

## Cantonese vowel shift

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### Résumé

L'observation d'une inversion en cantonais moderne de valeurs vocaliques reconstruites du chinois ancien amène à formuler, discuter et finalement rejeter l'hypothèse d'une intervention simultanée des valeurs phonétiques. Il propose une interprétation des mêmes faits et termes d'une chaîne propulsive de changements vocaliques.

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john newman

## CANTONESE VOWEL SHIFT<sup>(●)</sup>

One of the most distinctive phonological changes which occurred in the evolution of modern Cantonese from Middle Chinese (MC) was the realignment of MC 'inner' and 'outer' rimes. An account of this phenomenon in contemporary generative phonology would lead one to posit a flip-flop rule. The evidence for such a rule is presented in section 2. Despite the formal elegance of the flip-flop rule, the rule throws no light on some apparent exceptions. These exceptions are discussed in section 3. While the flip-flop account can be modified to handle the data, it is argued that an account in terms of a push-chain provides a more satisfying explanation. We begin, in section 1, with some necessary background to a discussion of Cantonese phonology.

### 1. BACKGROUND

The phonological system of MC which will be assumed here is the system argued for in Chen (1976a : 128-130) and called there 'Simplified Middle Chinese'. MC vowels are shown in (1a).

(1a) MC vowels

i		y		u
	e	ə	o	
	a	ɑ		

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(●) I am grateful to Matthew Chen for comments on an earlier draft of this paper.

Except for a marginal contrast in some Wu dialects, MC \*e is not distinguishable from MC \*ia (similarly, MC \*ue is not distinguishable from MC \*ya)(1). Also, \*y functions only as an onglide. This leaves (1b) as the MC system of vocalic nuclei relevant to the present discussion.

(1b) MC vowels (simplified)

i	u
ə	o
a a	

The modern Cantonese vowels are displayed in (2).

(2) Cantonese vowels

i, y	u
ɛ, œ	o
a:, a	

All three high vowels also function as glides. (2) shows the necessary phonemic contrasts among vowels but does not indicate the more detailed phonetic and allophonic characteristics. There are, for example, tense and lax varieties of i, ɛ, u, and o, the tenseness or laxness being allophonically determined. Hashimoto (1972) provides a full account of such phonetic detail. It might also be noted that the long and short contrast between the low vowels is accompanied by distinct tongue positions. Hashimoto represents the long vowel as a retracted [A:] and the short one as a central [ə]. Since the main source for the modern Cantonese forms referred to in the present discussion is Zì-huì, the Zì-huì convention will be followed, whereby these contrasting vowels are represented as a: and a. Zì-huì coincides in this respect with the systematization of the Cantonese vowels in Chao (1947).

In what follows, we will be concerned with the segmental level and all suprasegmental facts about MC and modern Cantonese will be disregarded. There have been important tonal developments (the split into high and low registers, a high/mid split in tone 4 words), but these changes have no bearing on the evolution of the Cantonese vowels(2).

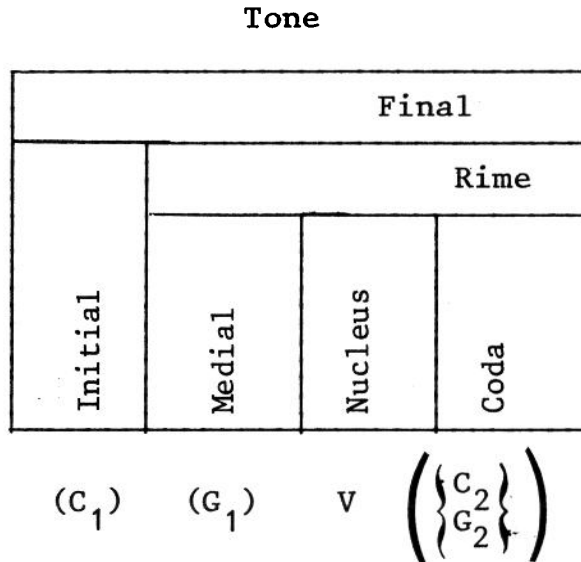
(1) An asterisk will be used to indicate a MC reconstruction.

(2) Tonal factors can, however, condition consonantal changes. For example, MC voiced initial stops and affricates became aspirated in tones 1 and 2, but not tones 3 and 4, as discussed in Chen and Newman (to appear).

## CANTONESE VOWEL SHIFT

It is convenient to make use of some traditional notions in discussing historical Chinese phonology. In particular, the terms in (3), referring to the various parts of the syllable, will prove useful.

(3)



where C = consonant  
G = glide  
V = vowel

Only the nucleus and tone are essential components of a syllable; the initial, medial, and coda are optionally present. One further traditional classification relevant to the present discussion is the distinction between 'inner' and 'outer' rimes. The inner rimes are characterized by a non-low vocalic nucleus, while the outer rimes contain a low vocalic nucleus, as shown in (4).

(4) MC vocalic nuclei

i	u	
ə	o	inner rimes
<hr style="width: 50%; margin: 0 auto;"/>		
a	ɑ	outer rimes

The MC-Cantonese correspondences which are assumed in the following discussion are based on the comparative dialectological dictionary compiled by linguists at the University of Peking, referred to here as *Zì-huì*. The *Zì-huì* data computerized as part of the DOC (Dictionary on Computer) project, under the direction of William S-Y. Wang at Berkeley, in 1966. The MC-Cantonese correspondences (tones, initials, finals) may be found in conveniently summarized form as the appendices in Chen and Newman (to appear) and, consequently, these tables will not be repeated here.

## 2. THE FLIP-FLOP HYPOTHESIS

In Cantonese, the MC pattern of vowels undergoes quite radical restructuring. One of the most significant changes is an interchange between inner and outer rimes - some MC low vowels are subject to raising to a non-low vowel, while some MC non-low vowels may lower to a. The inner-outer switch may be observed in a pair such as 鞭 pin 'whip' and 賓 pan 'guest'. The Cantonese inner rime in pin derives from a MC outer rime (\*pian), whereas the Cantonese outer rime in pan derives from a MC inner rime (\*piən). Exactly the same process is seen in the development of a number of finals, as shown in the MC-Cantonese correspondences in (5).

(5) MC final	Cantonese final		Example
*-iam	-im	欠	*k'iam 'to owe' > him
*-iəm	-am	林	*liəm 'forest' > lam
*-ian	-in	見	*kian 'to see' > kin
*-iən	-an	新	*siən 'new' > san
*-yan	-yn	捲	*kyan 'to wrap' > kyn
*-yən	-an	菌	*gyən 'germ' > k <sup>w</sup> an

Although the correspondences in (5) are illustrated by only one example for each category of final, the correspondences are quite regular and very extensive.

Rather than attempting to formulate sub-rules for each of the finals in (5), it is more appealing to formulate one flip-flop rule for all of these cases - call it IO-FLIP (Inner-Outer Flip-flop). The most elegant statement of the process at work in the correspondences listed in (5) would be the rule stated in (6).

## (6) IO-FLIP

$$\begin{array}{c} \vee \\ \left[ \begin{array}{l} - \text{ long} \\ - \text{ palatal} \\ - \text{ labial} \\ \alpha \text{ low} \end{array} \right] \rightarrow \left[ \begin{array}{l} - \alpha \text{ low} \end{array} \right] \end{array}$$

that is : a → ə  
ə → a

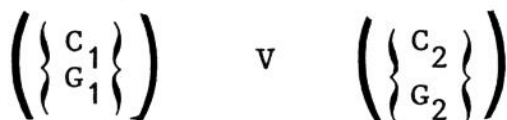
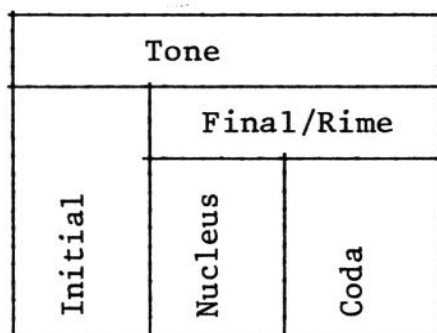
IO-FLIP operates in conjunction with other rules to give the modern Cantonese forms. Two further rules which are required are (7a) and (7b).

## CANTONESE VOWEL SHIFT

- (7a) ə- DELET                      ə    →  ∅ / glide \_\_\_\_\_  
 (7b) UNGLIDE                      glide → ∅ / C \_\_\_\_\_

The rules in (7) represent alternative ways in which MC forms accommodate a particular phonotactic constraint of Cantonese. While the syllable structure diagrammed as (3) holds true of MC and is virtually pan-dialectal, Cantonese represents a major departure from this norm. The Cantonese syllable is much more tightly structured, with even fewer components, as indicated in (8). In particular, it will be noticed that the Cantonese syllable can be analyzed as consisting of maximally three segments, the medial being absent altogether. This analysis requires postulating a series of labio-velar initials, as is usually done in fact.

## (8) Cantonese syllable structure :



where C = consonant, including  $k^w$  and  $k'^w$   
 V = vowel, including syllabic nasals  $m$  and  $\underline{n}$   
 G = glide

To accommodate the phonotactic constraint in (8), any output of IO-FLIP containing a medial is reduced either by removal of a schwa nucleus or, in the absence of a schwa nucleus, by removal of the glide. The mechanism by which the modern Cantonese syllable structure came about is more complex than the pair of rules in (7) suggest, but the details of this aspect of Cantonese phonology need not concern us here. The combined effect of IO-FLIP and the rules in (7) may be seen in the sample derivations in (9).

(9)	鞭	雪	新	賓	
	'whip'	'snow'	'new'	'guest'	
	*pian	*syat	*siən	*piən	MC
	piən	syət	sian	pian	IO-FLIP
	pin	syt	-	-	ə-DELET
	-	-	san	pan	UNGLIDE

(9) illustrates ways in which rules applying subsequent to IO-FLIP can, in part, obliterate the symmetry of the ə-a exchange. In addition, there are rules applying prior to IO-FLIP which either destroy or create inputs to IO-FLIP. The more important rules destroying what would otherwise be inputs to IO-FLIP are given in (10), and rules creating inputs to IO-FLIP are given in (11)(3).

(10a) BACK-ASM      a            → ɔ / \_\_\_\_\_ ŋ/k

(10b) COLOR            uən/t      → ɔn/t

                          yən/t      → ən/t

                          iəŋ/k     → iŋ/k

(11a) I-DIPH            i            → əi / labio-velar \_\_\_\_\_

(11b) U-DIPH            u            → əu

The derivations in (12) illustrate how the rules (10) - (11) either bleed or feed IO-FLIP.

(12)	邦	筍	貴	狗	
	'country, state	'bamboo shoot'	'expensive'	'dog'	
	*paŋ	*syən	*k <sup>w</sup> i	*ku	MC
	pɔŋ	-	-	-	BACK-ASM
	-	sən	-	-	COLOR
	-	-	k <sup>w</sup> əi	-	I-DIPH
	-	-	-	kəu	U-DIPH
	-	-	k <sup>w</sup> ai	kau	IO-FLIP

The rules which have been given to supplement IO-FLIP are motivated either by phonotactic considerations, as in (7), or on phonetic grounds, as in (10) - (11). It is necessary to posit one further rule which can not be so motivated. The rule

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(3) Full discussion and illustration of these rules may be found in Chen and Newman (to appear). Only the processes relevant to the present discussion are presented here, sometimes in a slightly simplified form. 'uən/t' refers to the finals ending in the dental nasal (-uən) or the dental stop (-uət). Also, the present discussion ignores changes affecting only, or mainly, literary forms, such as the merger of 'Geng' finals (\*-iaŋ/ɛ̃, \*yaŋ/ɛ̃) with the 'Zeng' finals (\*-iəŋ/k, \*-yəŋ/k).





## 3. THE PUSH-CHAIN HYPOTHESIS

The previous section provides an account, in terms of contemporary generative phonology, of the MC-Cantonese correspondences. For the finals discussed, the rules yield correct results. A complication appears, however, when we turn to another final not yet mentioned, namely *\*-iai*. Unexpectedly, the *a* in this final undergoes neither IO-FLIP nor LENGTH and corresponds regularly to Cantonese *-ai*, e.g. 溪 *\*k'iai* 'river' > *k'ai* (4). Note that the onglide *-i-* disappears completely. Exactly why the onglide is removed is irrelevant here - in Chen and Newman (to appear), it is attributed to a process of palatal dissimilation, well known in other Chinese dialects. The point is that, regardless of how the process is characterized, the correspondence is an unexpected one in the light of the foregoing account. If the onglide is removed before LENGTH, the result should be *-a:i*; if the onglide is removed after LENGTH, IO-FLIP should apply, giving rise to *ə* or some other non-low vowel.

The dilemma could be resolved by allowing the *a* in *\*-iai* to undergo IO-FLIP and adding a new rule to lower the derived *ə* to *a* again, along the lines shown in (16).

(16)	溪	
	'river'	
	<i>*k'iai</i>	MC
	-	LENGTH
	<i>k'ia:i</i>	IO-FLIP
	<i>k'iai</i>	( <i>ə</i> -lowering)
	<i>k'ai</i>	(palatal dissimilation)

The derivation proposed in (16) achieves the desired result *k'ai* and this is basically how such forms are accounted for in Chen and Newman (to appear). Yet it remains a disturbing solution. Invoking IO-FLIP in such cases is merely a way of forcing the facts into the system of rules set up in Section 2. A more obvious analysis would be to have nothing more than a rule of palatal dissimilation apply, giving Cantonese *k'ai* from MC *\*k'iai* in one step. Of course, the most obvious analysis for particular forms need not be the most insightful one when one considers more general facts about the language. In this case, however, the more complicated solution of (16) offers no particular insight into the structure of the language. Rather, the rule necessitates the addition of an entirely ad hoc rule -

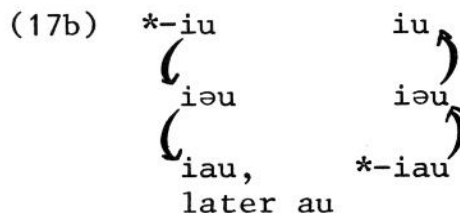
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(4) Of the 58 words with the *\*-iai* final in Zì-huì, 56 exhibit the modern Cantonese reflex *-ai*

## CANTONESE VOWEL SHIFT

the function of which is to simply undo the effects of IO-FLIP.

The fate of *\*-iai* shows that the  $\underline{a} \rightarrow \underline{\text{ə}}$  change is constrained in ways that its converse  $\underline{\text{ə}} \rightarrow \underline{a}$  is not. There would appear to be no phonetic basis for this discrepancy. Rather than seek any phonetic basis for these developments, I propose a functionally based account whereby MC *\*-a* undergoes change only as a way of preserving a contrast with finals containing newly created *a*. That is, MC *\*a* changes (to either  $\underline{\text{ə}}$  or  $\underline{a}$ ) as a result of being dislodged by new *a*'s (derived from  $\underline{\text{ə}}$ ). To establish the initial plausibility of this push-chain explanation, consider just the set of MC finals *\*-au*, *\*-ai*, *\*-iau*, and *\*-iai*. The first three of these finals show a change in the vocalic nucleus (*\*-au* >  $\underline{a}:u$ , *\*-ai* >  $\underline{a}:i$ , *\*-iau* >  $\underline{i\text{ə}u}$  >  $\underline{i}u$ ), whereas *\*-iai* shows no change in the nucleus. This state of affairs correlates nicely with the fact whereas the MC finals *\*-u*, *\*-i* and *\*-iu* evolved into  $\underline{\text{ə}u}$ ,  $\underline{\text{ə}i}$  and  $\underline{i\text{ə}u}$  and emerged as new outer rimes finals  $\underline{-au}$ ,  $\underline{-ai}$  and  $\underline{-iau}$  (later  $\underline{-au}$ ) respectively, no diachronic process gave rise to a new  $\underline{-iai}$  final. In other words, the MC finals *\*-au*, *\*-ai*, and *\*-iau* changed in order to maintain the contrast with new  $\underline{-au}$ ,  $\underline{-ai}$ , and  $\underline{-iau}$ ; MC *\*-iai* was under no pressure to change since no new  $\underline{-iai}$  forms were created. The deletion of the medial  $\underline{-i-}$  in both  $\underline{-iau}$  and  $\underline{-iai}$  is attributable to processes independent of the changes affecting the vocalic nucleus (either UNGLIDE or palatal dissimilation). The dynamics being hypothesized here are diagrammed in (17).



e.g. 漏 *\*lu* 'leak' >  $\underline{lau}$     e.g. 柳 *\*liu* 'willow' >  $\underline{lau}$   
 鬧 *\*nau* 'disturb' >  $\underline{na}:u$     尿 *\*niau* 'urine' >  $\underline{niu}$



e.g. 貴 *\*kui* 'expensive' >  $\underline{k}^w\underline{ai}$     e.g. 泥 *\*niai* 'mud' >  $\underline{nai}$   
 奶 *\*nai* 'milk' >  $\underline{na}:i$

Notice that the push-chain account summarized in (17) is couched in terms of the syllable *final*. If one were to look only at indivi-

dual vowels, isolated from their medial and coda, there would be no basis for assuming a push-chain situation. The account in (17) thus builds on the traditional insight regarding the segmentation of the Chinese syllable and is a further testimony to the naturalness of the final as a unit.

To make a push-chain account of the data compelling, it is necessary to demonstrate that the new set of outer rimes which emerged in Cantonese matches exactly the set of outer rimes containing a which were dislodged (i.e; became either an inner rime or an outer rime with nucleus a). Examination of the full set of MC-Cantonese correspondence tables in Chen and Newman (to appear) reveals the sets in (18).

(18) New Cantonese finals with <u>a</u>	Dislodged MC finals with <u>a</u>
	*-a > a:
-ai	*-ai > a:i
-au	*-au > a:u
-iau (> au)	*-iau > iu
-uai (> ai)	*-uai > ui
-iam/p (> am/p)	*-iam/p > im/p
-an/t	*-an/t > a:n/t
-ian/t (> an/t)	*-ian/t > in/t
-yan/t (> an/t)	*-yan/t > yn/t
-uan/t (> an/t)	*-uan/t > yn/t, a:n/t
-aŋ/k	*-aŋ/ɕ (> aŋ/k) > a:ŋ/k

With respect to the last pair of finals in (18), it should be noted that the newly created -aŋ/k final dislodged not the original MC \*-aŋ/k, but only those velar finals which came about as a result of the fusion of the palatal consonants with the velars in syllable-final position. MC \*-aŋ/k changed early by BACK-ASM, to ɔŋ/k and was thereby excluded from the processes affecting a.

The absence of a final -iai in both lists in (18) can now be appreciated as further evidence of a larger pattern of correlations(5). The only impediment to an account in terms of a push-

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(5) -yai is also absent from both lists. This final is ignored in the main discussion, since MC \*-yai is subject to a process like that referred to above as COLOR (< æy). This leaves only three relevant forms, each of which retains the simple a nucleus, e.g. 梘 \*kyai 'cassia' > k<sup>w</sup>ai.

## CANTONESE VOWEL SHIFT

chain appears to be MC \*a, which shows lengthening, despite the fact that no new -a finals were created. So, for example, 家 \*ka 'family' > ka:. An explanation for such lengthening is, however, readily available. Note that the only vocalic nuclei which occur in Cantonese without codas are, using the narrow phonetic transcription in Hashimoto (1972) : A:, ε:, i:, œ:, ɔ:, u:, y:. In other words, vocalic nuclei are subject to open-syllable lengthening, formulated as in (19).

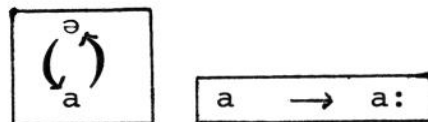
(19) V → V: / \_\_\_\_\_ #

The lengthening which is observed in the MC \*-a final can thus be attributed to a relatively low-level allophonic rule. This leaves us with a perfect correlation between the two sets of finals in (18), making a push-chain account of the vowel changes straightforward.

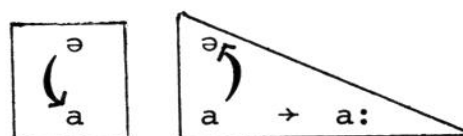
The three vowel changes with which we have been primarily concerned are the ones indicated in (20). The analysis imposed on these developments by assuming a flip-flop rule, as was done in section 2, may be represented as in (21a). Here, the vertical vowel movements are grouped together, with the lengthening of a treated as an entirely distinct process. The analysis which was argued for in section 3, hypothesizing a push-chain mechanism, is diagrammed in (21b). In this case, the two processes which a is subject to are grouped together, despite their phonetic dissimilarity. The unification of these two processes represents the response to the 'pushing' effect of ə lowering to a.

(20) 

(21a) The Flip-flop Hypothesis :



(21b) The Push-chain Hypothesis :



As a description of the historical changes, the Flip-flop Hypothesis is attractive, since it is easily translatable into the formalism of generative phonology. This approach fails, however, to explain why some outer rimes containing a apparently

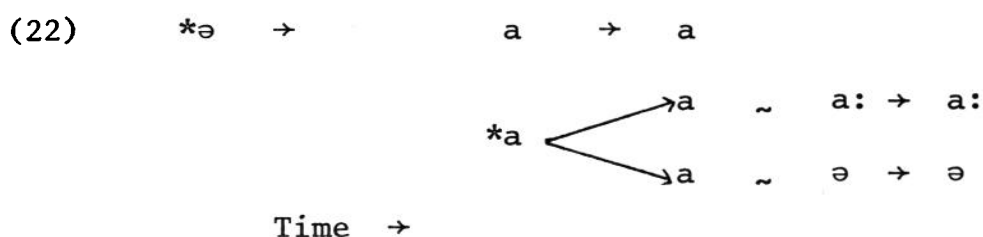
undergo no change at all from MC to modern Cantonese. The alternative hypothesis is not expressible in any accepted formalism of generative phonology, but it does illuminate why some a's change and others do not. Ultimately, the push-chain account is a more satisfying one because it provides motivation for at least some of the historical developments(6).

While some phonological changes may be construed in terms of either a push-chain or a drag-chain, the Cantonese data clearly points to a push-chain rather than a drag-chain(7). A drag-chain interpretation of the events would also assume the sub-grouping shown in (21b) but would claim that MC \*a underwent change, creating a 'hole' which, in turn, was filled by the lowering of ə. Such an account does indeed provide a structural motivation for the lowering of ə, but it leaves the peculiar constraints on the triggering processes unaccounted for. That is, it provides no explanation for the fact that a in \*-ia undergoes neither lengthening nor raising to ə. The push-chain account, on the other hand, provides a functional motivation for the troublesome constraints on rules applying to MC \*a. The triggering process (ə → a), considered in the context of an offglide, can be seen as a natural continuation of the diphthongization of the high vowels (\*i → əi → ai, \*u → əu → au). Even as a context-free rule, ə → a may be motivated as one of the processes which lead to greater sonority in the vowel system (see Stampe 1972 : 581 f. for a discussion of lowering rules of this type). As a drag-chain, the Cantonese sound-shifts would be initiated by a process conditioned in a phonetically inexplicable way ; as a push-chain, the events are triggered by a phonetically motivated change in the system. The choice of a push-chain interpretation over a drag-chain interpretation in this case is in accord with the reasoning expressed by Hyman (1972 : 205-206) : 'in cases where there is a series of changes such as... A > B > C which can be interpreted as either drag chains or push chains, an internal argument (or rule of thumb) is that if the change from B to C is unnatural, and the change from A to B is natural, then this sequence of events should be interpreted as a push-chain : the natural change from A to B caused the unnatural change from B to C'.

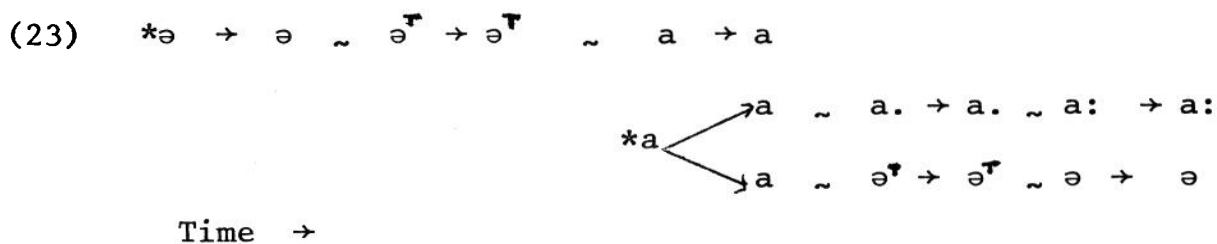
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- (6) Neither the Flip-flop Hypothesis nor the Push-chain Hypothesis provides an explanation for the split behaviour of MC \*a - changing either to ə or a :.
- (7) See Martinet (1955 : 59 f.) for the differentiation of the two mechanisms of sound-shift. Bynon (1977 : 82-85) discusses a number of sound-shifts which may be viewed equally well as either push-chains or drag-chains.

## CANTONESE VOWEL SHIFT

The finer details of the push-chain mechanism must remain a matter of speculation. In particular, there is no way to know whether some transitional phonetic sound, intermediate between ə and a, is ever involved. King (1969 : 194-200), in an early discussion of push-chains within the context of generative phonology, understood a push-chain as always involving a gradual phonetic transition. Since then, Chen (1976b : 228-232) has suggested a way to construe push-chains which does not rely on any gradual phonetic transition. Following Chen's model, the Cantonese push-chain would involve intermediate stages in which there is a fluctuation between conservative and innovative forms. New a's are distinguished at all times from original a's, as shown in (22).



While Chen's model of the push-chain mechanism is couched in terms of discrete phonetic shifts and gradual systemic change, there is nothing in this model to preclude gradual phonetic shifts. When dealing with vowels, as we are here, gradual phonetic change involving very slight adjustments in the tongue position is an attractive hypothesis. Thus, one might posit a transitional ə<sup>r</sup>, intermediate between ə and a, and an a, intermediate in length and articulation between a and the slightly more retracted a:. The sequence of events shown in (22) may then be described in the narrower phonetic version of (23).



It can be seen, then, that a push-chain (interpreted in terms of Chen's model) is compatible with both views of phonetic shift. It is unlikely that further study of historical Cantonese phonology will throw light on such details.

Finally, let me venture a comment on why push-chains take place, as opposed to mergers. Attempts to determine the conditions under which mergers may occur have usually relied on some notion of functional load, a low functional load of a contrast being more sympathetic to a merger of the contrasting units. The

results of such attempts have not been as convincing as one might have wished (cf. King 1969 : 200-201 and Samuels 1972 : 33). The Cantonese case suggests a different approach. Considerations of the patterning of MC finals lead one directly to positing a more abstract representation with two parallel sets of finals - one containing ə (corresponding to the inner rimes) as the nucleus, the other containing a (corresponding to the outer rimes). Presumably, the same considerations led Chinese philologists of the 8 - 9th century to the same conclusions, since they made a fundamental distinction between inner and outer rimes. (See Chen 1976a : 141-144 for a full discussion of the systematization of MC finals). MC \*a and \*a, while phonemically distinct, have never been interpreted as constituting a fundamental systematic division. The contrast between ə and a is, from a structural point of view, a much more salient distinction in Chinese phonology than that between a and a. Not only in Cantonese but in other dialects as well, the former contrast has been well preserved, whereas the latter has often been neutralized. It is only speculation, but it may be that the resistance to the merger of \*ə and \*a was directly related to the saliency of this contrast. To understand push-chains and their motivation, then, one may have to go beyond mere quantitative evaluations of phonemic contrasts and consider more abstract systematic aspects, e.g. whether a particular contrast plays a crucial role in a symmetrical pattern of phonemes.

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RESUME

*L'observation d'une inversion en cantonais moderne de certaines valeurs vocaliques reconstruites du chinois ancien amène l'auteur à formuler, discuter et finalement rejeter l'hypothèse d'une intervention simultanée des valeurs phonétiques. Il propose une interprétation des mêmes faits en termes d'une chaîne propulsive de changements vocaliques.*

## CANTONESE VOWEL SHIFT

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