

## Differential treatment of initial syllables\*

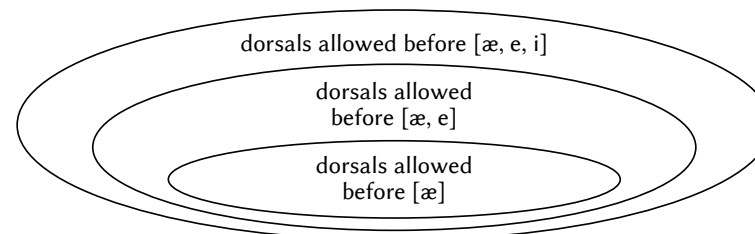
- Phonological alternations (e.g. *naif* ~ *naivz*) are particularly costly in prominent positions (root, onset, stressed syllable, initial syllable).
- Stem-final alternations are dispreferred in monosyllables — in Turkish, Portuguese, and many other languages. But English goes the other way, surprisingly, with more alternations in monosyllables.
- We show that the English situation is a historical accident: Speakers do not extend the generalization to **novel items**, and behave like Turkish speakers with **novel alternations** in an artificial grammar.
- Our experimental methods reveal a purely positional bias that goes against the data available to the speaker. The **surfeit of the stimulus** (Becker, Ketrez & Nevins 2011) is ignored.

### 1 The Subset Principle and Universal Grammar

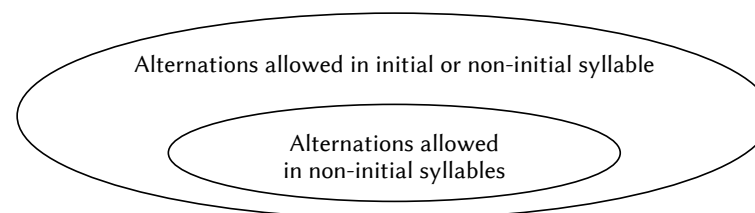
- (1) The Logic of the subset principle (Berwick 1985; Manzini & Wexler 1987)
- Learners start with the most restrictive grammar, moving outwards only with positive evidence
  - Immediate move to a superset grammar will include/allow everything in the subset grammar
  - In our case, English speakers who hear an alternation that impacts the stem’s initial syllable allow later syllables to be impacted, but not vice versa.

\*For their valuable comments and discussion, we thank Adam Albright, Lauren Eby, Peter Graff, John Kingston, John McCarthy, Anne Pycha, Matt Wolf, and the audience at NELS 40.

- (2) The Subset Principle: Markedness (cf. Wilson 2006)



- (3) The Subset Principle: **Faithfulness** (our focus today)



### 2 What is initial syllable faithfulness?

From Beckman (1997, 1998):

- (4) In Tamil, codas keep their place of articulation only in the initial syllable.

/tunbā/	IDENT(place)-σ <sub>1</sub>	AGREE(place)	IDENT(place)
a. <span>தூந்</span> tun.bā		*	
b. tum.bā	*!		*

/pasən+gə/	IDENT(place)-σ <sub>1</sub>	AGREE(place)	IDENT(place)
a. pa.sən.gə		*!	
b. <span>பாசெ</span> pa.səŋ.gə			*

Similarly in many other languages (see Casali 1998; Becker et al. 2011; Jesney 2009).

### 3 Initial syllables are protected from alternations

#### 3.1 Turkish (Becker, Ketrez & Nevins 2011)

In Turkish, voicing alternations affect stops (p, t, tʃ, k) in some short words,

- (5) *taɫ* ~ *taɫ*-i 'crown NOM/POSS'  
*saɫ* ~ *saɫ*-i 'hair NOM/POSS'

and some long words:

- (6) *amaɫ* ~ *amaɫ*-i 'goal NOM/POSS'  
*anaɫ* ~ *anaɫ*-i 'cub NOM/POSS'

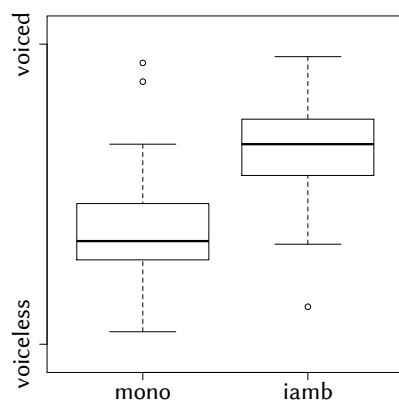
Long words are more likely to alternate (Lees 1961; Inkelas & Orgun 1995; Inkelas et al. 1997; Hayes 1995; Pycha et al. 2007). Data from Inkelas et al. (2000):

(7)

syllables	<i>n</i>	% voiced
σ	238	19%
σσ	454	64%
longer	806	49%

We asked 24 Turkish speakers to choose a possessive form for 72 nouns that we created, e.g. *tup*, *gujup* ("wug test", Berko 1958).

- (8) Monosyllables protected from voicing alternations:



Conclusion: Turkish speakers prefer alternations in polysyllables, and extend this preference to novel words.

#### 3.2 Brazilian Portuguese

In Brazilian Portuguese, word-final [w] changes to [j] (Gomes & Manoel 2010) in some short words,

- (9) *saw* ~ *sajs* 'salt SG/PL'  
*paw* ~ *paws* 'stick SG/PL'

and in some long words:

- (10) *de'daw* ~ *de'dajs* 'thimble SG/PL'  
*ka'kaw* ~ *ka'kaws* 'cocoa SG/PL'

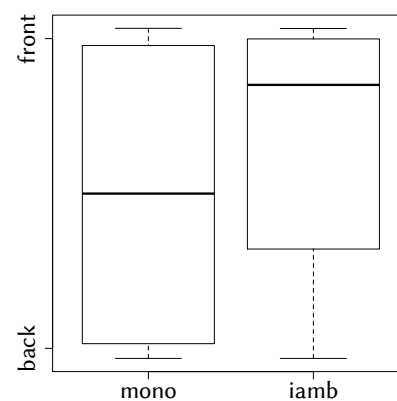
Real [w]-final words:

(11)

syllables	<i>n</i>	%[w]→[j]
σ	23	15%
σσ	87	83%
longer	107	94%

We gave 35 speakers of Brazilian Portuguese 63 [w]-final made-up words (e.g. *'daw*, *ma'haw*, *'jantaw*), and asked them to choose between a faithful [w] plural and an unfaithful [j] plural.

- (12) Monosyllables protected from backness alternations:



Conclusion: Brazilian Portuguese speakers prefer alternations in polysyllables, and extend this preference to novel words.

## 4 English Speakers ignore an anti-Universal trend

### 4.1 The lexicon: more alternations in monosyllables

Final [f/θ] alternate with the voiced [v/ð] in some nouns, but not others (Jespersen 1909; Berko 1958; Hayes 2009):

- (13) [naɪf] ~ [naɪvz] 'knife'  
[pæθ] ~ [pæðz] 'path'
- (14) [ʃɛɪɪf] ~ [ʃɛɪɪfs], \*[ʃɛɪɪvz] 'sheriff'  
[mæmɪθ] ~ [mæmɪθs], \*[mæmɪðz] 'mammoth'

What determines whether a noun alternates or not?

(15) Not (just) spelling:

- Spelling doesn't help at all with [θ].
- <roofs> is about 100 times more common than <rooves> in Google, but [rʊvz / ruvz] is very common.
- [dʒə'jævz] is spelled with <ff>, which is not expected to alternate.

(16) Not (just) history, since the patterns changed quite a bit in recent history:

- Post-[r] voicing is new: [dwoɪf] 'dwarf', [woɪf] 'wharf', [skɑɪf] 'scarf'.
- Loss of most vowel alternations: [stæf] ~ \*[steɪvz] 'staff'
- Alternations lost for many speakers (completely or in some contexts).

So what does determine whether a noun alternates or not?

(17) Morpho-syntactic context:

- No alternation in the genitive: knife's, roof's, path's, etc.
- Compounds: [buðz] 'booths' vs. [tɔl-buθs] 'toll-booths'
- Plurals vs. denominal verbs: Plurals voicier in some items (knives/to knife), verbs in others (beliefs/to believe), or same (halves/to halve).

(18) Segmental context:

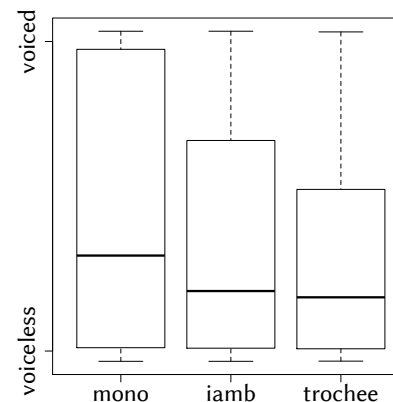
- Long vowels are voicier than short vowels (leaves vs. cliffs).
- Complex codas are voicier than simple codas (shelves vs. chefs).

(19) Prosodic shape (length and stress)

- Monosyllables are voicier: [naɪvz] 'knife', [pæðz] 'path'
- Iambs less voicy: [dʒə'jævz] 'giraffe', [və'muðz] 'vermouth'
- Trochees least voicy: \*[ʃɛɪɪvz] 'sheriff', \*[mæmɪðz] 'mammoth'

We asked 120 English-speaking Mechanical Turkers to rate plural forms for 126 real nouns. Amazon's Mechanical Turk is a web application that provides access to an arbitrarily large number of potential participants for survey-based experiments; see also Spruce (2010).

(20) Monosyllables alternate more than either iambs or trochees:



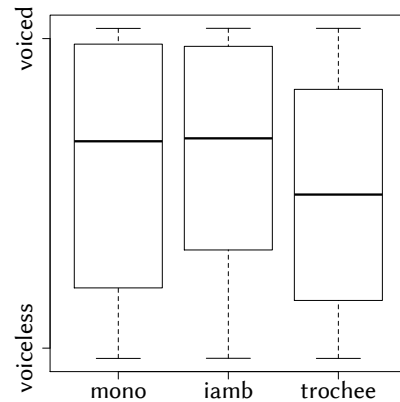
(21) Stress effect: less alternations in unstressed vowels.

(22) Anti-initial syllable effect: less alternations in non-initial syllables.

## 4.2 Novel words: No preference for monosyllables over iambs

We gave 120 English-speaking Mechanical Turkers 132 f/θ-final made-up nouns: Monosyllables (*'smaf*, *'waθ*), iambs (*gl'i'naf*, *ɟ'i'zaθ*), and trochees (*'takf*, *'hakiθ*).

(23) Monosyllables and iambs alternate at the same rate; trochees alternate less.



- (24) Stress effect is projected from the lexicon; anti-initial syllable effect isn't.  
 (25) “Surfeit of the stimulus” (Becker et al. 2011): The speakers are given ample evidence in the lexicon, yet fail to form a generalization.  
 (26) No anti-initial syllable effect even with twice the items and 3–4 times the participants as Turkish and Brazilian Portuguese.  
 (27) Similar preliminary results with Russian voicing alternations.

## 4.3 UG doesn't allow accurate projection from the lexicon

(28) Monosyllables rely on the ranking of IDENT(voi)-σ<sub>1</sub>

/naif + z/	IDENT(voice) <sub>aff</sub>	IDENT(voice)-σ <sub>1</sub>	IDENT(voice)
a. $\text{naivz}$		*	*
b. $\text{naifs}$	*!		

/stæf + z/	IDENT(voice)-σ <sub>1</sub>	IDENT(voice) <sub>aff</sub>	IDENT(voice)
a. $\text{stævz}$	*!		*
b. $\text{stæfs}$		*	

(29) Polysyllables aren't affected by IDENT(voice)-σ<sub>1</sub>:

/ɟəjæf + z/	IDENT(voice)-σ <sub>1</sub>	IDENT(voice) <sub>aff</sub>	IDENT(voice)
a. $\text{ɟəjævz}$			*
b. $\text{ɟəjæfs}$		*!	

/bəlif + z/	IDENT(voice)-σ <sub>1</sub>	IDENT(voice)	IDENT(voice) <sub>aff</sub>
a. $\text{bəlivz}$		*!	
b. $\text{bəlifz}$			*

The grammar:<sup>1</sup>

(30) IDENT(voice)-σ<sub>1stæf</sub> ≫ IDENT(voice)<sub>bəlif</sub> ≫ IDENT(voice)<sub>aff</sub> ≫ IDENT(voice)<sub>ɟəjæf</sub>, IDENT(voice)-σ<sub>1naif</sub>

A fuller lexicon:

(31) IDENT(voice)-σ<sub>130 items</sub> ≫ IDENT(voice)<sub>90 items</sub> ≫ IDENT(voice)<sub>aff</sub> ≫ IDENT(voice)<sub>10 items</sub>, IDENT(voice)-σ<sub>170 items</sub>

But now the odds are stacked against the monosyllables:

(32) IDENT(voice)-σ<sub>130%</sub> ≫ IDENT(voice)<sub>90%</sub> ≫ IDENT(voice)<sub>aff</sub> ≫ IDENT(voice)<sub>10%</sub>, IDENT(voice)-σ<sub>170%</sub>

Individual items can be learned, but the generalization cannot be projected.

Possible grammars: Monosyllables are protected more than polysyllables;  
 Monosyllables and polysyllables are equally protected.

Impossible grammar: \*Polysyllable are protected more than monosyllables.

<sup>1</sup>We use an “inside-out” analysis (Hayes 1995, 1999; Becker 2009; Becker et al. 2011; Albright 2002, 2008) with cloning (Pater 2006, 2009; Coetzee 2008; Becker 2009).

#### 4.4 Artificial voicing: More alternations in polysyllables

English speakers regulate voicing alternations in the plural on [f] and [θ]. We asked 80 Mechanical Turkers to voice [p, t, k] with the plural suffix [ni] and see what happens.

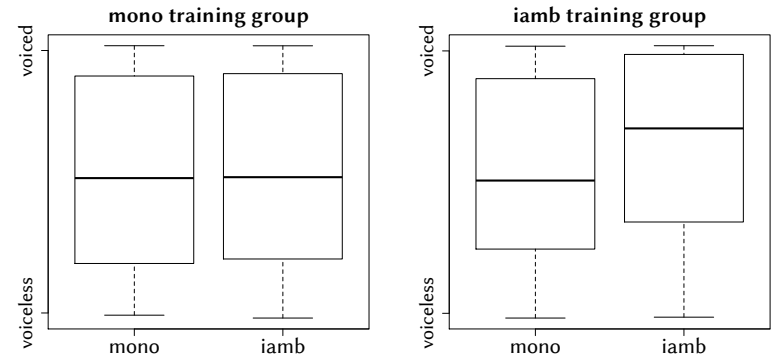
(33) Artificial grammar setup (à la Wilson 2006)

	the “mono training” group		the “iamb training” group	
Training	<i>10 stop-final monos</i>		<i>10 stop-final iambs</i>	
	mip	mibni	təgep	təgebni
	stut	studni	gəfut	gəfudni
	prok	progni	ləfok	ləfogni
	<i>5 sonorant-finals</i>		<i>5 sonorant-finals</i>	
	muŋ	muŋni	muŋ	muŋni
	nəɟol	nəɟolni	nəɟol	nəɟolni
Testing	<i>10 stop-final monos</i>		<i>10 stop-final iambs</i>	
	gaɪp	_____	fəʃɔp	_____
	klet	_____	bəgit	_____
	dok	_____	tʃəpak	_____
	<i>10 stop-final iambs</i>		<i>10 stop-final monos</i>	
	fəʃɔp	_____	gaɪp	_____
	bəgit	_____	klet	_____
	tʃəpak	_____	dok	_____
	<i>10 sonorant-finals</i>		<i>10 sonorant-finals</i>	
	plər	_____	plər	_____
	ʒətəɪm	_____	ʒətəɪm	_____

(34) The predictions

- If speakers generalize the anti-initial syllable effect from the fricatives: The “mono training” group should voice monos only, the “iamb training” group should voice both monos and iambs.
- If speakers use initial syllable faithfulness: The “iamb training” group should voice iambs only, the “mono training” group should voice both monos and iambs.

(35) The “mono training” group voiced monos and iambs equally (no anti-initial syllable effect), but the “iamb training” group voiced monos significantly less often than iambs.



Conclusion: Given a chance, English speakers ignore the anti-initial syllable effect of their language, and prefer a Turkish/Portuguese initial syllable effect.

## 5 Conclusions

The expected languages:

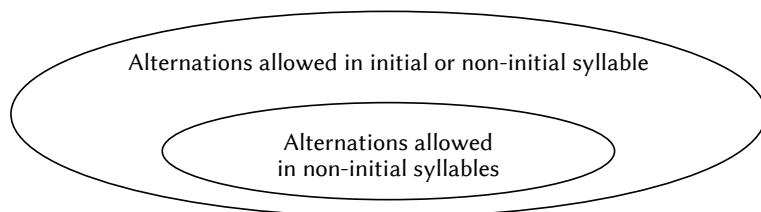
- Turkish and Portuguese protect monosyllabic lexical items from alternations more than polysyllabic items.
- The trend is projected from the lexicon onto novel items (“wug test”).

The unexpected language(s):

- English protects monosyllabic lexical items less than polysyllables.
- Step I: No projection of the trend from the lexicon onto novel items.
- Step II: Emergence of initial syllable faithfulness with novel alternations.

Initial syllable faithfulness shows up without any evidence from the ambient language = doesn't need to be learned.

- The Universal elements of phonological theory are not limited to those with a phonetic basis. Phonology includes purely positional formal properties.
- The Subset Principle: Artificial grammar experiments reveal implicational relationships in phonology – not just with markedness, but also with faithfulness.



Learners can start in the subset grammar and potentially move to the superset grammar, but not vice-versa.

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