Lexically restricted phonological alternation: the case for via-rules

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PREVIEW OF THE ARGUMENT

§1 This talk addresses **lexically restricted phonologically driven alternation**.

Case study: vocalic alternations in Spanish 3rd-conjugation verbs (Bermúdez-Otero 2016)

e.g.		*sent-i-r*	
	1PL.PRS.IND	sent-í-mos	
	1PL.PRS.SBJV	sint-á-mos	← 'raising'
	3SG.PRS.IND	sjént-e	← 'diphthongization'
		'feel'	

§2 Raising submits to a simple autosegmental analysis in which both alternants derive from a single underlier containing a floating feature (Scheer 2016: §6, Trommer 2019).

However, two sources of evidence indicate that Spanish learners fail to adopt this autosegmental solution and, instead, encode the alternation as an instance of **listed allomorphy**:

(i) *behavioural* wug-tests
(ii) *neurolinguistic* event-related potentials
} (Linares et al. 2006)

§3 This raises the question: what is stored, root-allomorphs or stem-allomorphs?

Three types of evidence support **stem-storage** (Bermúdez-Otero 2013):

(i) *internal* the local domain for selection is the second cycle;

(ii) *psycholinguistic* recognition latencies are predicted by the token frequency of stems, rather than that of roots or of wordforms;

(iii) *diachronic* the levelling of allomorphy is confined to single lexemes.

§4 However, an analysis of lexically restricted phonologically driven alternation that relies on suppletion faces three **challenges**:

(i) the putative instances of suppletion falls into a small set of *recurrent patterns* (Harley & Tubino Blanco 2013: 124);

(ii) there are *islands of reliability* in which new suppletive stems are highly acceptable (Albright 2002b, Albright & Hayes 2003);

(iii) children's learning performance in the acquisition of irregulars depends not on the token frequency of an individual item, but on the *aggregated token frequency of its class* (Yang 2005).

§5 To resolve the tension between §2-§3 and §4, I propose that

☞ the lexical entries of weakly suppletive stems are linked by **via-rules** (Vennemann 1972: 225), i.e. by nondirectional, nongenerative, relational schemata (Tiersma 1978: 65, Jackendoff & Audring 2018).

Via rules • are unproductive,
but • serve to overcome an anti-alternation bias in acquisition.

§6 Weak suppletion mediated by via-rules supplies a missing element in the **taxonomy of alternations** generated by Stratal Phonology (Bermúdez-Otero 2019).

SINGLE UNDERLIER OR STORED ALLOMORPHY?

Vocalic alternations in Spanish 3rd-conjugation verbs

§7 Spanish verbs fall into three inflectional classes distinguished by their theme vowels:

- 1st conjugation theme vowel *-a-* e.g. [kant-**á**-ɾ] 'sing-TH-INF'
- 2nd conjugation theme vowel *-e-* e.g. [beβ-**é**-ɾ] 'drink-TH-INF'
- 3rd conjugation theme vowel *-i-* e.g. [biβ-**í**-ɾ] 'live-TH-INF'

The 1st conjugation is the default; the 2nd and 3rd are synchronically closed.
The 3rd conjugation contains the smallest number of verbs.

§8 *'Raising'*

(i) The root-final syllable shows [e, o] if the following syllable is headed by [i],
[i, u] elsewhere.

(ii) The distribution of the alternants is automatic and exceptionless: e.g. *pedir* 'ask for'

e.g. inflection

	PRS.IND	PRS.SBJV	IPFV.IND	IPFV.SBJV	PRET
1SG	píð**o**	píð**a**	peð**í**a	pið**j**ése	peð**í**
2SG	píð**e**s	píð**a**s	peð**í**as	pið**j**éses	peð**í**ste
3SG	píð**e**	píð**a**	peð**í**a	pið**j**ése	pið**jó**
1PL	peð**í**mos	pið**á**mos	peð**í**amos	pið**j**ésemos	peð**í**mos
2PL	peð**í**s	pið**á**js	peð**í**amos	pið**j**ésemos	peð**í**mos
3PL	píð**e**n	píð**a**n	peð**í**an	pið**j**ésen	pið**j**éron

derivation	p**i**ð-j**é**-nte	'who asks for something'
	p**i**ð-**ó**n	'one who asks for things importunately'
	p**e**ð-**i**-ðóɾ	'one who asks for something'
	p**e**ð-**í**-βle	'which may be asked for'
	ped-**í**tʃe	= piðón (Mex.; cf. aβl-á-ɾ ~ aβl-**í**tʃe; Lope Blanch 1992)

(iii) Participation in the alternation is idiosyncratic and unpredictable:

e.g.

			1PL.PRS.SBJV	1PL.PRS.IND
high only	*vivir*	'live'	b**i**β-á-mos	b**i**β-í-mos
	fundir	'melt'	f**u**nd-á-mos	f**u**nd-í-mos
high~mid	*pedir*	'ask for'	p**i**ð-á-mos	p**e**ð-í-mos
	dormir	'sleep'	d**u**ɾm-á-mos	d**o**ɾm-í-mos
mid only	*divergir*	'diverge'	diβ**e**ɾx-á-mos	diβ**e**ɾx-í-mos
low only	*partir*	'split'	p**a**ɾt-á-mos	p**a**ɾt-í-mos

(iv) Type frequencies:

Figures from a comprehensive list of 11,095 Spanish verbs (Boyé & Cabredo Hofherr 2004)

- Raising in 27% of 3rd-conjugation verbs with nonlow root vowels 146 out of 543
  - 24% of all 3rd-conjugation verbs 〃 〃 601
  - 1% of all verbs 〃 〃 11,095

- A skew among 3rd-conjugation verbs with nonlow root vowels:

	n		%	
high	363	} 509	67	} 94
high~mid	146		27	
mid	34		6	
total	543		100	

☞ Non-alternating mid-vowelled 3rd-conjugation verbs are highly under-represented.

§9 *Diphthongization*

(i) The root-final syllable shows diphthongal [je, we] under primary stress
monophthongal [i, e, u, o] elsewhere.

(ii) Again, the distribution of the alternants is automatic and exceptionless (Bermúdez-Otero 2013: 61-62).

(iii) Unlike raising, diphthongization occurs in lexical items of all categories (Bermúdez-Otero 2013: 60-61), but only in verb do diphthongs alternate with high as well as mid vowels.

Raising and diphthongization are orthogonal to each other:

		1PL.PRS.SBJV	1PL.PRS.IND	3SG.PRS.IND	high~mid alternation?	diphthongal alternation?
vivir	'live'	b**i**β-á-mos	b**i**β-í-mos	b**í**β-e	✗	✗
divergir	'diverge'	diβ**e**ɾx-á-mos	diβ**e**ɾx-í-mos	diβ**é**ɾx-e	✗	✗
adquirir	'acquire'	aᶞ̥k**i**ɾ-á-mos	aᶞ̥k**i**ɾ-í-mos	aᶞ̥k**jé**ɾ-e	✗	✓
discernir	'discern'	disθ**e**ɾn-á-mos	disθ**e**ɾn-í-mos	disθ**jé**ɾn-e	✗	✓
pedir	'ask for'	p**i**ð̞-á-mos	p**e**ð̞-í-mos	p**í**ð̞-e	✓	✗
sentir	'feel'	s**i**nt-á-mos	s**e**nt-í-mos	s**jé**nt-e	✓	✓

Raising as phonologically conditioned suppletion

§10 It is technically straightforward to reduce the raising alternation to phonological derivation from a single underlier (e.g. Pérez Herrera 2022).

One approach:
- raising verbs have an underlying high vowel (the elsewhere option),
- but also a floating [-hi] feature;
- [-hi] docks when needed to avoid OCP violations (dissimilation).

		𝔖𝔏	DEP-[−hi]	OCP($V^{[+hi]}.C_0 i$)	IDENT-[hi]	MAX-[−hi]
'ask_for.1PL.PRS.IND'	[-hi]$_{\beta}$	pi$_{\alpha}$dímos		*!		*
	pi$_{\alpha}$d-i-mos	pe$_{\alpha,\beta}$dímos ☞			*	
'ask_for.1PL.PRS.SBJV'	[-hi]$_{\beta}$	pi$_{\alpha}$dámos ☞				*
	pi$_{\alpha}$d-i-a-mos	pe$_{\alpha,\beta}$dámos			*!	
'live.1PL.PRS.IND'	bib-i-mos	bibímos ☞		*		
		bebímos	*!		*	

§11 But in Bermúdez-Otero (2016) I pursued instead an analysis involving phonologically driven allomorph selection (see Iosad 2019 for a parallel from Russian):

- raising verbs have two listed stem-allomorphs;
- the high-vowelled allomorph is the elsewhere form because mid vowels are marked;
- but the mid-vowelled allomorph is selected when needed to avoid OCP violations.

NB Selection must operate by output optimization because
(i) it is driven by phonological markedness;
(ii) it is sensitive to the quality of the following vowel in the output, not the input;
(iii) it reverses the subcategorization preferences of theme vowels.

		§ℒ	IDENT-[hi]	OCP($V^{[+hi]}.C_0i$)	*[−hi,−lo]	*[+hi]
{pí.di / pé.di} - mos	pí.di-mos	pi.dí.mos		*!	(*)	*(*)
		pe.dí.mos	*!		*(*)	(*)
	pé.di-mos	pi.dí.mos	*!	*	(*)	*(*)
		pe.dí.mos ☞			*(*)	(*)
{pí.di / pé.di} - a -mos	pí.di-a-mos	pi.dá.mos ☞			(*)	
		pe.dá.mos	*!		*(*)	
	pé.di-a-mos	pi.dá.mos	*!		(*)	
		pe.dá.mos			*! (*)	

Behavioural evidence

§12 *Wug-test involving nonce 3rd-conjugation verbs* (Linares et al. 2006)

(i) First condition: cue to alternating (raising) behaviour

stimulus	first <redir> INF,	then <rido> 1SG.PRS.IND	
target	3PL.PRS.IND		
results	79%	<riden>	(raising: *pedir*-type response)

(ii) Second condition: no cue to alternating (raising) behaviour

stimulus	<redir> INF only		
target	3PL.PRS.IND		
results	75%	<reden>	(no alternation: *divergir*-type response)
	19%	<riden>	(raising: *pedir*-type response)
	6%	<rieden>	(diphthongization: *discernir/sentir*-type response)

§13 The results of the wug-test (second condition) involve a gross departure from relative lexical frequencies: cf. §8(iv)

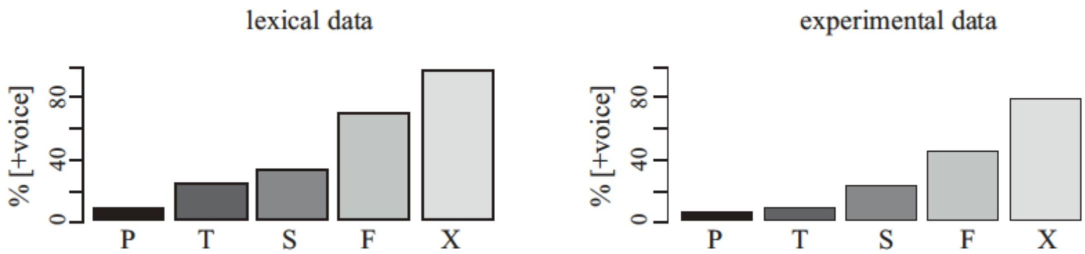
	3rd-conjugation verbs with root-final [e] in INF			
root-final vowel under stress	[í]	[jé]	[é]	
lexical data (155 types)	47% (73)	46.5% (72)	6.5% (10)	(í > jé > é)
experimental results	19%	6%	75%	(é > í > jé)

§14 Cf. lexical probability matching in phonological neutralization (see e.g. Moore-Cantwell 2019)

- When alternations involve genuine phonological neutralization, responses to wug-tests approximate relative lexical probabilities:

e.g. Dutch laryngeal neutralization (Ernestus & Baayen 2003)

wug stimulus	*responses*		
ɪk tif	tiftə	*or*	tivdə
ɪk dɑup	dɑuptə	*or*	dɑubdə
ɪk dɛnt	dɛntə	*or*	dɛndə



- But wug-test responses match lexical probabilities far less well in cases of arbitrary lexical patterns (Becker et al. 2011, Hayes et al. 2009).

§15 *A historical comparison: the levelling of rhotacism alternations in Latin 3rd-declension nouns*

(i) Projecting NOM.SG forms from GEN.SG forms in Preclassical Latin (Albright 2002a):

	confidence score	*example*	
[oːris]$_{\text{GEN.SG}}$ → [or]$_{\text{NOM.SG}}$ / [X]$_{\textit{polysyl,−neut}}$___#	0.723	soror~soroːris	'sister'
[oːris]$_{\text{GEN.SG}}$ → [oːs]$_{\text{NOM.SG}}$ / [X]$_{\textit{polysyl,−neut}}$___#	0.611	honoːs~honoːris	'honour'
[eris]$_{\text{GEN.SG}}$ → [us]$_{\text{NOM.SG}}$ / [X]$_{\textit{polysyl,+neut}}$___#	0.643	opus~operis	'work'
[eris]$_{\text{GEN.SG}}$ → [er]$_{\text{NOM.SG}}$ / [X]$_{\textit{polysyl}}$___#	0.374	aker~akeris	'maple'
[oris]$_{\text{GEN.SG}}$ → [us]$_{\text{NOM.SG}}$ / [X]$_{\textit{polysyl,+neut}}$___#	0.545	korpus~korporis	'body'
[Vris]$_{\text{GEN.SG}}$ → [Vr]$_{\text{NOM.SG}}$ / [X]$_{\textit{+neut}}$___#	0.198	marmor~marmoris	'marble'

(ii) Levelling in Classical Latin: honoːs~honoːris > hono**r**~honoːris

The high-confidence alternation pattern of *soror* is extended to *honōs*.

Cf. absence of change in aker~akeris *akus
marmor~marmoris *marmus

Why are the high-confidence patterns of *opus* and *corpus* not extended to these forms?

(iii) Bermúdez-Otero's (2018: §3) answer:

- Levelling in *honōs* involves simple UR-restructuring: /honoːs-/ > /honoːr-/
- But the alternation pattern of *opus* is synchronically suppletive in Classical Latin.

Neurolinguistic evidence

§16 Event-related potentials (ERPs) in electroencephalographic (EEG) study (Linares et al. 2006)

		ERP
(i) First condition:	wrong agreement marker <pides> 2SG.PRS.IND for <piden> 3PL.PRS.IND	enhanced P600
(ii) Second condition:	wrong stem allomorph unraised *<peden> for <piden> 3PL.PRS.IND	attenuated N400

Usual interpretation: enhanced P600 = combinatorial violation
attenuated N400 = lexical access effects

⇨ *<peden> is lexically, not grammatically, deviant

§17 In conclusion, the raising alternation is synchronically suppletive, as per §11.

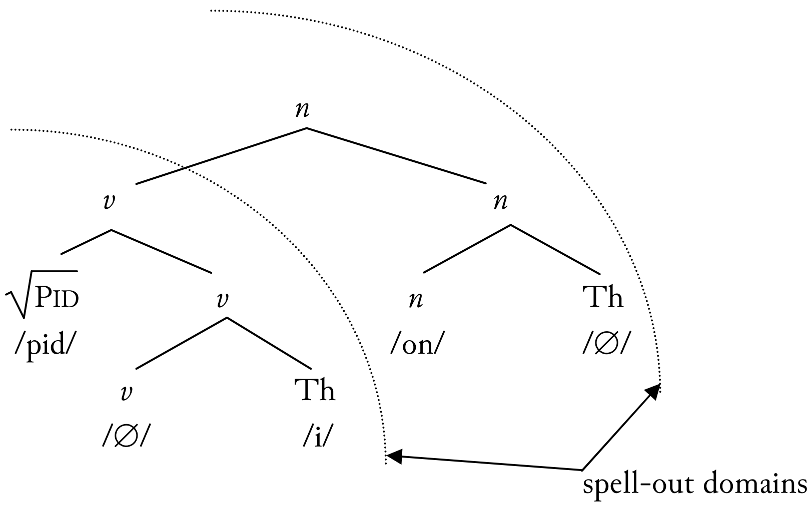
ROOT ALLOMORPHY OR STEM ALLOMORPHY?

§18 Two morphological traditions (Bermúdez-Otero 2013, 2016):

- *root-driven* full decomposition, single-terminal insertion, no lexical redundancy, etc
  (e.g. classical DM: Embick & Halle 2005, Embick 2017)
- *stem-driven* competition between decomposition and direct access, storage of complex expressions, lexical redundancy, etc
  (e.g. Jackendoff 1975, Jackendoff & Audring 2018)

Raising as root-specific phonology (Embick 2012)

§19 Syntax of [p**i**ð̽**ó**n] 'one who asks for things importunately' (§8ii)



§20 Root-specific phonological change (Embick 2012: 33)

Dissimilation: i → e/ __(C)i <for the specified class of Roots>

Violates modularity! See Bermúdez-Otero (2012), Scheer (2011), Trommer (2015), Haugen (2016).

§21 Dissimilation produces the wrong outcome if applied early in spell-out:

1st spell-out cycle	*vocabulary insertion*	pid-i	
	dissimilation	pé.di	
2nd spell-out cycle	*vocabulary insertion*	pé.di-on	
	truncation	*pe.dón	the target is [pi.dón]

Same problem as with diphthongization:
application in the first cycle of root-to-stem derivation gives the wrong results.

§22 Intended derivation:

		pidón	*pedidor*
first cycle	*insertion*	pid-i	pid-i
second cycle	*insertion*	pí.di-on	pí.di-doɾ
	truncation	pi.dón	—
postcycle	*dissimilation*	—	pe.ði.ðóɾ

But this is a massive violation on inward cyclic locality:
dissimilation has access to the root in the postcyclic phonology!

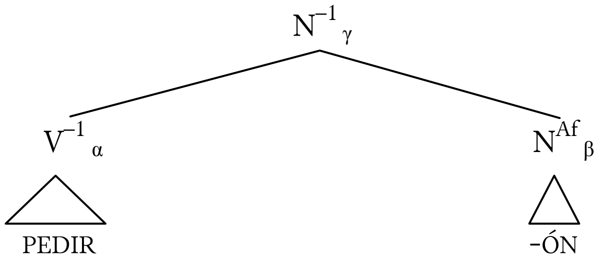
Cf. Orgun & Inkelas (2002), Bermúdez-Otero (2012: 44, 81-82).
Disappointing relaxation of locality (cf. Embick 2010: 101).

Raising as stem allomorphy (Bermúdez-Otero 2016)

§23 Key ideas:

- The Spanish lexicon stores stem allomorphs, rather than root allomorphs:
  i.e. not /$_{\surd}$ pid-/ ~ /$_{\surd}$ ped-/
  but /$_{V}$ pid-i/ ~ /$_{V}$ ped-i-/
- Each stem defines a cyclic domain by itself
  (*pace* Myler 2015: 175-176; see Bermúdez-Otero 2016: 408-413 for empirical counterevidence from high vocoid syllabification).
- When two stem allomorphs compete, the domain for selection is the cyclic domain triggered by the first syntactic operation on the stem.

§24 a. *word syntax*



b. *underlying phonological representation*

$$[\![^{\mathcal{SL}} \left\{ \begin{array}{l} [\![^{\mathcal{SL}}\,\text{pid-i}]\!] \\ [\![^{\mathcal{SL}}\,\text{ped-i}]\!] \end{array} \right\}_{\alpha} \text{-on}_{\beta} \;]\!]_{\gamma}$$

c. *phonological derivation*

	input		*output*
first cycle (𝔖𝔏)	/pid-i/	→	[pí.di]
	/ped-i/	→	[pé.di]
second cycle (𝔖𝔏)	{ [pí.di]-on / [pé.di]-on }	→	[pi.dón]

Additional evidence for stem storage

§25 *Stem storage predicts that allomorphy fails to cross lexical category boundaries*

- The verb *cont-a-r* 'tell' participates in the diphthongal alternation because it has two listed stem allomorphs: /$_V$ kont-a/ and /$_V$ kwent-a/.
- But there is nothing to guarantee that a noun derived from the root $\sqrt{\text{CONT}}$ will also have two listed allomorphs; the noun may not alternate.

That is correct!

E.g. the noun *cuent-o* doesn't alternate in the presence of any affix:

[**kwé**nt-o]	'story'
[**kwe**nt-éɾ-o]	'story-teller'
[**kwe**nt-íst-a]	'story-teller'

See Iosad (2017) for similar evidence from Welsh.

§26 The same phenomenon can be observed in historical change:

e.g. the levelling of the rhotacism alternations in Latin does not cross lexical category boundaries:

e.g.	N	*rōbus~rōboris*	>	*rōbu**r**~rōboris*	'oak, strength'
but	A	*robus-t-us, -a, -um*		no change	'oaken, strong'

§27 *Stem storage explains recognition latencies*

The hypothesis of stem storage makes very precise predictions about the effects of token frequency on response latencies in lexical recognition tasks (see e.g. Baayen et al. 2002: 62-63):

If • token frequency produces its effects by boosting the resting activation of lexical entries,
and • there is one lexical entry per stem (rather than per lexeme or per wordform),
then recognition latencies will be a function of stem frequency.

§28 E.g. the adjective CIEGO 'blind'

lexeme	CIEGO			
stems	/θjeg-o/ *o*-stem[M]		/θjeg-a/ *a*-stem[F]	
wordforms	[θjéγ-o] M.SG	[θjéγ-o-s] M.PL	[θjéγ-a] F.SG	[θjéγ-a-s] F.PL

§29 The prediction proves correct! Evidence from Domínguez et al. (1999: 488-91, 2000: 394):

(i) CIEGO 'blind' vs VIUDO 'widowed'

- CIEGO is masculine-dominant: frequency of *cieg-o*(*-s*) > frequency of *cieg-a*(*-s*)
- VIUDO is feminine-dominant: frequency of *viudo-o*(*-s*) < frequency of *viud-a*(*-s*)

→

- recognition speed for *cieg-o*(*-s*) > recognition speed for *cieg-a*(*-s*)
- recognition speed for *viud-o*(*-s*) < recognition speed for *viud-a*(*-s*)

(ii) *cult-o* 'cultivated.M' vs *bell-o* 'beautiful.M'

- frequency of *cult-o*(*-s*) = frequency of *bell-o*(*-s*)

→

- recognition speed for *cult-o*(*-s*) = recognition speed for *bell-o*(*-s*)

even though

- frequency of CULTO < frequency of BELLO

because

- frequency of *cult-a*(-s) < frequency of *bell-a*(*-s*)

(iii) *rat-o-s* 'while.PL' vs *bot-a-s* 'boot.PL'

- frequency of wordform *rat-o-s* = frequency of wordform *bot-a-s*

yet

- recognition speed for wordform *rat-o-s* > recognition speed for wordform *bot-a-s*

because

- frequency of stem *rat-o*(*-s*) > frequency of stem *bot-a*(*-s*)

as

- frequency of wordform *rat-o* (SG) > frequency of wordform *bot-a* (SG)

VIA-RULES

Three problems for the listing approach to weak suppletion

§30 *Failing to capture recurrent patterns*

> The first problem is lack of insight [...], the 'arbitrariness' issue discussed by Embick and Halle (2005). Listed forms need not bear any relationship to their other alternant or to each other. There is no reason why they should fall into [...] general classes [...], which are characterizable in broadly phonological terms ['raising', 'diphthongization'].
>
> (Harley & Tubino Blanco 2013: §3.2)

The objection restated as an observation about speaker behaviour:

- In the first condition of Linares et al.'s (2006) wug-test (§12i), participants produced raising alternations 79% of the time when presented with direct overt evidence.
- But responses replicating the alternating pattern of the stimulus would have been much lower if that pattern had no precedent in the Spanish lexicon:

  e.g. **fonár~fjéno* or **fonár~fjóno*

§31 *Islands of reliability*

Native speakers rate allomorphic alternation as highly acceptable in novel items when the alternation falls in an island of reliability (Albright 2002b, Albright & Hayes 2003):

e.g. English *spling* [splɪŋ] ~ *splung* [splʌŋ]
is highly acceptable, given

cling ~ clung	string ~ strung
fling ~ flung	swing ~ swung
sling ~ slung	wring ~ wrung
sting ~ stung	

(Bybee & Moder 1983, Prasada & Pinker 1993, Albright & Hayes 2003)

§32 *Item frequency vs class frequency in learning*

Children's learning performance in the acquisition of English irregular verbs depends not on the token frequency of an individual item, but on the *aggregated token frequency of its class* (Yang 2005).

The following data from are from Yang (2005: 304):

Figure 3. Frequency effects under the WR model

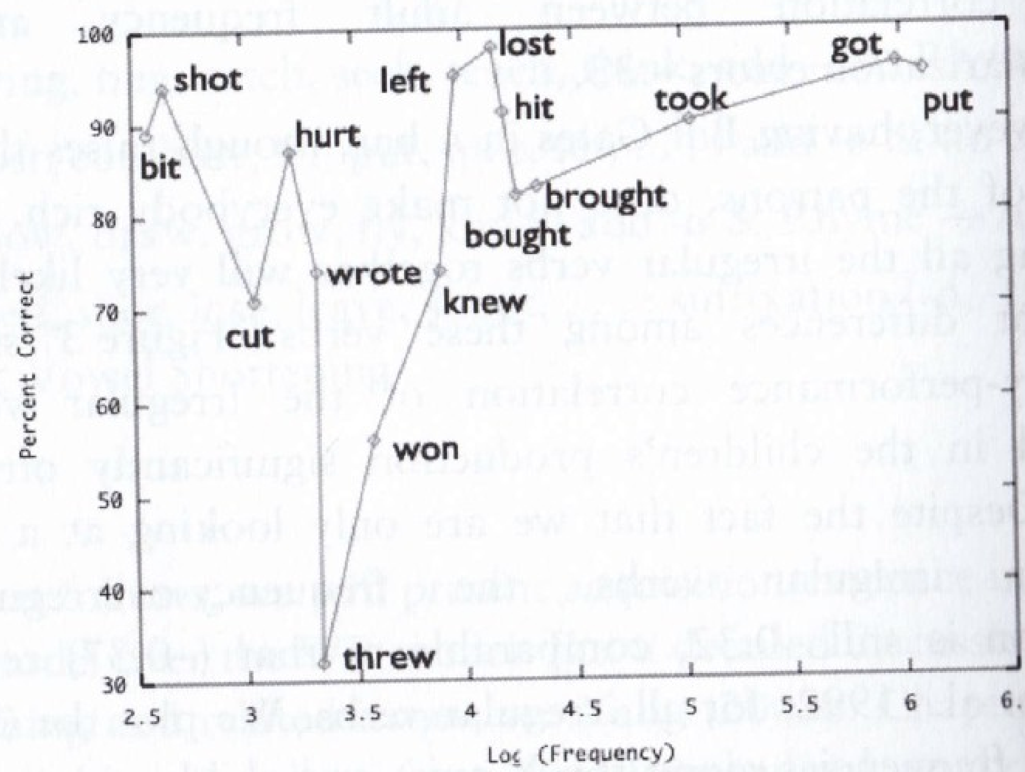
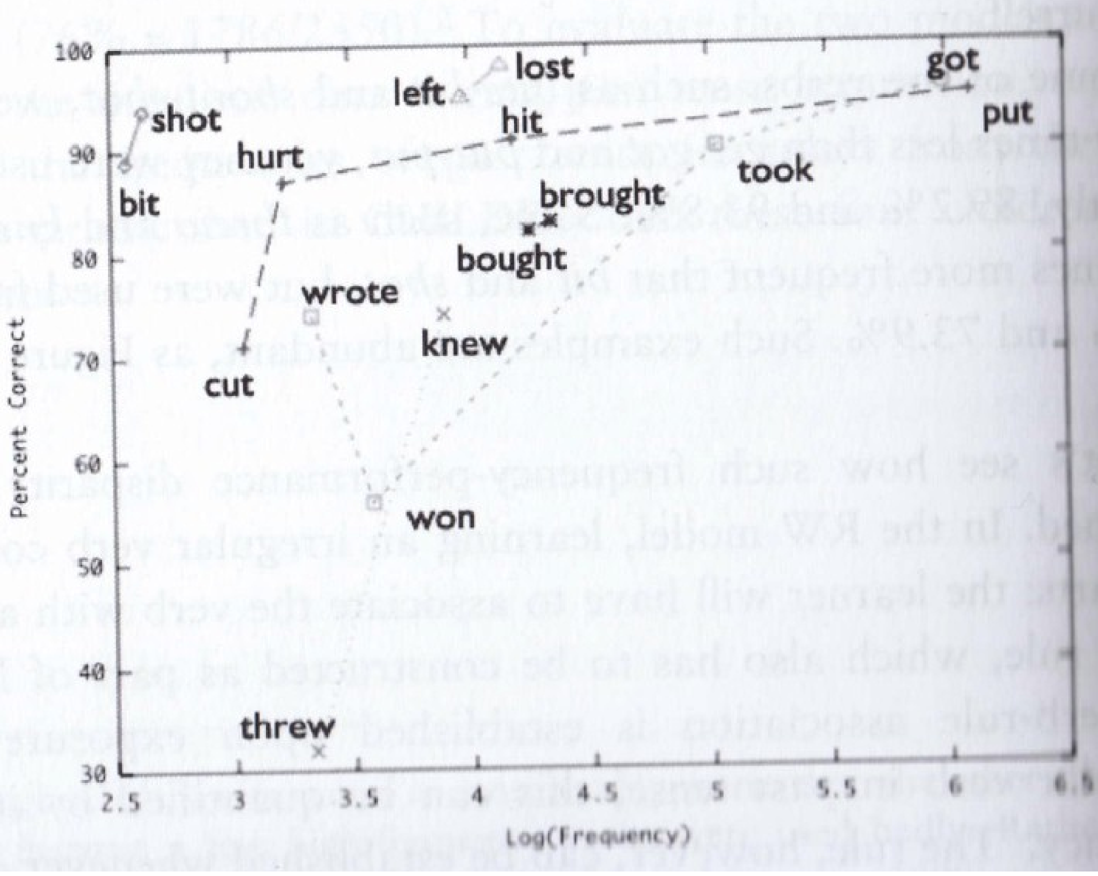


Figure 4. Frequency effects within irregular classes



A solution: via-rules

§33 All three problems disappear if we assume that,

in cases of weak suppletion,
listed allomorphs are linked by **nondirectional, nongenerative, relational lexical schemata**

An old idea:
- the term **'via-rule'** was popularized by Vennemann (1972: 224-232) and Hooper (1976);
- supported with diachronic evidence by Tiersma (1978);
- direct precursors of Jackendoff & Audring's (2018) 'non-productive schemata'.

§34 *The raising via-rule*

$$[\![_{\text{Vstem}} \ldots eC_0 i]\!] \sim [\![_{\text{Vstem}} \ldots iC_0 i]\!]$$

§35 (i) *Via-rules are nongenerative.*

Therefore, they play no role in production,

and they do not enable probability matching,
cannot trigger the systematic extension of allomorphic patterns.

(ii) *Via-rules play a role in lexical acquisition.*

Learners are subject to a very general anti-alternation bias
[McCarthy 1998; Hayes 2004; Tessier 2006, 2016; Do 2013, 2018]

but they accept new alternating items in a range of circumstances:

a. if the alternation can be generated by their current phonological grammar

b. if the alternation matches a pattern of allomorphy encoded in a via-rule

c. if the alternating items occur extremely frequently

⇩

a. *regular alternation*

b. *weak suppletion*

c. *strong suppletion*

§36 A taxonomy of non-automatic alternation in Stratal Phonology (Bermúdez-Otero 2019)

	systematic extension?	type of frequency effects
strong suppletion	impossible[1]	item[3]
weak suppletion	impossible[1]	class[3]
stem-level phonology	possible[2]	relative (base/derivative)[2]

[1] Bermúdez-Otero (2018)

[2] Bermúdez-Otero (2012: 28, 74)

[3] See §32 above.

Conclusions

§37 A **highly lexically-restricted alternation** such as raising in Spanish third-conjugation verbs is best analysed as involving **phonologically-driven allomorph selection**, despite the availability of a relatively simple single-UR analysis.

The stored allomorphs are of **stem-size**, not root-size.

This type of **weak suppletion** differs both from strong suppletion and from regular phonology. Its properties are nicely captured by nongenerative relational lexical schemata: **via-rules**.

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