The syllabification of medial clusters: evidence from stress assignment

Paul Olejarczuk and Vsevolod Kapatsinski

Department of Linguistics, University of Oregon, USA

1 Background

- English speakers both *rate* and *perceive* some word-initial CC clusters better than others (Albright, 2007; Berent et al, 2007)
- cluster well-formedness appears to be **gradient**:

pr — *dw* — *bn* — *bd* — *lb*

better ⟷ *worse*

- factors said to contribute to well-formedness include:
  - word-initial **legality**
    attested > novel (*pr, dw* > *bn, bd, lb*)
  - word-initial **frequency**
    frequent > rare (*pr* > *dw*)
  - **sonority** profile
    rising > flat > falling (*bn* > *bd* > *lb*)
- *word* onsets are assumed to be representative of all *syllable* onsets in behavior
  word-edge phenomena are taken as evidence of syllable structure at large

2 Question

Is the gradience of (word) onset well-formedness also reflected in **syllabification** (=production) **tendencies**?

- do **legality**, **frequency** and **sonority** all contribute to the way English speakers syllabify intervocalic clusters?

3 Previous Research

- **legality** correlates highly with syllabification; **frequency** under-investigated; mixed results on **sonority** (Treiman & Zukowski, 1990; Redford & Randall, 2005)
- variability may be due to the problematic nature of the tasks traditionally employed in syllabification studies:

tasks

- written hyphenation
  ban - dit
- pause insertion
  ban...dit
- permutation
  ditband
- reduplication
  babandit
- partial repetition
  ban
- substitution
  bantom

problems

- results often do not correlate
- employ **metalinguistic** knowledge that may override gradient properties of representations
- variably influenced by different factors
  prescriptive word division rules
  word edge/minimality effects
  CV reduplication bias...

(Goslin & Frauenfelder, 2000; Côté & Kharlamov, 2011)

4 Purpose

- develop an **ecologically valid** syllabification task that reflects syllabic representations accessed by speakers during **natural**, **online speech production**
- employ this task to answer the questions raised in 2

5 Predictions

- IF production mirrors perception/goodness judgments, and
- IF all syllable onsets behave like word onsets,
- THEN 'worse' medial clusters should be split more often than 'better' ones:

...VprV... *...VdwV...* *...VbnV...* *...VbdV...* *...VlbV...*

⟷

...V.CCV... *more likely* — ...VC.CV... *more likely*

6 Method

Assumptions

1. **syllable weight** affects **stress placement** in English (Hayes, 1982):

trisyllabic tendency: con.ˈ**duc**.tor vs. ˈ**di**.sci.pline

heavy (CVC) penult = penult gets the stress — light (CV_{SHORT}) penult = antepenult gets the stress

2. this tendency will generalize to **nonwords:**
   ca.ˈ**tal**.pid vs. ˈ**ca**.ta.pid
3. by noting how English speakers stress novel trisyllabic words, we **infer syllable boundaries**:
   - antepenultimate stress = CV.CV.CCVC*
   - penultimate stress = CV.CVC.CVC

* assuming penult vowel is short

Participants

- 37 adult English speakers (monolingual)

Stimuli

- CC clusters placed in CVCV_ _ VC frames to make nonwords
- 5 conditions based on word-initial **legality** and **sonority** profile:

	legal (in order of decreasing **frequency***)	**illegal**
rising sonority	pr, tr, kr, gr, br, fl, pl, fr, bl, kw, dr, sl, gl, thr, sm, sn, tw, shr, dw	pn, pm, tl, tn, kn, zr, bn, bw, dl, dm, gm, gn, thl, zl, fm, vr, vl, sr
flat sonority	st, sp, sk	zb, zd, zg
falling sonority		lp, mp, lt, nt, nk, rz, nb, rb, lb, md, mg, ng, lth, lf, mf, ns, lv, ls, nsh

* frequency values obtained from Vitevitch & Luce (2004)

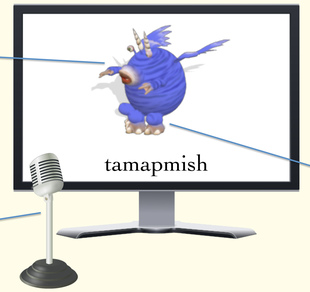
- controls contained singletons (CVCVCVC)
- context frames were kept constant across conditions:

legal/rising	illegal/rising	illegal/falling	control	legal/flat	illegal/flat	control (flat)
tamaprish	tamapmish	tamampish	tamapish	sibistoss	sibizdoss	sibidoss

- each comparison set placed in 2 (out of 44) unique frames
- 170 stimuli, 506 fillers (1-5 syllables, phonotactically legal)

Setup

pictures coerce **noun** interpretation of stimuli, controlling for effect of lexical class on stress pattern (Guion et al., 2003)



made-up creatures (as opposed to real objects) prevent priming of stress placement

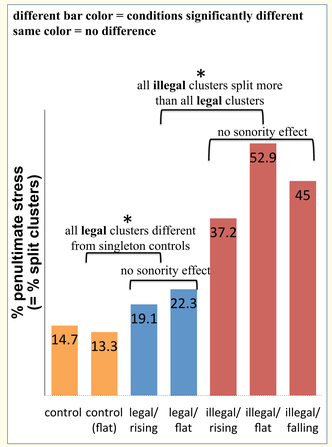
participants given 5 seconds to record each response before screen change

Coding

- off-line perceptual judgments of subjects' stress placement
- cases excluded from analysis:
  ambiguous/unclear stress
  final syllable stress
  responses with long vowels in the penult
  cluster repairs / other mispronunciations
  disfluencies

7 Results

Legality and Sonority



syllabification by medial cluster type

- **legality** influences syllabification
- **sonority** profile shows some numerical tendency but is not a significant factor

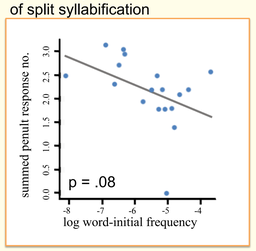
Analysis

- logistic mixed effects models
- fixed effect: cluster type
- random slopes for condition by subjects and items
- critical *p* value = .00625 (Bonferroni-corrected)

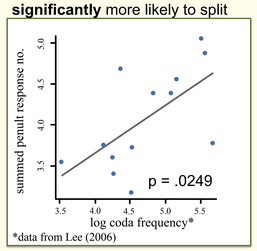
comparison	values	SIG?
legal flat v. control (flat)	t = -2.571 p = .0051	*
legal rise v. control	t = -2.60 p = .0047	*
legal flat v. illegal flat	t = -4.58 p < .0001	*
legal rise v. illegal rise	t = -5.694 p < .0001	*
legal flat v. illegal rise	t = -3.049 p = .0011	*
legal rise v. legal flat	t = -.671 p = .25	
illegal rise v. illegal flat	t = -2.076 p = .0189	
illegal rise v. illegal fall	t = -2.05 p = .02	
illegal flat v. illegal fall	t = -.208 p = .265	

Frequency

word-initial CC frequency **does not** significantly correlate with likelihood of split syllabification



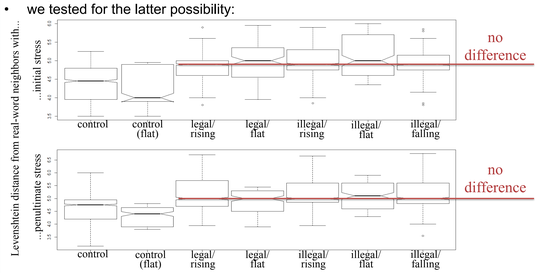
but, if the first C of the cluster is a **frequent coda**, the cluster is **significantly** more likely to split



*data from Lee (2006)

Verifying the method

- we assumed that stress assignment would be uniformly influenced by syllable weight
- however, it is also possible that stress was assigned by analogy to real-word neighbors, unequally across the conditions
- we tested for the latter possibility:



- stress by analogy did not interact with the conditions

8 Discussion

Conclusions

- with respect to syllabification, all word-initially legal CC onsets are equally 'good' and all illegal ones are equally 'bad', regardless of sonority profile
  - not a task effect, since subjects were only required to pronounce whole 'words', not metalinguistically manipulate sub-word units
- within attested clusters, syllabification is not predicted by word-initial frequency, but correlates with coda frequency of the first C of the cluster
- why do the present results differ from findings of perception and judgment studies?
  - perception more sensitive to gradience than syllabification?
  - word onsets differ from word-internal syllable onsets?
    is gradient well-formedness a word-edge phenomenon?

Future Work

- confirm perceptual judgments of stress placement in phonetic terms
- incorporate word-internal frequency measures
- investigate gradient well-formedness with respect to the perception of medial clusters

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contact: **paulo@uoregon.edu** or **vkapatsi@uoregon.edu**