rect</i>	< <i>rectify, rectilinear</i>	“rightness, straightness”
<i>spect</i>	< <i>spectate, spectacle</i>	“looking, sight”
<i>rupt</i>	< <i>rupture, bankrupt</i>	“breaking”
<i>venge</i>	< <i>vengeance, vengeful</i>	“avenging”
<i>vive</i>	< <i>vivace, vivid, vivify</i>	“life”

Possible mechanisms of recognition

Distributional recurrence: between opaque prefixed forms and productive prefixes or free forms

de- > *deceive, decide, defend, develop*

pre- > *precede, prepare, prescribe, pretend*

pro- > *proceed, produce, profess, project*

form > *conform, inform, perform, reform*

loud > *aloud*

press > *compress, depress, express, impress*

Possible mechanisms of recognition

Semantics of the prefix

Decomposition has to operate in constructions with a transparent prefix.

Isolated words:

acephalous “**lacking** a head”

circumscribe “to draw a line **round**; to encompass; to **encircle**”

cohabit “to live **together** as husband and wife”

Possible mechanisms of recognition

Semantics of the prefix

Decomposition has to operate in constructions with a transparent prefix.

Series opposed by the semantics of the prefixes:

<i>deflate</i>	↔	<i>inflate</i>	↔	<i>reflate</i>
<i>exhale</i>	↔	<i>inhale</i>		
<i>export</i>	↔	<i>import</i>	↔	<i>deport</i>

Possible mechanisms of recognition

Semantics of the prefix

Decomposition in a construction with a transparent prefix could facilitate decomposition in a related form with an opaque prefix:

<i>decelerate</i>	>	<i>accelerate</i>
<i>decrease</i>	>	<i>increase</i>
<i>demote</i>	>	<i>promote</i>
<i>dissimilate</i>	>	<i>assimilate</i>
<i>regress</i>	>	<i>progress</i>
<i>subjacent</i>	>	<i>adjacent</i>

Possible mechanisms of recognition

Root allomorphy (Aronoff 1976)

$$\left. \begin{array}{l} ad \\ e \\ com \\ per \\ sub \\ trans \end{array} \right\} \text{mit} + \text{-ion} \rightarrow \left. \begin{array}{l} ad \\ e \\ com \\ per \\ sub \\ trans \end{array} \right\} \text{mission} ; \quad \left. \begin{array}{l} con \\ de \\ per \\ re \end{array} \right\} \text{ceive} + \text{-ion} \rightarrow \left. \begin{array}{l} con \\ de \\ per \\ re \end{array} \right\} \text{ception}$$

Possible mechanisms of recognition

Root allomorphy (Aronoff 1976)

Could extend to irregular inflection:

Infinitive	Simple past	Past participle
<i>come – become</i>	<i>came – became</i>	<i>come – become</i>
<i>get – beget – forget</i>	<i>got – begot – forgot</i>	<i>gotten – begotten – forgotten</i>
<i>give – forgive</i>	<i>gave – forgave</i>	<i>given – forgiven</i>
<i>stand – understand – withstand</i>	<i>stood – understood – withstood</i>	<i>stood – understood – withstood</i>
<i>take – mistake – partake – undertake</i>	<i>took – mistook – partook – undertook</i>	<i>taken – mistaken – partaken – undertaken</i>
<i>wake – awake</i>	<i>waked ~ woke – awaked ~ awoke</i>	<i>waked ~ woken – awaked ~ awoken</i>

Possible mechanisms of recognition

Phonotactics

Certain medial consonant clusters are only found in opaque prefixed words:

- 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*).

Possible mechanisms of recognition

All these clues of internal structure often conspire together:

	Recurrence of the root	Semantics	Allomorphy	Phonotactics
<i>absolve</i>	✓	✗	✓	✓
<i>adhere</i>	✓	✗	✓	✓
<i>destroy</i>	✗	? (prefix)	✓	✗
<i>export</i>	✓	✓	✗	✓
<i>seduce</i>	✓	✗	✓	✗
<i>subjacent</i>	✓	✓	✗	✓

General conclusion

To sum up, in this talk:

- We gave a detailed descriptive account of the stress pattern of English verbs based on an extensive corpus (3397 verbs).
- We showed that the morphology-based approach and the weight-based approach have comparable efficiencies.
- We showed that there are arguments to include opaque prefixation in the parameters determining the position of stress in English

**Thank you for your
attention!**