Typology, judgments, and weights

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Outline

Collaborators

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- Jason Ginsburg
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The experimental paradigm

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- Judgments are correlated with phonological properties of the items.

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- Neighborhood density plays a role.
- Phonotactic probability plays a role.
- Phonology *per se* does not appear to play an independent role.

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- Similarity is reckoned in terms of minimum edit distance: a single segmental change, e.g. deletion, addition, permutation, alteration (Luce, 1986).
- *blick* [blɪk] has a neighborhood density of 11:

click [klɪk]	flick [flɪk]	lick [lɪk]
slick [slɪk]	brick [brɪk]	black [blæk]
bleak [blik]	block [blak]	blink [blɪŋk]
bliss [blɪs]	bilk [bɪlk]	

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- For example: [blɪk]. The onset [bl] occurs 957 times out of 477,416 monosyllables. The rhyme [ɪk] occurs 400 times out of the same number.
- $P(\text{blɪk}) = \frac{957}{477416} \times \frac{400}{477416}$

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- Certainly, nonsense items that are phonologically impossible are judged worse than items that are phonologically possible, e.g. wf([blɪk]) $>$ wf([bnɪk]).
- But this sort of effect can also be described with neighborhood density and phonotactic probability.

item	Neighbors	Probability
[blɪk]	11	.0000016794
[bnɪk]	2	0

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- Neighborhood density and phonotactic probability provide for gradient effects too.
- Phonologically well-formed nonsense items like *sphick* [sfɪk] are judged as worse than items like *blick* [blɪk] (and, of course, better than items like *bnick* [bnɪk]).

item	Neighbors	Probability
[blɪk]	11	.0000016794
[sfɪk]	4	.0000000421
[bnɪk]	2	0

There is more to phonology

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- But there is more to phonology than language-specific wellformedness.

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- There is phonological typology.

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- Sonority hierarchy: onset clusters prefer to increase in sonority.
- Onset size: onset clusters prefer to have fewer segments.

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- Maybe well-formedness judgments work the same way... or maybe they don't.
- In independent work, Albright (2007) has found an effect of the sonority hierarchy in a judgment task.

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- Even those minuscule differences sometimes show effects.
- Let's try a different strategy to search for an effect of phonological typology. (Cf. also Bailey & Hahn, 2001.)

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- What about appropriately constructed impossible items?
- Such items would have a phonotactic probability and neighborhood density of 0.

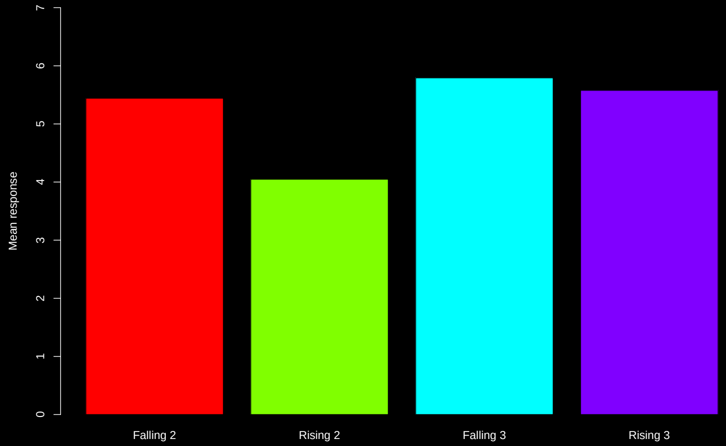
Experimental design

- Items with impossible onset clusters.
    - Constructed so there are no neighbors.
    - Phonotactic probability = 0.
- Single group, randomized presentation.
- Items are visually presented, since items can't be pronounced in English. (Cf. Bailey & Hahn, 2001.)
- Rank items for well-formedness on a scale from 1 (good) to 7 (bad).

Experimental items

2/Rising	mruke dliz shliz thliz fnape kneeb lmube pmazz thmazz zloog tmaz vmupe zmiv znafe vriss
2/Falling	rmuke ldiz lshiz lthiz nfape nkeeb mlube mpazz mthazz lzoog mtaz mvupe mziv nzafe rviss
3/Rising	bmluke gnruke knliz dmloke znlape fmreap zmrube fnlope tnlope kmroot thmled zmlen thnlem tnrafe pmreeze thmrass tmrofe thnreef
3/Falling	lmbuke rnguke lnkiz lmdoke lnzape rmfeap rmzube lnfope lntope rmkoot lmthed lmzen lnthem rntafe rmpeeze rmthass rmtofe rntheef rnvizz

Results of Experiment #1

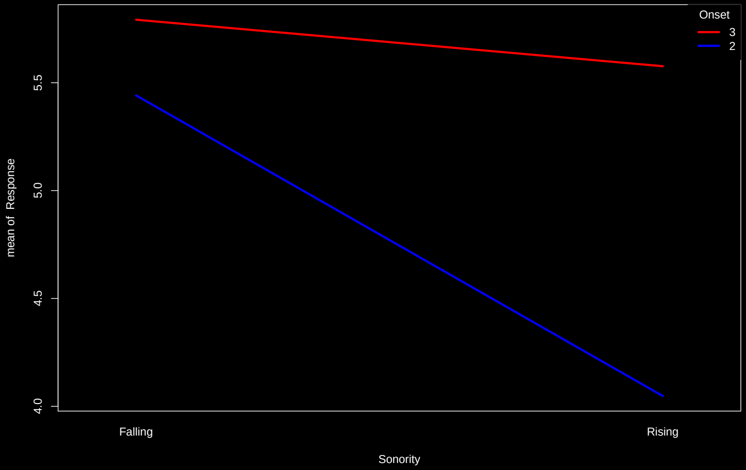


Numerical results for Experiment #1

By subjects	sonority	$F(1,20) = 75.807, p < .000$
	onset	$F(1,20) = 122.116, p < .000$
	sonority:onset	$F(1,20) = 47.979, p < .000$
By items	sonority	$F(1,64) = 23.521, p < .000$
	onset	$F(1,64) = 37.889, p < .000$
	sonority:onset	$F(1,64) = 14.886, p < .000$

	2	3
Falling	5.441270	5.791980
Rising	4.047619	5.576441

Interaction plot for Experiment #1



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- There is no effect of sonority when clusters have three consonants.
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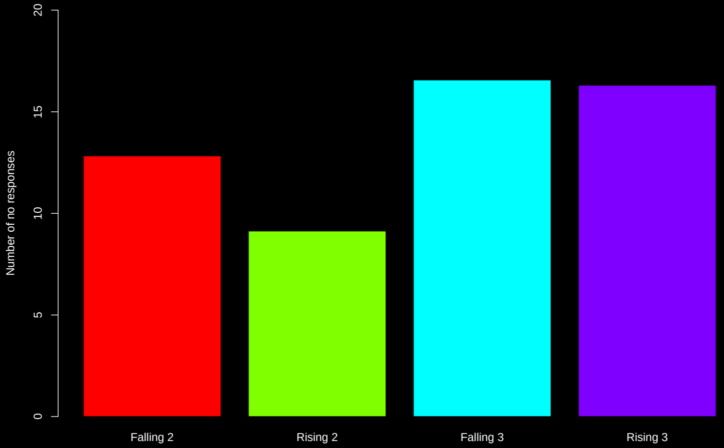
- Can we replicate this with yes–no judgments (and the same items)?

Results of Experiment #2



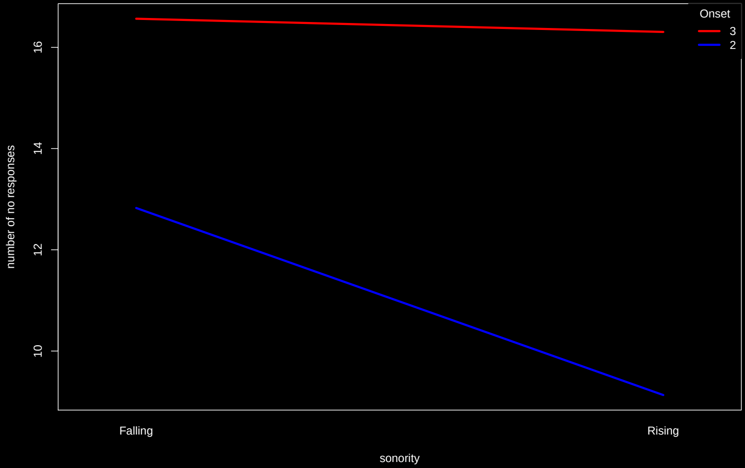
Numerical results for Experiment #2

Aggregated (number of 'no' responses) by item, anova by subject:

sonority	$F(1, 87) = 8.595, p < .004$
onset	$F(1, 87) = 65.391, p < .000$
sonority:onset	$F(1, 87) = 6.4777, p < .01$

	2	3
Falling	12.826087	16.56522
Rising	9.130435	16.30435

Interaction plot for Experiment #2



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- Hence, typology plays a role in judgment tasks.
- But what kind of role?

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- Typology plays a role Just so.
- Experience trumps typology If there is relevant experience, judgments reflect experience.
- Occlusion Some typological effects can occlude others, i.e. three-consonant clusters are so bad that sonority shows no effect *in that condition*.

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- $P([\text{km}]_{\text{onset}}) = P([\text{kmr}]_{\text{onset}}) = 0$
- What if the system underlying judgments is different?

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  - $P([\text{C}]_{\text{onset}}) = ?$
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- These values would correlate with judgments of items with novel onsets.
- Can these values be learned on the basis of English distributional data?

What is the distribution in English?

Items	Tokens
Total monosyllables	477,416
No onset	120,943
One-consonant onset	314,407
Two-consonant onset	40,102
s[ptkf] onset	5,882
Three-consonant onset	1,964
s[ptkf]C onset	1,964

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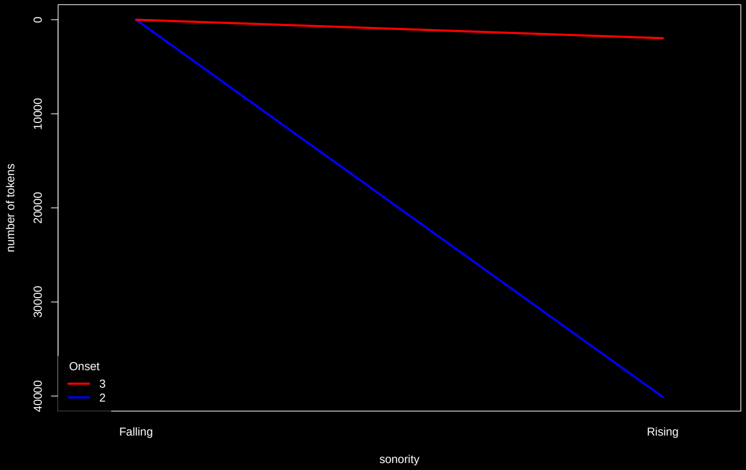
- Does s[ptkf] count as a violation, as a sonority reversal?
- If it does, then a two-consonant s[ptkf] cluster counts as a reversal.
- If it does, then what about a three-consonant cluster that begins with s[ptkf] and then rises in sonority, e.g. spl, skr, etc?

If English respects the sonority hierarchy



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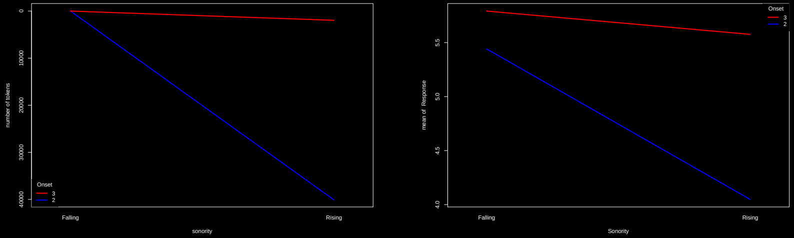

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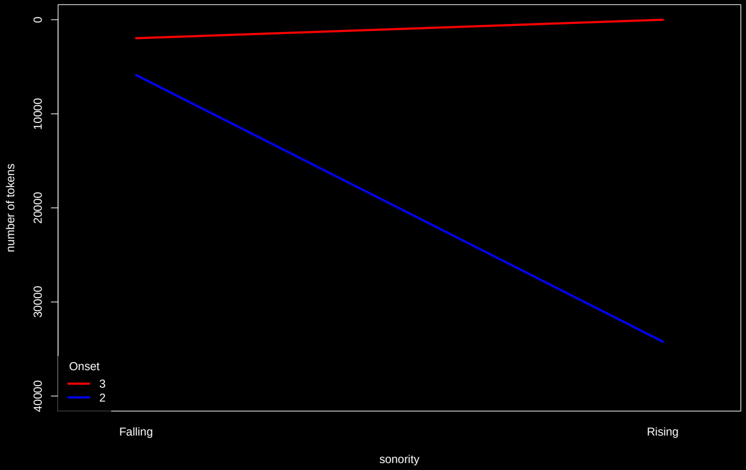

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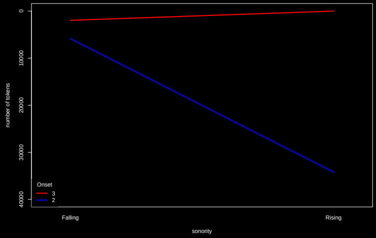

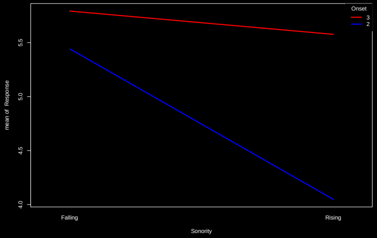

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- But the relationship looks pretty good either way.
- Thus typological generalizations in English may follow from innate general constraints and language-specific learning.
- This, of course, leaves open why English respects those typological generalizations.

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- Experience plays a role Rankings (and constraints?) can be learned.
- Typology plays a role There are innate constraints.
- Specificity There are a number of ways to formalize constraints on sonority and onset cluster size in OT. We've established that there must be such constraints *independent* of phonotactic probability and neighborhood density.

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- The size constraint must outrank the sonority constraint at a sufficient distance—or with sufficient weight—so that the former occludes the latter.
- (See Hammond, 1999 for a more general statement of the kinds of constraints we need for margin size and sonority.)

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- ...or do those generalizations follow from phonetic experience?

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- Hence phonology plays a role in judgment tasks.
- Not all generalizations mirror linguistic experience.
- This is consistent with innate constraints and learned probabilistic rankings.