Preference for locality is affected by the prefix/suffix asymmetry: Evidence from artificial language learning

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Macro goals

- Addressing two larger issues in the artificial grammar learning (AGL) enterprise.
  - Replicability across labs and populations.
  - Influence of L1 transfer (in addition to universal effects) on AGL results.

- Network of researchers across countries/L1s:
  - Dutch (Kager; Utrecht)
  - English (Nevins, White; UCL)
  - French (Linzen, Martin, Peperkamp; ENS)
  - German (van de Vijver; Düsseldorf)
  - Greek (Markopoulos, Topintzi; Aristotle U. of Thessaloniki)
  - Hungarian (Polgárdi; Hungarian Academy of Sciences)

Vowel harmony in AGL

- Well studied:
  - Simple patterns preferred to complex ones; no preference for harmony vs. disharmony. (Pycha et al. 2003, Skoruppa & Peperkamp 2011; but cf. Martin & Peperkamp, submitted)
  - Directional harmony preferred to majority vote. (Finley & Badecker 2008)
  - Non-high vowels make better triggers for rounding harmony than high vowels. (Finley 2012; Kimper 2016)
  - Height harmony preferred in front vowels, and when trigger/undergoer share backness features. (Finley & Badecker 2012)

…

Locality

- Robust bias towards locality when learning co-occurrence restrictions. (Finley 2011, 2015; McMullin & Hansson 2014; McMullin 2016)

- True even when learning consonant harmony, which is often non-local in natural languages (Finley 2015; McMullin & Hansson 2014; McMullin 2016)

- McMullin & Hansson 2014:
  - **CVS$_x$VCV-S$_x$V** $\Rightarrow$ **CVCVS$_x$V-S$_x$V** , **S$_x$VCVCV-S$_x$V**
  - **CVCVS$_x$V-S$_x$V** $\not\Rightarrow$ **CVS$_x$VCV-S$_x$V** , **S$_x$VCVCV-S$_x$V**

Edge effects

- However, non-local co-occurrence restrictions may be favoured when adjacent to salient prosodic edges.

- Endress & Mehler 2010:
  - Adults better at learning restrictions between C_1 and C_2 in **C_1VccVC_2** than in **cVC_1C_2Vc**.
  - Attributed to advantage from coding edge positions during learning:
    - e.g. "beginning" must be *x* and "end" must be *y*.

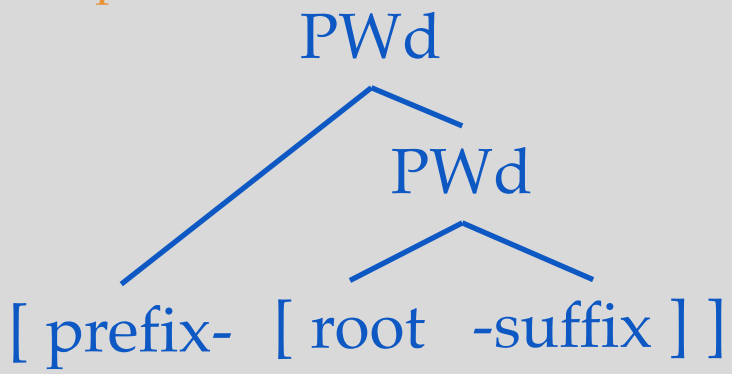
Today's study

When learning novel vowel co-occurrence restrictions, how is the preference for locality influenced by:

- Prosodic structure?
- Stress/prominence?

Suffix / prefix asymmetry

- Previous research arguing for structure in which root + suffix forms a domain to the exclusion of prefixes. (Nespor & Vogel 1986, Peperkamp 1997)



- Example: Zuraw et al. 2014 on Samoan.
  - Most suffixes, but not prefixes, take part in basic foot assignment with the root.
  - Diphthong formation of VV sequences blocked across prefix boundaries, but root+suffix generally behaves as monomorphemic words.

Prefix/suffix asymmetry and vowel harmony

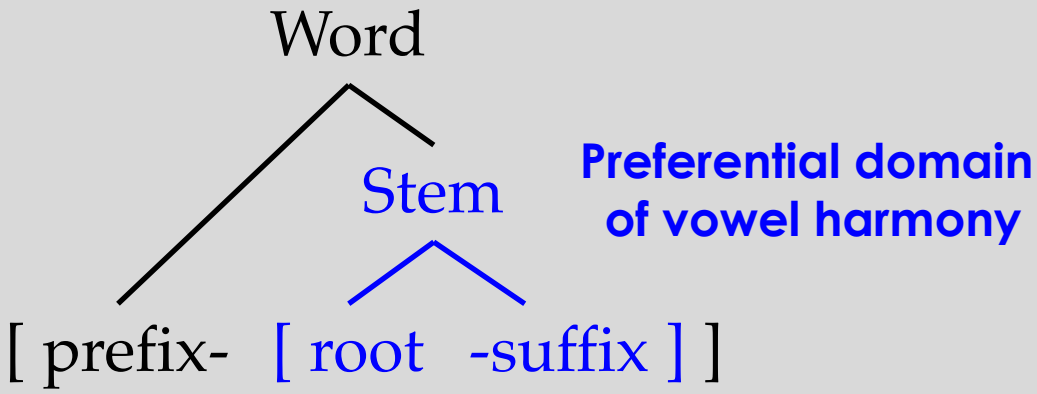
- Suffixes seem more likely than prefixes to participate in vowel harmony cross-linguistically.

- Affix-controlled harmony:
  - Harmony triggered from prefixes onto roots uncommon.
  - Languages in which suffixes, but not prefixes, spread onto root are attested. Reverse is unattested. (Bakovic 2000, Hyman 2002, Krämer 2002, Finley & Badecker 2009)

- Root-controlled harmony:
  - Less clear, but spreading to suffixes appears more common/robust. (Hyman 2002)

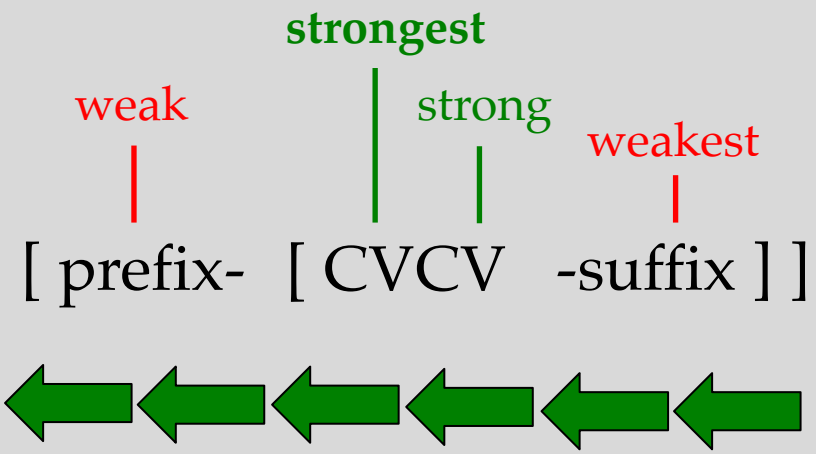
Prefix/suffix asymmetry and vowel harmony

- Some proposed explanations: (e.g. see Hyman 2002)
  - Domain of vowel harmony preferentially stem level (root + suffix), not word level (prefix + stem).



Prefix/suffix asymmetry and vowel harmony

- Some proposed explanations: (e.g. see Hyman 2002)
  - Domain of vowel harmony preferentially stem level (root + suffix), not word level (prefix + stem).
  - Preferential anticipatory direction (right-to-left) + preference for strong triggers, weak targets.



Finley & Badecker (2009)

- AGL study of root-controlled and affix-controlled vowel harmony (VH).
- Affix controlled:
  - Prefix-controlled VH learned more poorly than Suffix-controlled VH.
  - [beme] … [mu-bomo] worse than [beme] … [bomo-mu]
  - Consistent with bias against prefix as harmony trigger.
- Root-controlled:
  - Prefixes and suffixes as VH targets learned equally well.
  - Generalized equally often to other affix type.
  - Conclude that the bias is specifically against prefixes as harmony triggers.

Stress and vowel harmony

- Vowels in strong positions (e.g. stressed syllable of the root) might be preferred triggers for vowel harmony. (Hyman 2002)

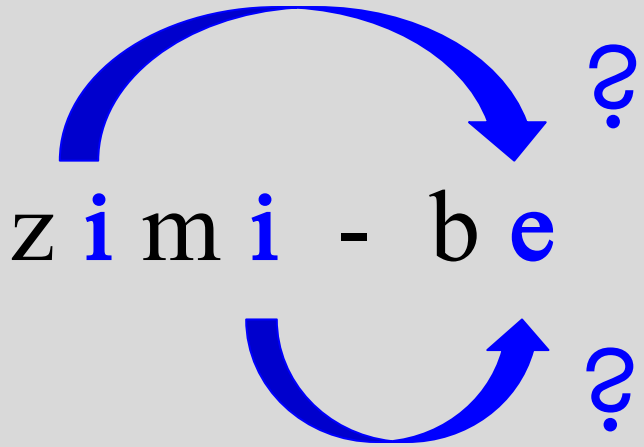
- E.g. Height harmony spreads leftward from a stressed syllable in Pasiego Spanish. (Penny 1969, Hualde 1991, Kaisse 2016)

- Metaphony-type harmony systems involve a co-occurrence restriction between a stressed syllable and a following vowel, often an affix. (Walker 2005)
  - In some varieties, target and trigger can even be non-local. (Walker 2004)

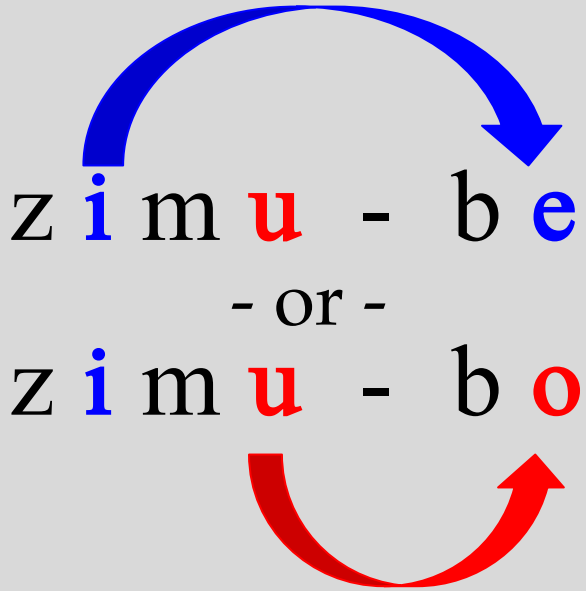
Experiment Overview

- AGL paradigm
- 'Poverty of the stimulus' design (Wilson 2006)

Training:
Harmonic stems only



Test:
Disharmonic stems



Design

- Stem vowels:
  - Front [i, e]
  - Back [u, o]

Stem types

C i C i	C e C i	C u C i	C o C i
C i C e	C e C e	C u C e	C o C e
C i C u	C e C u	C u C u	C o C u
C i C o	C e C o	C u C o	C o C o

- Stem consonants:
  - [z, n, g] any position; [m, l, d] as C_2 only.
  - No repeated consonants.

- Two alternating affixes: [fi]~[fu] and [be]~[bo]
  - One plural, one diminutive (counterbalanced).

- Stimuli recorded by native Hebrew speaker.

Design

- **Manipulated**: Affix Type and Stress between-subjects.

- Four groups:
  - Suffixes, Local stress: [nupó] … [nupó-fu]
  - Suffixes, Nonlocal stress: [núpo] … [núpo-fu]
  - Prefixes, Local stress: [núpo] … [fu-núpo]
  - Prefixes, Nonlocal stress: [nupó] … [fu-nupó]

- **Measured**: Proportion of test trials participants chose harmony with local vowel.

Hypotheses

1. **Locality**: Overall preference for agreement with local vowel vs. non-local vowel.

 # CVCV – CV #

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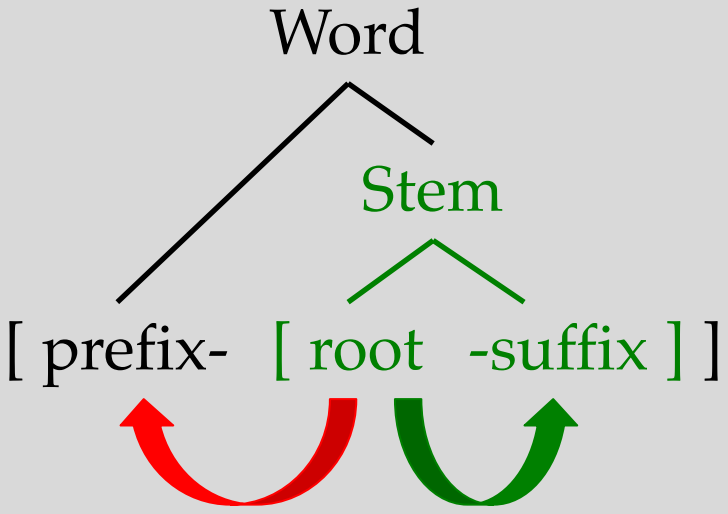

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[[CVCV – CV]] vs. [[CVCV – CV]]

Greater locality preference

[CV-[CVCV]] vs. [CV-[CVCV]]

Lesser locality preference

Hypotheses

1. **Locality**: Overall preference for agreement with local vowel vs. non-local vowel.

 # CVCV – CV #

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2. **Affix Type**: Greater locality preference for suffixes than for prefixes.

[[CVCV – CV]] vs. [[CVCV – CV]]

Greater locality preference

[CV-[CVCV]] vs. [CV-[CVCV]]

Weaker locality preference

3. **Stress**: Greater locality preference when local vowel is stressed.

CVCV́ – CV vs. CVCV́ – CV

Greater locality preference

CV́CV – CV vs. CV́CV – CV

Weaker locality preference

Participants

- L1 English speakers:
  - 66 tested at UCL.
  - 33 completed experiment. (see below)
- L1 German speakers:
  - 82 tested at Düsseldorf.
  - 54 completed experiment.
- Mostly university students.

Method

1. **Training phase** (harmonic stems only)

[núpo]

[núpofu]

(different trial…)

[núpo]

[núpobo]

Method

1. **Training phase** (harmonic stems only)

[núpo]

[núpofu]

- 16 trials in each training phase:
  - 8 CVCV stems x 2 affixes, [fi~fu] and [be~bo].
  - One stem for each possible V_1V_2 combination.
  - Which suffix meant plural/dimunitive counterbalanced.
  - Randomized order.

- Auditory-only presentation of words throughout.

Method

1. **Training phase** (harmonic stems only)

[núpo]

[núpofu]

2. **Verification phase** (harmonic stems only)

[gódo]

[gódofi]
-or-
[gódofu] ?

- 16 Verification trials :
  - 8 novel CVCV stems x 2 affixes, [fi~fu] and [be~bo].
  - One stem for each possible V_1V_2 combination.
  - Randomized order.
  - Participants provided accuracy after phase.

Method

1. **Training phase** (harmonic stems only)

[núpo]

[núpofu]

2. **Verification phase** (harmonic stems only)

[gódo]

[gódofi]
-or-
[gódofu] ?

80% correct? → **No**

↓ **Yes**

3. **Generalization phase** (harmonic and disharmonic stems)

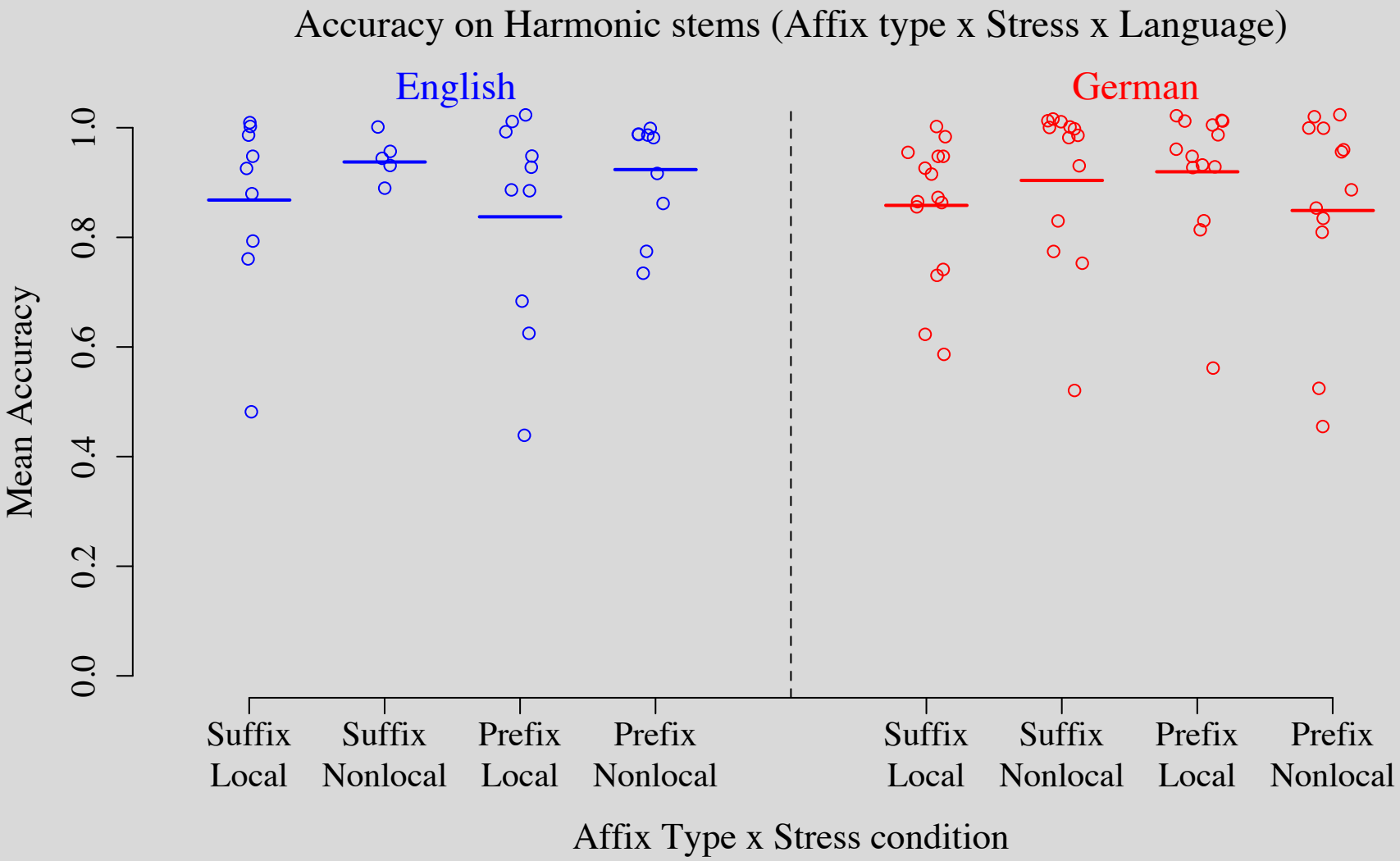
[púdi]

[púdifu]
-or-
[púdifi] ?

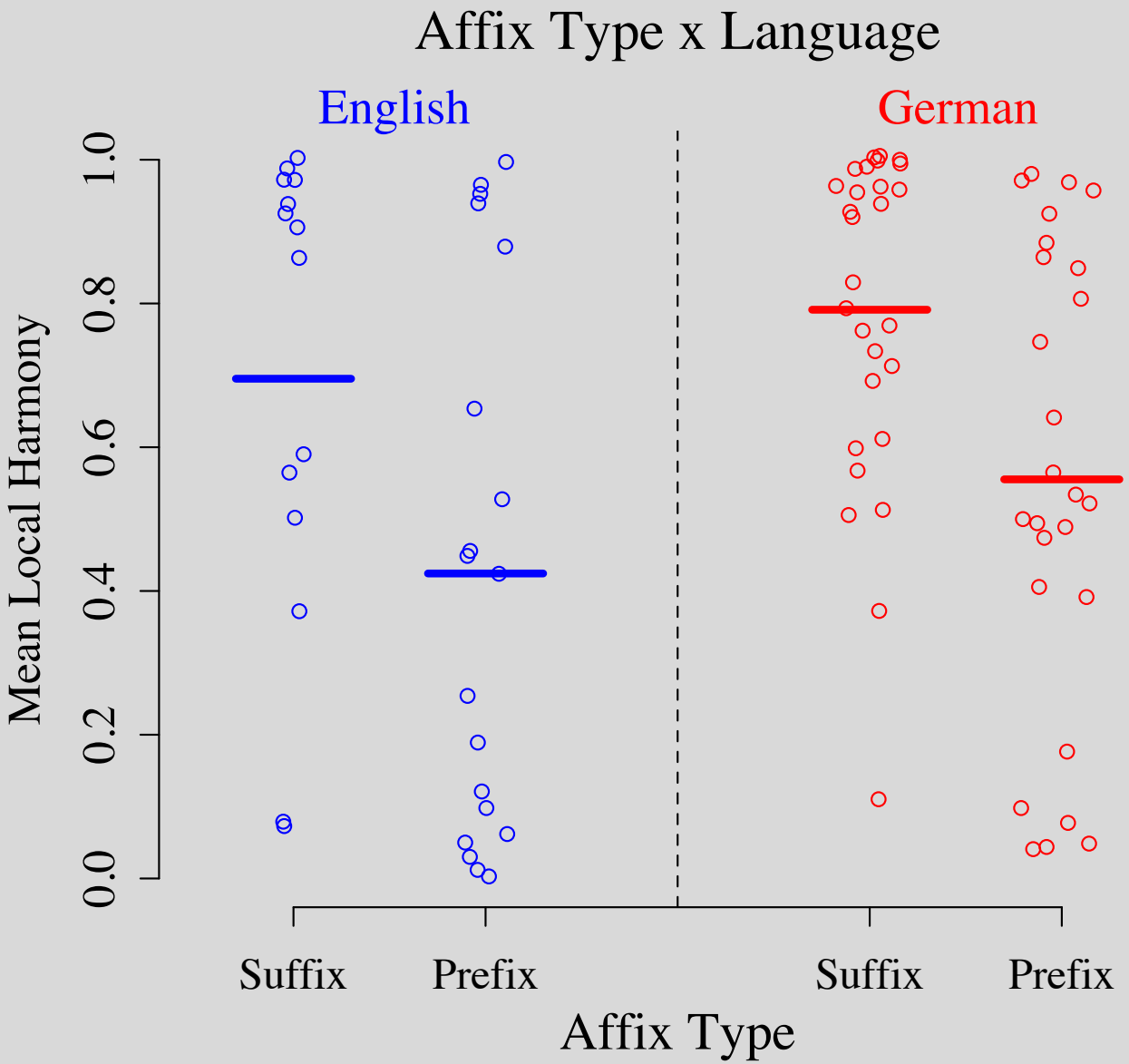
Method

- 80 total Generalization phase trials:
  - 16 harmonic stem trials.
    - 8 novel harmonic stems x 2 affixes.
    - Similar to those in training.
  - 64 disharmonic stem trials.
    - 32 disharmonic stems x 2 affixes.
    - Never encountered stems of this type before.
  - All trials mixed together; order randomized.

Results – Harmonic stems



Results – Disharmonic stems

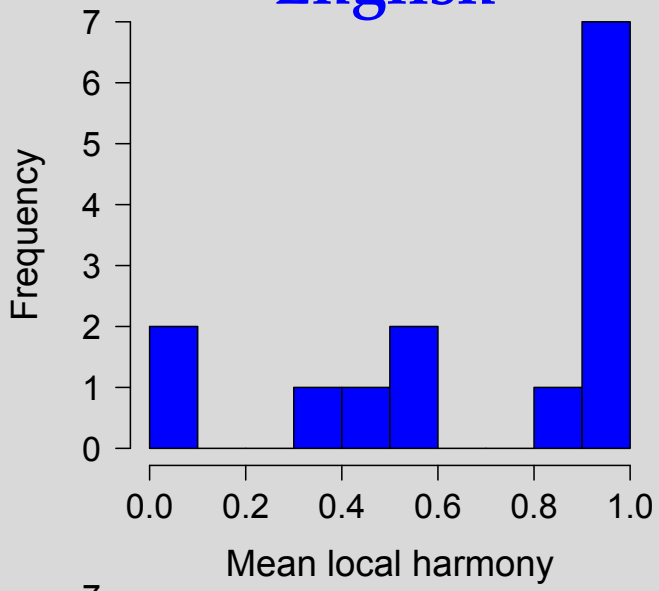


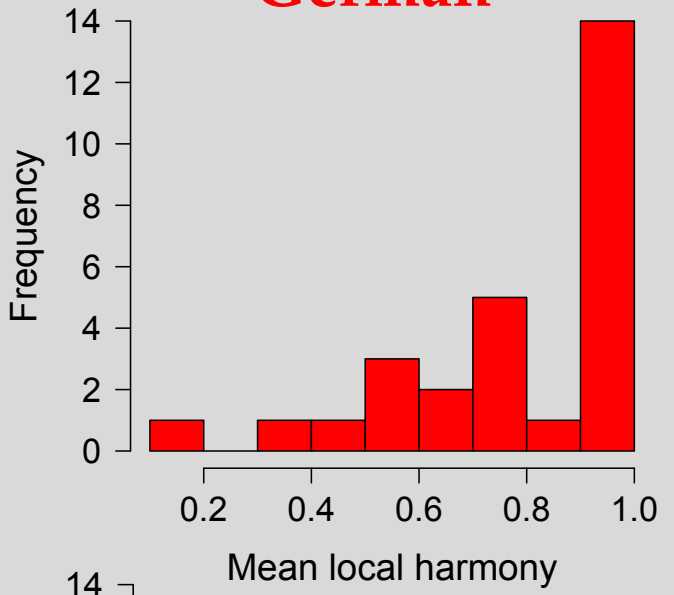
Distributions

English

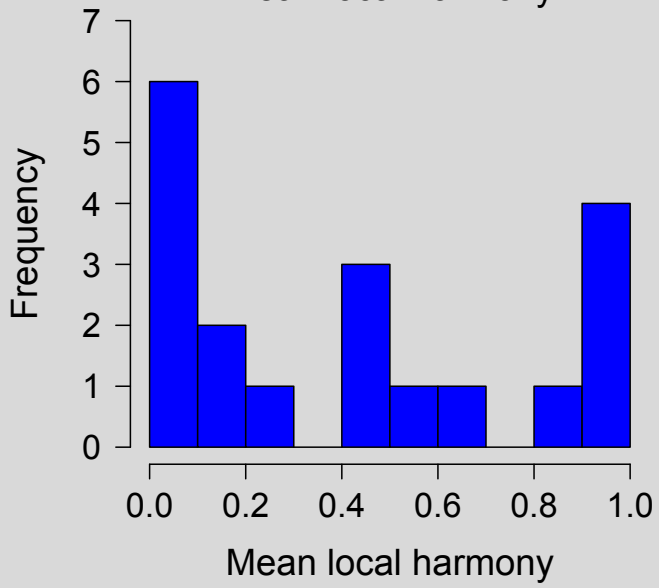
German

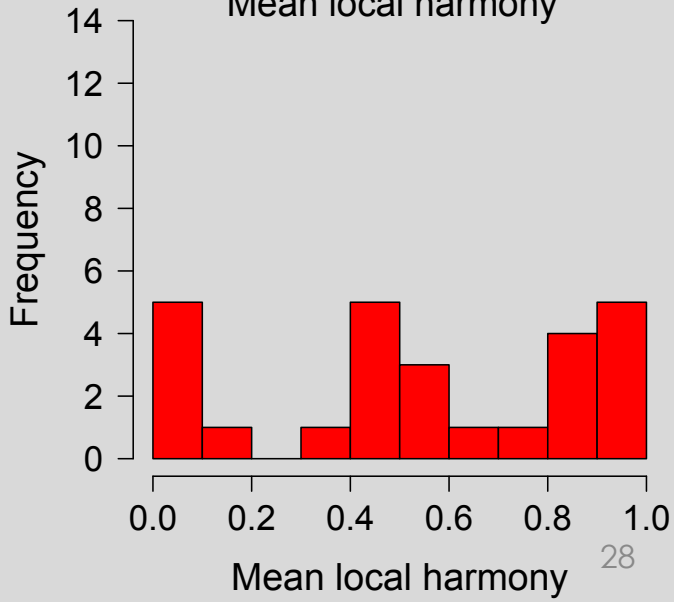
Suffix





Prefix





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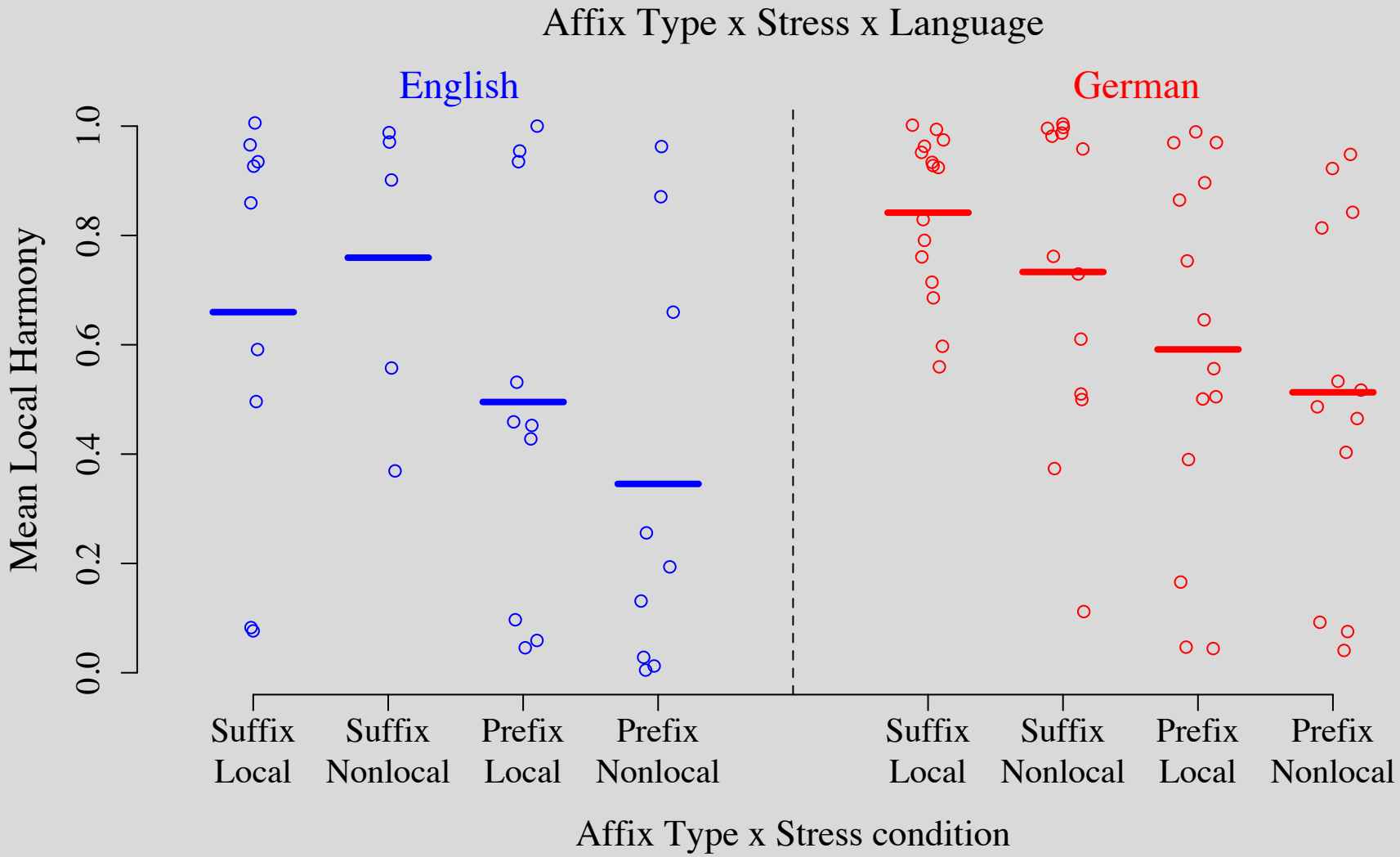
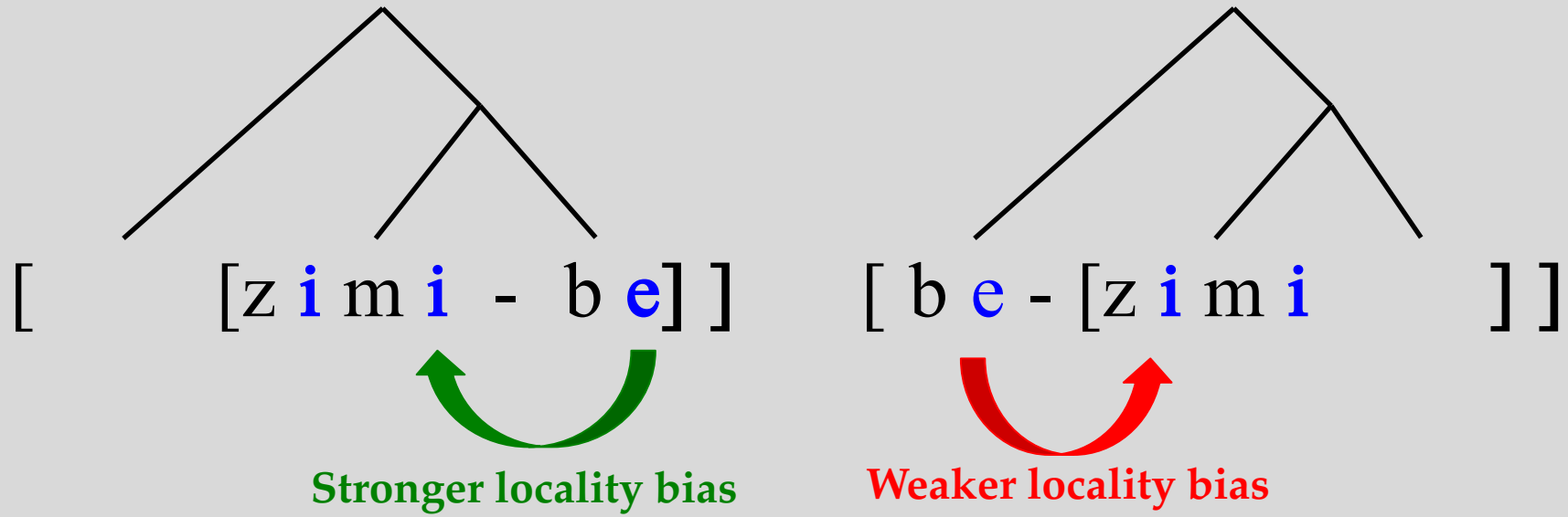


Local harmony and word structure

- Results consistent with a structure in which suffixes are more closely incorporated with the stem than prefixes are. (Nespor & Vogel 1986, Peperkamp 1997)



Comparison with Finley & Badecker 2009

- Unlike us, F&B found no preference for suffixes in root-controlled harmony.

- Perhaps due to task differences.

Comparison with Finley & Badecker 2009

- F&B training: [beme] … [mi-beme]
  - Very similar to ours.
  - Our results suggest that several participants actually learn a non-local co-occurrence restriction from such input, rather than local harmony: [mi_x-$beme_x$]

- F&B testing:
  - [tede] … [mi-tede] or *[mu-tede]
  - [beme] … [beme-gi] or *[beme-gu]

Comparison with Finley & Badecker 2009

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- F&B testing:
  - [tede] … [mi_x-$tede_x$] or *[mu_y-$tede_x$]
  - [beme] … [be_xme-gi_x] or *[be_xme-gu_y]

- Success on task does not tell us what kind of pattern was learned.

Implications

- Results suggest that [root+suffix] is a preferred domain for local harmony compared to [prefix+[root]].
  - Consistent with a (preferred) word structure with the root and suffix more closely integrated than the prefix.

- Possible role in explaining why prefixes are poor harmony triggers (found by Finley & Badecker 2009) and may be less likely to participate in root-controlled harmony.

- Unified account of prefix/suffix asymmetry for vowel harmony and other processes such as foot assignment.

Stress

- No significant effect of stress in this experiment.
  - Numerical trend in German in predicted direction.
- New version of this experiment currently being run may be more sensitive to such an effect.
  - Removed pictures so participants will focus more on the phonology.
  - Should also reduce number of participants failing to meet criterion.
- Plan to look at this more closely when all L1 are tested.
  - We expect: no effect in languages with fully predictable stress (French, Hungarian).
  - Largest difference in languages where stress plays the largest role (German, Dutch).

Work in progress

- Revised version of the experiment currently being run.
- New version will be run across all 6 languages.
- Is the effect related to a general preference for suffixation?
  - We would like to run the experiment in a predominantly prefixing language.

Thank you!

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