Non-phonological factors of phonological variation
A large scale wug-experiment for Hungarian vowel harmony

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Vacillating stems in Hungarian

Hungarian [±back] vowel harmony:

asztal	[ɒstɒl]	'table'	+ Dative *–nAk* =	*asztalnak*.
függöny	[fygːøɲ]	'curtain'	+ Dative *–nAk* =	*függönynek*.
fotel	[fotɛl]	'armchair'	+ Dative *–nAk* =	*fotelnak*∼*fotelnek*.

Backness = probability *P* of B-suffix, influenced (at least) by:

- Stem's vowel pattern: vacillating stems typically back V^+ + {ɛ, eː, i}$^+$
- Stem's fine-grained structure of V and C qualities (e.g., Hayes et al., 2009)
- Stem's semantic-stylistic properties. (e.g. Forró, 2013)
- Suffix (case)
- Speaker's dialect (Blaho and Szeredi, 2013)
- Speech rate (Hetényi and Biró, Wednesday)
- **What else?**

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Overview

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Wug-tests for Hungarian vowel harmony

Our starting point:

- Hayes, B., & Londe, Z. (2006). Stochastic phonological knowledge. *Phonology*, 59–104.
- Hayes, B., Siptár, P., Zuraw, K., & Londe, Z. (2009). Natural and unnatural constraints in Hungarian vowel harmony. *Language*, 85(4), 822–863.

> Women in the Middle Ages used *hádél* to wash clothing. Back then, __hádél__ grew abundantly in the fields. It is very hard to find nowadays, but it is said that __hádélnak or hádélnek__ had a wonderful fragrance.
> (Hayes and Londe, 2006:70)

Wug-tests for Hungarian vowel harmony

Wug-tests (Berko, 1958):

- Have native speakers generate inflected forms of novel stems.
- Demonstrate productive morpho-phonological rules/patterns.
- As with any experimental design,

can there be experimental artefacts?

> "Frames and instructions were composed with the goal of encouraging the subjects to treat the stems as long-forgotten but authentic words of Hungarian, rather than as recent loans." (Hayes and Londe, 2006:70)

- Intuition of some native speakers: old Hungarian words more likely to receive back suffixes than recent loans. Is it really so? (Cf. closed class of antiharmonic stems.)
- More generally, does the frame also influence the suffix choice?
- Are there other (non-phonological factors) affecting allomorphy?

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Matched-pair design

- Reproducing Hayes & Londe, 2006 with different frames: contrasting old Hungarian to new foreign + observe further factors.
- Weather event, old Hungarian context:

  Each year in the Middle Ages, the population of the Great Hungarian Plain prepared for the arrival of the *hádél*. The _hádél_ involved a sudden fall in temperature and much precipitation. We have to ascribe the extinction of more species [to] _hádélnak or hádélnek_.

- Weather event, new foreign context:

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Experimental material

- Reproducing Hayes & Londe, 2006 with different frames: contrasting old Hungarian to new foreign + observe further factors.
- Online questionnaire: `http://birot.web.elte.hu/ragozas/`. Self-coded. Snowball launched on Facebook, as well as `nyest.hu`.
- Number of participants: $N = 2999$ (frameset 1), $N = 689$ (frameset 2).
- Wug words: from earlier experiment
  - Minor adjustments: avoid phonemes unlikely in foreign words (e.g., [ɲ]). All words with initial C (no need to adjust definite article).
  - Targets: 5 strongly vacillating *(hádél, poribit, kolén, vuszék, vánél)*, 2 barely vacillating, dominantly back *(pozin, monil)*.
  - Fillers: 3 non-vacillating back *(szandat, kánit, bortog)*, 5 non-vacillating front *(zefét, petlér, fánedeg, luteker, kálendel)*.
  - (Vacillating vs. non-vacillating: according to the 2006 study.)

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Experimental material (cont'd)

- Frames: inspired by earlier experiment. In each frameset,
  - Targets – two *domains*: old Hungarian context (7 frames), and new foreign context (7 frames).
  - Targets – 6+1 *ontological categories* (2 frames each): human, animal, plant, artefact, naturally occurring object, natural force (weather events) + personal name.

    Motivation: relevant categories in developmental psychology (e.g., Keil 1979) and the cognitive science of religion (Boyer 1994). Different ontological categories subject to different folk-theories, different inferences, different association networks.

  - Fillers – 11 frames non-specified for domain, various or unclear for ontological category.
- Similarly to Hayes and Londe (2006): type wug words twice, first in nominative case, then in dative case. Boring?

Matched-pair design

- "Proto-patterns", such as `FBWFWBWWFWBWFW`, where `W` = target wug word, `F` = front filler, `B` = back filler. (Always start with `FB` or `BF`.)
- "Patterns", such as `FBNFHBCPFTBOFA`, where `N` = personal name, `H` = human, `C` = weather condition, etc.
- A random back filler wug word for each `B`. A random front filler wug word for each `F`. A random target wug word for each `N`, `H`, etc.
- Even-numbered subjects: 4 new foreign domain frames, and 3 old Hungarian domain frames.
- Matched (odd-numbered) subject: same questionnaire, but mirrored for target frame domains.

Subject $2n$	filler frame 2 fr filler ww 3	filler frame 7 ba filler ww 1	**old H** pn target ww 2	filler frame 5 fr filler ww 2	**new F** hum target ww 6	... ...
Subject $2n+1$	filler frame 2 fr filler ww 3	filler frame 7 ba filler ww 1	**new F** pn target ww 2	filler frame 5 fr filler ww 2	**old H** hum target ww 6	... ...

Matched-pair design

- Within Experiment 1 (or within Experiment 2), contrast
  - for given target wug word, and ontological category,
  - dative suffix allomorph in old Hungarian context
    vs.
  - dative suffix allomorph in new foreign context.
  - Subjects $2n$ vs. $2n+1$: only difference is domain, all other factors (ontological category, fillers, order, etc.) being the same.
- Between Experiment 1 and Experiment 2, contrast
  - for given target wug word, and ontological category and domain,
  - dative suffix allomorph in Experiment 1
    vs.
  - dative suffix allomorph in Experiment 2.
  - Subjects $k^{(1)}$ vs. $k^{(2)}$: only difference is frame text, all other factors (ontological category, domain, fillers, order, etc.) being the same.

Overview

Reproducing Hayes and Londe 2006

Overall backness of specific wug words (same ranks, larger values):

	Exp 1	Exp 2	Hayes & Londe (*)
hádél	0.45	0.41	0.27
poribit	0.31	0.28	0.34
kolén	0.43	0.44	0.36
vuszék	0.59	0.57	0.42
vánél	0.54	0.54	0.45
pozin	0.94	0.94	0.92
monil	0.95	0.94	0.92 (NB: *mo[n]il* !)

E.g., based on H&L, one might think *hádél* 'quite fronter' than the rest (and so,... [phonological theory]...). Reproduction shows it is not necessarily so.

(*) `http://www.linguistics.ucla.edu/people/hayes/HungarianVH/HayesLondeHungarianWugTestData.txt`

Depends on domain? old Hungarian vs. new foreign

- Matched-pair design with binary categorical outcome: McNemar's χ^2 test (H_0: same probabilities in the two conditions).
- **Bad news:** No significant difference in overall data.
  - Experiment 1: $\chi^2 = 0.2258$, df$= 1$, $p = .635$.
  - Experiment 2: $\chi^2 = 2.7589$, df$= 1$, $p = .097$.
- **Good news:** mutually neutralising significant results.
  - Personal names: backness oldH $<$ newF.
    (Experiment 1: $p = .0011$; Experiment 2: $p = 0.024$)
  - Human made artefacts: backness oldH $>$ newF.
    (Experiment 1: $p = .013$; Experiment 2: $p = 0.0016$)
  - Naturally occurring objects: backness oldH $>$ newF.
    (Experiment 1: $p = .0006$; Experiment 2: $p = .058$)
  - Humans, animals, plants, weather events: *n.s.*

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Dependence on various factors: logistic regression

Backness: $P($ suffix = [nɒk] $|...) = ?$

E.g., backness of *hádél* in Experiment 1:

overall:	1360/3072 =	.443
personal name:	187/433 =	.432
old Hungarian personal name:	87/217 =	.401
new foreign personal name:	100/216 =	.463
artefacts:	161/440 =	.366
old Hungarian artefacts:	89/225 =	.396
new foreign artefacts:	72/215 =	.335
weather event:	217/445 =	.488
old Hungarian weather event:	96/224 =	.429
new foreign weather event:	121/221 =	.548

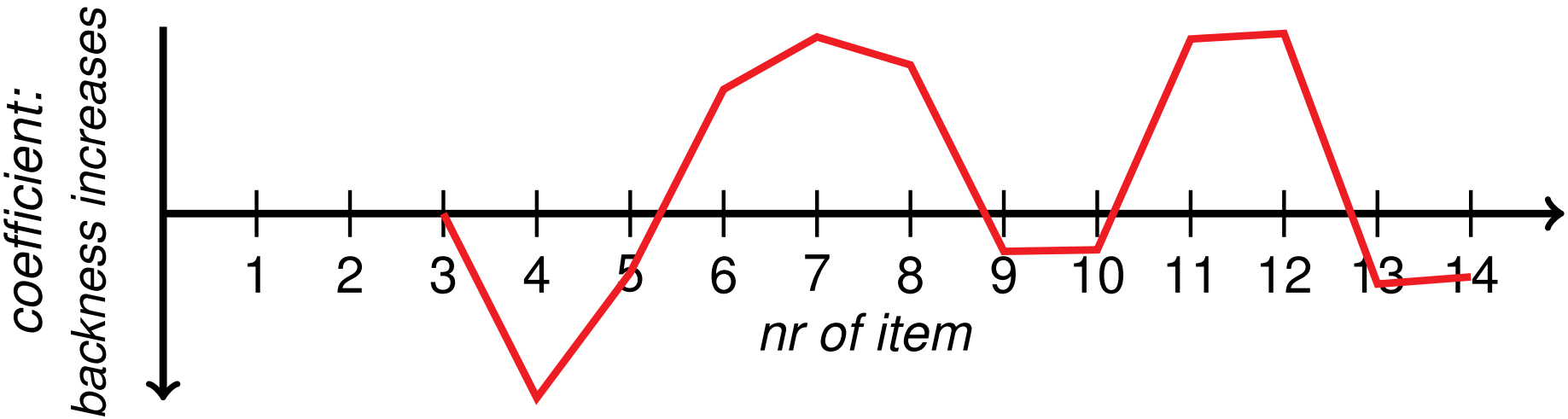
As the experiment proceeds...

nr: number of the item within questionnaire (NB: first two always fillers).

$$S \sim ww + PS + PPS + nr + frame : exp + ww : sem$$

Coefficients for most levels of categorical variable *nr* are significant.

(A non-significant model, $p = .761$, which can nonetheless be significantly improved by introducing *PS:nr* and *PPS:nr* interactions. Other models yield similar pictures.)



Further significant factors

1. The wug word.
   - The wug word's pattern (e.g., Bé, Bii) in interaction terms, rather than the wug word itself: sometimes improves the glm model.
   - Wug word and ontological domain interaction:
     E.g., *vuszék* as an artefact (but also as a natural object)
     more likely to get front suffix ($p < .01$).
2. **Priming:** the suffix given by the subject for previous items (last two tested, both highly significant).
3. Those finishing the test: more back responses than those not finishing it. (Otherwise, unfinished questionnaires not included in statistics).
4. **Sound symbolism**: negative weather events more often back suffix than positive weather events (newF: $p = .046$; oldH: $p = .0005$).

Non-significant factors

Since we had the information, why not test these:

- Time elapsed since the beginning of the questionnaire (worse predictor than *nr* of item).
- Gender of the subject.
- Time of day.

A note of caution: A factor that has been *n.s.* may still prove significant in a repeated experiment (with larger sample). Still, we expect the effect to be small.

Moreover, a factor that is significant here, can be due to type I error.

Overview

Conclusions

- Several native speaker's intuition: words for old Hungarian objects more likely to get [+back] suffix than new foreign objects.
  'Folk-historical linguistics'? This intuition seems to be confirmed.
  Interestingly, opposite direction effect for personal names.
- For sure: backness of a wug word depends on frame!
  Effect is small, but highly significant when measured on a large sample.
- Exactly which (phonological, syntactic, semantic) aspects of the frame influence allomorphy, remains to be established.
  Likely influence of ontological category.
  Likely sound symbolism: increased backness if negative connotation.
- Significant priming effect detected.

Thank you for your attention!

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