Exceptions

Class 3: Predictable alternations

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Spanish diphthongization

A three-way distinction in Spanish

- Mid vowels
  - *rentar*, *rento* ‘rent’
- Diphthongs
  - *alienar*, *alieno* ‘alienate’
- Alternators
  - *sentar*, *siento* ‘feel’

Mid vowel stems:

a. *rentar* ‘rent’						
Ind.	r[é]nt-o	r[é]nt-as	r[é]nt-a	r[e]nt-ámos	r[e]nt-áis	r[é]nt-an
Subj.	r[é]nt-e	r[é]nt-es	r[é]nt-e	r[e]nt-émos	r[e]nt-éis	r[é]nt-en
b. *montar* ‘mount’						
Ind.	m[ó]nt-o	m[ó]nt-as	m[ó]nt-a	m[o]nt-ámos	m[o]nt-áis	m[ó]nt-an
Subj.	m[ó]nt-e	m[ó]nt-es	m[ó]nt-e	m[o]nt-émos	m[o]nt-éis	m[ó]nt-en

Diphthongizing stems:

c. *sentar* ‘seat’						
Ind.	s**[jé]**nt-o	s**[jé]**nt-as	s**[jé]**nt-a	s[e]nt-ámos	s[e]nt-áis	s**[jé]**nt-an
Subj.	s**[jé]**nt-e	s**[jé]**nt-es	s**[jé]**nt-e	s[e]nt-émos	s[e]nt-éis	s**[jé]**nt-en
d. *contar* ‘count’						
Ind.	c**[wé]**nt-o	c**[wé]**nt-as	c**[wé]**nt-a	c[o]nt-ámos	c[o]nt-áis	c**[wé]**nt-an
Subj.	c**[wé]**nt-e	c**[wé]**nt-es	c**[wé]**nt-e	c[o]nt-émos	c[o]nt-éis	c**[wé]**nt-en

Diphthong stems:

e. *alienar* ‘alienate’						
Ind.	al[jé]n-o	al[jé]n-as	al[jé]n-a	al[je]n-ámos	al[je]n-áis	al[jé]n-an
Subj.	al[jé]n-e	al[jé]n-es	al[jé]n-e	al[je]n-émos	al[je]n-éis	al[jé]n-en
f. *frecuentar* ‘frequent’						
Ind.	frec[wé]nt-o	frec[wé]nt-as	frec[wé]nt-a	frec[we]nt-ámos	frec[we]nt-áis	frec[wé]nt-an
Subj.	frec[wé]nt-e	frec[wé]nt-es	frec[wé]nt-e	frec[we]nt-émos	frec[we]nt-éis	frec[wé]nt-en

An underlying contrast?

- Diphthongization? (schematically)
  - $\begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix} \rightarrow [+\text{diph}] \,/\, \underline{\quad\quad}\, [+\text{stress}]$
  - Doesn't cover forms like *rénto*
- Monophthongization? (schematically)
  - $[+\text{diph}] \rightarrow [-\text{diph}] \,/\, \underline{\quad\quad}\, [-\text{stress}]$
  - Doesn't cover forms like *alienár*
- Fancier UR's (Harris, 1969, 1977, 1978; Schuldberg, 1984; Harris, 1985; Garcia-Bellido, 1986; Carreira, 1991)
  - Long vowels, extra timing slots
  - Diacritic

Predictability of diphthong alternations

- Non-alternating monophthongs are the majority
- Non-alternating diphthongs are exceedingly rare
- Alternations encouraged by various factors
    - Conjugation class: especially, *-er*, *-ir*
    - Segmental contexts: Brame & Bordelois (1973)
    - Phonological and historical sources

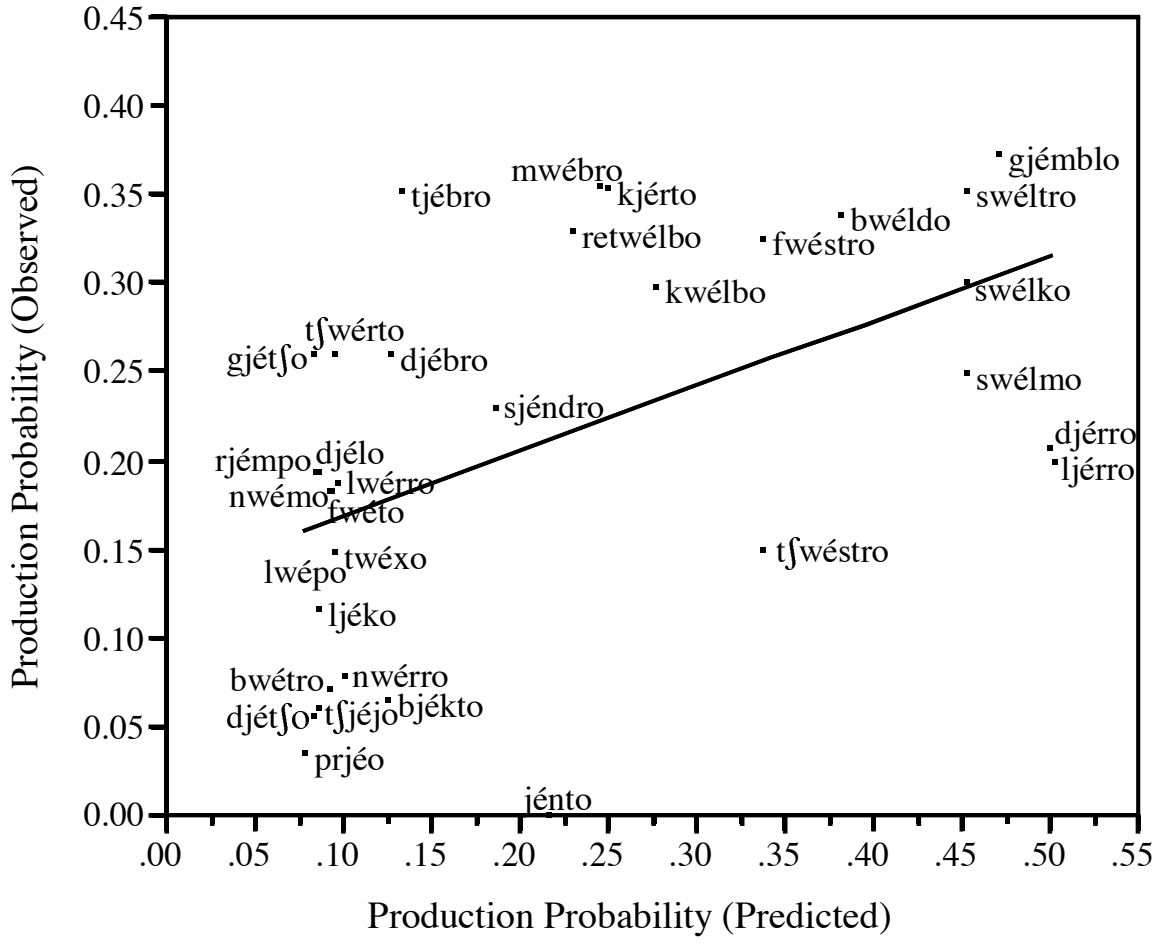
Predicting diphthongization (Albright et al., 2001)

- Ran MGL on *-ar* 1698 mid-vowel *-ar* verbs in LEXESP (Sebastián et al., 2000)
  - Only mid-vowel verbs undergo diphthongization (1 exception)
  - Confining to one class avoids morphological confound that *-er*, *-ir* independently favor diphthongization
  - *-ar* is the largest class, productive
- Task: map stressless $\rightarrow$ stressed allomorphs
- Diphthongization rules (stress + diphthongization)
  - Most general rules not particularly reliable: 68/543 o$\rightarrow$wé, 91/665 e$\rightarrow$jé
  - Many islands of reliability: 493 for o$\rightarrow$wé, 525 for e$\rightarrow$jé
- 'No change' rules (just stress)
  - Most general rules very reliable: 588/668 o$\rightarrow$wé, 919/1030 e$\rightarrow$jé
  - Many islands of reliability: 2517 o$\rightarrow$wé, 2014 e$\rightarrow$jé

Generalization: a wug test

- Albright et al. (2001): 33 novel *-ar* verbs
  - Chosen to favor either diphthong or monophthong outputs, to varying degrees
- Presented auditorily in stressless forms, elicited stressed form
- Participants produced 1SG form and then rated both options

Wug test results

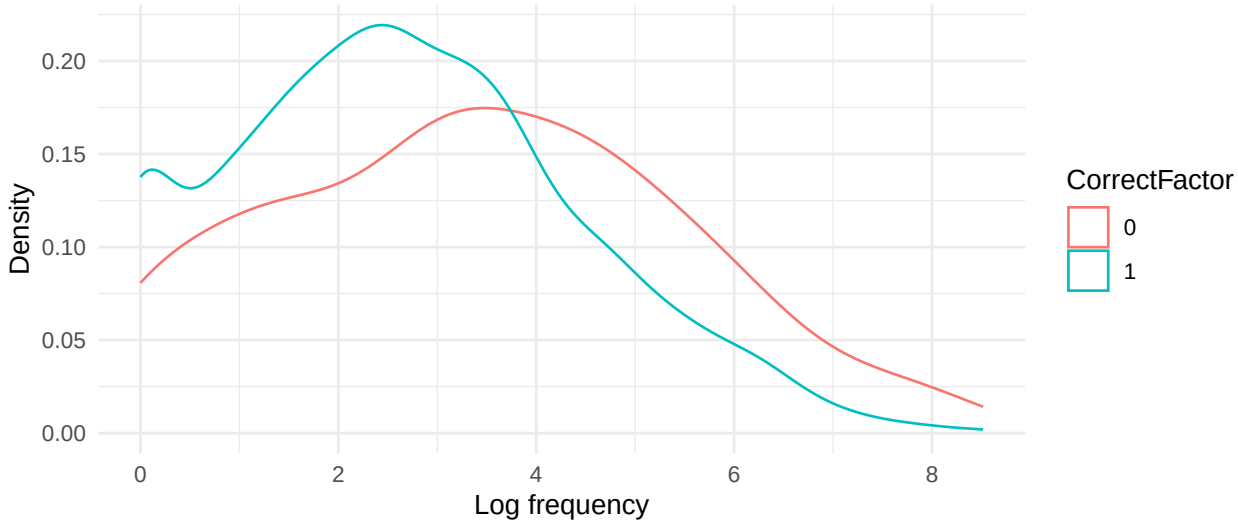


- Production probability generally correlated with reliability of relevant rules

Distribution of exceptions

- Resulting grammar correctly predicts 1515/1697 = 89% of existing items
- 182 errors, all fail to diphthongize
- 9 correctly diphthongize
    - In principle, could also examine more gradient measure of probability of correctness, like Fruchter et al. (2013) do
- Open question: how much credence should the model give to small-scale or imperfect rules for minority patterns?
    - Strategy so far: test with generalization (wug test) data

Distribution of exceptions



- Exceptions skewed towards higher frequency, though not as strongly as English irregular verbs
- Plot here only shows *-ar* verbs; more diphthongs among *-er*, *-ir* verbs, which are also generally higher frequency

Acquisition

- Clahsen et al. (2002) children sometimes fail to diphthongize, using monophthongs instead
- Reverse error is unattested in CHILDES
- We’ll return to this asymmetry in a later class

Language change

- Some verbs have lost diphthongization over time (Penny, 2002)
    - Especially, in *-ar* class
- New verbs do not undergo diphthongization

Summary of Spanish

- Grammar encoding lexical trends provides decent match to human judgments
- For the most part, grammar favors a single pattern (non-diphthongized)
- Exceptions have higher frequency, subject to regularization and change

Dutch voicing

Dutch final devoicing

Sg.	Pl.	Gloss
vut	vutən	‘foot’
bɛt	bɛdən	‘bed’
hɔnt	hɔndən	‘dog’

- Constraint against voiced obstruents in final position leads to voicing neutralization
- Ernestus & Baayen (2003): lexical trends by manner, place of articulation, preceding vowel quality

Predicting final voicing

- Trained MGL on a set of 1092 Dutch verbs
  - 1SG.PRES dɛlf → 1SG.PST dɛlvdə
  - 190 irregular, 901 regular (82.6% regular)
  - Two models: all verbs, regs only
- 2234 rules for regulars attempt to predict voicing
  - ∅ → tə (leave voiceless)
  - ∅ → də (voiced suffix alone, e.g., after sonorants)
  - f → vdə (voice *f*)
  - x → ɣdə (voice *x*)
  - etc.

How predictable is final voicing?

- When trained on both regulars and irregulars, resulting grammar is 82.7% accurate
  - Fair number of errors are overregularization
  - Model does extend some “irregular” patterns, voicing trends
- When trained on regulars alone, resulting grammar is 94% accurate
  - Voicing is not 100% predictable, but far better than chance!
  - Segment type, preceding C/V quality, etc.

Examining the resulting grammar

- Excel interlude: range of large and small trends
- Many perfect or nearly perfect rules
- Model’s preferred outputs generally have high reliability/confidence

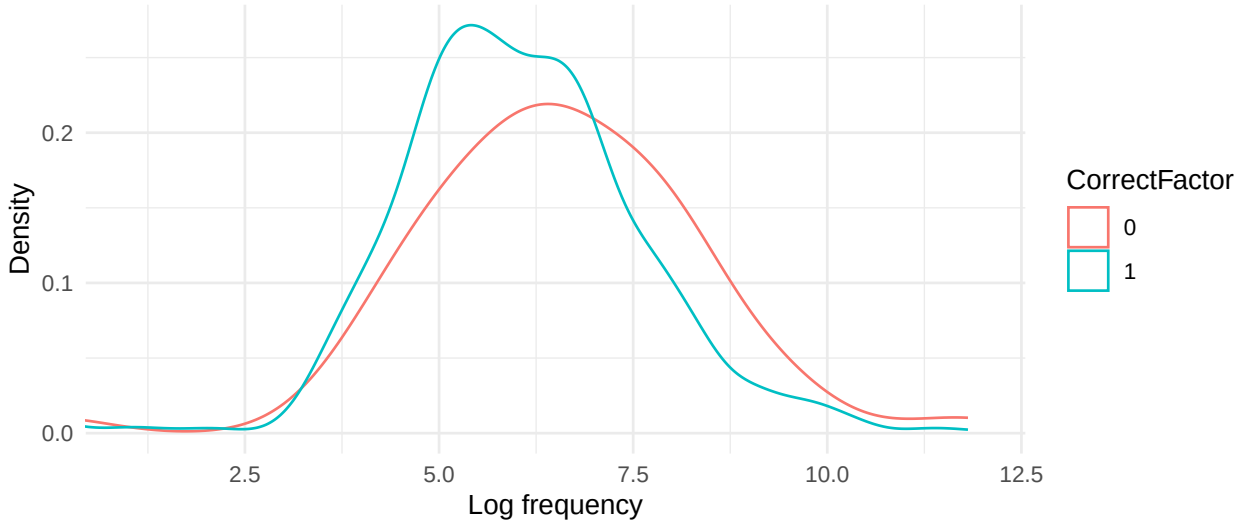
A surprising result?

- Baseline expectation for [±voice] contrast: 50% probability of voicing
- In actuality, obvious that many factors would make voicing more predictable
    - Different segments have different frequencies
    - Voicing may be restricted in certain phonological contexts
    - Expectation of 50/50 split seems naive
- Still, striking that grammar outperforms English regular *-ed* rule for past tense morphology

Caveats

- Smallish training set (≈900 verbs)
- Unknown: equally predictable in verbs and nouns?
    - Predictions?
- Unknown: distribution of voicing in lower frequency verbs?
    - Predictions?

Distribution of exceptions



- Exceptions skewed towards higher frequency items
- Not as radical as English irregular verbs, but similar to Spanish
    - Size of training set is relevant here (English was much larger)

Acquisition and Language Change

- Dutch-learning children do make significant numbers of final voicing errors (Kerkhoff, 2007)
  - General tendency to prefer voiceless
  - Voicing often overextended, as well
- Kerkhoff argues for a combination of paradigm uniformity (prefers voiceless) and extension of lexical trends
- I do not know of evidence from language change

Turkish voicing

Turkish final obstruent voicing: three-way contrast

- Non-alternating voiceless

at	atɨ	‘horse’
devlet	devleti	‘state’
sap	sapɨ	‘stem’

- Alternating

kanat	kanadɨ	‘wing’
kalɨp	kalɨbɨ	‘mold’

- Non-alternating voiced

ad	adɨ	‘name’
öǰ	öǰü	‘revenge’
etüd	etüdü	‘etude’

Modeling Turkish

- 3832 Turkish stop-final nouns from the TELL Lexicon
  - Caveat: fair number of duplicate entries (appear to be from spelling variants)
- Mapping: base, possessive
  - 1SG -(V)m, vowel given a single realization to abstract away from vowel harmony
- Also possible to compare models that do or don't refer to preceding vowel features
  - Becker et al. (2011) claim that speakers do not generalize V quality trends
- No frequency information

The resulting grammar

- Rules for voicing/no-change referring to various features of stem (length, final C place, etc.)
- Resulting accuracy: 82.5% when using V features, 83% when ignoring V features
    - Perhaps learners ignore V features not because of an intrinsic limit on UG, but rather, because they don’t help

Generalization

- Lexical trends often applied to loanwords from Arabic, English
- Becker et al. (2011) show that an MGL grammar predicts their wug test responses fairly well
    - Apart from the V features issue
- Ran the models to get predictions, but haven’t replicated the comparison with wug data here

Distribution of exceptions

- Unfortunately, no frequency information
- Acquisition evidence? Language change?

Taking stock

A recurring theme

- In all cases examined, a grammar that is large/detailed enough to capture fine-grained lexical trends can do very well at predicting existing words
    - Overall exceptionality rates roughly 15% or less, even for putative phonological contrasts like final obstruent voicing
- These grammars also provide a fairly good match to how humans generalize to novel words
- Where data is available, predicted ‘exceptions’ bear some of the hallmarks of exceptions
    - Susceptible to overregularization in acquisition and language change
    - Protected by higher frequency

What do grammars try and predict?

- All features, where possible?
- Affixed forms, from isolation form?
- Surface forms, from UR?
- Up next: distinguishing properties that speakers do seem to predict, from those that they do not

References

Albright, Adam; Argelia Edith Andrade; and Bruce Hayes. 2001. Segmental environments of spanish diphthongization. *Ucla working papers in linguistics, number 7: Papers in phonology 5*, ed. by Adam Albright and Taehong Cho, 117–151. http://www.linguistics.ucla.edu/people/hayes/Segenvspandiph/SegEnvSpanDiph.pdf.

Becker, Michael; Nihan Ketrez; and Andrew Nevins. 2011. The surfeit of the stimulus: Analytic biases filter lexical statistics in Turkish laryngeal alternations. *Language* 87.84–125.

Brame, Michael K., and Ivonne Bordelois. 1973. Vocalic alternations in Spanish. *Linguistic Inquiry* 4.111–168.

References (*cont.*)

Carreira, María. 1991. The alternating diphthongs of Spanish: A paradox resolved. *Current studies in spanish linguistics*, ed. by Héctor Campos and Fernando Martínez-Gil. Washington, D.C.: Georgetown University Press.

Clahsen, Harald; Fraibet Aveledo; and Iggy Roca. 2002. The development of regular and irregular verb inflection in Spanish child language. *Journal of Child Language* 29.591–622.

Ernestus, Mirjam, and R. Harald Baayen. 2003. Predicting the unpredictable: Interpreting neutralized segments in Dutch. *Language* 79.5–38.

Fruchter, Joseph; Linnaea Stockall; and Alec Marantz. 2013. Meg masked priming evidence for form-based decomposition of irregular verbs. *Frontiers in Human Neuroscience* 7.1–16.

References (*cont.*)

Garcia-Bellido, Paloma. 1986. Lexical Diphthongization and High-Mid Alternations in Spanish: An Autosegmental Account. *Linguistic Analysis* 16.61–92.

Harris, James. 1977. Remarks on Diphthongization in Spanish. *Lingua* 41.261–305.

Harris, James. 1978. Two theories of non-automatic morphophonological alternations. *Language* 54.41–60.

Harris, James. 1985. Spanish Diphthongisation and Stress: A Paradox Resolved. *Phonology Yearbook* 2.31–45.

Harris, James W. 1969. *Spanish phonology*. Cambridge, MA: MIT Press.

Kerkhoff, Annemarie. 2007. *Acquisition of morpho-phonology: The dutch voicing alternation*. LOT dissertations.

References (*cont.*)

Penny, Ralph. 2002. *A history of the spanish language*. 2nd edn. Cambridge University Press.

Schuldberg, Howard Kelly. 1984. Diphthongization in Spanish Verbs. *Hispanic Linguistics* 1.215–227.

Sebastián, Núria; Fernando Cuetos; M. Antònia Martí; and Manuel F. Carreiras. 2000. *Lexesp: Léxico informatizado del español. edición en cd-rom*. Barcelona: Edicions de la Universitat de Barcelona (Colleccions Vàries, 14).