# Affixation, compounding and the prosodic word in Singaporean English

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•I understand people are wondering how to pronounce my surname. It's Ng with no vowel, but it has a rising tone.

•Originally I was going to give a very simple guess at prosodic word structure in Singaporean English, because I was going to rely on tone only. But then I started looking at glottal stops as well. So now my talk is about affixation, compounding and the p-word in Singaporean English.

•Probably you haven't heard full-blown colloquial Singaporean English before. It's very hard for me to do in a formal non-Singaporean setting like this, but I'm going to try and do it for the next couple of minutes to give you a taste.

Singaporean English

(Kuo 1980: 41)
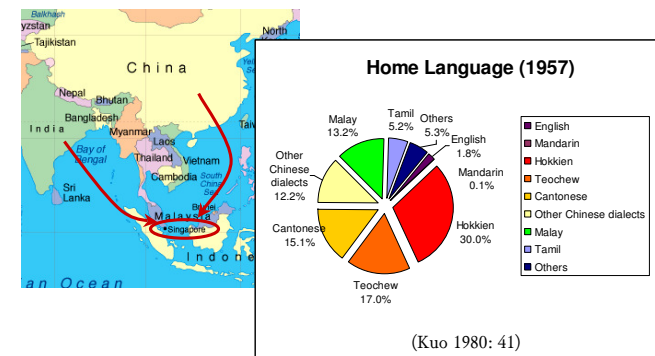
•Singapore <NEXT> neighbour ah, everyone speak Malay. 1819 the British come and colonise us, so got many immigrants come and work, from southern China got a lot <NEXT>, also small percentage from India <NEXT>.

•<NEXT> For most of the history ah, the lingua franca was a simplified version of Malay, call Pasar Melayu, the meaning is Market Malay. But 1960s come already, we become independent, then the government and school use English more and more. So you want to know the contact languages in the early history of Singlish, must see around that time.

•Did you understand that? I was sticking to English vocabulary. I'm told that if you don't use just English vocabulary, it's not intelligible to other English speakers. But the people who work on African creoles say that it's still too similar to English, so they call it a creoloid.

•For today, I'm only talking about the English spoken by Chinese Singaporeans, who continue to be the majority. Practically all of them spoke southern Chinese dialects: Hokkien, Teochew, Cantonese, Hakka, Hainanese and so on. These have very rich tonal systems with at least three level tones: low, mid and high.

Singaporean English

- **Stress** (Tongue 1974; Platt & Weber 1980; Bao 1998)
  - Paradigm uniformity effects
    - **psychólogy**, **psychólogi**cal, **psychólogi**cálly
  - Please see appendix on stress analysis
- **Tone** predictable by stress and morphology
  - Discourse particles (Lim 2008)
  - Tone on words of English origin
    (Wee 2008a,b; Ng 2008; Siraj 2008)
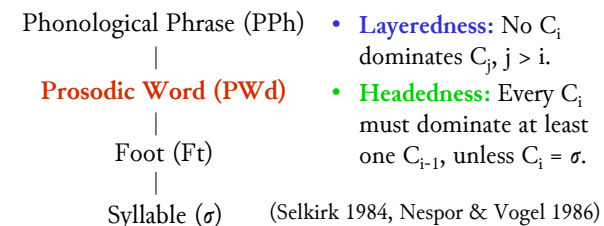 - Please see appendix for minimal triplet [aɪ.si]

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•There has been quite a bit of previous work on Singaporean English prosody, because as I'm sure you noticed, it definitely sounds different from other Englishes. For instance, many words have distinctive stress patterns. One effect is very strong paradigm uniformity. Level 1 suffixes don't change stress patterns <PLAY>. Bao Zhiming noted that stress is not very acoustically salient, but I've done some preliminary analysis and I would agree with previous work that there is stress.

•NOTE AFTER WORKSHOP PRESENTATION: Originally I cited only Tongue (1974) and Bao (2006), but in fact some of Bao's (2006) transcriptions do not agree with my intuitions. However I would agree with the transcriptions by Bao (1998) and Platt and Weber (1980).

•Now the most recent development is that last year, three of us independently realised that there is tone in Singaporean English. For several years before this, actually, people knew that the discourse particles had tone; Lisa Lim sums up this research. But what Wee Lian Hee, Pasha Siraj and I realised is that we have tone even on words of English origin. In the appendix you can see a minimal triplet for low, mid and high tone. I'll go into more depth a bit later.

SgEng and the prosodic hierarchy

- What do these new developments tell us about how Singaporean English compounds and affixed forms fit into the **prosodic hierarchy**?

Phonological Phrase (PPh)
|
Prosodic Word (PWd)
|
Foot (Ft)
|
Syllable (σ)

- **Layeredness:** No C_i dominates C_j, $j > i$.
- **Headedness:** Every C_i must dominate at least one C_{i-1}, unless $C_i = \sigma$.

(Selkirk 1984, Nespor & Vogel 1986)

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So I started wondering, what does tone tell us about the p-word structure of Singaporean English? What's the structure of compounds and affixed forms? So this is my research question. I'll be using the familiar prosodic hierarchy.
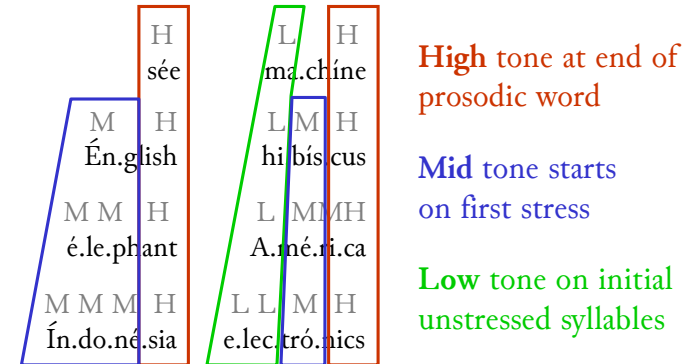
Outline

- Tests for prosodic word edges
  - **Right edge: high boundary tone**
  - Left edge: optional glottalisation
  - Generalisations
- Analysis

So first I'll discuss the tests I am using for the p-word edges, and then I'll give my generalisations on the structures, and then I will sketch out an analysis. Let's look at the tonal patterns first. It turns out that this will show us where the right edge is.

Word-level tone

High tone at end of prosodic word

Mid tone starts on first stress

Low tone on initial unstressed syllables

•So except for *electronics*, these are bare stems, and these are the tonal patterns.

•This is how I describe it. Let me tell you what Wee Lian Hee and Pasha Siraj say.

Alternative accounts

- **Wee** (2008a,b)
  - Identical transcriptions
  - Slightly different approach to stress (Wee 2008b)

- **Siraj** (2008)
  - Slightly different transcriptions and analysis for foot-final high: émerald, Pánama MHH
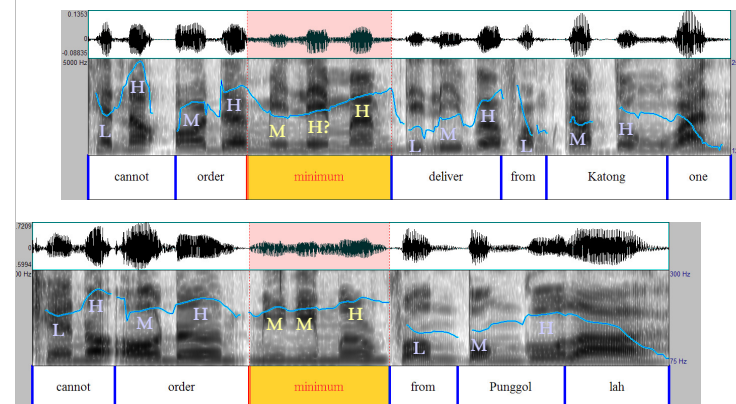 - But PWd-final H ≠ Foot-final 'H' …

•For today's purposes, Wee Lian Hee and I have the same account. We transcribe the tones identically. It's just the relationship between stress and tone where we have slightly different accounts.

•NOTE AFTER WORKSHOP PRESENTATION: Originally I cited Wee (2008b) as p.c. 13 Aug 2008, but since a number of linguists received the document it seems more appropriate to consider it a manuscript.

•Now Pasha Siraj, his transcriptions are a bit different from ours. He has a word-final high, but he also has a foot-final high. So *emerald*, *Panama* and *minimum* for me are mid-mid-high, but for him they're mid-HIGH-high. So let's look at a pitch track and see why he says that.

Foot-final 'H' vs. PWd-final H

| cannot | order | minimum | deliver | from | Katong | one |

| cannot | order | minimum | from | Punggol | lah |

•We see a straight climb up to the high tone. Some of my consultants did this sometimes, but I think Siraj had more data like this.

•I don't think this is a foot-final high. He only has this before the p-word-final high, so I think it's just interpolation for those speakers who don't specify a tone on every single syllable.

•If I try to do a really singsong version of Singaporean English, I get a pretty clear mid-mid-high. And I had many consultants who did this also <NEXT>. This is what it sounds like <PLAY, PLAY>.

•So I think we can agree that the p-word final high is a pretty clear landmark. So let's use this high tone to find the right edge of the p-word.

Right edge of the PWd?

Compounds, Acronyms	Prefixes	Suffixes
M H M H mó.ney)+lén.der)	L M H un+lú.cky)	M H wórk+ing)
H H H Ǵ)+Ś)+T́)	H L H ré)+de.sígn)	L M MMMH res.pón.si.bí.l+i.ty)
H M H stóp)+ó.ver)	H L M M H ír)+res.pón.si.ble)	M H thánk+ful)
M H íce+cream)	H M M H ír)+rá.tio.nal)	H H spóon)+fúl)

•I'll describe the typical patterns first, and then the exceptions.

•<NEXT> For compounds, the rule is that each stem forms its own prosodic word. I'll play these, you can hear the multiple high tones <PLAY,PLAY,PLAY>. But for all speakers there are some compounds where we only see one high tone, and therefore only one right edge of the p-word. <NEXT, PLAY>

•<NEXT> For prefixes, we seem to see clash and lapse. So in *unlucky* or *remodel* the prefix is unstressed due to clash, and apparently it can't form its own p-word. So we only get one high <PLAY>. But in *redesign* and *uninstall*, the prefix is stressed due to lapse, and it does get its own p-word. So now we have two highs <PLAY>. This tendency holds for prefixes from level 1 as well, like *irresponsible* or *illegal* <PLAY>. <NEXT> Now there also seems to be a tendency to stress prefixes if you're not so familiar with the word. So quite often for *irrational* you get two right edges <PLAY>. But I happened to record a Maths teacher who was quite familiar with irrational numbers, and for her the prefix never gets its own right edge.

•<NEXT> Now suffixes usually don't introduce a new p-word. You'll only hear one high in these. <PLAY> The first one sounds a bit different because it's spontaneous speech. Now the exceptions. For some speakers, there are a few level 2 suffixes which do introduce a new prosodic word. Let's focus on these for a moment.

Suffixes

Most suffixes

	M	H	M H	H	**Stressed suffixes**
	kíng	dom	schó.lar	shíp	
	M	H	H	H	
	dúck	ling	chíld	hóod	
	M M	H	MH	H	
	há.ppi	ness	lá.dy	líke	
	M M	H	H	H	
	có.lour	ful	hánd	fúl	

As we saw, most suffixes just have one high. <NEXT> And if we look at the exceptions, we find they are the stressed suffixes in English. And it's interesting that concrete *-ful* and abstract *-ful* pattern differently, but I have a friend who is an Australian English speaker and he says the vowel quality is different for him, so apparently it's not just Singaporean English.

Compounds and acronyms
High Frequency Fusion (Raffelsiefen 2005)

Less familiar?

	H / éye	H / séa	End in 2 monosyllables	M / Í	H / C	**More familiar**
	M H / pó.cket	M H / mó.ney		M / dúst	H / bin	
	H / gránd	M H / fá.ther	H / Ṕ	M / Á	H / P	
	M H / chí.cken	H / ríce	H / Ń H / Ṫ	M / Ú	H / C	

• Now let's look at the exceptions among the compounds. We use a lot of acronyms in Singaporean English and they pattern with the compounds, so I will discuss them together.

• Normally we have separate prosodic words. But sometimes we lose a right edge. And I've been trying to find cases where we lose all the internal right edges, but I haven't been able to find any.

• So why does this happen?

   • So one distinction is between less familiar and more familiar. We can see this from the minimal pair *eye sea* and *IC*.

   • But some of these on the left are very common terms, like *pocket money*, *grandfather* and *chicken rice* and I haven't found a single case where they clearly merge. In fact, I've got one consultant who pronounces a huge number of compounds with p-word merger, but not these. So it looks like merger also requires the compound to end in two monosyllables. And given that mid-high is the usual form for things like *teacher*, *orange*, *happy*, it looks very much like we destress the final syllable, and then we delete a right edge so we can form a trochee.

   • There is one exception. By these criteria *butterfly* should have no merger, but actually it does. I think this is a case where we have stopped thinking of it as a compound.

Frequency effects: Right PWd edge

- Compounds which **cannot** lose a right edge
  - *Unfamiliar:*   éye)+séa)   H)H)
  - *Don't need final trochee:* gránd)+fáther) H)MH)
  - *Can't form final trochee:* sáfe.ty)+bélt)   MH)H)

> **Generalisation**
>
> A familiar compound terminates in a trochee if it can be created by destressing the final syllable and losing a PWd right edge, e.g. íce cream, ÍC), Ń)Ṫ)ÚC.

So this is what we saw before, and it looks like the generalisation is that ...

Outline

- Tests for prosodic word edges
  – Right edge: high boundary tone
  – **Left edge: optional glottalisation**
  – Generalisations
- Analysis

Now let's look for the left edge of the p-word.

Optional glottalisation
(please see appendix for spectrograms)

- **Grammatical** at known left edges of PWds
  – *Stem-initial:* (ár.my) (M H)
- **Ungrammatical** at known non-left edges
  – *Stem-medial:* *(árm. y) *(M(H)
  – *Level 1 suffix:* *(má.gic+ al) *(MM(H)
  – *Level 2 suffix:* *(dó+ able) *(MM(H)
  – *Level 3 suffix:* *(éat+ ing) *(MH)

•I noticed glottalisation in my recordings, so I went and asked speakers for judgments informally. That's where this data comes from - really I would like to do a more formal experiment. And I'm showing glottalisation with a glottal stop, but really it comes out as pulses.

•NOTE AFTER WORKSHOP PRESENTATION: It turns out that in 1988 Adam Brown had already observed that such glottalisation is extremely common in Singaporean English.

   •This is grammatical at the beginning of a stem, where there really should be a p-word left edge.

   •It's not grammatical in some places where we're pretty sure there is no p-word left edge, like stem-medially and before suffixes. In fact the speakers will stare at you and say things like, "Are you still talking?"

•So now let's take this test and look at some places where we don't know if there is a p-word left edge.

Stems: Left PWd edge?

- Stem with initial **stressed** syllable
  - *Initial:*   ár.my)   (M H)
  - *Medial:*   árm. y)   *(M(H)
- Stems with initial **unstressed** syllable
  - *Initial:*   a.nnóy)   (L H)
  - *Medial:*   * ann. óy)   *(L(H)

> **Generalisations**
> 1. A bare stem is a single PWd, e.g. (ár.my), (in.stáll).

•We already looked at stress-initial. Now let's look at stems which don't start with a stress like *annoy* and *accuse*. You can't break them up with glottalisation either. So it looks like we can say <NEXT> that bare stems, whether they start with a stress or not, are single p-words.

Suffixes: Left PWd edge?

- Suffixes cannot form new PWds
  - *Level 1 suffix:*   *(má.gic+ al)   (MM H)
  - *Level 2 suffix:*   *(dó+ able)   (MM H)
  - *Level 3 suffix:*   *(éat+ ing)   (M H)

> **Generalisations**
> 2. A suffixed form is a single PWd, e.g. (éat+ing), (má.gic+al).

And we have already said that a suffixed form is a single p-word.

Prefixes: Left PWd edge?

- **Stressed prefix**
  - *Initial:*   ún)+a.fráid)   (H) LH)
  - *Medial:*   ún)+   a.fráid)   (H)(LH)

Generalisations

3. A stressed prefix creates adjacent PWds, e.g. (ún)+(a.fráid).

What happens with prefixes? For stressed prefixes, <NEXT> you can have glottalisation before the prefix, and <NEXT> you can also have it before the stem. It looks like there is one to match each high tone. So we can say <NEXT> that stressed prefixes form adjacent p-words.

Prefixes: Left PWd edge?

- **Unstressed prefix**
  - *Initial:*   un+árm)   (L MH)
  - *Medial:*   un+   árm)   (L(MH)

Generalisations

4. An unstressed prefix creates a recursive PWd, e.g. (un+(árm))

For unstressed prefixes, you can get glottalisation before the prefix, and again, you can get glottalisation before the stem. So given that there is only one high tone here, but two places for glottalisation, so it looks like we have a recursive p-word structure.

Compounds: Left PWd edge?

- **Compounds and acronyms** (unfamiliar)
  - *Initial:*   L)M)N)   (H) H) H)
  - *Every]$_{LexWd}$:*   L)   M)   N)   (H)(H)(H)

> **Generalisations**
>
> 5. A compound/acronym creates one PWd for each constituent lexical word, e.g. (L)(M)(N), (éye)(séa).

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Now compounds and acronyms. We know we need to split this into familiar and unfamiliar, so let's look at the unfamiliar ones first. We can get glottalisation for every lexical constituent here, one for every high tone. <NEXT> So it looks like we have adjacent p-word edges here, like with the stressed prefixes.

Frequency effects: Left PWd edge?

- **Familiar compounds and acronyms?**
  - *Initial:*   M)+O+E)   (H) M H)
  - *Every]$_{PWd}$*   ?   M)+   O+E)   ? (H)(M H)
  - *Every]$_{LexWd}$*   */?   M)+   O+   E) */? (H)(M(H)

- **Other familiar forms?**

  Prefixed: L   M H   H   L   M   H
                ? dis+ hó.nest)   ? ún)+ im.pór.tant)

  Phrases: L   H   H   H
               ? is   ít)   ? bóok). óut)

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•Now for familiar compounds and acronyms, speakers really prefer to have glottalisation only initially. But the other forms aren't completely ungrammatical. I actually have the second form in a recording, but most of my consultants said it doesn't sound right somehow. And if you add glottalisation everywhere, it seems to sound even less right.

•So let's focus on the form they actually produce, which is the first one. This implies a recursive p-word structure. And this is funny, because we had adjacent p-words for affixed forms. And you would expect familiar compounds to behave something like affixed forms.

•So I went looking for familiar affixed forms. And if you look at some VERY VERY common affixed forms - there aren't many - medial glottalisation is not sharply ungrammatical, but it does sound a little unnatural. Not so bad as the familiar compounds and acronyms. So that sounds promising!

•In familiar phrases you can see a similar effect. It's especially bad for the invariant question tag *is it*, but glottalisation is generally bad with object pronoun *it.* And when I was recording the military term ***book out***, one of my consultants specifically said that the normal pronunciation runs the two words together - so no medial glottalisation, and in fact resyllabification of /k/. So notice here again, we have multiple high tones, but we don't have enough left edges to match each right edge.

Frequency effects: Left PWd edge?

- **Familiar compounds and prefixed forms:**
  - *Initial:*   M)+O+E)   (H)MH)
  - *Initial:*   N)+R)+I+C)   (H)H)MH)
  - *Initial:*   ún)+im.pór.tant) (H)LMH)

Generalisations

6. A familiar form loses all internal PWd left edges, e.g. (dis+hónest), ((ún)+im.pór.tant), (((N)R)IC).

So it looks like familiar compounds, acronyms and prefixed forms don't have internal left edges. They have recursive structures. And I tried this with a four-letter acronym, *NRIC*, and if you give this the tone pattern for familiar compounds, then medial glottalisation is also rather unnatural, so you have almost the most recursive structure you could get.

Outline

- Tests for prosodic word edges
  - Right edge: high boundary tone
  - Left edge: optional glottalisation
  - **Generalisations**
- Analysis

So we are ready to make generalisations now.

Generalisations

1. A bare **stem** is a single prosodic word, e.g. (á.pple), (in.stáll).

2. A **suffixed** form is a single prosodic word, e.g. (éat+ing), (mágic+al).

3. A **stressed prefix** creates adjacent prosodic words, e.g. (ún)+(a.fráid).

4. An **unstressed prefix** creates a recursive prosodic word, e.g. (un+(árm)).

The general tendency is for ...

Generalisations

5. An **compound/acronym** creates one prosodic word for each constituent lexical word, e.g. (L)(M)(N), (éye)(séa).

6. A **familiar form** loses all internal PWd left edges, e.g. (dis.hónest), ((ún)im.pór.tant), ((M)OE), (((N)R)IC).

7. A **familiar compound** terminates in a trochee if it can be created by destressing the final syllable and losing a PWd right edge, e.g. íce cream, ÍC), Ń)T)ÚC.

Outline

- ~~Tests for prosodic word edges~~
- **Analysis**
  - Constraints
  - Crucial ranking
  - Future work

Constraints: Prosodic hierarchy

- **<u>Exhaustivity(C_i):</u>** Each element of category C_i should consist exclusively of elements of category C_{i-1}. Assign one violation otherwise. E.g. PPh can contain only PWds.

- **<u>NonRecursivity(C_i):</u>** Assign one violation if any prosodic element of category C_i contains an element of the same category. E.g. No nested PWds.

(Selkirk 1995)

Exhaustivity is the same as **Don't skip levels**.

Constraints: Alignment

- **PW=Lex:** Each prosodic word should enclose exactly one lexical word. Assign one violation otherwise.
  - Conjunction of **Anchor (PWd$_i$, LexWd$_j$, L)** and **Anchor (PWd$_i$, LexWd$_j$, R)** (McCarthy 2003).

[[sys.tem]a.tic]	PWd=Lex
☞ a. (sýs.te.má.tic)	
b. (sýs.tem)(á.tic)	*!

I use Anchor, but you could phrase things the same way with alignment constraints.

Constraints: Alignment

- **$_{PW}$[Stem:** The left edge of each stem should be aligned with the left edge of a prosodic word. Assign one violation otherwise.
  - **Anchor (Stem, PWd, L)** (McCarthy 2003).

[un[árm]]	$_{PW}$[Stem	NonRecurs(PW)
☞ a. (un(árm))		*
b. (un.árm)	*!	

Constraints: Alignment

- _{PW}]**Stem:** The left edge of each stem should be aligned with the right edge of a prosodic word. Assign one violation otherwise.
  - **D-Anchor (Stem, PWd, L)** (McCarthy 2003).

[dis[a.grée]]	_{PW}]Stem	NR(PW)	PW=Lex
☞ a. ((dís)a.grée)		*	*
b. (dís.a.grée)	*!		

Constraints: Stress

- **Stress:** This is a cover constraint requiring stress as reported by Tongue (1974) and Bao (2006); one violation otherwise.
  - Includes clash, lapse, paradigm uniformity effects
  - Does not distinguish primary and secondary stress

[[psychologi]cal]	Stress
☞ a. psy.chó.lo.gi.cal	
b. psý.cho.ló.gi.cal	*!

Constraints: Frequency effects

- **Fu̱se[$_{PW}$]:** Assign one violation for each internal left PWd edge in domain X.
  - Applies only to frequent forms (indexed constraint or a cophonology ranking).
  - Would Peperkamp's (1997) **Wrap(X$_0$,fam)** be better?

[[M][O][E]]	Fuse[$_{PW}$	$_{PW}$[Stem	$_{PW}$]Stem
☞ a. ((ém)ó.i)		**	*
b. (ém)(ó.i)	*!		

•Note that $_{PW}$]Stem is necessarily too low-ranked to solve the problem with Wrap.

Constraints: Frequency effects

- **NonFinality:** Assign one violation if the last syllable of domain X is stressed.
  - The usual version of this constraint forbids only primary stress, not secondary stress.

[[M][O][E]]	NonFinality	Stress
☞ a. ((ém)ó.i)		*
b. ((ém)ó.í)	*!	

Crucial rankings

NonFinality

Stress   Exh(PPh)

Exh(PW)   Fuse[$_{PW}$

$_{PW}$]Stem $_{PW}$[Stem

PW=Lex   NonRecursivity (PW)
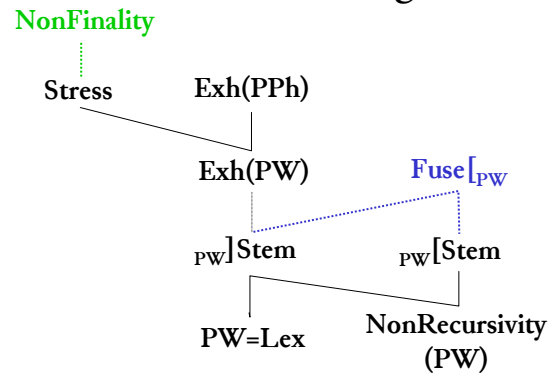
Conclusions

- PWd alignment can account for
  - Previously observed **tone** patterns
  - Newly observed **glottalisation** effects
  - **Variation**, e.g. in stressed suffixes and familiar forms

Future work

- **Currently in progress**
  - Tone assignment
  - Tonogenesis
  - Correlates of stress

- **Continuing from this project**
  - Frequency effects:
    - familiar compounds, optional glottalisation
  - PWd alignment:
    - function words, idioms, discourse particles

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Appendices

1. Data collection
2. Stress – preliminary analysis
3. Tone – minimal triplet + 1
4. Glottalisation - word-initial and -medial
5. Tableau - PWd alignment of compounds and affixed forms

1. Data collection

1.1. Recording from script

- *Speakers:* 5 females and 2 males, all lifelong Chinese residents of Singapore.
- *No. of targets/tokens:* 5 speakers read all 238 target words twice, 2 read it once.

Sample of script
1.   NEVER order IC from Katong lah.
2.   ALWAYS order Helpful from Punggol lah.
3.   BETTER order Locate from Jurong lah.

- *Most target words* were presented as imaginary brand names. Speakers were asked to pretend they were common brands such as Colgate.
- *Idioms* were presented in conversation fragments.
- *Presentation:* The experimenter asked "Can order ah?" before the speaker replied with each sentence read from the paper script.
- *Register:* Informally but clearly, as if to a deaf aunty.
- *Discards and repetition:* Speakers were free to repeat tokens if they had stumbled the first time, but were asked not to emphasise the correction.
- *Focus:* Speakers were instructed to emphasise only the words in capitals.
- *Equipment:* Marantz PMD671 solid state recorder, Shure SM10A microphone.
- *Phonetic analysis* was carried out using Praat.

- *Note:* I have listened to all this data but have not finished transcribing it. Also, I have taken into account data from another experiment with a similar script on PowerPoint slides (*ALI say cannot order ___ from Katong one. No standard*).

1.2. Grammaticality judgments: optional glottalisation

- *Consultants:* Three Singaporeans in New Haven and two living in Singapore.
- *Presentation:* Experimenter produced the target forms twice in isolation and in frames, e.g. *Go MOE lah!* Consultant requested repetitions as necessary.
- *Target forms:* 30 target words were tested with as many glottalisation patterns as possible. MOE was tested with two tone patterns as well.
- *Number of tokens:* Only one consultant judged all forms, because sessions were kept short to limit confusion. Other consultants were only asked to judge several of the forms for which the first speaker and I shared very clear grammaticality judgments. Everyone was asked to judge all MOE forms and other doubtful forms, repeating a few to check consistency.

2. Stress - preliminary analysis

A preliminary analysis for stress was carried out on part of the data from the aforementioned production experiment.

- *Number of tokens:* 41 tokens over three speakers (two male, one female).
- *Measurements:* Average & maximum intensity, consonant & vowel duration. Vowels judged by periodicity. Voice onset time considered part of consonant.
- *Conditions held constant:* tone (mid), syllable structure (CV), vowel (within the pair), word (adjacent syllables were paired).
- *Criterion for classification as stressed vs. unstressed:* Tone patterns. If the initial syllable was M, the first and third syllables were classified as stressed, and the second as unstressed. If L, the opposite. Tones verified from pitch tracks.

economy	minimum	psychology	technology	photography
economics	minimise	psychological	technological	wikipedia
economical	minimisation	psychologically	technologically	

- *Results:* A paired t-test finds that stressed and unstressed syllables differ significantly in average and maximum intensity and vowel duration (p = 0.000) and in consonant duration (p = 0.004).

3. Tone - minimal triplet + 1

- These were produced by a male speaker during his first repetition. The scale is constant. The pitch range shown is 50-250 Hz.

cannot   order   **I**   **see**   from   Jurong   lah

never   order   **I**   **C**   from   Katong   lah

cannot   order   **i**   **cy**   from   Punggol   lah

never   order   **eye**   **sea**   from   Punggol   lah
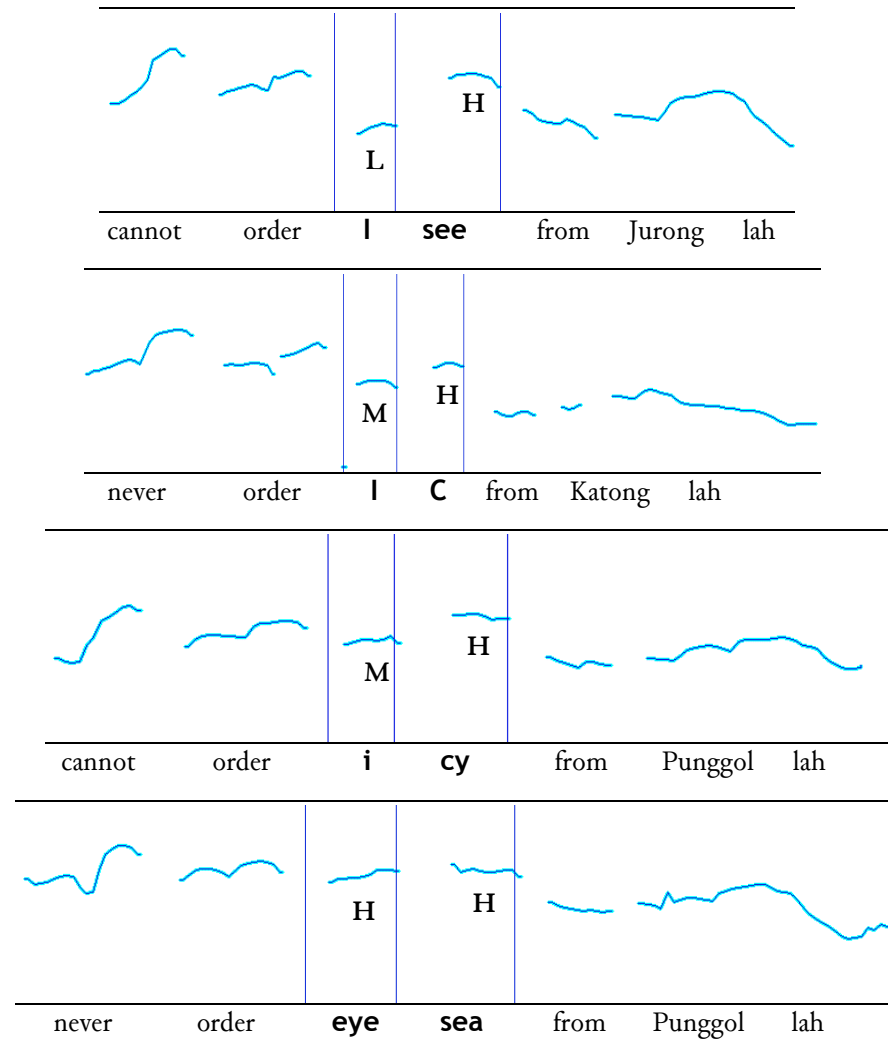
4. Glottalisation

- These were produced by the same male speaker during the same repetition. The time scale is identical to that used in the previous pitch tracks.

4.1. Initial

ALWAYS   order   unlucky   from   Punggol   lah

4.2. Medial

R   order   re   allocate   from   Katong   lah

4.3. Initial and medial

CANNOT   order   R   I   from   Katong   lah
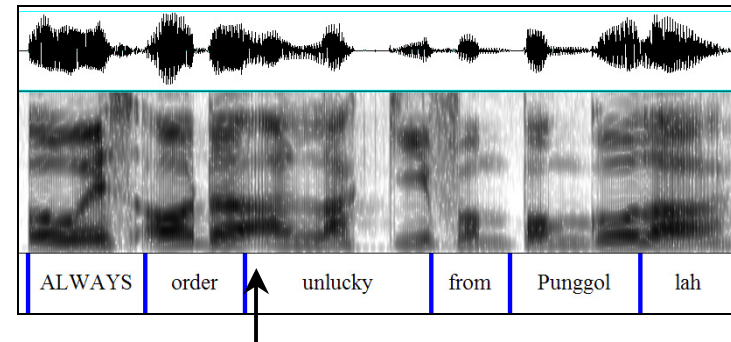
5. Parsing into prosodic words

Note that the stress patterns tested are quite limited.

STEMS

1. [a.nnounce]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (a.nnóunce)	/	-	-	/	/	*	/	/	/
a. (a(nnóunce))	/	-	-	/	/	*	/	W*	W*

2. [kin.der.gar.ten]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (kín.der.gár.ten)	/	-	-	/	/	/	/	/	/
a. (kín.der.gar.ten)	/	-	-	W*	/	/	/	/	/
b. (kín.der)(gár.ten)	/	-	-	/	/	/	/	/	W*

PREFIXED FORMS

3. [un[arm]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (un(árm))	/	-	-	/	/	*	*	*	/
a. (un.árm)	/	-	-	W*	*	*		L	/
b. un(árm)	W*	-	-	/	/	L	*	L	/
c. (ún)(árm)	/	-	-	W*	/	L	L	L	W*

4. [un[a.fraid]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (ún)(a.fráid)	/	-	-	/	/	*	/	/	*
a. ((ún)a.fráid)	/	-	-	W*	*	/		W*	*
b. (ún.a.fráid)	/	-	-	/	W*	*	W*	/	L
c. (ún(a.fráid))	/	-	-	/	/	*	W*	W*	L
d. (ún.a)(fráid)	/	-	-	/	W*	L	W*	/	W**

5. [an.ti[English]]

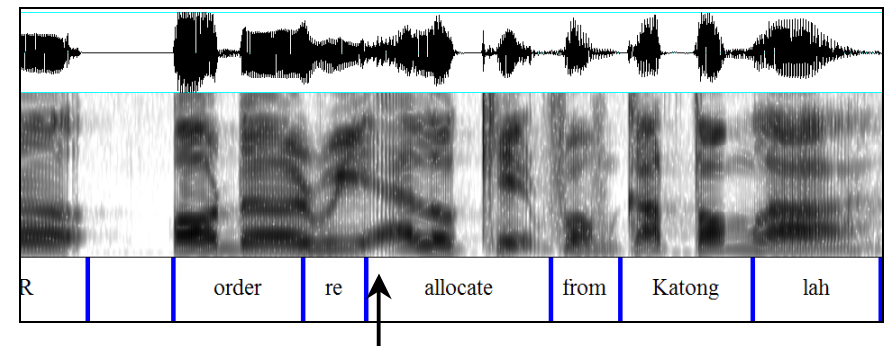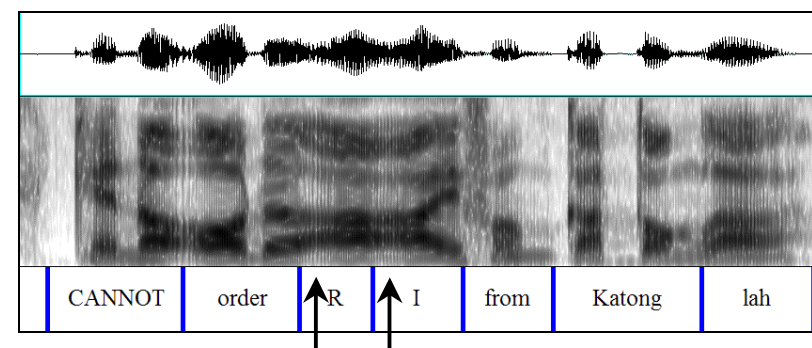|	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (án.ti)(Én.glish)	/	-	-	/	/	/	/	/	*
a. (án.ti.Én.glish)	/	-	-	W*	/	/	W*	/	L
b. (án.ti(Én.glish))	/	-	-	/	/	/	W*	W*	L
c. ((án.ti)Én.glish)	/	-	-	W*	/	/	W*	/	*

SUFFIXED FORMS

6. [[or.der]ing]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (ór.der.ing)	/	-	-	/	/	/	/	/	/
a. ((ór.der)(íng))	/	-	-	W*	/	/	/	W*	W*
b. (ór.der)ing	W*	-	-	/	/	/	/	/	/

7. [[sys.tem]a.tic]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (sýs.te.má.tic)	/	-	-	/	/	/	/	/	/
a. (sýs.te.ma.tic)	/	-	-	W*	/	/	/	/	/
b. (sýs.tem)(á.tic)	/	-	-	/	/	/	/	/	W*
c. ((sýs.tem)á.tic)	/	-	-	/	/	/	/	W*	/

8. [[[psy.cho.lo.gi]cal]ly]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (psy.chó.lo.gi.cál.ly)	/	-	-	/	/	*	/	/	/
a. (psy.chó.lo.gi)(cál.ly)	/	-	-	/	/	*	/	/	W*
b. (psy.chó.lo.gi.cál)ly	W*	-	-	/	/	*	/	/	/
c. (psý.cho.ló.gi.cál.ly)	/	-	-	W*	/	L	/	/	/

9. [[colour]ful]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (có.lour.ful)	/	-	-	/	/	/	/	/	/
a. (có.lour)(fúl)	/	-	-	W*	/	/	/	/	W*
b. ((có.lour)ful)	/	-	-	/	/	W*	/	W*	/
c. (có.lour.fúl)	/	-	-	W*	/	/	/	/	/

10. [[spoon][full]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (spóon)(fúl)	/	-	-	/	/	/	/	/	/
a. (spóon.fúl)	/	-	-	/	W*	/	W*	/	/
b. ((spóon)ful)	/	-	-	W*	W*	W*	W*	W*	/
c. (spóon.ful)	/	-	-	W*	W*	/	W*	/	/

CPDS/ACRONYMS

11. [[L][M][N]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (él)(ém)(én)	/	-	-	/	/	/	/	/	/
a. (él.ém.én)	/	-	-	/	W**	/	W**	/	/
b. ((él)ém.én)	/	-	-	/	W**	/	W*	W*	/
c. (él(ém(én)))	/	-	-	/	/	/	W**	W**	W*

12. [[corn][belt]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (córn)(bélt)	/	-	-	/	/	/	/	/	/
a. ((córn)bélt)	/	-	-	/	W*	/	/	W*	/
b. (córn.bélt)	/	-	-	/	W*	/	W*	/	/
c. (córn(bélt))	/	-	-	/	/	/	W*	W*	/

FREQUENCY EFFECTS

13. [[grand][father]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ ((gránd)fá.ther)	/	/	/	/	*	/	/	*	/
a. (gránd.fá.ther)	/	/	/	/	*	/	W*	L	/
b. (gránd)(fá.ther)	/	W*	/	/	L	/	/	L	/
c. (gránd(father))	/	W*	/	/	L	/	W*	*	/

14. [[ice][cream]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ (íce.cream)	/	/	/	*	*	/	*	/	/
a. (íce.créam)	/	/	W*	L	*	/	*	/	/
b. ((íce)cream)	/	/	/	*	*	W*	L	W*	/
c. ((íce)créam)	/	/	W*	L	*	/	L	W*	/
d. (íce)(créam)	/	W*	W*	L	L	/	L	/	/
e. (íce(créam))	/	W*	W*	L	L	/	*	W*	/

15. [[M][O][E]]

	Ex(PPh)	Fs[PW	NF	Str	PW[St	Ex(PW)	PW]St	NR(PW)	PW=Lex
☞ ((ém)ó.i)	/	/	/	*	**	/	*	*	/
a. (ém)(ó.i)	/	W*	/	*	L	/	L	L	/

b. ((ém)ó.í)	/	/	W*	L	**	/	*	*	/
c. (ém.ó.i)	/	/	/	*	**	/	W**	L	/
d. (ém.ó.í)	/	/	W*	L	**	/	W**	L	/
e. (((ém)ó)ì)	/	/	/	*	**	W*	L	W**	W*
f. (((ém)ó)í)	/	/	W*	L	**	/	L	W**	W*
g. (ém)(ó)(í)	/	W**	W*	L	L	/	L	L	/
h. (ém(ó(í)))	/	W**	W*	L	L	/	W**	W**	W*

16. [[N][R][I][C]]	Ex(PPH)	Fs[PW	NF	STR	PW[ST	Ex(PW)	PW]ST	NR(PW)	PW=Lex
☞ (((én)á)áɪ.si)	/	/	/	*	***	/	*	**	*
a. (((én)á)áɪ.sí)	/	/	W*	L	***	/	*	**	*
b. (én)(á)(áɪ)(sí)	/	W***	W*	L	L	/	L	L	L
c. (én)(á)(áɪ.si)	/	W**	/	*	L*	/	*	L	*
d. (én)(á)(áɪ.sí)	/	W**	W*	L	L*	/	*	L	*

17. [dis[honest]]	Ex(PPH)	Fs[PW	NF	STR	PW[ST	Ex(PW)	PW]ST	NR(PW)	PW=Lex
☞ (dis.hó.nest)	/	/	/	/	/	W*	*	/	/
a. (dis(hó.nest))	/	W*	/	/	W*	W*	*	W*	/
b. dis(hó.nest)	W*	W*	/	/	/	/	*	/	/
c. (dís)(hó.nest)	/	W*	/	W*	/	/	L	/	W*
d. (dís.hó.nest)	/	/	/	W*	W*	/	*	/	/

18. [dis[a.gree]]	Ex(PPH)	Fs[PW	NF	STR	PW[ST	Ex(PW)	PW]ST	NR(PW)	PW=Lex
☞ ((dís)a.grée)	/	/	*	/	*	W*	/	*	*
a. (dis.a.grée)	/	/	*	W*	*	W*	W*	L	L
b. (dís.a.grée)	/	/	*	/	*	/	W*	L	L
c. (dís)(a.grée)	/	W*	*	/	L	W*	/	L	*
d. dis(a.grée)	W*	W*	*	W*	L	W*	W*	L	L
e. (dís(a.grée))	/	W*	*	/	L	W*	W*	W*	L