Positioning English Derivational Affixes in the Lexicon

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1. Background & Research Question

English derivational affixes consistently attach to stems as *either* prefixes or suffixes. Holds for novel stems (*google*able) and novel affixes (Bridge*gate*).

-ness	***un-***
always a suffix	*always* a prefix
kind*ness*	*un*known
**ness*kind	*known*un

- Listeners' fine-grained phonotactic sensitivity allows probabilistic segmentation of complex words into smaller chunks (e.g. Saffran et al., 1996).
- Complex words are likely stored as full forms in the mental lexicon; their structure is gradiently salient to speakers (Hay & Baayen, 2005).
- **Question**: In forming and processing *novel* derived words, **how do speakers determine the *position* of an affix** relative to a stem?
  - Option 1: Positioning information is explicitly stored in a mental representation of the affix.
  - Option 2: Positioning info is not explicitly stored for each affix but can be derived from other properties of the grammar

We tested this question by means of (i) corpus analyses and (ii) an artificial language study.

2. Corpus Study

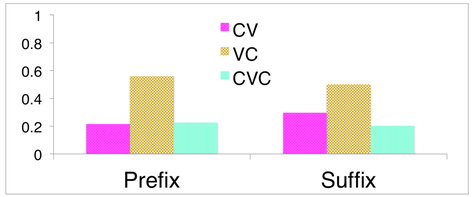
- What phonological information do English speakers use in differentiating derivational prefixes from suffixes?
- CELEX2 corpus (Baayen et al 1995)
- **Type frequencies** (not token frequencies).

English derivational affixes investigated in 3 ways:
1. Syllable Type
2. Edge segment identity
3. Conditional probabilities at stem-affix junctions

3. Corpus Study Findings

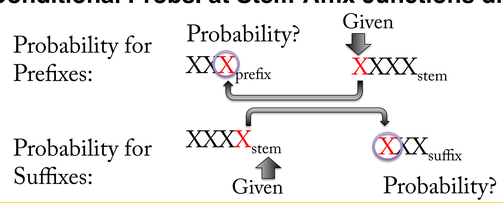
- Three common affix syllable shapes (**CV**, **VC**, **CVC**) used in following investigations (type n=88).
  - Affixes from Fudge (1985), type counts from Celex

1. Syllable Type Distribution ($p<.001$), $\chi 2=42.909$; 2df.



2. Edge Segment Identity does not differ in pref/suf

3. Conditional Probs. at Stem-Affix Junctions differ



- Prefix and suffix syllable shape differs significantly.
- Unigrams at affix edges do *not* differ significantly.
- Conditional probabilities of bigrams at opposite stem edges differ for prefixes and suffixes ($p<.05$).

Syllable shape and juncture bigram conditional probs. may help distinguish prefixes and suffixes.

4. Hypothesis & Predictions

Hypothesis: Speakers have implicit knowledge of phonotactic regularities of prefixes and suffixes and their relation to the stem-edge segments.

Predictions based on corpus study
1. Interaction of affix/stem shapes; overall suffix bias.
2. A highly probable bigram sequence at stem-affix juncture will encourage affix attachment there.

Predictions	CV_{affix}	VC_{affix}	CCV_{affix}
$C\_\_\_C_{stem}$	**CV+C_C prefix**	**C_C+VC suffix**	**CCV+C_C prefix**
$C\_\_\_V_{stem}$	**C_V+CV suffix**	**VC+C_V prefix**	**C_V+CCV suffix**
$V\_\_\_C_{stem}$	**V_C+CV suffix**	**V_C+VC suffix**	**CCV+V_C prefix**

5. Design

Experiment: Tests if English speakers (*n*=24) generalize affix position patterns found in corpus study to novel words.

- Manipulated affix syllable type (**CV**, **VC**, **CCV**) and **stem**-edge segments (C_C, C_V, V_C) in orthographically-presented artificial language (3x3 design).

Fig. 1: screen shot of word formation task

6. Experiment Results

Main effect of **affix syllable type** ($p<.001$) in Fig. 2: Indicates fine-grained sensitivity to stem-affix boundary phonotactics.

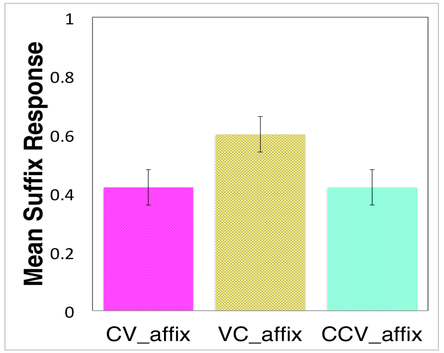


Fig. 2: Main effect of affix syllable shape

Mean Suffix Response	CV_{affix}	VC_{affix}	CCV_{affix}
$C\_\_\_C_{stem}$	**0.438 prefix ✓**	**0.75 suffix ✓**	**0.521 suffix ✗**
$C\_\_\_V_{stem}$	**0.479 prefix ✗**	**0.542 suffix ✗**	**0.375 prefix ✗**
$V\_\_\_C_{stem}$	**0.334 prefix ✗**	**0.667 suffix ✓**	**0.396 prefix ✓**

Fig. 3: Interaction of stem type and affix shape (✓= matched prediction; ✗= did not match prediction)

Affix syllable type by stem type interaction ($p=.021$): Type of affix had different effects on rate of "Suffix" response, depending on different edge segments in the different stem conditions.

7. Discussion

Corpus study *and* experiment showed that affix syllable shapes differ between prefixes and suffixes; and affixes attach preferentially to stems, depending on stem-edge segments.

- ***Affix syllable shape*** helps explain whether an affix surfaces as a prefix or a suffix.

Segments (unigrams) didn't differ by position.

- ***Single segments*** are unlikely to guide distinction between prefix and suffix.

Stem-affix juncture bigrams differed significantly by position in *corpus study.*

- ***Positional differences in conditional probabilities*** are informative of distinction between prefixes and suffixes
- Still need to run by-item analyses to test whether positional differences occur in experiment.

8. Implications

1. In absence of semantic/syntactic information, **phonotactic information *differentiates* prefixes from suffixes**, and affixes' positional information could be computed from phonotactic knowledge.
   - Would same results emerge if semantic or contextual information was present?
2. **Novel forms and grammaticalization**: Diachronic development of affix placement explains how affixes got to their positions, but does not explain *how speakers acquire positional information* for novel affixes or how speakers generalize extant affixes to novel stems.
   - Results from corpus and experiment show that affix positioning information *could* be computed, but storing this information in a mental representation is still a reasonable possibility.
3. This experiment used **visual, written stimuli**. Orthographic presentation without indication of pronunciation and word stress may complicate phonotactic results.
   - Would results obtain in a similar experiment using an auditory task?
   - Recorded subjects' pronunciations of artificial words, analysis on-going