Reduction, frequency and prosodic phonology in Singaporean English

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Qualifying Paper

1

Overview

1. **Background** Frequency and phonology
2. **Glottalisation** ⇒ (p(word left edge
3. **Tone** ⇒ (p)(word) right edge
4. **Stress** ⇒ ((p)(word) recursion
5. **Frequency** ⇒ ((p)wd), ((p)(wd)) variation
6. **Conclusion** Predictions, future work

2

1. Issues and background

http://blogs.wyomingnews.com/blogs/shutterspeed/2009/09/

3

- Singaporean English = Singlish

Frequency and phonetics

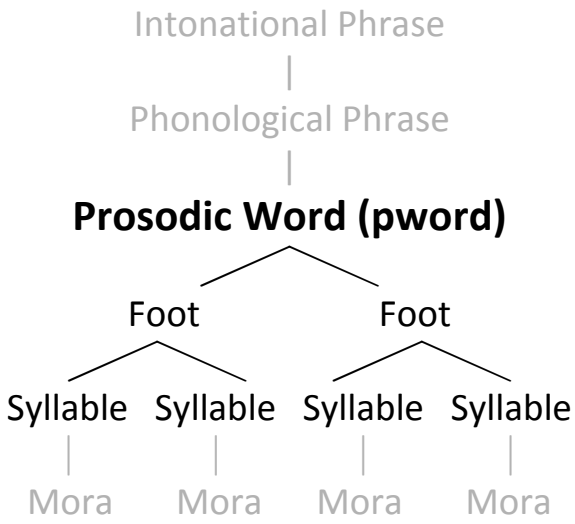
- **Lexical access (naming)**
  - High frequency → Faster lexical access
    (e.g. Segui *et al.* 1982)
- **Speech rate, duration (stress)**
  - High frequency → Faster, shorter, less stressed
    (e.g. Bell *et al.* 2009; Pluymaekers et al. 2005)
- **Segmental (t/d) deletion**
  - High frequency → Gestural overlap in fast/casual speech (Browman & Goldstein 1990; Coetzee 2009)

4

- **Segmental deletion:** Has been called a phonological effect. But you can explain it purely in terms of the phonetics: in fast speech, you don't hear the t/d in the acoustic signal, but your tongue is still making the t/d movement, it's just hidden by the other things your articulators are doing at the same time. So I would call this a phonetic effect rather than phonological deletion, because the t/d is still there in the articulation.
- Summing up: Similar things happen with high-frqeuency items and fast speech.

The prosodic hierarchy

(Selkirk 1984; Nespor & Vogel 1986)

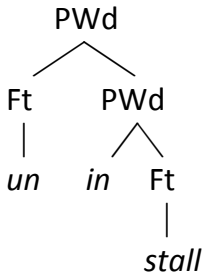


5

- There isn't much about frequency and phonology. But where would you expect to find it? You'd expect it in the prosodic hierarchy, which is where timing relations live in the phonology. I am concerned with this section of the prosodic hierarchy.

The prosodic word (pword)

- **Prosodic word ≈ Grammatical word**
  - Smallest prosodic unit sensitive to morphology
  - Prefixes often independent, suffixes often merge (Peperkamp 1997; Hall 1999)
- **Assumptions**
  - Recursive pwords: *((ˌun)inˈstall)*
  - Hierarchical stress: **((ˈun)inˈstall)* (Selkirk 1995; *SPE*)



6

- I'm not going to show the structure for the syllable level and below.

Morphology: Lexical access

- **Grammatical word vs. stem**
  - Stem: A part of the GWd which can occur as an independent word, e.g. *[in[sane]], [[tea][spoon]]*
  - Compounds and initialisms *[[C][I][A]]* (Harley 2004) have multiple stems
- **3 types of lexical access** (Baayen & Schreuder 1999)
  - Whole-word-only access: *infamous*
  - Decomposed-only access: *sub-, divide*
  - Mixed access: *insane, in-, sane*

7

Frequency and phonology

- **Exemplar theory:** Fine phonetic detail
  - High frequency → Faster, reduced execution (Pierrehumbert 2002; Bybee 2007)
- **Accessed lexical units**
  - High frequency → Whole-word-only access (Hay 2003; Zuraw 2007)
- **Lexical speed:** Coordinated with articulation
  - High frequency → Faster planning/execution (Bell *et al.* 2009)

8

- **Lexical speed:** We know it's coordinated with articulation because people do adjust their **speech rate** when they're thinking faster or slower. As a last resort, if the speed of access is very different from the speed of articulation, we have **disfluencies**, pauses and repetition.

Why SgEng?

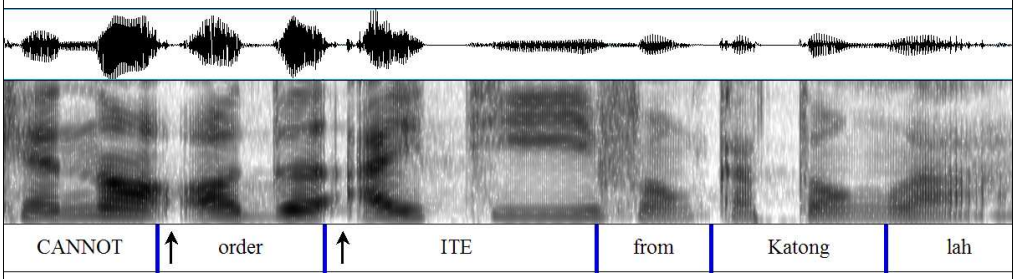
- **Exemplar theory**
  - Underlying stress, but surface tone

Why SgEng initialisms?

- **Accessed lexical units**
  - Initialisms have multiple stems
- **Lexical speed**
  - Initialisms are very common

9

2. Glottalisation



- Always word-initial, never word-medial (Tongue 1979: 38; Brown 1988)

10

- Glottal stop or creaky voice
- Saat

Pword left edges

- **Prefixes:** (prefix-(stem *(un-(install*
- **Suffixes:** (stem-suffix *(eat-ing*
- **Compounds:** (stem (stem *(stop(over*
- **Generalisation:** Stems must share a left edge with a pword.

11

- Magical, doable

OT analysis

- **Align (Stem, L, PWd, L)** **$_{PW}$([Stem**
  - Stems must share a left edge with a pword.
- **Economise (PWd)** **Econ**
  - One violation per pword created.

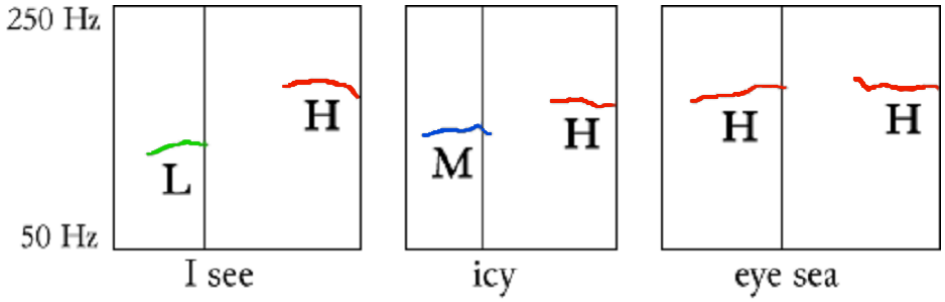
un-[install]	$_{PW}$[STEM	ECON
☞ a. (un-(install))		**
b. (un-install)	W*	L*

12

- This will get the correct candidate

3. Tone

(Wee 2008; Siraj 2008; Ng 2009)



13

Tone assignment

H ˈsee	L H maˈchine
M H ˈEnglish	L M H hiˈbiscus
M M H ˈelephant	L MM H AˈmericaL
M M M H ˈIndoˌnesia	L L M H elecˈtronics

Low tone on initial unstressed syllables

Mid tone starts on first stress

High tone at end of prosodic word

14

- So except for ***electronics***, these are bare stems, and these are the tonal patterns.
- There are very very few words where

Pword right edges

- **Prefixes**: (prefix)-(stem) *(ˌun)-(inˈstall)*
  (prefix-(stem)) *(un-(inˈstall))*
- **Suffixes:** (stem-suffix) *(ˌeat-ing)*
- **Compounds:** (stem) (stem) *(stop)(over)*

- **Generalisation:** A stem left edge must coincide with a pword right edge.

15

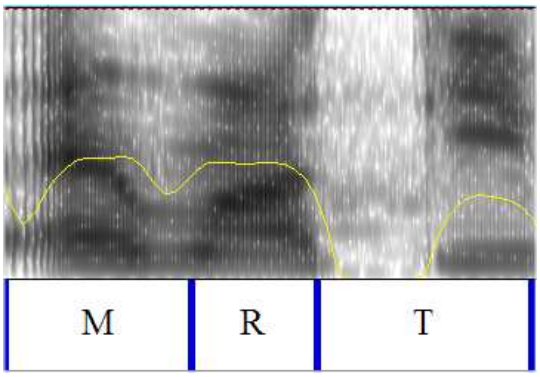
OT analysis

- **Align (Stem, L, PWd, R)** **$_{PW}$)[Stem**
  - A stem left edge must coincide with a pword right edge.

[century] [egg]	PW]STEM	PW[STEM	ECON
☞ a. (ˈcentury)(ˌegg)			**
b. (ˈcentury (ˌegg))	W*		**

16

4. Stress



17

SgEng stress is hard to hear

- **Phonetically masked**
  - Syllable-timed, little vowel reduction, final lengthening (Low 1998; Deterding 2005)
- **Phonologically inert**
  - No stress shift (Bao 1998)
- **Slight discrepancies in transcriptions**
  - ˌtable ˈtennis vs. ˈtable ˈtennis
    (Tongue 1979) (Uri Tadmor, p.c. July 2008)

18

What works

- **Acoustic correlates of stress** (Tan 2002)
  - Pitch (no), duration (iffy), intensity (yes)
  - Can't identify categorical stress
- **Surface tone** (Siraj 2008; Ng 2009)
  - Categorical production, perception
  - Can't distinguish primary/secondary stress
  - Tone variation ← Stress variation?

19

Destressing → Stress variation

- Weak stresses get weaker (Hayes 1995: 37)
- **Left-headed → Initial stress**
  - ˈtea ˌspoon → ˈteaspoon
  - ˈwater ˌfall→ ˈwaterfall
- **Right-headed → Initial lack of stress**
  - ˌtea ˈspoon → tea ˈspoon
  - ˌwater ˈfall → water ˈfall

20

- Left- and right-headedness

Destressing → Tone, pword variation

BEFORE destressing	Left-headed	Right-headed
Independent pwords	(ˈMH)(ˌH)	(ˌMH)(ˈH)

AFTER destressing	Left-headed	Right-headed
Recursive pwords	((ˈMH)H)	(LL(ˈH))
Merged pwords	(ˈMMH)	(LLˈH)

21

- Before destressing: Independent pwords, same tone patterns
- After destressing: Every pword must contain at least one stress, so you can't have independent pwords any more. You would prefer to signal the internal stem boundary with a pword boundary, so recursive pwords would be best. But if every single pword needs to be the direct parent of a foot, then you can't have those recursive structures, you need the merged structure.
- For our purposes, if we see initial low tones, then we can confirm right-headed structures.

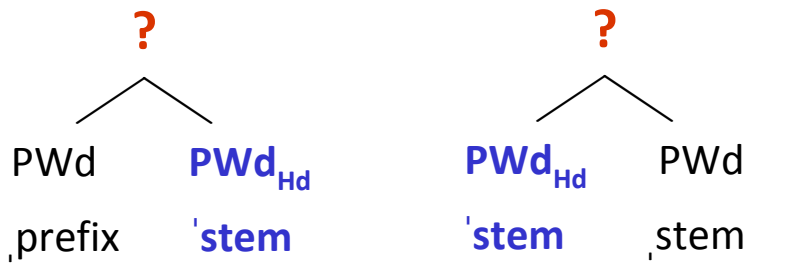
Pwords after destressing

- **Prefixes:** Right-headed → recursive
  - *un-install* (ˌH)(LˈH) → (L(LˈH))
- **Suffixes:** Left-headed
  - Pseudo-compounds: *censor-ship*
    (ˈMH)(ˌH) → (ˈMMH)
- **Compounds:** Left-headed → merged
  - *waterfall* (ˈMH)(ˌH) → (ˈMMH)

22

- If the variation in pword structure is due to destressing, we can infer the following:
- Prefixed forms are right-headed. When the prefix has stress, we get independent pwords. When the prefix is unstress, we get the recursive pwords predicted from destressed right-headed structures.
- Suffixed forms are probably left-headed. Most cases don't give us any clues, but some suffixed forms can optionally behave like compounds, such that the suffix induces a pword edge as if it were a stem. If this reanalysis is possible, it means that suffix stress must be similar to compound stress.
- Compounds are left-headed. Some speakers have more independent pword structures, others have more merged structures. If they are related by destressing, then the merged structure looks like the one we predicted for right-headed destressing.
- Now there are several things we must account for. Firstly, why do we get different stress with the same pword structure for stressed prefixes and compounds?

Enforcing stem stress



Prefix
Right-headed by stem

((prefix)(stem))

Compound
Left-headed by stem

((stem)(stem))

23

Constraints

- **Wrap (GWd, PWd)**
  - Every grammatical word is contained in a pword. (Truckenbrodt 1999; Vigário 2003)

[un-[install]]	WRAP	ECON
☞ a. ((ˌun)(inˈstall))		***
b. (ˌun)(inˈstall)	W*	L**

24

Pwords after destressing

- **Prefixes:** Right-headed → recursive
  - Stress: *un-install* ((ˌH)(LˈH)) → (L(LˈH))
- **Suffixes:** Left-headed
  - Pseudo-compounds: *censor-ship* (ˈMH)(ˌH) → (ˈMMH)
- **Compounds:** Left-headed → merged
  - Frequent: *waterfall* ((ˈMH)(ˌH)) → (ˈMMH)

25

- We have been assuming this is from destressing.
- Prefixes: Yes, you can only get that internal stem edge preserved by destressing.
- Compounds: This could be whole-word-only access. How can we tell them apart?
  - Predictions: Destressing will merge the last two pwords. Whole-word-only will merge all pwords.
  - Well, we have compounds with more complex structure: initialisms.

Pword merger in initialisms

SPCA	((((ˈH)ˌH)ˌH)ˌH)			
ACJC	((((ˈH)ˌH)ˌH)ˌH)	(((ˈH)ˌH)ˌMH)		
NRIC	((((ˈH)ˌH)ˌH)ˌH)	(((ˈH)ˌH)ˌMH)	((ˈH)ˌMMH)	
NTUC	((((ˈH)ˌH)ˌH)ˌH)	(((ˈH)ˌH)ˌMH)	((ˈH)ˌMMH)	(ˈMMMH)

Recursive → **Merged**

26

- These do look like compound patterns, just more variety. We can have recursive structure (1st column), we can merge the last two pwords (2nd column), we can merge the last three pwords (3rd column), or we can merge all pwords (last column).
- You would expect independent pwords as well. You don't get them very often for initialisms that mean something, but they happen occasionally, e.g. RI. And if you get people to read a novel sequence like LMNO, that's also independent pword structure. So these really do look like the compound patterns.

Explaining initialism merger

- **Surface tone: No** (Kuo et al. 2007)
  - Greater pitch change/range : HHHH → HHMH
- **Whole-word-only access: No**
  - Signals non-existent stems: *((ˈN)ˌRIC)* ← **RIC*
- **Stress: Yes**
  - Directional and hierarchical
  - Intensity and non-final duration ($p < 0.05$)

27

- Can this be explained in any other way?
- Fast speech and frequency both cause

Pwords after destressing

- **Prefixes:** Right-headed → recursive
  - Stress: *un-install* ((ˌH)(LˈH)) → (L(LˈH))
- **Suffixes:** Left-headed
  - Pseudo-compounds: *censor-ship* (ˈMH)(ˌH) → (ˈMMH)
- **Compounds:** Left-headed → merged
  - Frequent: *waterfall* ((ˈMH)(ˌH)) → (ˈMMH)

28

- (We have already seen how we get different stress for prefixes and compounds before destressing.)
- But after destressing, they end up with different pword structures. Why?
- The key is that the host pword has to be on the right.

What causes pword merger?

AFTER destressing	Left-headed	Right-headed
Recursive pwords	((ˈMH)H)	(LL(ˈH))
Merged pwords	(ˈMMH)	(LLˈH)

- **Generalization:** A pword right edge must coincide with a foot right edge.
- **Compare:** SgEng *veˈhicle, coˈlleague*

29

Constraints

- **Align (PWd, R, Ft, R) Ft)$_{PW}$**
  - A pword right edge must coincide with a foot right edge.

[[ˈM][ˈO][ˈE]]	Ft]$_{PW}$	$_{PW}$]Stem
☞ a. ((ˈM)ˌOE)		*
b. (((ˈM)ˌO)E)	W*	L

30

Constraints

- **Stress**
  - Cover constraint for stress.

un-[inˈstall]	STRESS	PW]STEM
☞ a. (un(inˈstall))		*
b. ((ˌun)(inˈstall))	W*	L

31

5. Frequency

32

- Really we're talking about lexical access speed. But the way to estimate that is frequency.
- Had to exclude all the two-letter initialisms.
- If high frequency predicts destressing, we should see a relationship with surface tone.

Hits and tones

744,000

1	**Complete merger** (ˈMMMH)	*NTUC, MRT*
2	**Partial merger** ((ˈH)ˌMMH) ((ˈHˌH)ˌMH)	*NUS, NTU, MOE, SIA, UOB, LRT, SMU, NRIC, CCA, NYP, ACJC*
3	**No merger** (((ˈH)ˌH)ˌH) ((ˈH)ˌ(H)ˌ(H))	*GST, CBD, ITE, NDP, RGS, SDU, LMN, LMNO*

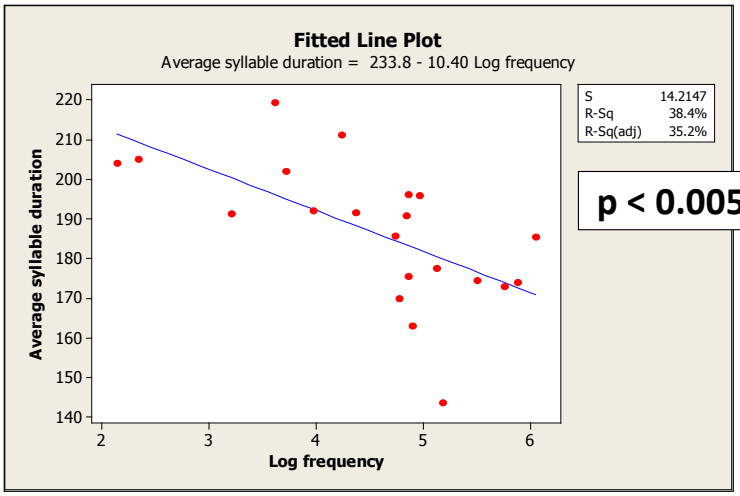
p < 0.01

140

33

- Really there are five tone patterns for initialisms.
- **Partially merged class:** But I didn't have a lot of tokens of four-letter initialisms, so there was not much point splitting up the partially merged class.
- **No merger:** And I put recursive and independent pword structures together, because people just don't produce the independent structures very often. Usually for the meaningless alphabet sequences LMN and LMNO.
- If high frequency predicts destressing, then it shouldn't just affect surface tone. More frequent items should also have shorter duration.

Hits and duration



p < 0.005

34

3 models for interaction

- **Exemplar theory: No** (Kuo et al. 2007)
  - Greater pitch change/range : HHHH → HHMH
- **Whole-word-only access: No**
  - Signals non-existent stems: *((ˈN)ˌRIC) ← *RIC
- **Lexical speed: Yes**
  - Speaker-centred: articulation
  - Hearer-centred: predictability

35

- One week ago I thought that predictability and lexical speed were separate things. Well, in some ways they are.

Hearer vs. speaker

- **Hearer/predictability: Not from context**

  CANNOT order Webcast from Punggol lah.
  ALWAYS order NTUC from Jurong lah.
  NEVER order Gingerbread Man from Katong lah.
  BETTER order Superstitious from Punggol lah.

  - But fast lexical access → greater predictability

- **Speaker/articulation: Two paths**
  - Execution: Fast speech rate → Destressing
  - Planning: Fast lexical access → Destressing

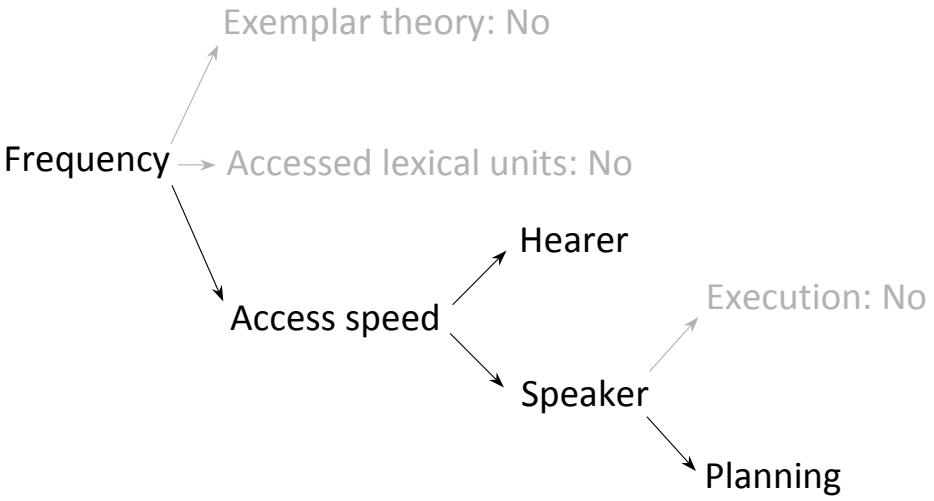
36

Speaker/articulation

- **Execution: No**
  - Different constraint rankings needed for fast speech rates (Yip 1999)
  - But fast *SPCA* ((ˈH)ˌMMH) is still bad
- **Planning: Interesting issues**
  - At high speed, we can't make enough:
  - Stress distinctions? (Flemming 2004; Tilsen, submitted)
  - Prosodic structures for stress distinctions? (*SPE*)

37

Frequency and phonology



38

Possible pword structures

- **Prefixes:** ((ˌprefix)(ˈstem)) ˌun-inˈstall
  (prefix (ˈstem)) un-inˈstall
  ((ˌprefix)ˈstem) ˌdis-aˈgree
  (ˌprefix ˈstem) ˌun-surˈprising
- **Suffixes:** (ˈstem-suffix) *ˈeat-ing*
- **Compounds:** ((ˈstem)(ˌstem)(ˌstem)) *LMNO, LMN*
  (((ˈstem) ˌstem)ˌstem) *SPCA, ITE*
  ((ˈstem) ˌstem stem) *NRIC, MOE*
  (ˈstem stem stem) *NTUC, MRT*

39

- Two things to explain in the high-speed forms: (1) destressing, (2) no internal pword left edges.

Destressing

- ***StrongClash (access speed *x*)**
  - A grammatical word accessed at speed *x* allows only *x* levels of stress at most.
  - Compare Russian (Gouskova & Roon, to appear)

[[M][O][E]]$_{S_2}$	WRAP	*SCLASH$_S$	STRESS
☞ a. (('M),OE)			*
b. (('M),O,E)		W*	L
c. (('M)(,O)(,E))		W*	L
d. ('M)('O)('E)	W*		L

40

Loss of internal pword left edges

- **Economise (Speeds 1, 2, 3)**
  - One violation per pword created.
  - Applies only to speeds 1, 2 and 3.
  - Compare Mandarin fast speech (Yip 1999)

$[[M][O][E]]_{S2}$	ECON$_S$	$_{PW}$[STEM	ECON
☞ a. (('M),OE)	**	**	**
b. (('M)(,OE))	W***	L*	W***

41

6. Predictions

- **Stress changes → Tone**
  - Citation form vs. continuous speech
- **Lexical access changes → Tone**
  - But short-term stored articulatory plans (Bybee 2007)
  - Also frequency attenuation effect (Forster & Davis 1984))

42

Extending the proposal

- **Function words**
  - Object pronouns *make it* ((ˈH)ˌH) → (ˈMH)
  - Utterance-final discourse particles *lah*
- **Applicable to other Englishes?**
  - Raffelsiefen (1999) proposed (ˌprefix)(ˈstem)
  - Arguably ((ˌprefix)(ˈstem)) as in SgEng

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48