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VARIATION AND OPACITY IN SINGAPORE ENGLISH

1. Introduction

(1) Acknowledgements: This talk is based on Anttila, Fong, Benus, and Nycz 2004, in progress. Help from K.P. Mohanan and Tara Mohanan was essential.

(2) What motivates consonant cluster processes?
  a. Syllable structure (e.g. Blevins 1995, Borowsky 1986, Itô 1988, Steriade 1982).
  b. The perceptibility of place cues in stops (Côté 2000, 2004, Flemming 2005, Hume 1998, Labov 1997, Steriade 2001).

(3) This talk: How does a language choose among cluster processes?

(4) Resolving an /sp/-cluster

MARKEDNESS	No *sp*-clusters.
LIN(EARITY-IO)	The linear order of input segments must be preserved in the output (McCarthy and Prince 1995)
MAX-IO(C)	No consonant deletion (McCarthy & Prince 1995)
DEP-IO(V)	No vowel epenthesis (McCarthy & Prince 1995)

/lisp/	MARKEDNESS	LIN-IO	MAX-IO(C)	DEP-IO(V)
lisp	*			
lips		*		
lis			*	
lisəp				*

(5) But how about languages with multiple cluster processes?
  a. Which cluster process is chosen in which environment?
  b. Is the choice always deterministic or is there variation and preferences?
  c. Does the variation arise within or across individuals?
  d. How do the different cluster processes interact?
  e. Does morphology play a role in the choice of cluster process?

(6) Singapore English: Bao (1998), Mohanan (1992), Poedjosoedarmo (2000), Tay (1982). Mohanan (1992) identifies five cluster processes.

(7) Plosive Deletion: Delete a plosive in a coda if it is preceded by an obstruent.
  a. *li*[sp] → *li*[s] 'lisp'
  b. *li*[ft] → *li*[f] 'lift'
  c. *te*[st] → *te*[s] 'test'
  d. *a*[kt] → *a*[k] 'act'

(8) Voicing Assimilation: An obstruent becomes voiceless when adjacent to a voiceless obstruent in the same syllable.

a. *se*[t-z] → *se*[ts] 'sets'

b. *ba*[g-z] → *ba*[gz] 'bags'

(9) Epenthesis: Insert a [ə] between tautosyllabic consonants if they share the same manner and primary place of articulartion.

a. *rai*[z-z] → *rai*[zəz] 'raises'

b. *hi*[s-z] → *hi*[ss] → *hi*[səs] 'hisses'

(10) Metathesis: [sp] becomes [ps] in the coda.

	Dialect A	Dialect B	
a.	*li*[sp] → *li*[ps]	*li*[sp] → *li*[ps]	'lisp'
b.	*li*[sp]*ing* → *li*[sp]*ing*	*li*[sp]*ing* → *li*[ps]*ing*	'lisping'

(11) Degemination: If a consonant is preceded by an identical consonant in the same syllable, delete it.

a. *li*[sts] → *li*[ss] → *li*[s] 'lists'

b. *li*[sp-z] → *li*[pss] → *li*[ps] 'lisps'

(12) The processes involve VARIATION. Examples:

a. Metathesis dialects A and B. Note that dialect B has a Metathesis process:
li[sp-z] → *li*[pss] → *li*[ps] 'lapses'
la[ps-z] → *la*[psəs] 'lisps'

b. Metathesis vs. Deletion environments overlap and the choice appears to depend on the speaker: *li*[sp] → *li*[ps] vs. *li*[sp] → *li*[s]

(13) The processes involve OPACITY. Examples:

a. Epenthesis counterbleeds Voicing Assimilation: /his-z/ → *hiss* → *hisəs*

b. Metathesis counterfeeds Epenthesis: /grasp-z/ → *grapss* → *graps*

c. Deletion counterbleeds Metathesis: /lisp/ → *lips*

(14) Rule ordering: Voicing Assimilation < Epenthesis < Metathesis < Deletion.

(15) The ordering of cluster processes in Educated Singapore English (Mohanan 1992)

	a. /list-z/	b. /his-z/	c. /grasp-z/	d. /lisp/	e. /læps-z/
Vc. Assim.	lists	hiss	grasps	--	læpss
Epenthesis	--	hisəs	--	--	læpsəs
Metathesis	--	--	grapss	lips	--
Deletion	liss	--	--	--	--
Degeminat.	lis	--	graps	--	--
	[lis]	[hisəs]	[graps]	[lips]	[læpsəs]
	'lists'	'hisses'	'grasps'	'lisp'	'lapses'

(16) Two additional opacities are correctly predicted:
  a. Deletion counterfeeds Epenthesis: /list-z/ → *lists* → *liss* → *lis*
  b. Degemination counterbleeds Epenthesis: /his-z/ → *hiss* → *hi*[səs]

(17) This talk: an empirical study of consonant clusters in Singapore English, focusing on Metathesis. Data: 710 /sp/-clusters elicited from 56 speakers

(18) Metathesis is interesting for a number of reasons:
  a. Metathesis exhibits extensive variation across speakers.
  b. Metathesis interacts opaquely with both earlier and later processes.
  c. Metathesis is a relatively rare process compared to e.g. plosive deletion which occurs in almost all varieties of English (Guy 1991a,b).
  d. Metathesis is easy to hear.

(19) Main results:
  a. The typological and quantitative patterns follow from a small number of constraints, independently of their ranking.
  b. The observed patterns of opacity are problematic for Stratal Optimality Theory (see e.g. Kiparsky 2000).

(20) Outline:
  a. Describe the elicitation test and the 8 cluster processes.
  b. Show that the quantitative variation patterns are entirely natural and follow directly from the constraints (t-order).
  c. Show that Metathesis is a word-level process and how that is problematic for Stratal Optimality Theory (see e.g. Kiparsky 2000).

2. Procedure

(21) The stimuli: /sp/ clusters in 8 environments read by 56 NUS undergraduates

	NEXT WORD	
NEXT SEGMENT	V-INITIAL	C-INITIAL
#V	*Say* lisping *again*	*Say* lisping *my way*
##	*Say* lisp *again*	*Say* lisp *my way*
#C = /z/	*Say* lisps *again*	*Say* lisps *my way*
#C = /d/	*Say* lisped *again*	*Say* lisped *my way*

(22) Procedure:
  a. 8 examples × 56 speakers × 2 repetitions = 896 tokens. Only 883 obtained.
  b. Annotated by two transcribers with the aid of PRAAT (Boersma & Weenink 1996). Only tokens where transcibers agreed were included.
  c. Of the remaining tokens, we included only those that occurred ≥ 10 times.

Result: 710 remaining tokens which cover about 80% of the elicited data.

(23) Evidence for eight cluster processes:

a.	Metathesis	/lisp/ → *li*[ps]	Reordering processes
b.	Copy	/lisp#ing/ → *li*[psp]*ing*	
c.	Fricativization	/lisp/ → *li*[fs]	Lenition processes
d.	Place Assimilation	/lisp#z/ → *li*[ts]	
e.	*t/d*-Deletion	/lisp#d/ → *li*[sp]	
f.	*p*-Deletion	/lisp#d/ → *li*[st]	
g.	*s*-Deletion	/lisp#z/ → *li*[sp]	
h.	Degemination	/lisp#z/ → *li*[ps]	

3. Variation

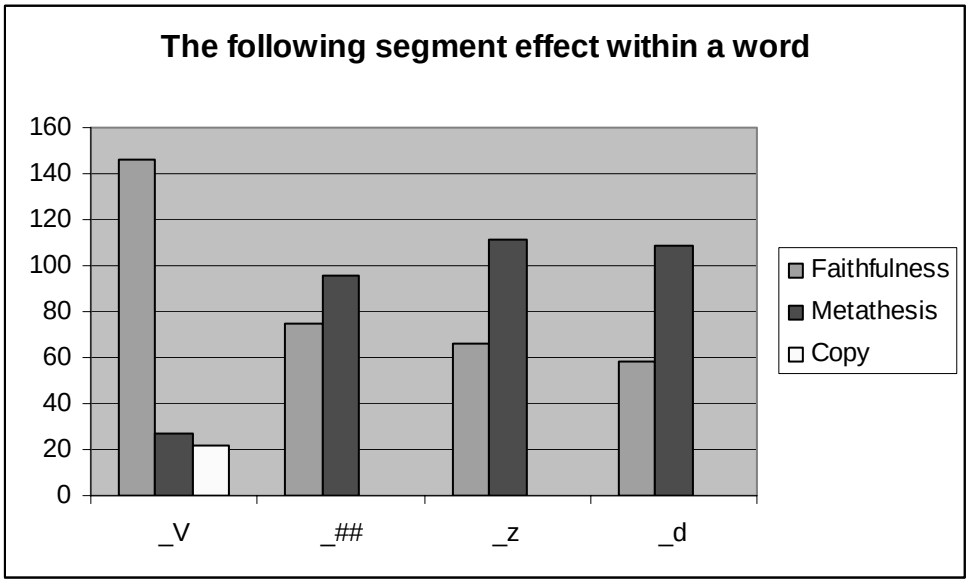
3.1 Empirical generalizations

(24) The following segment effect within a word (aggregate data)

	_#V lisp#ing		_## lisp##		_#z lisp#z		_#d lisp#d	
Faithful + no lenition	*lisping*	146	*lisp*	75	*lisps*	53	*lispt*	37
Faithful + *p*-Deletion	--						*list*	11
Faithful + *t/d*-Deletion							*lisp*	10
Faithful + *s*-Deletion	--		--		*lisp*	13	--	
Faithful total		**146**		**75**		**66**		**58**
Metathesis + no lenition	*lipsing*	27	*lips*	84	*lipss*	18	*lipst*	95
Metathesis + Degemination	--		--		*lips*	68	--	
Metathesis + Assimilation	--		--		*lits*	10	--	
Metathesis + Fricativization	--		*lifs*	12	*lifs*	15	--	
Metathesis + *t/d*-Deletion	--		--		--		*lips*	14
Metathesis total		**27**		**96**		**111**		**109**
Copy	*lipsping*	22	--		--		--	
Copy total		**22**	--		--		--	

(25) The following segment effect within a word (aggregate data), simplified

	_#V lisp#ing	_## lisp##	_#z lisp#z	_#d lisp#d	TOTAL
Faithful	74.9% (146)	43.9% (75)	37.3% (66)	34.7% (58)	(345)
Metathesis	13.8% (27)	56.1% (96)	62.7% (111)	65.3% (109)	(343)
Copy	11.3% (22)	--	--	--	(22)
TOTAL	100% (195)	100% (171)	100% (177)	100% (167)	(710)



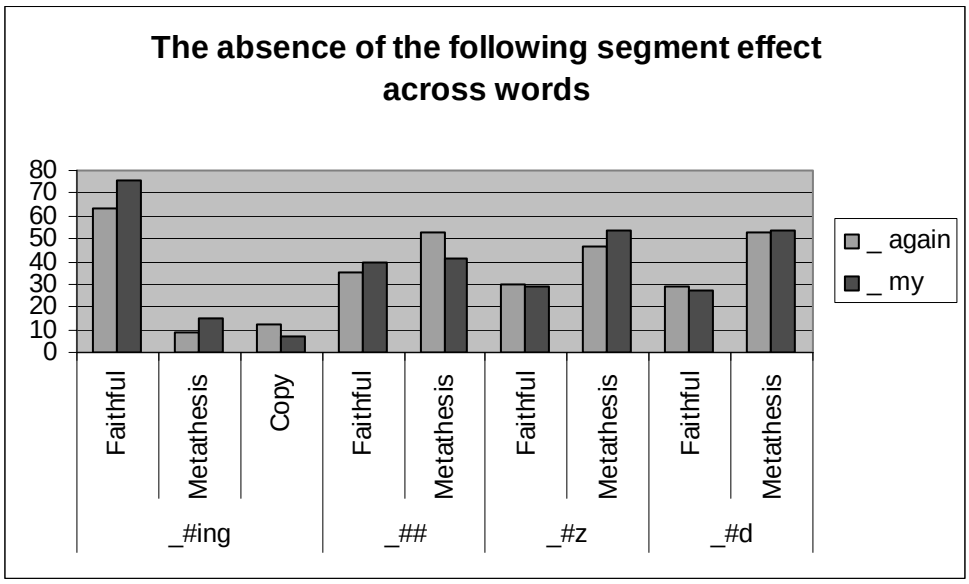
(26) Observations

a. The faithful order is more likely before vowels than before consonants.
b. Word boundaries fall in between, but pattern more like consonants.
c. Copy is only possible before vowels.

Vowel vs. consonant: $p < 0.0001$; Vowel vs. word boundary: $p < 0.0001$; word boundary vs. consonant: $p = 0.1023$; /z/ vs. /d/: $p = 0.6540$ (Fisher's Exact Test, two-tailed).

(27) The absence of the following segment effect across words (aggregate data)

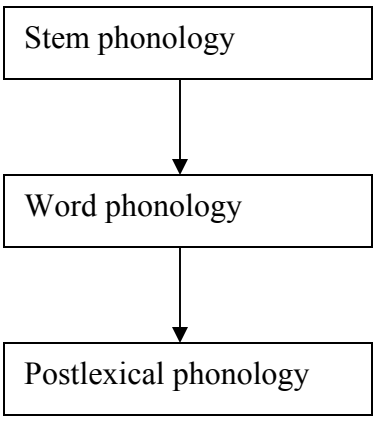
		_ again	_my way
_#V lisp#ing	Faithful	63	76
	Metathesis	9	15
	Copy	12	7
_## lisp##	Faithful	35	40
	Metathesis	53	41
_#C lisp#z	Faithful	30	29
	Metathesis	47	54
_#C lisp#d	Faithful	29	27
	Metathesis	53	54



(28) Observation: The first segment of the next word has no effect on reordering.

lisping again/my, $p = 0.7283$; *lisp again/my*, $p = 0.2193$; *lisps again/my*, $p = 0.6258$; *lisped again/my*, $p = 0.8693$ (Fisher's Exact Test, two-tailed).

(29) Stratal Optimality Theory (Kiparsky 2000; cf. Kiparsky 1982, Mohanan 1986)



(30) A phonological process can only be sensitive to morphosyntactic material introduced at the same level or at an earlier level.

a. Metathesis is sensitive to the vowel vs. consonant distinction within a word, but not across words. Hence Metathesis is lexical, not postlexical.

b. Metathesis is sensitive to the vowel vs. consonant distinction created by word-level suffixes (/#ing/ vs. /#z/, /#d/). Hence Metathesis is a word-level process, not a stem-level process.

(31) Individual patterns. F = Faithful, M = Metathesis, C = Copy

Pattern	Speakers	_ing	_##	_z	_d
A	12	F	F	F	F
B	10	F	M	M	M
C	6	M	M	M	M
D	5	F~C	M	M	M
E	3	C	M	M	M
F	2	M~C	M	M	M
G	2	F	F~M	F~M	M
H	2	F	F	F	M
I	2	F	F	F	F~M
J	2	F	F	F~M	F
K	1	F~M	M	M	M
L	1	F~C	M	-	M
M	1	F~C	F	F	F~M
N	1	F	F~M	M	M
O	1	F	F~M	-	M
P	1	F	F~M	M	F~M
Q	1	F	F~M	F~M	F
R	1	F	F	M	F~M
S	1	F	-	F~M	F~M
T	1	-	M	M	M

(32) Empirical generalizations (individual speakers)

a. If Faithfulness is possible preconsonantally, it is possible elsewhere.
b. If Faithfulness is possible at word boundary, it is possible prevocalically.
c. If Metathesis is possible prevocalically, it is obligatory elsewhere.
d. If Metathesis is possible at word boundary, it is possible preconsonantally.
e. If Copy is possible prevocalically, Metathesis is obligatory elsewhere (1 exception, pattern M).

3.2 The analysis

(33) <u>Assumption</u> (following Côté 2000, Hume 1998, Steriade 2001, among others): If an oral stop surfaces next to a vowel, it enhances the perception of its place cues. [The data provide no evidence for/against the syllabic alternative.]

(34) <u>Prediction</u>: Metathesis should be preferred before consonants and word boundaries, but dispreferred before vowels: /lisp-d/ → *lipst*, /lisp/ → *lips* (improvement), /lisp-ing/ → *lipsing* (no improvement).

(35) <u>Markedness constraints</u>

TV	Obstruent stops occur before a vowel.
TVT	Obstruent stops occur adjacent to a vowel.
*PL(ACE)	Minimise the number of place nodes in a cluster (gradient).

(36) Faithfulness constraints

LIN(EARITY)-IO	The order of input segments is preserved in the output.
UNI(FORMITY)	Input segments are not split in the output.
MAX	No segment deletion.
DEP	No segment epenthesis.

(37) LIN-IO >> TVT yields *lisp*, TVT >> LIN-IO yields *lips*

/lisp/	DEP	MAX	LIN-IO	UNI	TV	TVT	*PL
→ lisp (Faithful)					*	*	**
→ lips (Metathesis)			*		*		**
lipsp (Copy)				*	**	*	***
lis (Deletion)		*!					
lisəp (Epenthesis)	*!				*		

(38) We abstract away from lenition (Fricativization, Deletion, Degemination, Place Assimilation) by assuming that faithfulness constraints MAX, DEP, and IDENT are undominated at the word level.

(39) The opacity problem: Reordering overapplies in /lisp-ing/

/lisp-ing/	LIN-IO	UNI	TV	TVT	*PL
→ lisping (F)					**
? lipsing (M)	*		*		**
? lipsping (C)		*	*		***

(40) The opacity problem persists under the syllable-based analysis

/lisp-ing/	LIN-IO	UNI	*CODA(*sp*)	TVT	*PL
→ li.sping (F)					**
? lip.sing (M)	*				**
? lip.sping (C)		*			***

(41) Solution: Faithfulness among outputs (OO-FAITH) (Benua 1995). If the input is /lisp/ and the base is *lips*, there are three options for /lisp-ing/:

a. Be faithful to the input /lisp/, hence *lisping*.
b. Be faithful to the base *lips*, hence *lipsing*.
c. Be faithful to both /lisp/ and *lips*, hence *lipsping*.

(42) Prediction: Reordering in the prevocalic position should be parasitic to reordering in the base: *lipsing* and *lipsping* should only be possible in dialects where /lisp/ is realised as *lips*. This is (almost) correct, see (32).

(43) LIN(EARITY)-OO The ordering of the segments in the base is preserved in the output.

(44) (a) /lisp-ing/ with base *lisp* (LIN-IO >> TVT)

I: /lisp-ing/ B: *lisp*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
→ lisping (F)						**
lipsing (M)	*		*	*		**
lipsping (C)	*				*	***

(b) /lisp-ing/ with base *lips* (TVT >> LIN-IO)

I: /lisp-ing/ B: *lips*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
→ lisping (F)				*		**
→ lipsing (M)	*		*			**
→ lipsping (C)	*				*	***

(45) (a) /lisp-z/ with base *lisp* (LIN-IO >> TVT)

I: /lisp-z/ B: *lisp*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
→ lisps (F)	*	*				***
→ lipss (M)	*		*	*		**
lipsps (C)	**	*			*	****

(b) /lisp-z/ with base *lips* (TVT >> LIN-IO)

I: /lisp-z/ B: *lips*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
lisps (F)	*	*		*		***
→ lipss (M)	*		*			**
lipsps (C)	**	*			*	****

(46) (a) /lisp-d/ with base *lisp* (LIN-IO >> TVT)

I: /lisp-d/, B: *lisp*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
→ lispt (F)	**	**				***
→ lipst (M)	**	*	*	*		**
lipspt (C)	***	**			*	****

(b) /lisp-d/ with base *lips* (TVT >> LIN-IO)

I: /lisp-d/, B: *lips*	TV	TVT	LIN-IO	LIN-OO	UNI	*PL
lispt (F)	**	**		*		***
→ lipst (M)	**	*	*			**
lipspt (C)	***	**			*	****

3.3 Typological and quantitative predictions

(47) a. What kinds of patterns does the analysis predict to be possible?
b. What kinds of patterns does the analysis exclude as impossible?

(48) Pure combinatorics predicts $3^4 = 81$ logically possible dialects: 4 environments (*_ing*, *_##*, *_z*, *_d*), 3 variants (Faithful, Metathesis, Copy).

(49) Most of these dialects are linguistically unnatural and therefore nonexistent, e.g. *lipsing*, *lisp, lisped, lisps* (M, F, F, F). Such dialects should be ruled out.

(50) Only 5 dialects are predicted (factorial typology computed by OTSOFT):

	_ing	_##	_z	_d
(i)	F	F	F	F
(ii)	F	M	M	M
(iii)	F	F	M	M
(iv)	M	M	M	M
(v)	C	M	M	M

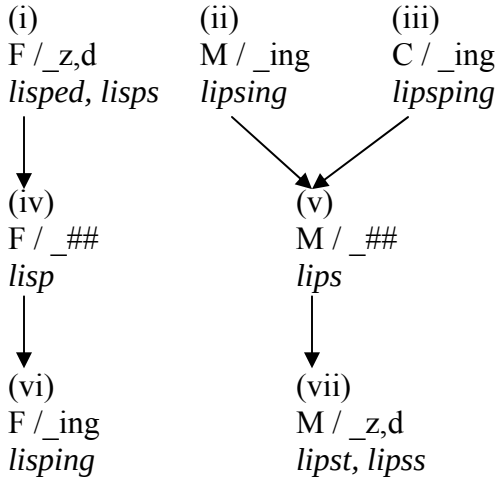
(51) Problem 1: Variation
a. In the aggregate data, reordering is optional in all environments.
b. In 22/56 dialects, reordering is optional in at least one environment.

(52) Problem 2: Quantitative patterns
a. Metathesis rate is higher in _C than in _V.
b. Metathesis rate in _C is higher than Copy rate in _V [etc.]

(53) Assume the Multiple Grammars Theory (Kiparsky 1993, Anttila in press b). A hypothetical variable dialect F~M, F~M, F~M, F~M:

	_ing	_##	_z	_d
(i)	F	F	F	F
(iii)	F	F	M	M
(iv)	M	M	M	M
Metathesis rate:	1/3	1/3	2/3	2/3

(54) t-order



(55) Predictions and observations

(a) Qualitative predictions

	PREDICTED	OBSERVED
(a)	If faithfulness is possible before a consonant, it is possible elsewhere.	True for all dialects.
(b)	If Faithfulness is possible at a word boundary, it is possible prevocalically	True for all dialects.
(c)	If Metathesis is possible before a vowel, it is possible elsewhere.	True for all dialects.
(d)	If Metathesis is possible at a word boundary, it is possible before a consonant.	True for all dialects.
(e)	If Copy is possible before a vowel, Metathesis is possible elsewhere.	1 exception: pattern M
(f)	Copy is only possible prevocalically.	True for all dialects.

(b) Quantitative predictions

	PREDICTED	OBSERVED (AGGREGATE DATA)
(a)	Faithfulness before vowel ≥ Faithfulness at word boundary ≥ Faithfulness before consonant	74.9% ≥ 43.9% ≥ 36.0%
(b)	Metathesis before consonant ≥ Metathesis at word boundary ≥ Metathesis before vowel	64.0% ≥ 56.1% ≥ 13.8%
(c)	Metathesis at word boundary ≥ Copy before vowel	56.1% ≥ 11.3%
(d)	The quality of the following consonant (/d/ vs. /z/) has no effect on Metathesis.	True in the aggregate data, but only for 43/56 = 77% of the individual dialects.

(56) Recall and precision:
a. How many of the observed dialects are predicted (= recall)?
b. How many of the predicted dialects are observed (= precision)?

(57) Predictions and observations: 34 invariant speakers

	_ing	_##	_z	_d	
(i)	F	F	F	F	(A, 12 speakers)
(ii)	F	M	M	M	(B, T, 11 speakers)
(iii)	F	F	M	M	--
(iv)	M	M	M	M	(C, 6 speakers)
(v)	C	M	M	M	(E, 3 speakers)
	F	F	F	M	(H, 2 speakers)

(58) One dialect is observed, but not predicted (Dialect H).

a. The two preconsonantal environments in H differ, whereas we predict that all preconsonantal environments should behave identically.

b. In the aggregate data, no statistically significant difference between the consonants was found, but dialect H does not match the generalization.

c. The 5 predicted dialects cover 94% (32/34) of the invariant speakers.

(59) One dialect is predicted, but not observed (F F M M).

(60) Predictions and observations: 22 variable speakers

	_ing	_##	_z	_d	
(i)	F	F~M	F~M	F~M	(S, 1 dialect)
(ii)	F	F	F~M	F~M	--
(iii)	F~M	F~M	F~M	F~M	--
(iv)	F~C	F~M	F~M	F~M	--
(v)	F	F~M	M	M	(N, O, 2 speakers)
(vi)	F~M	M	M	M	(K, 1 speaker)
(vii)	F~C	M	M	M	(D, L, 6 speakers)
(viii)	F~M	F~M	M	M	--
(ix)	F~C	F~M	M	M	--
(x)	M~C	M	M	M	(F, 2 speakers)
(xi)	F~M~C	F~M	F~M	F~M	--
(xii)	F~M~C	M	M	M	--
(xiii)	F~M~C	F~M	M	M	--
	F	F~M	F~M	M	(G, 2 speakers)
	F	F	F	F~M	(I, 2 speakers)
	F	F	F~M	F	(J, 2 speakers)
	F~C	F	F	F~M	(M, 1 speaker)
	F	F~M	M	F~M	(P, 1 speaker)
	F	F~M	F~M	F	(Q, 1 speaker)
	F	F	M	F~M	(R, 1 speaker)

(61) 7 dialects are observed, but not predicted (Dialects G, I, J, M, P, Q, R).

a. Again, the main problem is that the two preconsonantal environments differ, whereas we predict that they should behave identically.

b. In the aggregate data, no statistically significant difference between the consonants was found. This seems a sparse data problem: the maximum number of tokens per cell in each individual dialect is only 4 per speaker.

c. The 13 predicted dialects only cover 55% (12/22) of the speakers.

(62) Eight dialects are predicted, but not observed.

(63) Conclusion:

a. Perceptual constraints (TV, TVT) and OO-FAITH yield predictions that closely approximate the variable segment reordering effects in Singapore English, typologically as well as quantitatively (in the aggregate data).

b. The quantitative predictions are ranking-independent and follow from the constraints (= t-order).

4. Opacity

(64) Consequences for Stratal Optimality Theory (Kiparsky 2000, 2003; see also McCarthy & Prince 1993, Bermúdez-Otero 1999, Rubach 2000, Kenstowicz 1995, Kiparsky 2000, Itô & Mester 2002).

a. Stems, words, and phrases are subject to distinct rankings.

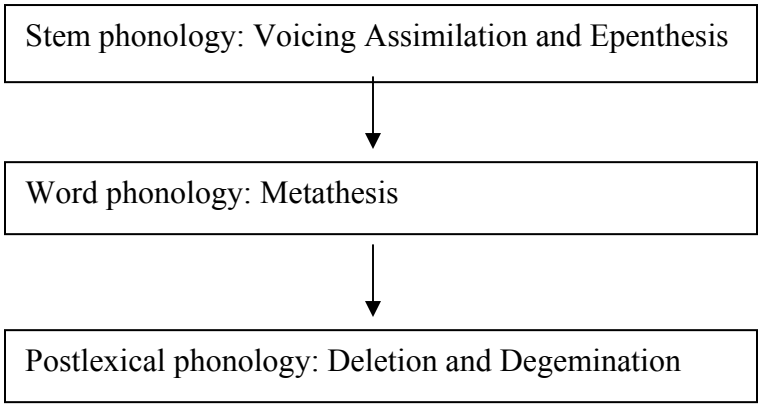
b. Interactions within a level are transparent (feeding, bleeding); interactions across levels may be opaque (counterfeeding, counterbleeding).

(65) There should be at most two layers of opacity:

a. Stem-level processes may be rendered opaque by word-level and postlexical processes

b. Word-level processes may be rendered opaque by postlexical processes.

(66) We have evidence that Metathesis is a word-level process. Putting this together with Mohanan's (1992) analysis, we get the following picture:



(67) Predictions

a. Voicing Assimilation and Epenthesis should interact transparently and be sensitive only to stem-level morphology.

b. Metathesis should be able to opacify Voicing Assimilation and Epenthesis and be sensitive to both stem-level and word-level morphology.

c. Deletion and Degemination should interact transparently; they should never be opaque; they should be able to opacify all other processes; they should have no morphological or lexical conditions; and they should be sensitive to material across word boundaries.

(68) Project: Combine our new facts with Mohanan's (1992) description of the rest of the system and see what happens. In particular, we can study:
a. Voicing Assimilation-Epenthesis interaction
b. Metathesis-Copy interaction
c. Epenthesis-Metathesis interaction

4.1 The interaction of Voicing Assimilation and Epenthesis

(69) Stratal OT: Voicing Assimilation and Epenthesis should interact transparently. Mohanan (1992): Epenthesis counterbleeds Voicing Assimilation (/his-z/ → *hiss* → *hisəs*).

(70) Alternative description (Tara Mohanan, p.c.): For some speakers,
a. /-z/ is devoiced after vowels and voiceless consonants, e.g. *bee*[s], *hi*[səs], *ro*[zəs], *se*[ts]
b. /-z/ or the entire cluster is optionally devoiced after voiced consonants, e.g. *do*[gz] ~ *do*[gs] ~ *do*[ks].

(71) Advantage: Devoicing (*hi*[səs]) is now transparent, and Voicing Assimilation can thus be demoted to postlexical phonology.

(72) This yields a natural phonological system: all lenition processes are postlexical.

4.2 The interaction of Metathesis and Copy

(73) The *lipsing* / *lipsping* overapplication opacity. Can level ordering capture it?

(74) a. Optional Metathesis at the word level (/lisp/ → *lisp* ~ *lips*)
b. /-ing/ is postlexical (*lisp*-/ing/ → *lisping*, *lips*-/ing/ → *lipsing*), optionally accompanied with Copy (*lipsing* → *lipsping*).

(75) (a) Word level

/lisp/	LIN-IO	UNI	TV	TVT	*PL
→ lisp (Faithful)			*	*	**
→ lips (Metathesis)	*		*		**
lipsp (Copy)		*	**	*	***

(b) Postlexical level, input *lisp*-/ing/

lisp-/ing/	LIN-IO	UNI	TV	TVT	*PL
→ lisping (F)					**
lipsing (M)	*		*		**
lipsping (C)		*	*		***

(c) Postlexical level, input *lips*-/ing/

lips-/ing/	LIN-IO	UNI	TV	TVT	*PL
→ lisping (F)	*				**
→ lipsing (M)			*		**
lipsping (C)		*	*		***

(76) Morphological problem: /-ing/ cannot be postlexical (clitic) because then it should occur outside the plural /-z/, e.g. **lispsing* 'lispings'.

(77) Phonological problem: Copy (*lipsping*) is harmonically bounded by Metathesis (*lipsing*).

4.3 The interaction of Epenthesis and Metathesis

(78) Epenthesis is counterfed by Metathesis (Mohanan 1992):

	/læps-z/	/lisp-z/
Epenthesis	læpsəs	--
Metathesis	--	lipss
	[læpsəs]	[lips] (*[lipsəs])

(79) Our corpus: 111 examples of counterfeeding, 12 examples of feeding ([lipsəs], N = 9, [lifsəs], N = 3).

(80) The counterfeeding problem in classical Optimality Theory

/læps-z/	OCP	DEP	MAX	LIN-IO	UNI	TV	TVT	*PL
a. læpss	*					*		**
b. → læpsəs		*				*		**

/lisp-z/	OCP	DEP	MAX	LIN-IO	UNI	TV	TVT	*PL
a. → lipss	*			*		*		**
b. lipsəs		*		*		*		**

(81) Review of the evidence that Metathesis is a word-level process:

a. Metathesis is sensitive to the word-level suffixes /-ing/, /-z/ and /-d/.

b. Metathesis is not sensitive to phonological material across words.

c. Metathesis counterfeeds Epenthesis (/lisp-z/ → *lips*). Hence there is at least one level before Metathesis where Epenthesis occurs, making Metathesis word-level at the earliest.

d. Metathesis feeds Fricativization (*lifs*) and Fricativization counterbleeds Metathesis (*lisp* → *lips* → *lifs*). Hence there is at least one level after Metathesis where Fricativization occurs, making Metathesis word-level at the latest.

(82) Problem:

1. Epenthesis is sensitive to the presence of the word-level suffix /-z/, e.g. /læps#z/ → [læpsəs].
2. Hence both Epenthesis and Metathesis must be word-level processes.
3. Stratal OT therefore predicts that Epenthesis and Metathesis should interact transparently.
4. The interaction is opaque.
5. So something is not right in Stratal OT.

(83) Counterargument: Perhaps /-z/ is a stem-level suffix in Singapore English?

(84) Answer: That is unlikely because

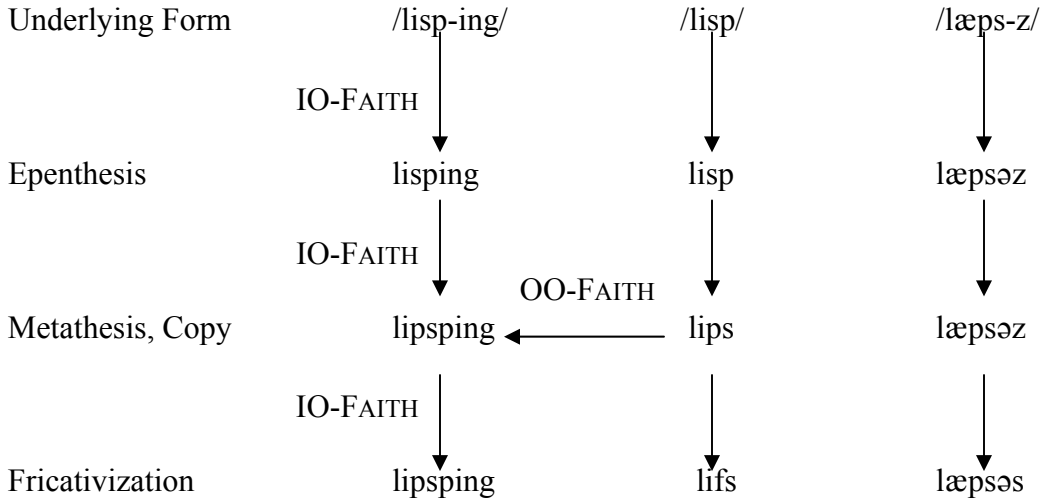
a. /-z/ does not trigger other stem-level processes, such as vowel shortening (e.g. *keep*-/z/ → **keps*).
b. /-z/ should then occur inside word-level suffixes (e.g. *-ness*, *-less*, *-hood*) as well as *-ing* which must be postlexical for independent reasons.

(85) Conclusion: Level ordering cannot explain the opacity of Epenthesis.

4.4 Summary

(86) Hypothesis (Stratal OT): Opacity results from the interleaving of transparent phonological grammars within independently motivated morphological constituents. This fails in Singapore English.

(87) The structure of opacity in Singapore English (Voicing Assimilation omitted)



(88) Three layers of phonology as in Stratal OT, but the layers do not line up with morphology in the expected way.

5. Conclusions

(89) The typological and quantitative patterns of Singapore English consonant reordering can be derived from a small set of OT constraints, independently of their ranking.

(90) The interaction of Singapore English cluster processes goes against the central hypothesis of Stratal OT (see e.g. Kiparsky 2000).

(91) "New Englishes" (creoles?) can be phonologically more complex than standard varieties of English.

Appendix A

An exhaustive list of the excluded marginal variants attested at a frequency < 10 in our corpus. The total number of excluded tokens is 131, which is about 15% of all tokens.

/lisp#ing/ (20 excluded tokens):
litsping (5), lipsfing (4), lifsping (4), lifsting (3), litsfing (1), lispo?ing (1), lisp ?iping (1), lifshping (1)
/lisp##/ (40 excluded tokens):
lipst (8), lits (7), lis (7), list (3), lifst (3), litsp (2), lipsp (2), livs (1), litspt (1), lispt (1), lisps (1), lish (1), lipss (1), lipsk (1), liis (1)
/lisp#z/ (37 excluded tokens):
lipsos (9), lis (5), lists (4), lifst (4), lipst (3), lifsos (3), litsps (2), lispt (2), liss (1), lisfss (1), lisfs (1), lifsts (1), lifss (1)
/lisp#d/ (34 excluded tokens):
lifst (9), lispst (4), lits (3), lift (3), litspt (2), lisps (2), lipt (2), litst (1), lispot (1), lisft (1), lipsst (1), lipps (1), lifstuh (1), lifspt (1), lifsp (1), li?ts (1)

Appendix B

An extract from the annotated corpus is shown below. Key: U = underlying form; T = target cluster; M = morphophonological environment; S = speaker/utterance identifier; P = pause vs. no pause before *my/again*; F = faithful vs. unfaithful output; A = alternation type (F = Faithful, M = Metathesis, C = Copy); H = what the transcribers heard.

U:/lisping my/ T:sp M:#V S:38-1 P:0 F:0 A:F H:lisping my
U:/lisp again/ T:sp M:##V S:38-1 P:0 F:1 A:M H:lips again
U:/lisped my/ T:sp M:#C##C S:38-1 P:0 F:1 A:M H:lipsst my
U:/lisping again/ T:sp M:#V S:38-1 P:1 F:0 A:F H:lisping again
U:/lisps my/ T:sp M:#C##C S:38-1 P:0 F:1 A:M H:lips my
U:/lisp my/ T:sp M:##C S:38-1 P:0 F:1 A:M H:lips my
U:/lisps again/ T:sp M:#C##V S:38-1 P:0 F:1 A:M H:lips again
U:/lisped again/ T:sp M:#C##V S:38-1 P:0 F:1 A:M H:lipst again