

Monomoraic Lengthening in Japanese as Incomplete Neutralization

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Roadmap

- 1 Incomplete neutralization
- 2 Bimoraic minimality and lengthening in Japanese
- 3 Method
- 4 Results
- 5 Discussion

Introduction

- Japanese prefers prosodic words to be minimally bimoraic (i.e., one foot) (e.g., Poser 1990, Itô 1990)
- Japanese monomoraic nouns, when produced without a case particle, are lengthened (Mori 2002)
- Our experiment shows that the contrast between lengthened monomoraic nouns and underlyingly long nouns is not completely neutralized

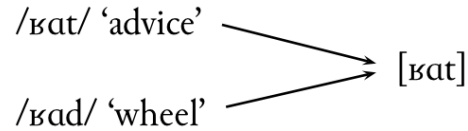
Complete neutralization

- Complete neutralization: two underlyingly distinct segments become identical
- /X/ → [Z] / (Context A)
- /Y/ → [Z] / (Context A)

Complete neutralization

- The classically-cited case of complete neutralization: German final devoicing (Trubetzkoy 1939/1969, p. 235; Bloomfield 1933/1984, pp. 218-219; Jakobson et al. 1952/1975, p. 9; Hyman 1975, pp. 29, 71-72)

- The classic picture of German final devoicing:



Incomplete neutralization

- Incomplete neutralization: two underlyingly distinct segments become nearly identical
- Some small trace of the underlying distinction is manifested on the surface, in the direction of the canonical realization of the contrast
- $/X/ \rightarrow [Z^{(\alpha F)}] / (\text{Context A})$
 $[\alpha F]$
- $/Y/ \rightarrow [Z^{(\beta F)}] / (\text{Context A})$
 $[\beta F]$

German devoicing revisited

- German devoicing is actually incompletely neutralizing
 - A trace of the underlying voicing distinction remains on the surface
 - $/\text{ʁat}/ \neq / \text{ʁad}/$, even on the surface
- Findings from Port and O'Dell (1985):
 - Vowels before devoiced stops are, on average, 15ms longer than underlyingly voiceless stops
 - 15ms less aspiration, on average, in devoiced stops
 - Voicing into closure is longer for devoiced stops (by about 5ms)
 - Closure duration is marginally shorter in devoiced stops

Commonly-cited cases of incomplete neutralization

Devoicing is the most commonly-cited case of incomplete neutralization

- German final devoicing (Port and O'Dell 1985, Mittleb 1981a,b, Dinnsen and Garcia-Zamor 1971, though see Fourakis and Iverson 1984)
- Catalan final devoicing (Dinnsen and Charles-Luce 1984)
- Polish final devoicing (Słowiaczek and Dinnsen 1985, Słowiaczek and Szymanska 1989)
- Russian final devoicing (Dmitrieva 2005)
- Dutch final devoicing (Warner et al. 2004, though see Warner et al. 2006)

A taxonomy of incomplete neutralization I

■ Featural contrast

- Final devoicing (vowel duration differences)
- American English flapping (vowel duration differences) (Braver 2011, to appear)
- Eastern Andalusian Spanish word-internal coda aspiration (aspiration duration differences) (Gerfen 2002)

■ Epenthetic segments vs. underlying segments

- Levantine Arabic epenthetic schwa (vowel quality differences) (Gouskova and Hall 2009)
- Vowel epenthesis in non-native clusters by English speakers (vowel duration and quality differences) (Davidson 2006)
- English nasal-fricative intrusive stop (stop duration differences) (Fourakis and Port 1986)

A taxonomy of incomplete neutralization II

■ Deleting a segment affects its neighbors

- Schwa deletion in French (differences in cluster realization) (Fougeron and Steriade 1997)
- Turkish /g/ deletion in /VgV/ vs. /V:/ sequences (vowel duration differences) (Dinnsen 1985, Rudin 1980)

■ Morphological conditioning

- Cantonese mid-rising tone (F0 differences) (Yu 2007)

■ Lexical-level near-merger

- NYC English: *source* vs. *sauce* (vowel quality differences) (Labov et al. 1972)

Question

Can we expand the typology of incomplete neutralization to include new types of phonological contrasts?

Phonetic duration and phonological length

Many cases of incomplete neutralization are seen on the surface in a small difference in phonetic duration (like German).

but

We know of no previously-reported cases of incompletely neutralized phonological length distinctions

Phonological length contrasts

What would it take to convincingly show that a phonological length contrast can be incompletely neutralizing?

- Context:
 - A short vowel being lengthened or a long vowel being shortened
 - The lengthening/shortening should be phonologically motivated (e.g. not phonetic final lengthening or phonetic undershoot)
 - Not caused by deletion/epenthesis of neighboring segments
- Resulting duration:
 - Lengthening: short < lengthened < long
 - Shortening: short < shortened < long

Nickname formation (Poser 1990, Itô 1990)

Evidence for bimoraic minimality

Nicknames map to bimoraic units

| Name | Possible Nickname | Impossible Nickname |
|--------|-------------------|---------------------|
| yumiko | yumi-chaN | *yu-chaN (1 mora) |
| megumi | megu-chaN | *me-chaN (1 mora) |
| keiko | kei-chaN | *ke-chaN (1 mora) |
| ti | tii-chaN | *ti-chaN (1 mora) |

Japanese prefers minimally bimoraic words

- (Morpho-)phonological evidence for bimoraic minimality in Japanese (Poser 1990, Itô 1990)
 - Loanword abbreviation
 - Geisha/bargirl client names
 - Nickname formation
 - Schedule compounding
 - Telephone number recitation
 - Verbal root reduplication

Schedule compounding (Itô 1990)

Evidence for bimoraic minimality

Days of the week:

| | |
|------------|------------|
| ka-yoobi | `Tuesday' |
| moku-yoobi | `Thursday' |
| do-yoobi | `Saturday' |

Compounded forms:

| | | |
|-----------|---------|-----------|
| kaa-moku | `TuTh' | *ka-moku |
| getsu-kaa | `MTu' | *getsu-ka |
| kaa-doo | `TuSat' | *ka-do |

When they must stand as their own prosodic word, as in the compounded forms, monomoraic days of the week lengthen, so that they have two moras.

Telephone number recitation (Itô 1990)

Evidence for bimoraic minimality

- Each digit in a phone number stands as its own prosodic word
- If the digit has more than one mora, it gets used with no modification
 - 3: saN (μμ)
- If the digit has a bimoraic variant, that one gets used
 - 4: yoN (μμ), *shi (μ)
- If a bimoraic variant does not exist, the digit is lengthened
 - 5: /go/ → [goo], *[go]

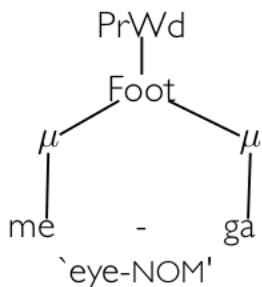
A sample phone number

| | | | | | | | |
|------|-----|------|------|-----|-----|-------|------|
| 4 | 5 | 9 | - | 3 | 2 | 8 | 4 |
| yoN | goo | kyuu | (no) | saN | nii | hachi | yoN |
| *shi | *go | | | | *ni | | *shi |

Monomoraic noun lengthening

Nouns with case particles

- In spite of the preference for bimoraicity, some Japanese nouns are monomoraic (e.g., *me* 'eye')
- If the noun is monomoraic, a case particle usually provides the second mora necessary to form a bimoraic prosodic word



Verbal root reduplication (Poser 1990, Itô 1990)

Evidence for bimoraic minimality

Verbal root reduplication

| | | | | |
|---------|------------|---|-------------|-----------------|
| tabe | 'to eat' | → | tabe-tabe | 'while eating' |
| nak(i) | 'to cry' | → | naki-naki | 'while crying' |
| odor(i) | 'to dance' | → | odori-odori | 'while dancing' |

Verbal root reduplication with monomoraic verbs

| | | | | |
|-------|------------|---|-----------|-----------------|
| mi | 'to look' | → | mii-mii | 'while looking' |
| ne | 'to sleep' | → | nee-nee | 'while dozing' |
| sh(i) | 'to do' | → | shii-shii | 'while doing' |

Monomoraic noun lengthening

Nouns without case particles

In colloquial speech, these case particles can sometimes be dropped

- me-ga akai-yo
 - me-Ø akai-yo
'(Your) eyes are red'
- te-o aratta?
 - te-Ø aratta?
'(Did you) wash (your) hands?'

Examples from Mori (2002)

Monomoraic noun lengthening

Nouns without case particles

Mori (2002) shows that the monomoraic nouns without particles undergo lengthening

- Monomoraic nouns not followed by a case particle or a pause are 40–50% longer than monomoraic nouns that are followed by a case particle

At first we might think that the lengthened monomoraic nouns simply gain an additional mora...

Monomoraic lengthening as incomplete neutralization

Incomplete neutralization: some small trace of an underlying distinction remains on the surface

If the lengthened nouns are longer than short nouns, but are not quite as long as underlyingly long nouns, a trace of their underlying 'shortness' remains visible on the surface

Monomoraic noun lengthening

Nouns without case particles

...However:

- Bimoraic syllables in Japanese are generally 66–80% longer than monomoraic syllables (Beckman 1982, Hoequist 1983)
- Why, then, are the lengthened monomoraic nouns only 40–50% longer?
 - Mori (2002): to preserve the length contrast between underlyingly short and underlyingly long vowels

What would it look like?

Monomoraic lengthening as complete vs. incomplete neutralization

Vowel duration if neutralization is *complete*

| | |
|------------|---|
| Short |  |
| Lengthened |  |
| Long |  |

Vowel duration if neutralization is *incomplete*

| | |
|------------|---|
| Short |  |
| Lengthened |  |
| Long |  |

Motivation for the current study

Methodological considerations

- Mori's (2002) experiment uses several sentences with different accentual patterns and syntactic configurations, but only two different monomoraic nouns (*ne* 'root' and *na* 'vegetable')
 - Does the pattern found by Mori (2002) hold in a broader sample of nouns?
- Two important claims: (a) lengthened nouns are longer than their corresponding short nouns, and (b) lengthened nouns are shorter than their corresponding long nouns
 - Mori (2002) showed (a) experimentally, but not (b)
 - No study has directly compared the relevant lengthened nouns to underlyingly long nouns with identical segmental content
 - Will minimal triplets result in a three-way distinction?

Stimuli

- || sets of three sentences
 - Monomoraic noun, with a particle ('short/prt')
 - Monomoraic noun, without a particle ('short/∅')
 - Underlyingly long noun ('long')
- Nouns within each set had the same segmental content
 - Accent was controlled in 9 of the sets (see appendix)
- In the long condition, long vowels were indicated by either (a) kanji alone, or (b) kana with a length mark (ー)
 - Some morphemes written with kanji, had they been written in hiragana, would have been written as diphthongs (see appendix). They are generally pronounced as long monophthongs (see Vance 2008, pp.63-68, for discussion)

Motivation for the current study

Theoretical considerations

- Most known examples of incomplete neutralization revolve around a voicing contrast
 - If monomoraic noun lengthening is incompletely neutralizing, we would broaden list of phonological contrasts susceptible to incomplete neutralization
- Some potential cases of incomplete neutralization are plausibly analyzed as simply gradient phonetic processes
 - Intrusive stop (Ohalá 1974), vowel deletion (Bürki et al. 2011), flapping (Turk 1992, de Jong 1998)
 - Itô (1990) argues bimoraic minimality is enforced only in derived environments, suggesting that this requirement is 'deep' or 'early' in phonology

Sample stimuli sets

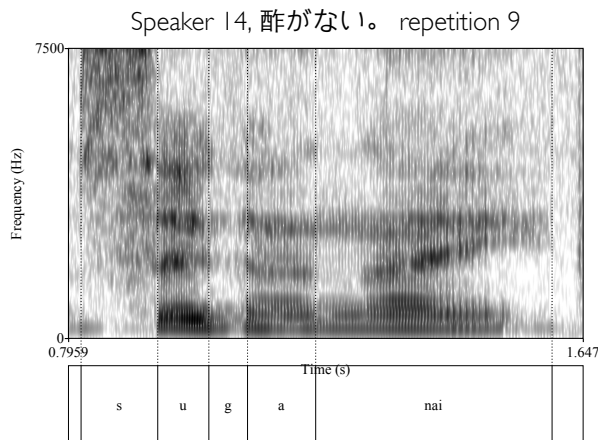
- | | |
|--|--|
| (3) a. 木が倒れた。 b. 木倒れた。 c. キー見つかった? | (4) a. 麩が美味しい。 b. 麩美味しい。 c. 封がとれた。 |
|--|--|

Participants and recording information

- Participants
 - 7 female native speakers of Japanese
 - Speaker #17 was excluded from analyses since she may have been aware of the lengthening phenomenon
 - 6 speakers from Kanto area (near Tokyo)
 - Speaker 17 was from Mie, but spoke Standard Japanese
 - Undergrad and grad students at Japanese universities
- Recordings
 - Sound-attenuated room at International Christian University
 - TASCAM DR-40 recorder

Acoustic measurements

- For each noun, the consonant and vowel durations were measured



Procedure

- SuperLab was used to present the stimuli
- Speakers practiced all items once to ensure they read kanji as intended
- Each speaker read all 33 sentences in random order
- The sentences were re-randomized, and the speaker re-read the sentences
- Each speaker read each sentence a total of 10 times
- Speakers were instructed not to pause mid-sentence, in order to prevent them from inserting a pause or glottal stop rather than lengthening

Statistical analysis

A linear mixed model was run using the `lme4` package in R.

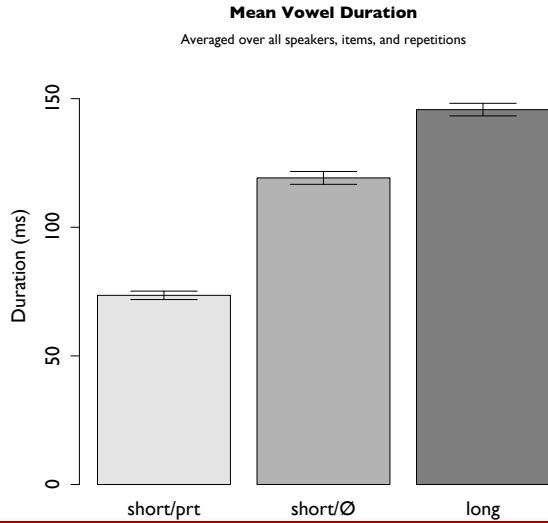
- Vowel duration was regressed against phonological length (short/lengthened/underlyingly long) as a fixed factor, and speaker and item as random factors
 - Phonological length was treatment coded, to produce comparisons between short vs. lengthened nouns, and lengthened vs. underlyingly long nouns.

A three-way distinction

Vowel duration

Mean vowel durations

- short/prt: 73.54ms
- short/∅: 119.19ms
- long: 145.74ms



Statistical significance

Vowel duration

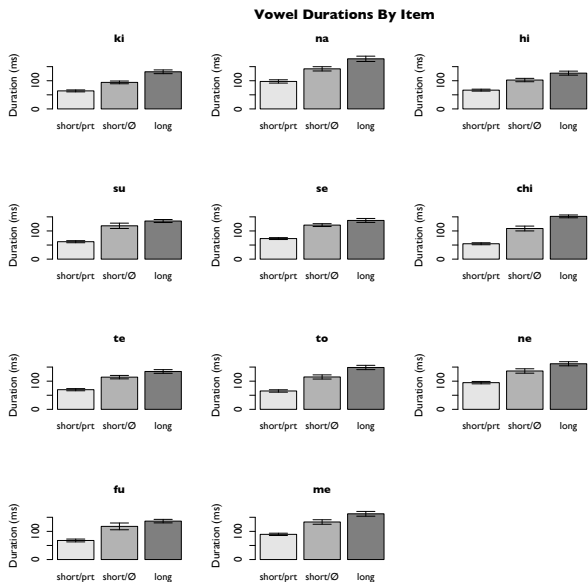
Phonological length has a significant effect on measured vowel duration¹

- Short/prt vs. short/∅: mean difference -45.65ms, $t=-8.018$, $p<0.001$
- Long vs. short/∅: mean difference 26.55ms, $t=1.369$, $p<0.05$

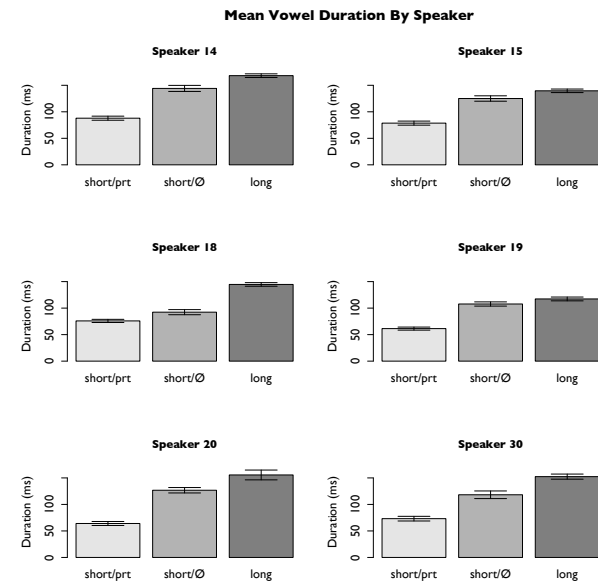
A t-test confirms the significance of the long vs. short/∅ vowel length distinction ($t(1278.99) = -14.90$, $p<0.001$)

¹p values estimated by Markov Chain Monte Carlo method

The pattern holds for all | | triplets...



...And for the 6 analyzed speakers



Before concluding there's a three-way distinction:

If an individual speaker...

(a) ...didn't lengthen some short/∅ tokens at all...

and

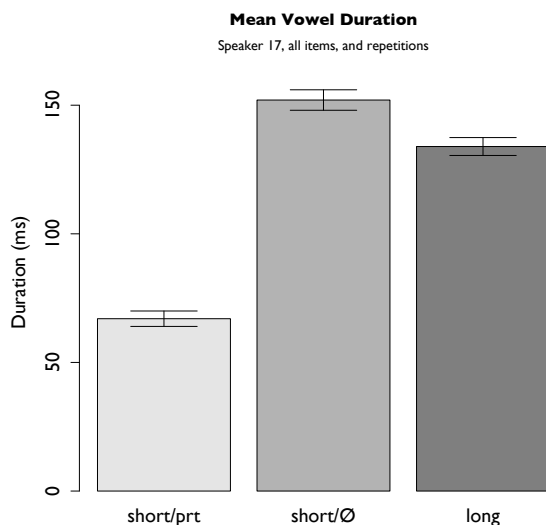
(b) ...also *completely* neutralized some short/∅ tokens...

...we might have obtained the above results, even if speakers didn't incompletely neutralize.

If that were the case, the speaker's short/∅ vowel durations would show a bimodal distribution.

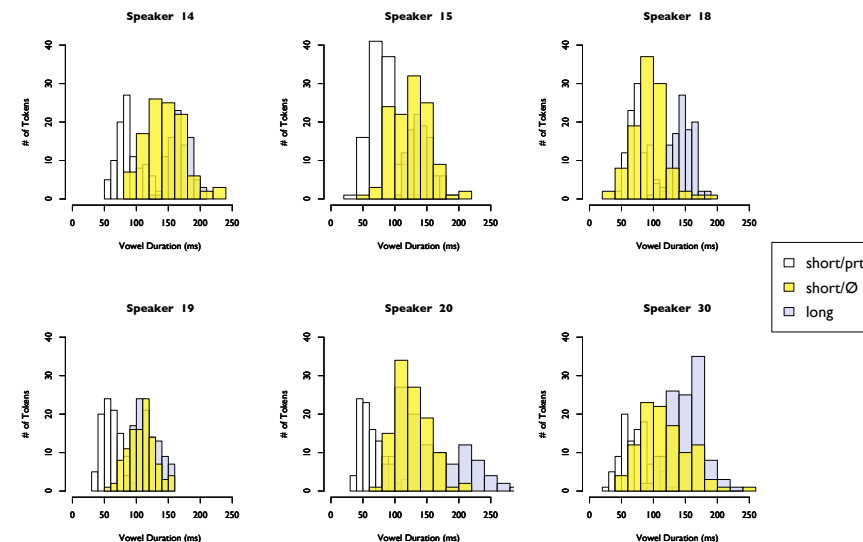
The speaker who knew about the pattern

Speaker 17, who was aware of the pattern, overemphasized the lengthening of particle-less nouns. Her data was not included in analyses.



Speakers' short/∅ vowels distribute unimodally

Frequency of V durations by speaker



Discussion

Monomoraic nouns in Japanese are longer without a particle than with a particle

- This result holds for all |l| triplets tested, across six speakers

The lengthening of monomoraic nouns in Japanese is incompletely neutralizing

- While we might have expected lengthened nouns to become identical to underlyingly long nouns, a trace of their underlying phonological length is apparent on the surface
- Lengthened nouns have a trace of their underlying phonological shortness—they are shorter than underlyingly long nouns

A follow-up experiment with modified stimuli is in the works

Implications for incomplete neutralization

- Most cases of incomplete neutralization have to do with a voicing contrast
- The case presented here shows that languages can incompletely neutralize a very different type of contrast (phonological length)

Appendix

Stimuli I

The following details of the experimental stimuli are reflected in the chart on the following slide:

- Nine of the eleven stimuli sets had accent matched across all members of the set
- Had they been written in hiragana, some kanji in the long condition would have been written as diphthongs
 - Kanji 背 (sei, 'positive') would be written as hiragana せい (se+i), but is pronounced [se:]
- Some of the long nouns are quoted expressive words

Thanks

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Appendix

Stimuli II

| Nouns | Accent mismatch | Diphthong in hiragana | Long noun is quoted |
|----------|-----------------|-----------------------|---------------------|
| 木 / キー | ki'/ki'i | | |
| 菜 / 「なー」 | na'/na'a | | ✓ |
| 火 / 「ひー」 | hi'/hi'i | | ✓ |
| 酢 / スー | su'/su'u | | |
| 背 / 正 | se'/se'i | ✓ | |
| 血 / 地位 | chi'/chi'i | ✓ | |
| 手 / 低 | te'/te'i | ✓ | |
| 戸 / 「とー」 | to'/to'o | ✓ | ✓ |
| 根 / 「ねー」 | ne'/ne'e | | ✓ |
| 麩 / 封 | fu'/fu'u | | |
| 目 / 「メー」 | me'/me'e | | ✓ |

(V' = accented short, V'V = accented long)

Appendix

Effects of accentuation

- Hoequist (1983) finds a small effect of pitch on syllable duration in Japanese
 - High pitch:Low pitch = 1.08:1
 - For comparison:
 - Overall long:short/∅ ratio = 1.22:1
 - Accent mismatched long:short/∅ ratio = 1.35:1 (only two sets)
- Mean long vowel duration in matched vs. mismatched sets
 - Accent-matched sets: 144.71ms
 - Accent-mismatched sets: 150.15ms
 - Difference: -5.44ms, $t(221.819) = -2.02$, n.s.
- Given the small effect size found by Hoequist, the small difference in long vowel duration between accent matched and accent mismatched sets, and the consistent pattern across all lexical sets, we argue that the accent-mismatched sets are legitimate evidence

Appendix

Effects of hiragana spelling as diphthong I

Had they been written in hiragana, some kanji in the long condition would have been written as diphthongs

- Mean long vowel duration in hiragana-diphthong vs. non-hiragana-diphthong sets
 - Non-hiragana-diphthong Long vowels: 148.12ms
 - Hiragana-diphthong Long vowels: 132.87ms
 - Difference: 15.25ms, $t(154.93) = 4.42$, $p < 0.001$

Appendix

Effects of hiragana spelling as diphthong II

- Since Long-item vowel durations are depressed in the hiragana-diphthong sets, we might expect short/∅ vowels to reach the same duration as these depressed Long-item vowels, looking like complete neutralization
 - In spite of this, we still see a difference between short/∅ and long vowel duration in hiragana-diphthong sets
 - This effect is not due to segmental factors, since it is not seen in the short/prt items:
 - Non-hiragana-diphthong short/prt vowels: 74.07ms
 - Hiragana-diphthong short/prt vowels: 71.29ms
 - Difference: 2.78ms, $t(269.349) = 1.72$, n.s.

Appendix

Effects of quoted/expressive long noun I

Some of the items in the Long condition were quoted expressives

- Mean long vowel duration in non-quoted vs. quoted sets
 - Non-quoted Long vowels: 137.06ms
 - Quoted Long vowels: 155.48ms
 - Difference: -18.42ms, $t(516.365) = -7.55$, $p < 0.001$
- It is possible the difference between short/∅ and Long vowel durations in the quoted sets is partly attributable to the apparent lengthening effect of quoted sets
 - However, it is possible that the segmental properties of these tokens are the cause:
 - Non-quoted short/prt vowels: 65.26ms
 - Quoted short/prt vowels: 83.17ms
 - Difference: -17.91ms, $t(492.702) = -11.56$, $p < 0.001$

Appendix

Effects of quoted/expressive long noun II

- So: All vowels in the quoted sets—not just long ones—are longer than non-quoted sets
- Further evidence this is due to segmental properties:
 - Mean not-quoted consonant duration: 92.97ms
 - Mean quoted consonant duration: 57.23ms
- Perhaps the vowel duration difference is because shorter consonants in the quoted condition allow vowels to expand, rather than an effect of being quoted

The main results from this experiment still hold if the quoted sets are removed from the data:

- Lengthening occurs: short/∅ vowels are longer than short/prt vowels (mean diff: 48.81ms, $t=-9.68$, $p<0.001$)
- Neutralization is incomplete: short/∅ vowels are not as long as underlyingly long vowels (mean diff: 22.98ms, $t=2.50$, $p<0.05$)

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