FROM MIDDLE CHINESE TO MODERN PEKING*

MATTHEW Y. CHEN

UNIVERSITY OF CALIFORNIA, SAN DIEGO

ABSTRACT. This paper is an attempt to sketch a succinct, integrated, and self-contained history of phonology from Middle Chinese to modern Peking. The essential facts are presented and analyzed, new interpretations are offered on a number of points, but purely theoretical discussions are kept to a minimum. The article is divided into the following main sections:

0. Prefatory remarks
I. Background
II. Phonotactic conditions
III. Tonal developments
IV. Initial changes
V. Medial changes
VI. The great vowel shift
VII. The weakening of consonantal endings
VIII. Summary of rules and conditions
IX. Relative chronology
X. Concluding remarks

Footnotes
References

Appendix A. Tone correspondences
Appendix B. Initial correspondences
Appendix C. Final correspondences

---

* Much of the work leading to this contribution was undertaken during my tenure of a Guggenheim Fellowship (1974-75), although the manuscript was not completed until the summer of 1976.

The author is grateful to the editor of JCL for allotting extra space in order for this inordinately long paper to appear in one single issue. This facilitates considerably the reading of the article, interlaced as it is with numerous cross-references to nearly every portion of the entire work.

0. PREFATORY REMARKS

0.1 Of all modern dialects of Chinese, the Peking dialect, on which Standard Mandarin is based, is the most intensely studied, and one or another aspects of its history have come under the scrutiny of linguists. I will attempt to gather the results of these endeavors into an integrated whole. I intend this exposition to be self-contained in the sense that all decisions and arguments will be based on the merits of the factual evidence furnished within the body of the article, and no appeal will be made to any privileged source of information outside of what is presented here. This last point is particularly important in view of the fact that general linguists as a rule shy away from issues of general interest which can be raised in the context of historical Chinese phonology partly because they do not feel confident as to how to assess the merits of the analyses proposed and the force of their supporting arguments in the absence of an overall framework of reference; rightly or wrongly, they often suspect that there are hidden facts that would invalidate the arguments or throw an entirely different light on the evidence presented. Conscious of this fact, I have taken pains to supply a large number of examples, state their step-by-step derivation wherever appropriate, and the full range of data available to me. From the examples and data sheets the readers can decide for themselves whether or not the analysis proposed here is factually correct and accounts for the data in an insightful and explanatory manner. This expository procedure will hopefully dispel to some degree the diffidence on the part of some linguists who are interested in what Chinese phonology has to offer but are mystified by its complexity, apparent or real.

Needless to say, foremost in my mind are the specialists of Chinese. Recent refinements in linguistic theory have afforded us a better understanding of phonological change in general; as a consequence, on many important issues certain well known facts will be cast in a new light and given a new interpretation. Sinologists steeped in the philological tradition may come to a fruitful confrontation between their understanding of the historical events and the alternative interpretation delineated here (roughly along the lines of generative phonology). Beginners, on the other hand, will, I hope, find in this essay a useful introductory survey.

0.2 Given the long tradition of Sinological scholarship, one may question the raison d'être of yet another history of Chinese phonology. Unfortunately, the Chinese language is

over-documented -- if that is at all possible -- but woefully under-analyzed. To date, Hashimoto's 1965 dissertation remains the only serious attempt at a systematic and rigorous account of the phonological evolution between Middle Chinese and the present day Mandarin. But even Hashimoto's treatment of the historical changes is merely a forward projection of the reconstructed phonological system of Middle Chinese, which is his main concern. Generally speaking, the existing descriptions of historical Chinese phonology suffer from one or more of the following inadequacies:

(1) Most traditional handbooks treat phonological changes as changes of philological categories. Thus one finds statements such as that Middle Chinese *i, *iai and *iəp etc. become an apical vowel /ɿ/, and that certain other finals such as *ia, *iuŋ, etc. lose their palatal medial glide. This approach misses the generalization that these two changes are basically identical in that both represent depalatalizing processes ('medial dissimilation', as I will call it in the ensuing discussion), and that the appearance of an apical vowel is merely a by-product of this primary change.

(2) The same standard reference works characteristically lack the concept of rule ordering. All changes are treated as if they operate uniformly and directly on the Middle Chinese protoforms. Only elementary rule relations (primarily of the 'feeding' kind) are apparent in such descriptions. The result is a set of direct, and seemingly unrelated, mapping rules, which do not go very far beyond simple restatements of sound correspondences. Defects (1) and (2) are typical of such otherwise indispensable works as L. Wang (1958) and Dong (1968).

(3) Hashimoto (1965), on the other hand, is handicapped by a different set of problems. His uncritical acceptance of and excessive preoccupation with the descriptive formalism -- including the Jakobsonian distinctive features, abbreviatory conventions, etc., which were de rigueur in the mid-60's -- rendered his account exceedingly mechanical and all but impenetrable except to the most determined reader. To make the matter worse, he rarely condescends to illustrate his rules with any actual examples.

(4) But the most common shortcoming of all is the failure to discern general patterns underneath individual changes. As a result, the history of Chinese phonology has the appearance of a series of disjointed and random innovations. (This is, of course, often true of other language histories as well.) For instance, apicalization (/i/ → /ɿ/), diphthongization (/i, u/ → /ei, ou/), raising (/ia/ → /ie/,

and /ei, iei/ → /i/), rounding (/ɑ/ → /o/), and sharpening (/a/ → /ia/) have been traditionally regarded as unrelated changes. It will become apparent that these seemingly disparate phenomena fit together as links of a chain movement which I will label 'The Great Vowel Shift'. We can hardly begin to write a rational history of Chinese phonology before we piece together fragments like these into a recognizable mosaic.

It is the realization of deficiencies such as the ones singled out above and the desire to fill some of the gaps left by earlier attempts that prompted the present undertaking. I hasten to add that the task at hand would not have been feasible without the groundwork laid down by many others before us in the field, particularly the ones I have just mentioned. My debts to their contributions will become amply apparent in the pages that follow.

0.3 It is not my intention to write a comprehensive history of Chinese phonology. I have a more modest immediate aim in mind. In this paper I will limit myself to those aspects of the phonological history of Chinese that are reconstructible on purely linguistic evidence, that is, based on the systematic correspondences between Middle Chinese and the modern pronunciation. This does not mean that one must ignore such philological evidence as provided by Zhao (1957) and Pulleyblank (1970-71), to mention only a few -- quite the contrary. However, a full documentary history of Chinese phonology must await another occasion.

It would be superfluous to add that I do not presume to have said the last word on the history of Chinese phonology even within the narrow scope defined here. I would be elated if the present work serves merely as a fresh start in an ongoing search for a better understanding of the subject matter.

I. BACKGROUND

1.1 THE SYLLABLE. Since this study is intended for general linguists as well as for specialists of Chinese, a few words concerning the traditional nomenclature of phonological categories are in order. The notion of the syllable plays a central role in Chinese phonology, and phonological units are defined in terms of the positions they occupy in the syllable. The canonical form of a syllable can be represented as (1.1):

rime group	*AC (cont'd)				*UK					
LMC	*uac		*yac		*uk	*iuk				
dialect	ua	uo	y	i	u	u	ou	uo	y	iou
*p										
*p'					1					
*b					1					
*m					2					
(*f)						3				
(*f')										
(*v)						3				
(*m)						1				
*t										
*t'					1					
*d					4					
*n										
*l					2	2			1	1
*ts						1				
*ts'										
*dz					1					
*s					1	2				
*z						1			1	
*ʈ						2				
*ʈ'						1				
*ɖ						1				
*ɳ						2	1			
*tɕ						3	1			
*tɕ'						1				
*dʑ						1				
*ɕ						1				
*ʑ						1	1			
*tʂ										
*tʂ'										
*dʐ										
*ʂ								1		
*ʐ										
*k					1				1	
*k'					1				3	
*ɡ			1						1	
*ŋ									2	
*x									1	
*ɣ	1	1								
*ʔ					1					
*j										
*ø				1					2	

Appendix C-14 Final correspondences

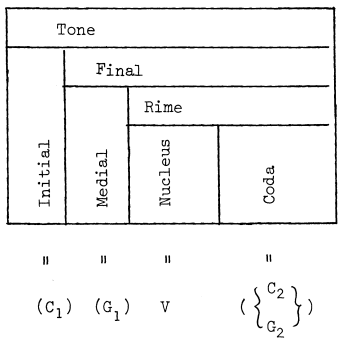
rime group	*EK									*AC					
LMC	*ək				*iək				*uək	*yək	*ac			*iac, *ec		
dialect	ei	ɤ	ai	o	i	ɿ	ɤ	ua	uo	y	o	ai	ɤ	i	ɿ	ai
*p	1				1						3	2				
*pʻ												1		1		
*b												1				
*m				2								2		1		
(*f)																
(*fʻ)																
(*v)																
(*ŋ)																
*t		2												2		
*tʻ														2		
*d		1												2		
*n																
*l	2	1			1									1		
*ts		1			1									5		
*tsʻ																
*dz		1												1		
*s			1		2									3		
*z																
*ȶ																1
*ȶʻ													1			
*d̠						2						3	2			
*n̠																
*ʈ͡ɕ						2									1	
*ʈ͡ɕʻ															2	
*ɖ͡ʑ						2										
*ɕ						2									1	
*ʑ						1									1	
*ʈ͡ʂ							1					1	1			
*ʈ͡ʂʻ							2						2			
*ɖ͡ʐ																
*ʂ							2	1								
*ʐ																
*k									1				3	2		
*kʻ		2											1		1	
*g					1											
*ŋ													1	1		
*x	1															
*ɣ									1				1			
*ʔ					1									1		
*j										1						
*ø														3		

Appendix C-13 Final correspondences

(1.1) $(C_1)\ (G_1)\ V\ (\begin{Bmatrix} G_2 \\ C_2 \end{Bmatrix})$

where C = consonant, V = vowel, G = glide. C_1 is referred to as 'initial', and C_2 as 'ending'; the syllable minus the initial is called 'final', while the final minus the 'medial' (= G_1) is labelled 'rime'. I have chosen 'coda' as a cover term for the offglide (= G_2) and the consonantal ending (C_2). Tone, which is phonemic in Chinese, is considered to be coextensive with the whole syllable. Only the nucleus and tone constitute the essential components of a syllable; all other elements are optionally present. The hierarchical syllable structure of Chinese can be captured by the following diagram (1.2):

(1.2)



Most of the descriptive terms employed here to refer to the various portions of the syllable are self-explanatory, with the possible exception of 'rime'. The portion consisting of nucleus+coda is called a rime, because according to the riming scheme of Chinese poetry, words pronounced as /p-an, tśi-an, tu-an, śy-an/ can all rime with each other, despite the fact that they differ in terms of the initial consonant and the medial onglide, as long as they share the identical portion /-an/.

1.2 MIDDLE CHINESE (MC). The major effort of the past decades of historical Chinese phonology has been focused on the reconstruction of the MC sound system. Many

attempts and revisions have been made since Karlgren's pioneering work (Karlgren, 1915-26), most notably: Lu (1947), Zhou (1948, 1954, 1968), Li (1952), Martin (1953), Karlgren (1954), Dong (1954, 1968), L. Wang (1957), Pulleyblank (1962, cf. 1971-72), and Hashimoto (1965).

MC distinguished 4 tones, 36 initials and 293 finals.[1] For the moment, it is best to regard the MC tones simply as categories, as their exact pitch contours are still imperfectly understood despite the significant insights gained in such recent investigations as Mei (1970) and Hirayama (1975). I will refer to the MC tones as *T1-4. Their traditional names and a highly tentative phonetic description are given in Table 1.

36 MC initial consonants have been generally recognized. They fall into 7 series roughly corresponding to the 5 points of articulation, with the dental and the palatal series split into 'fricated' (affricates and fricatives) and 'non-fricated' (all others) subcategories.[2] In the philological literature, each of the 7 series is known by the traditional name of the first consonant of the series; thus, one refers to the 'p-series', 't-series', 'ts-series', and so forth. Here I will occasionally use the class symbols *P, *T, *S, etc. for the same purpose. Within each series, the consonants are further classified according to the usual manner of articulation. The system of MC initials as reconstructed by Li (1952) is given in Table 2. The phonetic value of the MC initials is, by and large, non-controversial -- except for two moot points: (a) the *R series has been reconstructed as alveopalatals (in other words, *ts, *ts', *dz, *s, *z) instead of retroflexes by Dong (1969:149); and (b) the *Ś series is alternately interpreted by Hashimoto (1965) as alveopalatals instead of pure or pre-palatals. Tentatively, I will accept Li's reconstruction.

There are 293 distinct -- segmentally and/or tonally -- finals in the MC phonological system of *Qiè-yùn*. Since tonal categories are already separately marked (by means of *T1-4), in what follows I will speak only of segmentally distinct finals. 160 such segmentally differentiated MC finals have been established. Each of these 160 finals has a label by which it is known in Chinese philological literature. I will not make use of the traditional labels or keywords at all; instead, I will refer directly to the Li phonetic reconstruction prefixed by an asterisk (*).

rime group	*AK																	
LMC	*ak					*iak			*uak	*ak								
dialect	o	au	u	uo	ɤ	iau	ye	uo	uo	o	au	uo	ye	ɤ	iau			
*p	1									2	1							
*p'																		
*b	1	1									1							
*m	2		1															
(*f)																		
(*f')																		
(*v)																		
(*ŋ)																		
*t																		
*t'				1														
*d																		
*n																		
*l		1		2	1		1											
*ts				1														
*ts'						1	1											
*dz		1		1		1												
*s				1		1	1											
*z																		
*ȶ												1						
*ȶ'												1						
*ɖ							1	1				1						
*ɲ								2										
*tɕ																		
*tɕ'																		
*dʑ																		
*ɕ																		
*ʑ							1											
*ʈʂ												1						
*ʈʂ'																		
*ɖʐ												1						
*ʂ																		
*ʐ																		
*k					3	1			1				1		1			
*k'				1			1							2	2			
*g																		
*ŋ						1	1											
*x																		
*ɣ													1					
*ʔ					1		1					1						
*j																		
*ø						2												

Appendix C-12 Final correspondences

rime group	*EP					*ET								
LMC	*iəp					iət			uət		yət			
dialect	ɿ	ɤ	i	ei	u	i	ɿ	ɤ	u	o	u	o	y	
*p *p' *b *m						3 1 2				1				
(*f) (*f') (*v) (*ɱ)											1 2	1		
*t *t' *d *n *l			2			1			1				1	
*ts *ts' *dz *s *z			1 1			2 1			1			1		
*ʈ *ʈ' *ɖ *ɳ					1		1 1							
*tɕ *tɕ' *dʑ *ɕ *ʑ	2 1 2						1 1 2				1 1			
*tʂ *tʂ' *dʐ *ʂ *ʐ		1					1	1						
*k *k' *g *ŋ			3 1	1		1			1				1 1	
*x *ɣ *ʔ *j *ɸ			1			2			1 1					

Appendix C-11 Final correspondences

Traditional labels with literal translation		Symbols used in this paper	Phonetic description
平	'Even'	*T1	(low?) level pitch
上	'Ascending'	*T2	rising pitch
去	'Departing'	*T3	falling pitch
入	'Entering'	*T4	short, checked syllable ending in a stop. (Strictly not a prosodic category, but rather a segmental feature; the short duration is an automatic consequence of the segmental composition.)

Table 1. MC Tones

Labial	Dental (non-fricated)	Dental	Retroflex	Palatal (non-fricated)	Palatal (fricated)	Velar (and glottal)		
幫	端	精	莊	知	章	見	Traditional labels	
*P	*T	*S	*R	*T	*S	*K	Class symbols used in this paper	
p	t	ts	ṭs	t̂	tś	k	Voiceless	Non-continuant
p'	t'	ts'	ṭs'	t̂'	tś'	k'	Aspirated	Non-continuant
b	d	dz	ḍz	d̂	dź	g	Voiced	Non-continuant
		s	ṣ		ś	x	Voiceless	Continuant
		z	ẓ		ź	γ	Voiced	Continuant
m	n			ń		ŋ	Nasal	
	l						Lateral	
						ʔ	Other	
						ø		

Table 2. MC Initials

rime group	*AP	*AT																		
LMC	*yap	*at		*at		*iat			*uat		*uat	*yat								
dialect	a	a	ɤ	a	ia	ie	ɤ	ye	o	uo	ua	a	ye	ie						
*p				1		1			1											
*p'						1			1											
*b				1		1														
*m						1			4											
(*f)	1											2								
(*f')																				
(*v)	1											1								
(*ŋ)												1								
*t						1				1										
*t'						1				1										
*d		1				1														
*n						1														
*l		1				2								1						
*ts						1														
*ts'		1				1														
*dz						1							1							
*s						1		1					1							
*z																				
*ṭ							1													
*ṭ'							1													
*ḍ																				
*ṇ							1													
*tś							2													
*tś'																				
*dź							1													
*ś							1													
*ź																				
*tʐ				2																
*tʐ'				1																
*dʐ				1																
*ʂ				1							1									
*ʐ																				
*k			1			3				1	1		1							
*k'			1							1			1							
*g						1														
*ŋ													1							
*x					1	1							1	1						
*ɣ					1					1	1									
*ʔ						1					1									
*j																				
*ø													3							

Appendix C-10 Final correspondences

rime group	*AŃ (cont'd)			*UNG						*AP					
LMC	*yań, *ueń			*uŋ		*iuŋ				*ap		*ap		*iap, *ep	
dialect	yŋ	uŋ	iŋ	əŋ	uŋ	uəŋ	əŋ	uŋ	yŋ	a	ɤ	a	ia	ie	ɤ
*p															
*p'															
*b				1											
*m				1			1								
(*f)							4								
(*f')							4								
(*v)							7								
(*ŋ)															
*t				4						2					
*t'				4						3				2	
*d				6										3	
*n				3						1					
*l				4			3			2				1	
*ts				5			2							1	
*ts'				1											
*dz				1			1			1					
*s				4											
*z							1								
*ʧ							2								
*ʧ'							1								
*ʤ							4								
*ʃ							3								
*ʦ́							5								
*ʦ́'							2								
*ʣ́															
*ś							1								
*ź															1
*ʦ												1			
*ʦ'												1			
*ʣ												2			
*s															
*z															
*k				3			7			1			3		
*k'			1	3			2						2	1	
*g	1						1		1						
*ŋ														1	
*x	1	1		1					2						
*Y			1	4						2		1		1	
*?					2				1			2			
*j	1	1							2						
*ø			1				2		2					1	

Appendix C-9 Final correspondences

The MC finals have been traditionally divided into 16 or 14 'rime groups', each of which, again, has a keyword for identification. Instead of the traditional keywords, I will use, for reference and identification, a series of capital letters *A, *I, *U, *AM, *AN, etc., chosen for their obvious resemblance to the reconstructed phonetic values of their respective sets of MC finals. The various finals within each rime group are cross-classified according to the 'open/close' dichotomy and the four vowel 'grades'. The 'open/close' distinction is straightforward: a 'close' final contains a labial medial onglide (u), which is absent in an 'open' final. The label 'grade' refers to the relative position the nuclear vowel occupies in the phonological space. Specifically, for the rime group containing an a-type nuclear vowel, grades 1, 2, 3, 4 characterize the varying degrees of vowel 'sharpening': ɑ, a, ia, e, respectively. Take the rime group *AN, for instance, the combination of the open/close contrast and the 4 grades yields the following eight distinct finals:

(1.3)	Open	Close
Grade 1	ɑn	uɑn
2	an	uan
3	ian	iuan (= yan)
4	en	uen

I interpret the medials -iu- as phonetically -y-.

Not all rime groups exhibit the full set of eight combinatorial possibilities exemplified by *AN above. On the other hand, some rime groups display further subdivisions. Thus both grade 2 and 3 of *AN have more than one final each. Fortunately, we need not concern ourselves with such finer distinctions for the purpose of this study except for a few cases to be noted as the occasion arises.

Table 3 presents the system of the 160 segmentally distinct MC finals as reconstructed by Li (1952). The traditional keywords or labels can be safely ignored by all except those students of 'traditional' Chinese phonology who can use them as familiar landmarks to find their bearings along the way.

Labels for MC rime groups	Rime group labels used here	Vowel grades	Traditional labels for MC finals	Qiè-yùn MC (R. Li) *T1-3 Open	Close	*T4 Open	Close	Simplified MC (M. Chen) *T1-3 Open	Close	*T4 Open	Close
果假	*A	1	歌	â	uâ			ɑ	uɑ		
		2	麻二	a	ua			a	ua		
		3	麻三	iâ	iuâ			ia	ya		
止	*I	3	支 A	ie	iue			i	ui		
			支 B	ie	iue						
			脂 A	i	ui						
			脂 B	ji	jui						
			之	iə							
			微	iəi	iuəi						

Table 3 MC Finals (a)

rime group	*ENG						*AŃ					
LMC	*əŋ	*iəŋ				*uəŋ	*ań			*iań		*uań
dialect	ɤŋ	iŋ	əŋ	ɐŋ	yn	uŋ	ɐŋ	iŋ	ɐŋ	iŋ	in	əŋ	ɐn	uŋ	əŋ
*p	1	1								5					
*p'							1				1				
*b	2	3					2			6					
*m							2			5		1			
(*f)															
(*f')															
(*v)															
(*ŋ)															
*t	3								1	6					
*t'										2					
*d	5									7					
*n	1									1					
*l	1	1					1			6					
*ts	2									4					
*ts'										3					
*dz	3									4					
*s	1									6					
*z															
*ʈ													1		
*ʈ'													1		
*ɖ			1				1					3			
*ɳ			2												
*tɕ			2									5			
*tɕ'			2	1											
*dʑ			3												
*ɕ			2									2			
*ʑ			1									5			
*tʂ							3								
*tʂ'															
*dʐ															
*ʂ							4								
*ʐ															
*k							6	1		10					
*k'	1						1			3					
*g										1					
*ŋ		1						1		1					
*x		2													
*ɣ	1					1	1	3		1				1	2
*ʔ		2						1		4					
*ʨ															
*ø		1			1					2					

Appendix C-8 Final correspondences

rime group	*EN (cont'd)					*ANG								
LMC	*uən		*yən			*aŋ	*iaŋ		*uaŋ	*yaŋ		*aŋ		
dialect	ən	uən	ən	uən	yn	in	aŋ	iaŋ	aŋ	uaŋ	uaŋ	aŋ	uaŋ	iaŋ
*p	2						2					1		
*p'	1											1		
*b	2						1					1		
*m	2						1							
(*f)			4								4			
(*f')			1								5			
(*v)			4								2			
(*ŋ)			2								4			
*t		1		1			3							
*t'							4							
*d		5					2							
*n	1						1	1						
*l		2		1			2	6						
*ts		1		1	1		2	5						
*ts'		2					2	2						
*dz		1					2	2						
*s		2		1	1		4	3						
*z					1			4						
*tɕ								4					1	
*tɕ'								1						
*dʑ								6					1	
*ɲ								3						
*tʂ				1				3						
*tʂ'				2				4						
*dʐ				2										
*ʂ								2						
*ʐ				1				6						
*tʂ									3					
*tʂ'									3				1	
*dʐ									2				1	
*ʂ									2					
*ʐ									2					
*k		2			2		3	2			2	1	3	3
*k'		3					5				1	1		1
*g					4			1				1		
*ŋ					1		1	1						
*x		1		1	2		4				2	1		
*ɣ		3					1				3			3
*ɦ		2		1			1	1						
*ɕ				4								1		
*ʑ				1		1		7						

Appendix C-7 Final correspondences

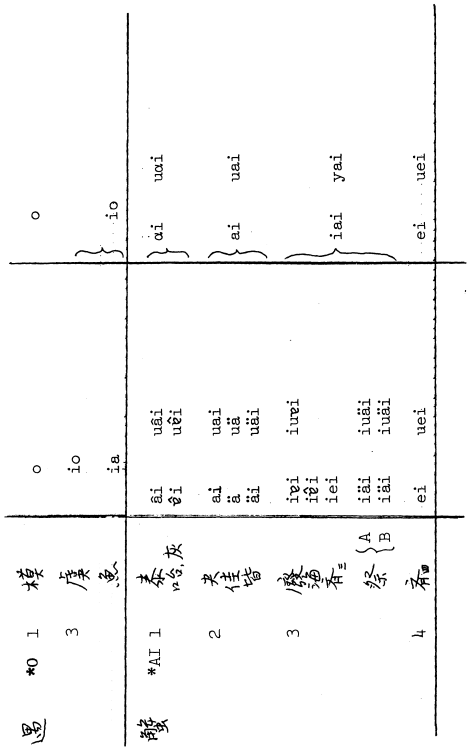


Table 3 (b)

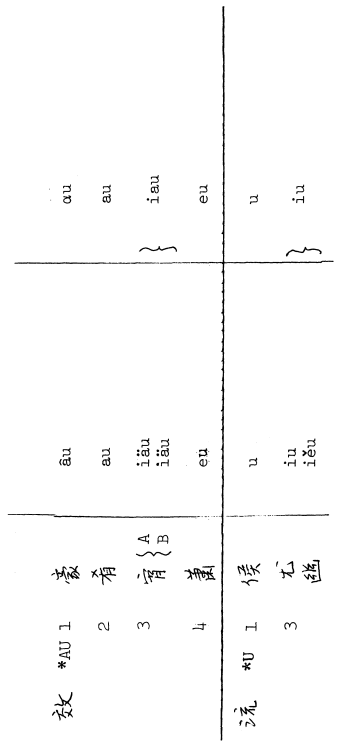


Table 3 (c)

rime group	*AN (cont'd)							*EM			*EN			
LMC	*uɑn		*uan	*yan, *uen				*iəm			*ən		*iən	
dialect	an	uan	uan	an	uan	yan	ian	in	yn	ən	ən	uən	in	yn	ən
*p	3												2		
*p'	2							1							
*b	3												2		
*m	4												2		
(*f)				2											
(*f')				1											
(*v)				2											
(*m)				4											
*t		4													
*t'												1			
*d		4													
*n		1						1							
*l		3						1					3		
*ts		2											3		
*ts'								2					1		
*dz						2							2		
*s		2				2		1					2	1	
*z						1			1						
*ȶ					2										2
*ȶ'															1
*ȡ					4					1					3
*ȵ					1					1					5
*tɕ					1					3					3
*tɕ'					4										
*dʑ					1										1
*ɕ										4					2
*ʑ										1					4
*tʂ															
*tʂ'										1					
*dʐ															
*ʂ			2							3					
*ʐ															
*k		8	2			4		5			2		4		
*k'		2				3					1				
*g						4		1					3		
*ŋ			2			3							1		
*x		3				1							1		
*ɣ		4	4			2	1				2				
*ʔ		2	1			2		3			1		5		
*j						7									
*ɰ						2	1						2		

Appendix C-6 Final correspondences

rime group	*AM						*AN					
LMC	*am	*am			*iam, *em	*yam	*an	*an		*ian		
dialect	an	an	uan	ian	ian	an	an	an	ian	ian	yan	an
*p					1			4		7		
*p'								2		3		
*b								1		4		
*m								2		4		
(*f)												
(*f')												
(*v)						4						
(*ŋ)												
*t	4				2		3			2		
*t'	3				2		4			1		
*d	4				1		4			5		
*n	2				3		2			3		
*l	5				2		4			6		
*ts					2		1			6		
*ts'	2				1		1			3		
*dz	2				1		3			4		
*s	1						2				1	
*z												
*tʂ		1				2						1
*tʂ'												
*dʐ			1									1
*ʂ												2
*ʐ						1						
*tɕ	1					1		1				2
*tɕ'												
*dʑ												
*ɕ												2
*ʑ												2
*k	1											
*k'	1							2				
*g	1							1				
*ŋ	1							1				
*x	4			2	5		6		7	5		
*ɣ	3				2		2			1		
*ʔ					2		2			5		
*ø				1	2		1		3	3		
*x	1				1		4			4		
*ɣ	2			4	1		4		2	2		
*ʔ	1				4		1			4		
*ø					3					2		

Appendix C-5 Final correspondences

Labels for MC rime groups	Rime group labels used here	Vowel grades	Traditional labels for MC finals	Qiè-yùn MC (R. Li) *Tl-3 Open	Qiè-yùn MC (R. Li) *Tl-3 Close	Qiè-yùn MC (R. Li) *T4 Open	Qiè-yùn MC (R. Li) *T4 Close	Simplified MC (M. Chen) *Tl-3 Open	Simplified MC (M. Chen) *Tl-3 Close	Simplified MC (M. Chen) *T4 Open	Simplified MC (M. Chen) *T4 Close
咸	*AM 1		談覃	ɑ̃m		ɑ̃p		ɑm		ɑp	
		2	咸銜	ɛ̃m		ɛ̃p					
				am		ap		am		ap	
				ɐm		ɐp					
		3	嚴凡 A	iɐm	iuɐm	iɐp	iuɐp				
			鹽添 A	iɛ̃m		iɛ̃p		iam	yam	iap	yap
			B	i̯ɛ̃m		i̯ɛ̃p					
		4	添	em		ep		em	uem	ep	uep
深	*EM 3		侵 A	iəm		iəp		iam		iap	
			B	i̯əm		i̯əp					

Table 3 (d)

山			ân	uân	ât	uât	ɑn	uɑn	ɑt	uɑt
	*AN	1	an	uan	at	uat	an	uan	at	uat
	寒 桓	2	än	uän	ät	uät				
	山		iɐn	iuɐn	iɐt	iuɐt	iɑn	yɑn	iɑt	yɑt
		3 元	iän	iuän	iät	iuät				
		仙 A	jän	juän	jät	juät				
		B								
		4 先	en	uen	et	uet	en	uen	et	uet
寒	*EN	1 痕,魂	ən	uən	ət	uət	ən	uən	ət	uət
		3 殷,文	iən	iuən	iət	iuət	iən	yən	iət	yət
		真,祥 A	iěn	iuěn	iět	iuět				
		B	jěn	juěn	jět	juět				
桓	*AM	2 庚一	ɐŋ	uɐŋ	ɐk	uɐk	ɑń	uɑń	ɑc	uɑc
		耕	äŋ	uäŋ	äk	uäk				
		3 庚三	iɐŋ	iuɐŋ	iɐk	iuɐk	iɑń	yɑń	iɑc	yɑc
		清	iäŋ	iuäŋ		iuäŋ				
		4 青	eŋ	ueŋ	ek	uek	eń	ueń	ec	uec

Table 3 (e)

rime group	*AI (cont'd)								*AU						
LMC	*uai				*uai		*yai,*uei		*au		*au			*iau, *eu		
dialect	ei	í	uei	uai	uai	ua	ei	uei	au	u	au	ua	iau	iau	au	uei
*p	2								7	1	3			2		
*p'	2	1									2			4		
*b	4								3		3			3		
*m	6								3		5			5		
(*f)							1									
(*f')							1									
(*v)																
(*ɱ)																
*t			2						6					5		
*t'			3						4					3		
*d			2						6					4		
*n	1								1		2			1		1
*l	2								5					4		
*ts			1						6					2		
*ts'			1					1	3					1		
*dz			1						4					2		
*s			1					1	5					4		
*ʐ																
*tʂ											1				1	
*tʂ'															1	
*dʐ															4	
*ɳ															3	
*tɕ															3	
*tɕ'																
*dʑ																
*ɕ								1							3	
*ʑ															1	
*k					3	1		1	4				12	3		
*k'					2				3				1	2		
*g														3		
*ŋ			1	1					3				1			
*x			3		1				5				1	1		
*ɣ			6		3	2		1	2				4			
*ʔ														4		
*j																
*ɦ														2		

Appendix C-4 Final correspondences

rime group	*A (cont'd)						*AI								
LMC	*a		*ia		*ua		*ɑi		*ai				*iai, *ei		
dialect	a	ia	ie	ɣ	ua	a	ei	ai	ai	a	ie	ia	i	ʅ	y
*p	4						2		2				2		
*p'	1								1				1		
*b	1								4	1			2		
*m	4								4				3		
(*f)															
(*f')															
(*v)															
(*ɱ)															
*t								3					5		
*t'								5					5		
*d								6					7		
*n	1							3	1				1		
*l								2					7		
*ts			2					5					3		
*ts'			1					4					2		
*dz								3					3		
*s			4					3					2		1
*z			2												
*ȶ			1												
*ȶ'															
*ȡ	2														
*ń				1											
*tś				1										1	
*tś'				2											
*dź				2											
*ś				3										1	
*ź				1										1	
*tʂ	3								2						
*tʂ'	4								1						
*dʐ	2								1						
*ʂ	3				1	1			2						
*ʐ															
*k		11			2			3	1		7	1	3		
*k'					3			2	1				3		
*g			1												
*ŋ		3			1			2							
*x		3			2										
*ɣ		4			1			1							
*ʔ		3						2	3				1		
*j			3					2	2						
*ø															

Appendix C-3 Final correspondences

宕江	*ANG 1	唐	âŋ	uâŋ	âk	uâk	ɑŋ	uɑŋ	ɑk	uɑk
	2	江	åŋ		åk		aŋ		ak	
	3	陽	iaŋ	iuaŋ	iak	iuak	iaŋ	yaŋ	iak	yak
曾	*ENG 1	登	əŋ	uəŋ	ək	uək	əŋ	uəŋ	ək	uək
	3	蒸	iəŋ		iək	iuək	iəŋ		iək	yək
通	*UNG 1	東一 冬	uŋ oŋ		uk ok		uŋ		uk	
	3	東三 鍾	iuŋ ioŋ		iuk iok		iuŋ (= yŋ)		iuk (= yk)	

Table 3 (f)

Key to Table 3

i̯, j = non-syllabic i
ë = centralized e
ä = ae
å = ɔ
ɐ = low-mid, central vowel (ə = mid-high central)
â, ɐ̂ = ɑ, A, i.e. the low, retracted counterparts of a, ɐ, respectively
ń, c = palatal nasal and stop

(cf. vowel chart in (1.4))

1.3 SIMPLIFIED MIDDLE CHINESE (SMC). I will refer to the system of MC presented so far as *Qiè-yùn* MC (QMC for short), because it has been based primarily on the framework set up by the authors of *Qiè-yùn*, a 7th c. pronouncing dictionary which epitomizes our presently available information on MC phonology. Notice that in Table 3 we have both QMC and Simplified MC (hereinafter SMC) reconstructions. The QMC system consisting of 4 tones, 36 initials and 160 finals as outlined in the preceding section seems to be extraordinarily complex as compared to any of the existing dialects of modern China. If the 17 dialects surveyed in *Zì-huì*, a comparative dialectological dictionary compiled by a team of linguists at the University of Peking (1962), are at all representative of Chinese dialects, the typical sound system of Chinese exhibits 4 (as in Peking) to 9 tones (as in Cantonese; 6 tones if we exclude the derivatives of MC *T4), 15 (Fú-zhōu) to 28 initials (Shuāng-fēng), 33 (Wēn-zhōu) to 67 finals (Méi-xiàn). On the average a Chinese dialect has 5.82 tones (or 4.65 excluding *T4 derivatives), 21.65 initials (including zero initial), and 45.88 finals (including syllabic nasals, liquids, etc.). The number of actually occurring syllable types (differentiated by tone or segmental composition) in MC (3,617) is three times as large as that of the modern Peking dialect (roughly 1,200).

More importantly, it is probably correct to say that the MC distinctions are never realized in toto in any one contemporary dialect. In fact, many MC distinctions -- particularly the finer distinctions of finals -- find no correspondent at all in any modern dialect. For instance, the distinction between grade 3 and grade 4 (e.g. the contrast between *ian and *en, between *yan and *uen -- see Table 3) is not attested by any observable contrast except marginally and sporadically in two Wú dialects (cf. Jin 1964 and Yue 1958). Furthermore, the extremely fine-grained differences in the vowel quality that supposedly kept the numerous otherwise identical MC finals apart strain the credibility of such a vowel system. The MC finals according to Li would require a vowel system like:[3]

(1.4)

i̯	i			u
	e	ĕ	ə	o
	ä		ɐ	å
	a		ê	â

rime group	*0								*A						*ya
MC	*o				*io				*a			*ua			*ya
Peking	u	o	ou	uo	u	y	o	uo	ɣ	uo	a	o	uo	ɣ	ye
*p	4											4			
*p'	3											4			
*b	8											1			
*m	4	1										3			
(*f)					8										
(*f')					3										
(*v)					6										
(*ɱ)					4										
*t	3		1							1			2		
*t'	3									2	1		1		
*d	9									1	1		1		
*n	3					1				1			1		
*l	5					5				2			1		
*ts	3			1						1					
*ts'	2					2				1					
*dz						1							2		
*s	3					3							4		
*z						1									
*ʈ					5										
*ʈ'															
*ɖ					5										
*ɳ					2										
*tɕ					5										
*tɕ'					2										
*dʑ															
*ɕ					5										
*ʑ					3										
*tʂ					1										
*tʂ'					2										
*dʐ					2										
*ʂ					4			1							
*ʐ															
*k	4				2	7			2				3		
*k'	3					2			1					4	
*g						3									
*ŋ	6					7			2	1			1	1	
*x	2					2							2		1
*ɣ	9								4				2	2	
*ʔ	2												1		
*j						3									
*ø						8									

Appendix C-2 Final correspondences

rime group	*I								*U					
MC	*i				*ui				*u			*iu		
Peking	i	ei	ɿ	ʅ	ər	ei	uei	uai	i	ou	au	u	ou	u	iou	iau
*p	5	3														1
*p'	3	1														
*b	6	2														
*m		3								1	2	2				
(*f)						3							1	1		
(*f')						1										
(*v)						1							1	3		
(*ɱ)						5										
*t										4					1	
*t'										2						
*d	1									3						
*n	3															
*l	11					4				2						
*ts			6				2			2					3	
*ts'			5				1			1					1	
*dz			4												1	
*s			10				1								2	
*z			6				2								2	
*ʈʂ				4			1						2			
*ʈʂ'				1									1			
*ɖʐ				4			1						4			
*ʂ					4		1						1			
*ʐ																
*tɕ				11			1						2			
*tɕ'							2						2			
*dʑ				1												
*ɕ				7			1						3			
*ʑ				6		1	2						6			
*tʂ													1			
*tʂ'																
*dʐ				3									1			
*ʂ				5				4					3	1		
*ʐ																
*k	10						7		1	5					6	
*k'	6						1			4					1	
*g	7						3								4	
*ŋ	3						4			2					1	
*x	4						4								2	
*ɣ										6						
*ʔ	5						4			2					3	
*j							10								7	
*ø	6						1		1						3	

Appendix C-1 Final correspondences

a rather implausible vowel system, to say the least. Observations of this nature have long led scholars to pose questions about the reality of the phonological system reconstructed mainly on the basis of the framework of *Qiè-yùn* and related historical sources. In particular, some have wondered if the MC sound pattern was not a composite scheme set up by the compilers of *Qiè-yùn* to represent the sum of all distinctions found in any one dialect known to them.[4]

For these and other reasons I will not elaborate here (cf. Chen, forthcoming), I will take the Simplified MC (SMC) sound system as the point of departure. I shall accept in toto and without modification the 4 tones, and the 36 initials as reconstructed by Li (1952), whose system comes close to what can be regarded as the 'standard view' of MC phonology. As for the finals, I have made a procedural decision to initially disregard the following kinds of distinctions: (a) the 'multiple finals' (known as *chóng-yùn* in Chinese) within the same rime group, the same grade, and belonging to the same open/close category; (b) the 'doublets' (commonly referred to as *chóng-niǔ*), that is, the subdistinctions (indicated by means of A and B in Table 3) within one and the same final, not overtly recognized even by the authors of *Qiè-yùn*. I have underscored the words 'procedural' and 'initially', for I do not wish to foreclose the as yet unsettled controversy over the real or composite nature of the MC system as presented by *Qiè-yùn*, and because I will not hesitate to reintroduce whatever distinction(s) initially disregarded in order to account for their subsequent developments. Notice that I am in fact taking the most conservative position: the SMC system consists of a subset of MC categories which constitute the non-controversial core of our knowledge about the speech pattern of MC; the residue of finer distinctions (a,b) excluded from SMC are precisely those phonological contrasts and phonetic details about which considerable disagreements and grave doubts have persisted. In short, I am positing as few MC contrasts as possible, and as many as necessary.

SMC would then have the following vowel system:

(1.5) SMC Vowel System

i y u
e ə o
a ɑ

QMC and SMC finals are juxtaposed in Table 3 for comparison. Aside from the simplifications already mentioned above (a,b), I have followed Li's reconstruction in the main -- with one major deviation. I have posited for SMC a pair of palatal endings *-ń and *-c in addition to the three pairs of consonantal codas: *-m/p, *-n/t, *-ŋ/k, which have been universally recognized. I take Hashimoto's (1965 and 1970) arguments in support of the palatal endings to be highly convincing. Hashimoto's hypothesis has since been tacitly accepted by Pulleyblank (1970:237) and others.

From this point onward, except when stated to the contrary, I will speak solely of SMC finals (QMC and SMC are identical in all other respects). The distinction between QMC and SMC will be made only where relevant, so that MC will continue to be used with the understanding that, unless otherwise specified, MC = SMC.

The patterning of MC (= SMC) finals can be seen more clearly in Table 4, in which these finals are cross-classified according to such considerations as:

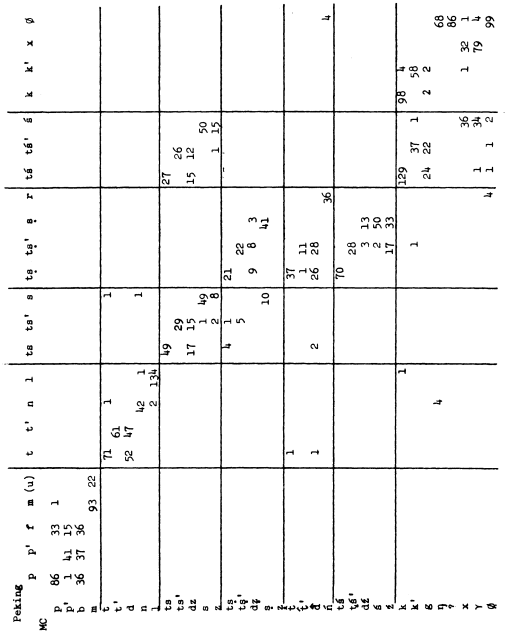
1. The medial onglides, if any. Hence the four columns with such labels as 'kāi, qí, hé, cuò' (literally meaning: 'open', 'spread', 'closed', and 'puckered' respectively, all referring to the various shapes of the lips), corresponding to the four types of medials: /Ø, i, u, y/.

2. The principal vowel. The 'outer rimes' contain an a-type vowel (/a, ɑ/ and their grade 4 counterpart /e/; the 'inner rimes', on the other hand, have either /ə/ or one of the high vowels as nucleus.

3. The consonantal ending. Open syllables are known as 'yīn' rimes; syllables ending in a nasal are called 'yáng' rimes; and syllables checked by a corresponding stop are referred to as 'rù' rimes.

It is clear that labels like 'inner/outer', 'yīn/yáng/rù' and so forth have specifiable phonetic interpretations despite their apparent arbitrariness and, occasionally, 'metaphysical' connotations.

The co-occurrence relations between the initials and the finals are given in Table 5. The phonotactic conditions of both MC and the Peking dialect will be the subject of section 1.5.



Appendix B. Initial correspondences

MC Tones	Peking Tones	Environment (defined in terms of MC initials) voiceless	voiced obstruents	sonorants
*T1	T1A	486	2	9
	T1B	1	270	194
	T2	2	2	1
	T3	-	2	-
*T2	T1A	4	-	-
	T2	280	9	93
	T3	4	91	1
*T3	T1A	3	-	2
	T1B	-	1	1
	T2	5	3	1
	T3	343	136	130
*T4	T1A	85	2	4
	T1B	43	80	1
	T2	26	1	1
	T3	22	9	76

Appendix A. Tone correspondences

(numbers refer to the instances attesting to the correspondences)

			开 'Kāi' -Ø-	齐 'Qí' -i-	合 'Hé' -u-	撮 'Cuò' -y-
阴声韵 'YIN' rimes	外转 'Outer' rimes	*A	ɑ a	ia	u ua	ya
		*AI	ɑi ai ei	iai	uɑi uai uei	yai
		*AU	ɑu au eu	iau		
	内转 'Inner' rimes	*I		i	ui	
		*O	o	io		
		*U	u	iu		
阳入声韵 'YANG' (and 'RU') rimes	外转 'Outer' rimes	*AM	ɑm/p am/p em/p	iam/p		yam/p
		*AN	ɑn/t an/t en/t	ian/t	uɑn/t uan/t uen/t	yan/t
		*AŃ	ań/c eń/c	iań/c	uań/c ueń/c	yań/c
		*ANG	aŋ/k aŋ/k	iaŋ/k	uaŋ/k	yaŋ/k
	内转 'Inner' rimes	*EM		iəm/p		
		*EN	ən/t	iən/t	uən/t	yən/t
		*ENG	əŋ/k	iəŋ/k	uəŋ/k	yə(ŋ)/k
		*UNG		iuŋ/k	uŋ/k	

Table 4. The Patterning of SMC Finals

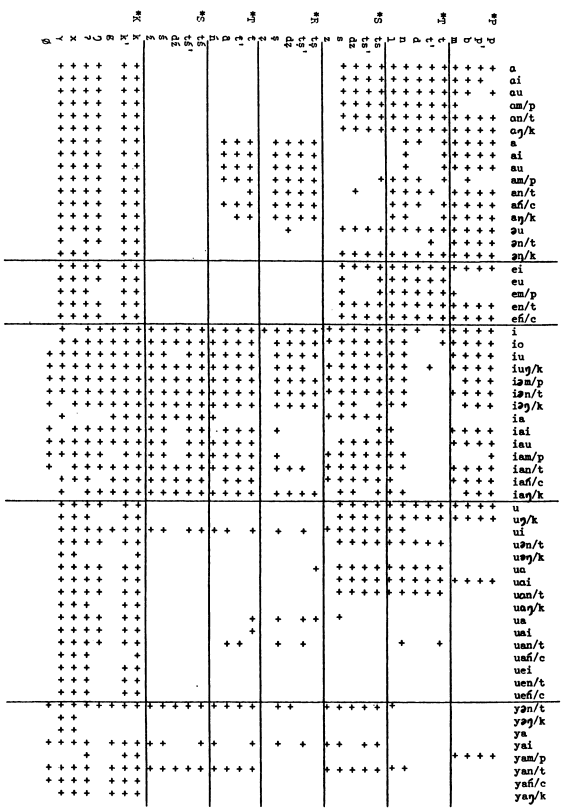


Table 5.

SHIBATANI, M. 1973. The role of surface phonetic constraints in generative phonology. Lg 49.87-106.

WANG, L. 1958. Hàn-yǔ Shǐ-gǎo (A Tentative History of the Chinese Language). vol. 1. Peking: Ke-xué Chu-bán-shè.

_____. (n.d.) Hàn-yǔ Yin-yùn. Hong-Kong: Wén-chang shu-jú.

WANG, W. 1969. Competing changes as a cause of residue. Lg 45.9-25.

_____. 1971. The basis of speech. In: The learning of Language, ed. by C.E. Reed. New York. p. 267-305.

YUE, C. 1958. Jin-huá fang-yin yǔ Běi-jing yǔ-yin de duì-zhào (Correspondences between the pronunciations of Jin-huá and the Peking dialect). Fang-yán yǔ pǔ-tong-huà jí-kan 5.25-98.

ZHAO, Y-T. 1957. Děng-yùn Yuán-liú (The Origin and Evolution of Chinese Phonology). Shanghai: The Commercial Press.

ZHENG, Z-F. 1966. Hàn-yǔ yin-yùn-shǐ de fen-qí wèn-tí (Problems in the periodization of the history of Chinese phonology). BHIP 36.635-48.

ZHOU, F-G. 1948. Gǔ-yin zhong de san-děng-yùn jian lùn gǔ-yin de xiě-fǎ (On the 3rd 'grade' finals in Ancient Chinese and the transcription of Ancient Chinese). BIHP 19.203-33 (also in Zhou 1968 a.125-50).

_____. 1954. Gǔ-dài hàn-yǔ de yin-wèi (The phonemes of Ancient Chinese). BIHP 25.1-19 (also in Zhou 1968 a.263-82).

_____. 1968a. Zhong-guó Yǔ-yuán-xué Lùn-wén-jí (Collected Papers on Chinese Linguistics). Hong-Kong: Chung-chi Shu-jú.

_____. 1968b. Lùn Qiè-yùn-yin (On the Qiè-yùn system). Journal of the Institute of Chinese Studies of the Chinese University of Hong Kong 1.90-112.

_____. 1970. Lùn shàng-gǔ-yin hé Qiè-yùn-yin (On Archaic Chinese phonology and the Qiè-yùn system). Journal of the Institute of Chinese Studies of the Chinese University of Hong Kong 3.321-457.

Zì-huì, see Peking University 1962.

XXX. 1970. Fang-yán Diào-chá Zì-biǎo (A Word-list for Dialectological Surveys). Re-issued by Princeton University.

KARLGREN, B. 1915-26. Études sur la phonologie chinoise. Chinese translation by Y-R. Chao, F-K Li and C-P. Luo under the title 'Zhong-guó Yin-yùn-xué Yán-jiu', Changsha: The Commercial Press, 1948. (all quotes and page numbers refer to the 1948 translation).
_____. 1954. Compendium of Phonetics in Ancient and Archaic Chinese. Stockholm: The Museum of Far Eastern Antiquities, Bulletin no. 26.
KENNEDY, G.A. 1951. The monosyllabic myth. JAOS 71 (reprinted in Selected Works, ed. by T.Y. Li, pp. 104-18).
LI, R. 1952. Qiè-yùn Yin-xì (The Phonological System of Qiè-yùn). Peking: Ke-xué Chu-bǎn-shè.
LU, Zh-W. 1947. Gǔ-yin Shuo-lüè (A Brief Description of Ancient Chinese Pronunciation). Monograph of the Yenching Journal of Chinese Studies, no. 20.
LUO, C-P. 1933. Táng, Wǔ-dài Xi-běi Fang-yin (The Phonology of the Northwestern Dialects during the Táng and the Five Dynasties). BIHP monograph, no. A-121.
MARTIN, S. 1953. The Phonemes of Ancient Chinese. JAOS Supplement 16.
MASPÉRO, H. 1920. Le dialecte de Tch'ang-ngan sous les Tangs. BEFEO 20.1-124.
MATISOFF, J. 1973. Tonogenesis in Southeast Asia. In: Consonant Types and Tone, ed. by L. Hyman, pp. 71-96.
MEI, T-L. 1970. Tones and prosody in Middle Chinese and the origin of the rising tone. HJAS 30.86-110.
MOHR, B. 1971. Intrinsic variations in the speech signal. Phonetica 23.65-93.
NAGEL, P. 1942. Beiträge zur Rekonstrucktion der Ts'ieh-yuen-Sprache auf Grund von Ch'en Li's Ts'ieh-yuen-kao. T'oung-Pao 36.95-158.
PEKING UNIVERSITY. 1962. Hàn-yǔ Fang-yin Zì-huì (A Pronouncing Dictionary of Hàn (Chinese) Dialects). Peking: Wén-zì Gǎi-gé Chu-bǎn-shè.
POSTAL, P. 1968. Aspects of Phonological Theory. Harper and Row.
PULLEYBLANK, E. 1962-63. The consonantal system of Old Chinese. Asia Major 9.59-144 and 206-65.
_____. 1970-71. Late Middle Chinese. Asia Major 15.197-239 and 16.121-168.
_____. 1972. The analysis of vowel systems. Acta Linguistica Hafniensia 14.39-62.
SANDERS, G. 1974. The simplex-feature hypothesis. Glossa 8.141-92.

1.4 MODERN PEKING. The modern dialect of Peking, on which Standard Mandarin is based, has been reported many times over. Since this paper is the first of a series of similar studies on the history of representative dialects of Chinese, for the sake of uniformity I will use *Hàn-yu Fāng-yīn Zì-huì* ('A Pronouncing Dictionary of Chinese Dialects'; hereafter referred to as *Zì-huì* for short), a comparative pronouncing dictionary of 17 dialects of contemporary China compiled by the University of Peking in 1962, as the principal source of information. Occasionally I will supplement *Zì-huì* with data taken from the widely used *Fāng-yán Diào-chá Zì-biǎo* ('A Word-list for Dialect Survey', reissued by the Princeton University in 1970), or Ding-Li's (1966) *Gǔ-jīn Zì-yīn Duì-zhào Shǒu-cè* ('A Handbook of Correspondences between Ancient and Modern Readings').

The 4 tones, 22 initials, and 36 finals of Peking are listed in Tables 6, 7, and 8 respectively. The tone marks, tone letters, and the numerical notation (devised by Y-R. Chao, 1930) have now become standard. The initials are grouped according to the places and manners of articulation in the usual format. Let me mention in passing that /r/ has a free variant [ẓ], but for pattern congruity I have chosen to represent this initial as a liquid rather than a voiced obstruent, since voicing does not otherwise constitute a phonemic contrast in the Peking sound system as a whole. The finals are arranged according to the same criteria also applied to MC (namely medial, principal vowel, and consonantal ending).

The possible combinations of initials and finals -- and systematic gaps -- in modern Peking are presented in Table 9.

1.5 MC-PEKING CORRESPONDENCES. Facts about the two end points of the period of the Chinese phonological history we are examining are well-known and uncontroversial. What happened between these two synchronic states -- the focus of our interest in this paper -- can be inferred in part, from the systematic sound correspondences between MC and Peking. The tables of MC-Peking correspondences (see Appendix) I have used as the primary source of internal evidence are based on *Zì-huì* (= Peking University 1962). The data contained in *Zì-huì* has been recorded in a machine-readable format as part of a project called DOC (for Dictionary on Computer), initiated under the direction of William S-Y. Wang at Berkeley in 1966. The coding part of the project was completed and DOC fully functional by 1970. In the summer of 1970, with the generous help and support of

a number of my former associates at the Berkeley project as well as its director, I had undertaken to sort all the available dialectal readings according to the MC categories. As a result, about 20 volumes of computer print-outs were obtained. The contents of these bulky print-outs were further reduced to a more compact and manageable form. Appendices A, B, C, summarizing the MC-Peking correspondences in three parts -- tones, initials, finals -- represent part of the end results of these concerted efforts.[5]

去	上	陽平	陰平	Traditional labels
'Falling'	'Dipping'	'Rising'	'Level'	Standard labels in current usage
T3	T2	T1B	T1A	Labels used in this paper
falling pitch	slight falling then rising pitch	high rising pitch	high level pitch	Phonetic description
ˇ	ˇ	ˊ	ˉ	Tone marks in current usage
∠	∨	↗	⌐	Tone letters (Y-R. Chao's notation)
51	214	35	55	Numerical values on a 5-point scale

Table 6. Peking Tones

CHEN, M. and W. WANG. 1975. Sound change: actuation and implementation. Lg 51.255-81.
CHENG, C.C. 1973. A Synchronic Phonology of Mandarin Chinese. Mouton.
CHOMSKY, N. and M. HALLE. 1968. The Sound Pattern of English. Harper and Row.
DING, Sh-Sh and R. LI. 1958. Gǔ-jin zì-yin duì-zhào shǒu-cè. (A Handbook of Correspondences between Ancient and Modern Pronunciations.) Reissued in 1966 by Tài-píng Shu-jú, Hong Kong.
DONG, T-H. 1954. Zhong-guó Yǔ-yin Shǐ (History of Chinese Phonology). Taipei: Zhong-huá Wén-huà Chu-bǎn shì-yè Wěi-yuán-huì.
_____. 1968. Hàn-yǔ Yin-yùn Xué (Chinese Phonology). Taipei: Guǎng-wén Shu-jú.
HARTMAN, L.M. 1944. The segmental phonology of the Peiping dialect. Lg 20.28-42 (also in M. Joos 1957).
HASHIMOTO, M. 1965. Phonology of Ancient Chinese. Ohio State University Ph.D. dissertation.
_____. 1969. Nasal and stop endings in Ancient Chinese. Unicorn 5.29-53.
_____. 1970. Internal evidence for Ancient Chinese palatal endings. Lg 46.236-65.
_____. 1973. Retroflex endings in Ancient Chinese. JCL 1.183-207.
HAUDRICOURT, A. 1954. De l'origine des tons en vietnamien. Journal Asiatique 242.68-82.
_____. 1961. Bipartition et tripartition dans les systèmes de tons. Bulletin de la Société Linguistique de Paris, 56.163-80.
HIRAYAMA, H. 1975. Xià-mén-huà gǔ-diào-zhí de nèi-bù gòu-nǐ (Internal reconstruction of the ancient tones of Xià-mén). JCL 3.3-15.
HOCKETT, C. 1947. Peiping phonology. JAOS 67.253-67.
HOMBERT, J-M., W. EWAN and J. OHALA. 1975. Tonogenesis: theories and queries. Paper presented at the 8th Sino-Tibetan Conference, Berkeley.
JAKOBSON, R. 1931. Principes de phonologie historique. Reprinted in R. Jakobson, 1971, Selected Writings, vol. 1, pp. 202-20.
JIN, Y-J. 1964. Yì-wu-huà lǐ Xián-Shan liǎng shè san-sì-děng zì de fen-bié. (The distinction between the 3rd and 4th 'grade' of the two rime-groups 'Xián' and 'Shan' in the dialect of Yì-wu).
JOOS, M. (ed.). 1957. Readings in Linguistics, I. University of Chicago Press.

8. Among the transcriptions in question are *Chéng-shì Mò-jí* (-1605) and *Xī-rú Er-mù zǐ* (1625). These documents only attest to the palatalization of velar initials. The palatalization of the dental series is not documented until *Tuán-yīn Zhèng-kao* (1743). The two types of palatals are known in the traditional terminology as 'tuán-yīn' (round sounds) and 'jiān-yīn' (sharp sounds) respectively.

REFERENCES

CHAFE, W. 1968. The ordering of phonological rules. IJAL 34.115-136.

_____. 1970. Meaning and the Structure of Language. University of Chicago Press.

CHANG, K. 1974. Ancient Chinese phonology and the Ch'ieh-Yün. The Tsing Hua Journal of Chinese Studies, new series, 10.61-82.

CHANG, K. and B. SHEFTS. 1972. The Proto-Chinese Final System and the Ch'ieh-Yün. Academia Sinica: BIHP Monograph, series A, no. 26, Taipei.

CHAO, Y-R. 1930. A system of tone letters. Le Maître Phonétique, 45.24-7.

_____. 1934. The non-uniqueness of phonemic solutions of phonetic systems. BIHP 4.363-97 (page numbers refer to the version appearing in M. Joos, 1957).

_____. 1941. Distinctions within Ancient Chinese. HJAS 5.303-22.

CHEN, M. 1970. Vowel length variation as a function of the voicing of the consonant environment. Phonetica 22.129-59.

_____. 1972. The time dimension: contribution toward a theory of sound change. FL 8.457-98.

_____. 1973. Cross-dialectal comparison: a case study and some theoretical considerations. JCL 1.38-63.

_____. 1974. Natural phonology from the diachronic vantage point. Papers from the Parasession on Natural Phonology, ed. by A. Bruck, R. Fox and M. La Gay, Chicago Linguistic Society, pp. 43-80.

_____. 1975. An areal study of nasalization in Chinese. JCL 3.16-59.

_____. 1976 (in press). Relative chronology: three methods of reconstruction. To appear in JL.

_____. (Forthcoming). From Middle Chinese to Modern Dialects.

Labial	Dental (Non-fricated)	Dental (Fricated)	Retroflex	Palatal	Velar (includes zero)		
p	t	ts	tṣ	tś	k	Voiceless	Non-continuant
p'	t'	ts'	tṣ'	tś'	k'	Aspirated	
f		s	ṣ	ś	x	Fricative	
m	n					Nasal	
	l		r (=ẓ)			Liquid	
					ø	Other	

Table 7. Peking Initials

	-ɸ-	-i-	-u-	-y-
ɨ	ɨ̃ (= ɿ,ʅ)			
i		i		
u			u	
y				y
ər	ər(= ɚ)			
e		ie		ye
ɤ	ɤ			
o	o		uo	
a	a	ia	ua	
ai	ai		uai	
au	au	iau		
ei	ei		uei	
ou	ou	iou		
an	an	ian	uan	yan
ən	ən		uən	
in		in		
yn				yn
aŋ	aŋ	iaŋ	uaŋ	
əŋ	əŋ			
iŋ		iŋ		
uŋ			uŋ (= uəŋ)	
yŋ				yŋ (= iuŋ)

Key to Table 8

ɨ̃ = apical vowel
ɿ = dental apical
ʅ = retroflex apical
ɚ = retroflexed
ɤ = high-mid, back, unrounded vowel

Table 8. Peking Finals

2. The final /ŋ/ is sometimes weakened to an undifferentiated /-N/; similarly /-k/ is often further reduced to the minimal stop, that is a glottal catch /-ˀ/.
3. M. Hashimoto (1969:30ff) attributes the diphthong/monophthong reflexes of MC *ac, *ak, and *ak to the fusion of two dialectal strands in modern Peking: the colloquial pronunciation (diphthongal) is traceable to the Qín prototype, once spoken in what is now Shen-xī, Gān-su and parts of Hé-nán; the literary overlay (monophthongal), on the other hand, reflects the influence of the dialect of Jìn, which had its center in modern Shān-xī, and extended to parts of Hé-nán and Hé-bei.

SECTION IX

1. We are referring, needless to say, to the diachronic counterpart of the distinction between intrinsic and extrinsic rule ordering much discussed in synchronic phonology.
2. And probably wrong. There is evidence for T1-SPLIT already in *Huáng-jí Jìng-shī* (1011-1077), whereas T2-MERGE is not attested until much later, in *Zhōng-yuán Yīn-yùn* (1324). Cf. Zhao 1957 and Zheng 1966.
3. T4-TRIPART and APOCOPE are inseparable, in fact one single process split into two rules for expository reasons. Consequently, an intermediate form like /bauk T1B/, an artefact of our descriptive apparatus, would be an impossible syllable type, for despite its overt tone mark (T1B) it is, by definition, a T4 word on account of the presence of a stop ending.
4. That is, assuming that *ˀ would undergo PALAT like an initial of the velar/glottal series. That the glottal stop behaves on the whole like a velar initial is suggested by SHARP and ROUND, among others.
5. Whereas in fact there are reasons to believe that GVS was a 'push-chain' phenomenon. For details, see Chen 1974, and 1976 in press.
6. Given 33 rules (RETROF-1,2 and DIPHTHONG-1,2 are counted as two each), there are 1,056 possible ordering relations.
7. All except U-DELET, which cannot be proven on internal grounds to be crucially ordered vis-a-vis any other P-rule. PC's, on the other hand, can of course apply after it.

8. MC *iai did not co-occur with retroflex initials. Hence the gap in (6.22).
9. I have included *tsei 'crowded' to show two alternative derivations. Recall, by G4-MERGE, *tsei merged with *tsiai as in 'sacrifice' (ignoring the tone). In this case, 'crowded' follows exactly the same derivation as 'sacrifice'. However, the derivation may be considerably shortened if we apply RAISE directly to *ei, as is the case here in (6.24). Either way, exactly the same output is obtained.
10. In one case, *ai became Peking /ia/, namely *kai 'good' -- Peking /tɕia/.
11. The same position is implicit in M. Hashimoto (1965), who reconstructed QMC *ä and *äi, respectively as *ɛ and *ɛi (notational variants of R. Li's reconstructions).
12. The exceptional behavior of MC *ań and *ac with regard to SHARP provided one of the main arguments that M. Hashimoto (1965; cf. 1970) put forward for reconstructing these MC finals with a palatal ending, rather than with a velar ending, in a major departure from the traditional schema of the MC phonological system.
13. Cf. discussion in Chao (1934:45).

SECTION VII

1. Since neither *aŋ nor *aŋ was affected by VOCAL, (7.5) should be refined by a condition, such as if β = +, C must be [-nasal]. Notice, too, that VOCAL applied only to those finals which were to undergo subsequently either FUSION or APOCOPE. Since *aŋ and *aŋ were not subject to either of these processes, they were also outside of the scope of VOCAL. It is clear that VOCAL, FUSION, and APOCOPE are intimately related: VOCAL served to preserve part of the information once carried by the syllable endings which was subsequently lost because of FUSION and APOCOPE.

   In addition to the functional considerations pointed out above, there are also some articulatory factors which contributed to shaping VOCAL as it is. Notice that both *-p and *-t did undergo APOCOPE, and yet the information once carried by them was not re-encoded by means of VOCAL. My speculation is that whereas palatals and velars are articulated with the tongue body, which is also involved primarily with the production of vowel sounds, the labials and dentals do not share the same articulators in the same way.

ø	x	k'	ʂ	tʂ'	tʂ	ʐ	ɕ'	tɕ'	ʃ	tʃ'	tʃ	l	n	t'	t	f	m	p'	p	
+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	a
																+	+	+	+	o
+	+	+					+	+	+	+	+	+	+	+	+					ɤ
									+	+	+									ɿ
							+	+	+	+										ʅ
+																				ɚ
+	+	+						+	+	+	+	+	+	+	+			+	+	ai
+	+	+						+		+			+	+		+	+	+	+	ei
+	+	+					+	+	+	+	+	+	+	+	+			+	+	au
+	+	+					+	+	+	+	+	+	+	+	+	+	+	+		ou
+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	an
+	+	+					+	+	+	+	+	+		+			+	+	+	ən
+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	an
+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	əŋ
+			+	+	+								+	+	+			+	+	i
+			+	+	+								+							ia
+			+	+	+								+	+	+			+	+	iau
+			+	+	+								+	+	+			+	+	ie
+			+	+	+								+	+	+			+		iou
+			+	+	+								+	+	+			+	+	ian
+			+	+	+								+	+				+	+	in
+			+	+	+								+	+						iaŋ
+			+	+	+								+	+	+			+	+	iŋ
+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	u
+	+	+				+	+	+	+											ua
+	+	+				+	+	+	+	+	+	+	+	+	+					uo
+	+	+					+	+	+											uai
+	+	+				+	+	+	+	+	+			+	+					uei
+	+	+				+	+	+	+	+	+	+	+	+	+					uan
+	+	+				+	+	+	+	+	+	+		+	+					uən
+	+	+					+	+	+											uaŋ
+	+	+				+		+	+	+	+	+	+	+	+					uŋ
+			+	+	+								+	+						y
+			+	+	+								+	+						ye
+			+	+	+															yan
+			+	+	+															yn
+			+	+	+															yŋ (~iuŋ)

Table 9. Peking
Possible Combinations of Initials and Finals

II. PHONOTACTIC CONDITIONS

2.0 Before we proceed to examining the phonological changes between MC and modern Peking -- which will take up the bulk of the present article -- it is necessary to look at some of the phonotactic facts about both MC and Peking.[1] It will become amply apparent in the subsequent sections that the phonotactics of MC and Peking interacted intimately with and partly determined the course of the intervening changes. A brief statement about the phonotactic facts will greatly simplify our study.

One of the most striking properties of the phonological system of Chinese is the prominent status of the syllable. Despite well-known qualifiers (cf. Kennedy 1951), it is an inescapable fact about the Chinese language that it is basically monosyllabic. The tones, initials, and the various subparts of the final combine into syllables in strict conformity to highly selective co-occurrence relations. What constitutes a possible syllable is governed by a set of sequential and distributional rules -- which I will refer to as 'phonotactic conditions' (PC's). As a detailed synchronic treatment of the phonological system of either MC or Peking is beyond the scope of this paper, I will limit the ensuing discussion in this section to those PC's that have a direct bearing on the historical changes. In what follows both phonological rules (in the diachronic sense, needless to say) and PC's will be given a descriptive label consisting of (abbreviated) keywords in capital letters. In order to set PC's apart from the ordinary rules, PC's are prefixed with an asterisk (*), and shafts (↓) are used instead of arrows (→). In the case of PC's, each will be specified whether it applies to MC or Peking, or both.

2.1 The monosyllabicity of the Chinese language rules out sequences of (a) while permitting those of (b) in (2.1).

(2.1) *MONOSYL (MC, Peking)

(a) ~ V G V
~ V V

(b) G V
V G
G V G
G G

where G = i, u, y
V = all other vowels

While (b) constitute monosyllabic units, the high vowels

SECTION VI

1. The relationship between the two subparts of the rule is obvious. I will not concern myself with the exact formalism designed to make this relationship explicit, as it would raise technical problems not relevant to the matter at hand.
2. The two exceptional Wú dialects are Yì-wū and Jīn-huá as reported in Jin (1964) and Yue (1958), respectively.
3. There are a sizable number of exceptions to DIPHTHONG: (a) the homophonous *mu 'mother' (母) and 'acre' (畝) failed to diphthongize, but remained /mu/. Similarly, words like 'rich' (富), 'to float' (浮), 'woman, wife' (婦), all segmentally identical *piu (differentiated only by tone), and the word 'to carry (a load)' (負) *biu, somehow escaped this process of 'Brechung', and end up as /fu/ instead of the expected /fou/. *siu 'to rinse, gargle' should be /ṣou/ or perhaps /ṣou/ (via DERET), but turned up as /ṣu/ instead (漱). (b) *mu 'spear' (矛) is pronounced today /mau/ instead of /mou/ as one would expect. By the same token, *piu 'young tiger' (彪) and *miu 'luxuriant' (茂) became /piau/ and /mau/ respectively.
4. It goes without saying, (6.9) must be ordered after DIPHTHONG. Otherwise MC *iu would become Peking /y/ instead of /iou/. (6.9) holds for Peking only.
5. *mo 'to touch' (摸) failed to undergo RAISE, and is pronounced today as /mo/ not /mu/. *tso 'to do, make' (做), and *ṣo, a relative pronoun, (所) are exceptional in the same way, and as a consequence of retaining the original *o, became /tsuo/ and /suo/ respectively by U-INSERT(b). *to 'all' has a completely idiosyncratic modern reading /tou/. There is no general or semi-regular rule to account for this pronunciation. Notice, however, that the homographic *to meaning (都) 'metropolis, capital city' is entirely regular: it is pronounced /tu/, as expected.
6. *pui and *mui are *Zì-huǐ* reconstructions.
7. To be precise, MC *iac fell together with *iək (via COALESCE, see section 7.3) and both gave rise to the tertiary /i/ by APOCOPE. Notice, in passing, that the modern /u/ has three sources: the primary /u/ being the MC *u; the secondary /u/ from *o through RAISE; and the tertiary /u/ from *uəC and *uk by APOCOPE.

SECTION V

1. Hashimoto (1973:188-9) pointed out the effect of lip-rounding of retroflex consonants, citing examples from Russian and French. My U-INSERT rule is identical to an earlier formulation proposed by Hashimoto (1965:585).
   In contrast, Pulleyblank (1970-71:238) suggested that *aŋ was actually a diphthong *auŋ, and became /uaŋ/ by metathesis. Pulleyblank's somewhat speculative proposal can be criticized on the following grounds: (a) /auŋ/ or a configuration consisting of the sequence /-VGC/ violates one of the syllable structure constraints which holds true of both MC and modern Peking, namely *CANON referred to in section 2.3; (b) the change involving metathesis, as Pulleyblank would have it, simply lacks independent support: metathesis is unsubstantiated in Chinese, to my knowledge. The only other putative case of metathesis that has been proposed has to do with the change from *ńi to Peking /ər/ supposedly via /źi/, then /ri/ -- according to L. Wang (1958:129, 165). I will argue below (section 5.3 , esp. derivation (5.29)) that at no point in the derivation of /ər/ was metathesis ever involved.
2. The process is analogous to the change suggested by such words as 'Bäume' (/beume/ > /boime/) and 'heute' (/heute/ > /hoite/) in German.
3. See footnote 9 of section 4.
4. Examples of this sort abound in the literature under the heading of 'rule conspiracy', 'functional unity of phonological rules' or 'surface phonetic constraint'. To cite but one of them, in Tonkawa, an American Indian language of Texas, certain vowels are deleted except when the vowel elision results in a cluster precluded by a phonotactic rule. Cf. Kisseberth(1970).
5. Another putative metathesis, that of *ai → /ia/ (> /ie/), will be shown to be just another case of misanalysis in section 6.8.
6. Dong (1968:149) was not without reason in arguing -- too strongly, perhaps -- that the MC initial series *R must have been palato-alveolars *tš, *tš', *dž, *š, *ž instead of retroflexes *tʂ, *tʂ', *dʐ, *ʂ, *ʐ, which could not possibly, physiologically speaking, co-occur with the palatal vowel or glide /i/ or /y/.

being realized as glides in the presence of another vowel, (a) are interpreted as disyllabic sequences by (presumably) universal syllabification rules.[2]

2.2 It is also a universal condition that a syllable must contain a syllabic peak, which is usually a vowel -- although syllabic nasals, liquids and certain continuants are quite common. Whenever this condition, which I shall call *SYLLAB, is violated (e.g. through vowel loss as part of a general rule to be discussed further on), it is restored by syllabifying the last consonant, if there are more than one tautosyllabically. The syllabified consonant is realized phonetically either as a consonant with a hom-organic release /ï/, or a sequence of a neutral vowel /ə/ + the consonant. *SYLLAB can be stated in two parts, as in (2.2):[3]

(2.2) *SYLLAB (MC, Peking)

(a) # (C) C #
        ↓
    [+syllabic]

(b) [C]
    [+syllabic]
        ↓

{ C + ï, if C = sibilant } (i)
{ ə + C, elsewhere   } (ii)

The PC *SYLLAB can also act as a negative constraint on certain otherwise general processes. Thus MED-DISM(b) is blocked from applying just in those cases where its application would result in a syllable deprived of its vocalic nucleus (cf. section 5.3, esp. (5.25-27)).

2.3 In addition to such language-specific versions of universal conditions, there are other PC's peculiar to the phonology of Chinese. Recall that the canonical form of the syllable (see diagram (1.2)) allows an optional coda, which consists of either a consonantal ending, or an offglide, but not both. This syllable structure can be formulated as a negative condition in (2.3):

(2.3) *CANON (MC, Peking)

~ V G C

The relevance of *CANON to the post-MC developments will become apparent when we come to examining the individual innovations.

2.4 Another general fact about both MC and Peking phonology is the total absence of gemination: no geminate vowels or consonants occur either in modern Peking, or its antecedent, MC. This PC has the effect of eliminating one of the identical and contiguous segments within a syllable:

(2.4) *DEGEMIN (MC, Peking)

X_i / X_i
↓
$\emptyset$ Where $X_i X_i$ are two identical segments

Like any PC, *DEGEMIN can apply iteratively. It will be shown that by a general rule of raising (RAISE), MC *iai → iei → iii, creating three identical vowels in a row. The output of RAISE is then reduced to /ii/, ultimately /i/ by the reapplication of *DEGEMIN.

2.5 Both MC and Peking tended to avoid certain syllable types which begin and end in a labial segment. Let us symbolize the two types of labial segments by P for labial consonants, and U for rounded vowels (u, y). Of the four possible combinations in (2.5), only PVU is allowed; UVU and UVP are both ruled out. As for PVP, the sequence appeared in MC in a handful of residual forms (8, to be exact, in the entire *Zĭ-huĭ*)[4], and do not occur at all in modern Peking. I will call this co-occurrence restriction *LAB-DISM (labial dissimilation).

(2.5) *LAB-DISM (MC, Peking)

PVU
?PVP
~UVP
~UVU

2.6 No comparable dissimilatory restriction among the palatals was imposed on MC: *iai, *yai, *iań/c, *yań/c freely occurred. However, somewhere along the line finals like these disappeared through a combination of historical changes, and a new sequential constraint came into force. In modern Peking, sequences like (2.6) do not exist:

6. (4.13) does not really work, since only *iu_1 (from QMC *iu) but not *iu_2 (from QMC *iĕu) triggered LABDNT. I will ignore this problem here since we will abandon the solution suggested by (4.13) anyway.
7. L. Wang echoed Karlgren's position as late as 1958. See L. Wang (1958:114-5).
8. More accurately, *Zĭ-huĭ* posits a series of labiodentals consisting of *f, *f', *v and *ɱ alongside the bilabial series made up of *p, *p', *b and *m. It goes without saying, for a MC system with two separate series of labial initials, LABDNT has no possible application. But it is now generally agreed that the split of labiodentals from the original bilabials was a post-MC development. The tables of correspondences (cf. Appendix C) which are based on *Zĭ-huĭ* indicate the controversial status of labiodentals by enclosing *f, *f', *v and *ɱ in parentheses.
9. Maspéro (1920:74) already suspected that the inconsistencies regarding the open/close contrast in the context of labial initials sprang from mere 'bizarreries orthographiques'; Chao (1941:217ff) relegated the same putative contrast to one of his 'non-distinctive distinctions'. Nagel (1942:131) was perhaps the most explicit in stating the defective distribution noted above of open vs. close finals after labial initials.

   The distributional restriction stated by these authors is almost true. There are two exceptional cases in this respect: both *uɑi and *yam as well as their corresponding open finals *ɑi and *iam in fact co-occurred with labial initials. Cf. Table 5.
10. Nagel (1942:133) independently arrived at the same conclusion. Dentilabialization or, F-Regel or F-Lautverschiebung, as he called it, is formulated in his words: 'F-Regel: Die mc. (= MC) bilabialen jodizierten Verschlusslaute (pj-, p'j-, b'j-, mj-) sind vor ə, ɒ, ɑ̂ = ɑ, o, u (d.h. vor dunkeln und mittleren Vokalen) zu dentilabialen Reibelauten (f-, f'-, v'-, ɱ-, später f-, f-, f-, w-) geworden, vor ä, ɛ, e, ɐ̈ (d.h. vor hellen Vokalen) dagegen nicht'.
11. The details are given in section 9.3, where we shall see the interaction between DERET and three other processes, namely DIPHTHONG, I-DELET, and COALESCE, which combine to create the appropriate strings to which DERET can apply.

7. The application of *RIMEMIC would reduce /uɐn/ to /un/. Instead of detracting from the simplicity and symmetry of *RIMEMIC as it is stated here, it would be best to regard /un/ →[uənɹas a low level phonetic rule. I will henceforth subsume this low level phonetic realization rule under *RIMEMIC.
8. For the sake of uniformity I have replaced Chao's IPA symbols and the National Phonetic Script by the notation used throughout this paper.
9. Zero, glottals, and velars constitute one natural class, namely the *K-series of initials in MC. This natural grouping is manifested for example by ROUND (rounding, whereby *α → /o/, see section 6.4) and SHARP (sharpening, whereby *a → /ia/, see section 6.9), both of which are conditioned by the class of velar/glottal/zero initials as a whole.
10. Cheng (1973) regards [ɤ] as the 'tense' counterpart of [ə]; this approach renders it difficult to capture the generality expressed in (2.19).

SECTION IV

1. The large proportion of residue to regular correspondence as shown in Table 14 has led some to doubt the reality of the affricate vs. fricative distinction between *dẓ, dź and *ẓ, ź. Among the sceptics is K. Chang (personal communication), who observes that the corresponding contrast between voiced affricates and fricatives does not exist at all in the Wú dialects, which have preserved the MC voiced initials. No instance of *ẓ is found within the corpus of data recorded in *Zì-huì* which I have used as the primary source of information for the analysis offered here.
2. Cf. footnote 2 to section 1.
3. Several paragraphs and footnotes (including footnote 4) have been eliminated or moved elsewhere. Hence the non-consecutive numbering of examples, inserts, and footnotes.
5. It has been shown in section (and will be further discussed below) that the presence or absence of a labial glide is not distinctive after labial initials -- except for the opposition between QMC *iuɐm/p and *iɐm/p. For this reason, I have parenthesized the labial glide in QMC *i(u)ən/t in the LABDNT formulated here.

(2.6) $\begin{bmatrix}+\text{high}\\+\text{palatal}\end{bmatrix}$ (V) $\begin{bmatrix}+\text{high}\\+\text{palatal}\end{bmatrix}$

Note that [+high, +palatal] serve to specify both consonants and vowels: I regard palatal consonants (including /ń,c/) as redundantly [+high], as is the current practice. In anticipation of the discussion in the ensuing sections, let it be noted here that actual or potential violations of the sequential constraint, which I shall refer to as *PAL-DISM (palatal dissimilation), can be resolved in several ways: (a) by depalatalizing the palatal onglide, or (b) by blocking a process like SHARP (sharpening, to be given in section 6.9) which would have created forbidden configurations like (2.6),or -- failing which -- (c) by absorbing the palatal offglide into the principal vowel by means of a process called COALESCE (coalescence, see section 7.3). In short, *PAL-DISM is implemented in the following ways:

(2.7) *PAL-DISM (Peking only)

(a) [+high] → [-palatal] (V) $\begin{bmatrix}+\text{high}\\+\text{palatal}\end{bmatrix}$

(b) blocks SHARP

(c) triggers COALESCE

2.7 Let us now turn back to Table 8. Notice the distribution of the various 'rimes' (= final minus the medial) is highly idiosyncratic; there are too many gaps in the table. Consider in particular the -VN finals. While /an/ freely combines with /ø, i, u, y/, /ən/ has a defective distribution in this respect. The sequence /əŋ/ is peculiar in the same way with respect to /aŋ/. Suppose we do posit a full set of /ən, iən, uən, yən/ corresponding to /an, ian, uan, yan/, and allow a PC to eliminate those occurrences of /ə/ which do not surface phonetically, the result would be a much more symmetrical pattern at a more abstract level of representation. Schematically represented, the set of finals in (A) are related to each other in a way which parallels exactly those of (B), although the former are realized as (C):

(2.8)

(A)		(B)
ən iən	::	an ian
uən yən		uan yan

||

(C)
ən in
uən yn

Similarly,

(2.9)

(A)		(B)
əŋ iəŋ	::	aŋ iaŋ
uəŋ yəŋ		uaŋ -

||

(C)
əŋ iŋ
uŋ yŋ

On the grounds of pattern congruity it is legitimate to posit (A) as the 'underlying' representation of the aforementioned finals, despite the phonetic realizations of (C). As a matter of fact, it has been customary since Y-R. Chao's masterly 1934 'Non-uniqueness' article to analyze the sound pattern of modern Peking along the lines suggested by (1.12-13). C. C. Cheng (1973) proposed essentially the same analysis.[5]

As regards MC, it is of considerable interest to note that the notions of symmetry and partial identities underlying the more 'systematic' representations of the finals under discussion were already quite manifest in the classification and arrangement by the scholars of late Táng (8-9th c.) and Sòng (10-13th c.) of the materials contained in *Qiè-yùn* (early 8th c.). Notice that in Table 4, we have two perfectly matching sets of nasal finals ending in /ən/ and /an/ (and correspondingly /ət/ and /at/):

(2.10)

(A)		(B)
*ən *iən	::	*an *ian
*uən *yən		*uan *yan

2. There is no reason to introduce a contrast between vowels and glides in Chinese. In conformity to *MONOSYL, high vowels are automatically realized as glides when adjacent to other vocalic elements. Sequences like /iu/ or /ui/ are, by the nature of things, ambiguous: they can be interpreted as either [ju] or [iw] , or as either [wi] or [uj] , respectively. From pattern congruity, however, /iu, ui/ are best regarded as G+V sequences, namely [ju] and [wi] , respectively.
3. The vowel /ə/ can be characterized simply as [+vocalic] (or [-consonantal], as only one of these two major class features is necessary for Chinese, since the vowel/glide distinction is a purely surface phonetic fact and never introduces a phonemic contrast -- cf. the preceding footnote). The 'colorless' vowel /ə/ has a negative value for all other features: [-high, -low, -palatal, -labial] and so forth (see matrix (2.13)). The unique status of /ə/ as the least specific vowel is made more explicit in a system of 'simplex' features which admit of only one possible value (a plus '+'). For an elaboration of this potentially important notion of 'simplex' features, see Sanders 1974. 'Simplex' semantic features had been in use already in Chafe (1970). Note in passing that 'sibilant' is defined as a non-grave (i.e. dental, retroflex, or (alveo-)palatal) 'fricate' (see footnote 2 of section 1).
4. The number of PVP words increases to 18 if we include the material from Li (1952). The additions consist mostly of obscure and obsolete characters.
5. Except that Cheng posits /ɔ/ instead of /ə/ as the underlying vowel. Chao (1934) called our chameleon /ə/ the 'non-committal vowel', and symbolized it as /ɸ/.
6. Table 10 is based on an important monograph by Luo (1933). For consistency of notation, a few orthographic modifications were made. Hashimoto (1965) devoted long sections to the interpretation of the final consonants /b, r, g/ corresponding to MC /p, t, k/. MC *yət showed up in the Sino-Tibetan transliterations as /ur/ instead of the expected /yr/, but in such cases the palatality was already carried by a preceding consonant. E.g. *tś'yət 'exit' was transcribed as /c'ur/ [tś'ur]. The parenthesized element in /(i)ur/ is intended to signal the presence of an adjacent palatal consonant.

FOOTNOTES

SECTION I

1. These figures are taken from Li (1952:80-81, 94).
2. To my knowledge there is no common term to refer to all affricates and fricatives in contradistinction to all other types of consonants. For this purpose I will employ 'fricated' and 'fricate(s)' as adjectival and nominal expressions respectively. I am indebted to S. Schane for suggesting this terminological solution.
3. For the interpretation of these vowel symbols, please refer to key to Table 3.
4. This position has been most strongly advocated by K. Chang (1974) and K. Chang and B. Shefts (1972). For dissenting view, see Zhou (1968a, b; 1970).
5. In addition to William S-Y. Wang, I take pleasure in acknowledging a few friends and former associates who contributed in specially significant ways to making DOC into a useful tool or helped in direct ways in the compilation of the correspondence tables (Appendices A, B, C). In the early stages Anatole Lyovin, C. C. Cheng and Johanna Kovitz played important parts in designing and improving the coding system of DOC and continually purging its content of mistakes. Mary S. Wang and Teresa M. Chen spent countless hours helping the author with the sorting programs. To Cecilia C. Gore and William Mathews of UC, San Diego, goes the credit for reducing the computer print-outs to their present form. It was the concerted efforts of the above-mentioned -- and many more who must remain unnamed -- that made the present report possible.

The DOC project at Berkeley was supported in part by NSF Grant No. GS-2386 made to Project on Linguistic Analysis; the work carried out on the San Diego campus was facilitated by a series of smaller grants from the Academic Senate Research Committee.

SECTION II

1. According to Hartmann (1972), 'phonotactics' is defined as 'the system and study of the characteristic arrangement of phonemes in sequence.'

	MC Reconstruction		Sino-Tibetan Transliteration	
*EM	*iəm	*iəp	im	ib
*EN	*ən	*ət	en, in	-
	*iən	*iət	in	ir
	*uən	*uət	un, on	ur
	*yən	*yət	yn	(i)ur
*ENG	*əŋ	*ək	en	eg
	*iəŋ	*iək	in	ig
	*uəŋ	*uək	-	-
	-	*yək	-	-
*AM	*iam	*iap	iam	iab
*AN	*an	*at	an	ar
	*ian	*iat	ian	iar
	*uan	*uat	uan	uar
	*yan	*yat	yan	yar
*ANG	*aŋ	*ak	aŋ	ag
	*iaŋ	*iak	iaŋ	iag
	*uaŋ	*uak	uaŋ	-
	*yaŋ	*yak	-	uag

Table 10. Sino-Tibetan transliterations

The same goes with the pairing of *əm, *əŋ with *am, *aŋ (correspondingly of *əp, *ək with *ap, *ak) -- mutatis mutandis. The finals of (A) have been reconstructed with the identical portion /ən/ precisely because they were designated in the philological sources by the identical category, the 'rime group' labelled here *EN, and whatever differences there were among them were associated with the 'open/close' distinction and/or vowel 'grade' (see section 1.2). But there is good reason to suppose that such designation and classification was not based purely on raw phonetic data, but presupposed an analysis at some level of abstraction and systematization. The most direct evidence comes in the form of the earliest known phonetic transcription of Chinese in an alphabetic script. In the

8-10th c. Sino-Tibetan transliterations we can see that what was supposed to be /iən, uən, yən/ in MC was actually rendered as /in, un, yn/ -- exactly like in modern Peking, except that the Sino-Tibetan transliteration was even more consistent in exhibiting /un/ instead of the Peking /uən/. By the same token, MC /iət, uət, yət/ was transcribed as /ir, ur, (i)ur/. The same pattern can be observed with the finals of *ENG, though there are gaps in the Sino-Tibetan material in this respect. In contrast to the 'inner' rimes of *EM, *EN, and *ENG, the principal vowel /a,ɑ/ in the finals of the 'outer' rime groups *AM, *AN, *ANG remains constant on the whole. The correspondences between the standard MC reconstruction and the 8-10th c. Sino-Tibetan transliteration are given in Table 10.[6]

Henceforth I will refer to the principle underlying the 'systematic' representations of the finals in both MC and Peking as the 'rimemic principle'. Specifically, the 'rimemic principle' made it possible to set up a more symmetrical system of finals by introducing a simple PC which serves to map the 'systematic' finals into their phonetic representations not only in modern Peking but also in MC, as attested by the Sino-Tibetan transcriptions. This PC can be formulated as *RIMEMIC below:[7]

(2.11) *RIMEMIC (MC, Peking)

G ə C
↓
Ø

G = i, u, y
C = any consonantal ending

2.8 The neutral /ə/ we are positing underlyingly is actually a 'chameleon' vowel: but being the least specific, it assumes its shape and color from the neighboring segments. This chameleon /ə/ can be used to reduce the seemingly random distribution of Peking finals to a neat pattern. It would be best to discuss this aspect of Peking phonology in the context of the vowel system as a whole. Modern Peking has the following phonetic vowels:

(2.12)

ï i y u
e ə o ɤ
a

[y] = front rounded; [ɤ] = back unrounded. [ï] = apical, actually comprising two varieties: [ɿ] = dental apical, occurring only after dental sibilants, and [ʅ] = retroflex

10.2 As I stated in the prefatory remarks (section 0.3), we have concerned ourselves exclusively with those aspects of the phonological history that can be inferred from purely linguistic evidence. Our results must be complemented by the investigation of other types of data, notably philological documents and dialectological material. A comprehensive history will require the combination of all three techniques.

There remain a number of tasks. Almost as soon as I completed the manuscript, I began to discover residual problems. Although most of these problems concern matters of detail and technicality and do not invalidate the analysis presented here as a whole, it would be very helpful to have a computer testing program to catch all the inconsistencies and flaws in the formulation of the rules and their orderings -- which, I suspect, have persisted in considerable number.

More importantly, the facts described here raise certain issues of general theoretical interest. For instance, the role of phonotactics in synchronic and diachronic phonology; the relatedness of phonological processes which cannot be 'formalized' by the usual means of rule-collapsing (a problem already alluded to in Chomsky-Halle 1968:401); the choice of the right set of distinctive features: in the vowel system of MC and Peking, the key features are [palatal] and [labial], whereas [back] is clearly of an ancillary status (cf.(2.13)); lastly, the notion of what constitutes a 'natural' or 'plausible' process vs. an 'unnatural', 'implausible' or even 'impossible' one. These and other issues of theoretical import can be profitably investigated in the context of the empirical data presented here.

X. CONCLUDING REMARKS

10.1 The 'succinct' phonological history of Peking we had set out to outline has turned out to be nearly a book-length article. The phonological history as sketched here differs significantly from all previous accounts both in form and in substance. The expository format calls for little comment; on the other hand, I wish to highlight, by way of conclusion, some of the major substantive areas in which our approach represents an innovation and, hopefully, an improvement over the previous attempts:

1. I have taken the Simplified MC (SMC) instead of Qie-yun MC (QMC) as the point of departure. SMC has proven to be adequate for all purposes with the sole exception of accounting for LABDNT. Our decision has the advantage of clearly separating a whole set of mergers of QMC categories -- if indeed these once existed as real phonetic contrasts -- from all other changes. The failure to do so has created confusions and artificial problems in earlier attempts. In Hashimoto (1965), for example, QMC mergers are interspersed among the other rules, thereby obscuring the broader contours of historical evolution.

2. I have pressed into the service of diachronic phonology the time-honored notion of phonotactic conditions and allowed these to interact with the customary phonological rules. In doing so I believe I have simplified the description and rendered the same explanatorily more satisfying.

3. Several processes which have been hitherto regarded as unrelated now appear to combine into larger patterns. Specifically, the Great Consonant Shift (GCS), the medial dissimilation (MED-DISM), and the weakening processes of the consonantal endings (WEAKEN), together with the phonotactic conditions referred to as *CHAMEL and *SYLLAB, now stand out as the most important sets of interconnected events rather than a haphazard assortment of random shifts. Only viewed in this fashion will the variegated post-MC changes assume the recognizable shape of a linguistic history.

4. The complex interplay among the phonological rules has been made explicit by detailed derivations of specific lexical items. In particular, a set of chronological relations has been established. On strictly linguistic evidence, a maximum of six levels of time-depth can be reconstructed (see Table 18).

apical, occurring only after retroflex sibilants. Since the subdistinction into these two types of apical vowels belongs to a low level rule of phonetic realization and has no bearing on any other aspect of Peking phonology, I will generally use the symbol ï for both. The 9 vowel sounds in (2.12) are specified as follows:

(2.13)

	ï	i	u	y	e	o	ə	ɤ	a
high	+	+	+	+	-	-	-	-	-
low	-	-	-	-	-	-	-	-	+
palatal	-	+	-	+	+	-	-	-	-
labial	-	-	+	+	-	+	-	-	-
apical	+	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
velar	(-)	(-)	(+)	(-)	(-)	(+)	-	+	(-)

[Apical] is relevant only for [ï], and [velar] serves only to separate [ɤ] from [ə]. Hence the parenthesized feature values.

Of the high vowels, /i, u, y/ are without question distinctive phonemic units. /ï/, on the other hand, can be analyzed as underlyingly zero, so that syllables consisting of a sibilant plus /ï/ (= the homorganic release) can be represented underlyingly as #sibilant#, where # stands for word/syllable boundary, since the vowel-less #sibilant#is realized as #sibilant + ï# in accordance to *SYLLAB (see (2.2)). Recall that a sibilant is a dental or a retroflex fricated sound; as a consequence, the homorganic release /ï/ can be either a dental [ɿ] or a retroflex [ʅ] apical vowel. The analysis of the phonetic [ɿ,ʅ] (= ï) as phonemically zero is not new. It is implicit in the 'romanization' and the 'National Phonetic Script' (guó-yǔ zhù-yīn fú-hào). The principle underlying the phonetic spelling convention was made explicit by Y-R. Chao (1934:43), who stated, in part:

> In the Chinese syllables [tʂʅ], [tʂ'ʅ], [ʂʅ], [rʅ],[tsɿ], [ts'ɿ],[sɿ], there is a vowel which is a vocalized prolongation of the preceding consonant, and it is understood to be present when these syllables are written in the standard way, that is with the consonantal symbol standing alone: /tʂ, tʂ', ʂ, r, ts, ts', s/ in the National Phonetic Script. This is therefore a way of representing actual sounds by zero symbol . (my emphasis)[8]

Consequently, we need to posit only three high vowel phonemes /i, u, y/, plus a zero.

2.9 We now come to the chameleon vowel /ə/. Modern Peking has four mid vowels phonetically: [e, o, ə, ɤ]; it is possible to represent all these sounds as one single phoneme /ə/, as the distribution of its allophones is contextually predictable by rule. The allophones of /ə/ are tabulated below:

(2.14) Allophones of /ə/

S_1 \ S_2	i	u	C	#
i, y	-	o	ø	e
u	e	-	ø	o
P	e	o	ə	o
C, #	e	o	ə	ɤ

Key:

S_1 = preceding segment
S_2 = following segment

P = labial consonant
C = any other consonant
\# = word/syllable boundary

Since neither labial consonants (P), nor the palato-labial (front-rounded) offglide (y) occur syllable finally, S_2 consists of a smaller set of environments. Furthermore, the Peking PC's *PAL-DISM and *LAB-DISM, discussed above, prohibit certain syllable types, thereby creating some systematic gaps (marked '-' in (2.14)). The alternation between [ø] and [ə] has been accounted for already by *RIMEMIC. So, ignoring the occurrances of [ɤ] for the time being, we can state the allophonic distribution of [e, o, ə] by means of a simple PC, which I will from now on refer to as *CHAMEL (chameleon vowel):

(2.15) *CHAMEL (Peking only)

$$\begin{bmatrix}\text{-high}\\\text{-low}\end{bmatrix} / \begin{bmatrix}\alpha\ \text{palatal}\\\beta\ \text{labial}\end{bmatrix} \rightarrow \begin{bmatrix}\alpha\ \text{palatal}\\\beta\ \text{labial}\end{bmatrix}$$

In order to correctly apply *CHAMEL, the following facts must be kept in mind: Firstly, modern Peking lacks the mid, palato-labial (front-rounded) vowel [oe], which is realized as [e]. This fact can be expressed by a redundancy (or readjustment) rule, like

(2.16) $\begin{bmatrix}\text{-high}\\\text{+palatal}\end{bmatrix} \rightarrow [\text{-labial}]$

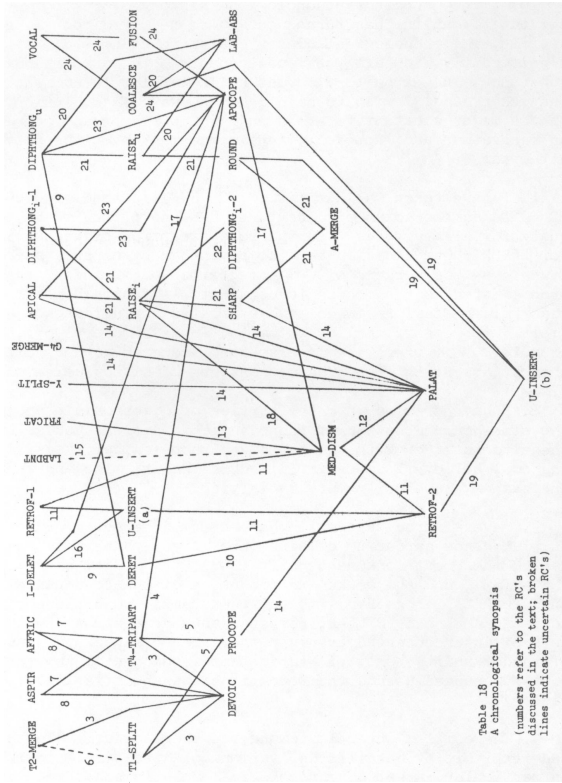


Table 18
A chronological synopsis
(numbers refer to the RC's discussed in the text; broken lines indicate uncertain RC's)

of Peking and, consequently, in all likelihood, a late addition to the Peking phonology. The inference about relative chronology from the geographical distribution of the phonetic traits is based on the principle I have referred to as 'latitudinal reconstruction' (cf. Chen 1973; and more fully Chen 1976, in press).

If, on the other hand, one were to reorganize Table 18 according to the 'push-down' principle, so that a rule that need not precede any other comes at the bottom, the overall picture would become skewed in the opposite direction. For instance, DEVOIC, which must follow the tone rules as well as ASPIR and AFFRIC, but need not be ordered before any rule, would accordingly be relegated together with PALAT to the latest stratum of the reconstructed time scale. This inferred relative chronology is definitely counterfactual. The 11th c. *Huáng-jí Jīng-shì* (ca. 1011-77) bears unmistakable witness to the devoicing of initial obstruents; PALAT, on the other hand, is a demonstrably very recent innovation, as documentary evidence for PALAT is not available until the earliest phonetic records in Latin alphabet of Mandarin pronunciation furnished by Christian missionaries at the turn of the 17th century.[8]

The discrepancy between the inferred diachronic rule order on the one hand, and the kind of time depth based on geographic diffusion and documentary evidence on the other, constitutes the crux of the problem involving the reconstruction of relative chronology. Elsewhere (Chen 1976, in press) I have highlighted the limitations of each of the three approaches and demonstrated the usefulness of complementing one method of reconstruction with another. For now, as I had stated at the outset, we shall have to content ourselves with the kind of temporal relationships that can be established on internal grounds.

Thus, /yə/ → /yoe/ (by *CHAMEL) → /ye/ (by redundancy rule (2.16)).

Secondly, wherever possible I employ the same set of features for both vowels and consonants, so that both rounded vowels and labial consonants are specified as [+labial]. This means that not only /uə/ → /uo/ but also /pə, fə/ → /po, fo/ by *CHAMEL.

Thirdly, *CHAMEL is obviously an assimilatory process and, as such, obeys the general principle according to which regressive assimilation prevails over its progressive counterpart. Accordingly, the palatality of the offglide in (2.17a) overrides the labiality of the onglide or the labial initial; by the same token, the labiality of the offglide determines the quality of the mid vowel in (b):

(2.17) (a) /uəi/ = [uei]

/pəi/ = [pei]

/fəi/ = [fei]

(b) /iəu/ = [iou]

Finally, the input to *CHAMEL is not merely /ə/, but any mid vowel, just as specified by the formulation of this PC. For instance, MC *pac '(paternal) uncle' became /pai/ (by vocalization, cf. VOCAL to be given, section 7.2), which in turn coalesced into /pe/ (by COALESCE, cf. section 7.3); this mid vowel /e/ which resulted from a combination of historical changes was subject to the PC of Peking, and emerged as /po/ in conformity to *CHAMEL. The character meaning '(paternal) uncle' is now pronounced [po] in the Peking dialect.

There is one additional detail to take care of. The neutral /ə/ is realized as [ɤ] in open syllables:

(2.18) ə # → ɤ

Thus MC *kak 'pavilion' and *kac 'style, character' → /kau/ and /kai/ (by VOCAL) → /ko/ and /ke/ (by COALESCE), and both → /kə/ (by *CHAMEL) since the neighboring consonant is [-labial, -palatal], which → /kɤ/ (by (2.18)). I shall henceforth regard (2.18) as an integral part of *CHAMEL.

(2.18) is part of a more general rule. In narrower transcriptions, /əŋ/, /αŋ/, are phonetically [ʌŋ], [αŋ], respectively, with a retracted vowel sound under the assimilatory influence of the velar nasal; in open syllables /a/ is rendered as [α](see Chao 1934 and C. C. Cheng 1973). Observing that in the sound pattern of both MC and Peking, zero (or word/syllable boundary) behaves like velars (and glottals)[9] and that [ʌ, ɤ] and [α] are the retracted ([+velar]) counterparts of /ə/ and /α/ respectively (cf. (2.13)), one could generalize (2.18) as (2.19):[10]

(2.19) $$[-\text{high}] / \left\{ \begin{matrix} \# \\ [+\text{velar}] \end{matrix} \right\}$$
$$\downarrow$$
$$[+\text{velar}]$$

Phonetic minutiae like these are not generally registered, e.g. in the main source we are using, namely *Zì-huì*. I am making a note of them in anticipation of their relevance to certain historical changes to be discussed in the subsequent sections (cf. section 7.3).

2.10 Having stated the PC's that operate in the Peking dialect, we can reduce (2.12) to a 5-vowel system:

(2.20) The vowel phonemes of Peking

i y u

ə

a

(2.20) is in overall agreement with the current analyses of Peking phonology. In addition to the three high vowels (or glides), two 'vowel grades' are generally recognized: /ə/ and /a/ (cf. Chao 1934, Hartman 1944, Hockett 1947, L. Wang n.d., Cheng 1973, and Pulleyblank 1972). This analysis also accords remarkably well with the traditional dichotomy of 'outer rimes' (a-type principal vowel) vs. 'inner rimes' (ə-type principal vowel).

2.11 We are now in a better position to see the symmetry and patterning of the Peking finals listed in Table 8. On the left-hand side of Table 11, the finals, this time in their 'underlying' representation, are cross-classified according to the presence or absence of the high vowels /i, u, y/ and the 'rimes'. The actual phonetic rendering of these finals are given in their corresponding slots on the right-hand side.

COALESCE is triggered, in part, by *CANON, that is COALESCE applies, in part, to resolve the conflict between VOCAL which adds an off-glide on the one hand, and the PC stated as *CANON which rules out precisely just such a sequence consisting of /-VGC/. In these cases, then, COALESCE must apply before APOCOPE. Notice, however, that violations against *CANON can be resolved simply by eliminating the final stop, as by APOCOPE. In those cases, then, APOCOPE preempts COALESCE. These two alternative routes of development have been discussed in section 7.3, using the MC homophonous pair *pac 'white' and *pac 'uncle' as examples (see (7.9)). It goes without saying that VOCAL > COALESCE, as VOCAL is the sole supplier of /-VGC/ sequences which trigger COALESCE. FUSION > APOCOPE for the simple reason that otherwise there would be no final stops to fuse -- assuming that these do undergo mergers (/-p, -c/ > /-t, -k/ respectively) just like their nasal counterparts (/-m, -ñ/ > /-n, -ŋ/).

9.7 Table 18 sums up the results obtained in sections 9.1-6 and presents a chronological synopsis of the various phonological innovations occurring between MC and modern Peking. The only rule that is not linked to the network of ordering relations is U-DELET (except, of course, that *CHAMEL, as a PC is always applicable after U-DELET).

It goes without saying that we are far from having exhausted all the crucial orderings among the rules,[6] but Table 18 suffices to provide us with an overview of the chronological linkages that hold all the post-MC developments together.[7] In Table 18 I have adopted the 'push-up' principle (cf. Chafe 1968), so that a rule that need not follow any other rule is placed at the top of the diagram. Thus Y-SPLIT, a minor and probably rather late rule, is ranked on the top line, on par with, for instance, G4-MERGE. This does not necessarily mean that Y-SPLIT is as old as G4-MERGE. On the contrary, looking at the matter from a cross-dialectal perspective, one must conclude that whereas G4-MERGE is pan-dialectal (cf. section 6.1, and the qualification given in footnote 2 of section 6) and, therefore, quite plausibly of considerable antiquity, Y-SPLIT is, on the other hand, an idiosyncratic feature

(from *iai and *iəC). When one looks at the total picture of the phonological history of Peking, it appears more accurate to say that the apical vowel of modern Peking owes its origin to three separate processes, two of which (APICAL and I-DELET) apply only to the original *i, the third (MED-DISM) applying to the secondary /i/ as well as the primary *i.

9.6 Finally we are left with the ordering of the four rules related to the weakening of the consonantal endings. These are linked to each other in the following way:

RC24 VOCAL > { FUSION / COALESCE } > APOCOPE

(9.40) illustrates the interaction of these processes:

(9.40)

'country'	'to cook'	'to scrape off'	'footprints'	
*paŋ	*p'ań	*siak	*tsiac	MC
-	p'aiń	siauk	tsiaic	VOCAL
-	p'aiŋ	-	tsiaik	FUSION
-	p'əŋ	siok	tsik	COALESCE, *CHAMEL, *RIMEMIC
-	-	sio	tsi	APOCOPE
-	-	sye	-	LAB-ABS, *CHAMEL
-	-	śye	tśi	PALAT

VOCAL and FUSION are 'intrinsically' ordered in that the former serves to preserve part of the phonemic contrasts once assigned to the final consonants -- contrasts that are subsequently eliminated by FUSION. Thus /-aŋ/ vs. (-ań/ becomes /-aŋ/ vs. /-əŋ/, while /-iak/ vs. /-iac/ is replaced by /-ye/ vs. /-i/.

		Underlying Representation				Phonetic Representation			
		-Ø-	-i-	-u-	-y-	-Ø-	-i-	-u-	-y-
Open Syllables	'Outer' rimes	a	a	ua		a	ia	ua	
		ai	ai	uai		ai		uai	
		au	au	iau		au	iau		
	'Inner' rimes	Ø	i	u	y	ï,ər	i	u	y
		ə	iə	uə	yə	o,ɤ	ie	uo	ye
		əi		uəi		ei		uei	
		əu	iəu			ou	iou		
Closed Syllables	'Outer' rimes	an	ian	uan	yan	an	ian	uan	yan
		aŋ	iaŋ	uaŋ		aŋ	iaŋ	uaŋ	
	'Inner' rimes	ən	iən	uən	yən	ən	in	uən	yn
		əŋ	iəŋ	uəŋ	yəŋ	əŋ	iŋ	uŋ	yŋ-iuŋ

Table 11. A 'rimemic' interpretation of Peking finals

Table 11 is self-explanatory except for the following minor points: (a) phonetic [ər] is underlyingly /r/, which → /ṛ/ (by *SYLLAB, a), → /ər/ (by *SYLLAB,b,ii, see (2.2)); (b) [yŋ] and [iuŋ] are in free variation; (c) [uŋ] when preceded by a zero-initial is realized as [uəŋ].

Zì-huì uses a fairly broad phonetic transcription. Accordingly, I do not overtly mark [ɑ, ɑŋ, ʌŋ], but stick to the broader transcriptions [a, aŋ, əŋ] throughout this paper.

We are now ready to proceed to the examination of the individual changes that had fashioned MC phonology into what it has come to be in modern Peking.

III. TONAL DEVELOPMENTS

3.0 Generally speaking, post-MC tonal splits and mergers were conditioned by the manner of articulation of the initial consonants. For convenience, I will regard the ∅ initial as voiced and sonorant, since ∅-initialed syllables begin with a vocalic element.

3.1 T1-SPLIT. *T1 → { T1A / voiceless initial ; T1B / if syllable begins with a voiced segment }

T1-SPLIT can be seen as a process of rephonemicization. The voiced/voiceless contrast of MC initials that was to be subsequently neutralized by DEVOIC (devoicing) (see section 4.1) has been preserved in the guise of a new tonal division. Notice that the rule is so formulated that the conditioning factor need not be an initial consonant, but any segment, including a vocalic element, which is, of course, specified as voiced. *m̥ and *ŋ̊ (> Peking /u/ and /∅/ respectively) behave in this respect as voiced sonorants, as expected. Now let us contrast *ʔ and *∅ (both > Peking /∅/). The tonal correspondences set forth below bring out clearly their different behavior as the crucial environment for the tonemic bifurcation stated as T1-SPLIT:

(3.1)

*T1 \ Env.		*ʔ	*∅
Peking	T1A	39	-
	T1B	-	45

(9.39)

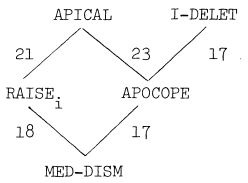
1	4	6	7	8	
'silk'	'teacher'	'poetry'	'world'	'style'	
*si	*ṣi	*śi	*śiai	*śik	MC + *RIMEMIC
sï	-	-	-	-	APICAL, *SYLLAB
-	ṣ'ï	-	-	-	I-DELET, *SYLLAB
-	-	śi		-	RAISE, *DEGEMIN
-	-		śi		*RIMEMIC, APOCOPE
-	-		śï		MED-DISM, *SYLLAB
-	-		ṣ'ï		RETROF-2

(compare with (6.23); the numbers for the identification of the lexical items are the same in both derivations). Lexical items 2, 3, and 5 in (6.23), however, do not emerge with an apical vowel. The word 'color' *ṣiək = /ṣik/ (*RIMEMIC) does undergo I-DELET, thereby becoming /ṣk/, but the PC *SYLLAB automatically applying in this instance has a different effect: instead of supplying a homorganic apical vowel after /ṣ/, it inserts a neutral /ə/ on account of the presence of the final stop /k/. This final stop is not dropped at this point, because I-DELET precedes APOCOPE as per RC17. On the other hand, *siai 'west' and *siək (= /sik/ by *RIMEMIC) merge into /si/ after RAISE and APOCOPE. But, by this late stage, APICAL is no longer in force; and so this derived /si/ turns out to be /śi/ (PALAT).

In Chen (1976, in press) I referred to the appearance of /ï/ in lexical items 1, 4, 6 as APICAL-1, and in the rest as APICAL-2. The division parallels the distinction between the primary *i and the secondary /i/

ing *ei) via RAISE, and *iəC (including *iac) through APOCOPE. In addition, there are three classes of /S/: dental (< *S), retroflex (< *R), and palatal (< *Ś, *T̀). Of these 9 logical possibilities, 8 actually occur in MC, and only 5 have given rise to an apical vowel (see (6.21-22)). This is so because APICAL, I-DELET, and MED-DISM, which potentially create apical vowels, interact with such other rules as RAISE and APOCOPE in a rather intricate sort of way. We have broken up this network of inter-rule relations into RC17, 18, 21, and 23. The relevant rules, then, are linked as diagrammed below:

(9.38)



(where the figures refer to the numbered RC's). We can now see more clearly how the aforementioned processes combine with PC's to produce apical vowels. For the sake of clarity, I will combine the rules with the automatic PC's in the following derivation:

This means that T1-SPLIT must have occurred before the PROCOPE (see section 4.10) of *ʔ, otherwise *T1 words with the *ʔ initial would have incorrectly assumed the tone value T1B instead of T1A. The ordering relations holding among the rules proposed here will be examined in section 9.

3.2 T2-MERGE. *T2 → T3 / voiced obstruent

T2-MERGE is straightforward and requires no comment, except that its effect extended to a large area of Chinese dialects beyond the confines of the Mandarin group. The only remaining tonal process has to do with the distribution of the original *T4 syllables among the other tonal categories. This process may be stated as follows:

3.3 T4-TRIPART

$$*T4 \rightarrow \begin{cases} T3 \text{ / sonorant initial (incl.}\emptyset) \\ T1B \text{ / voiced obstruent} \\ T1A, 1B, 2, 3 \text{ / voiceless initial} \end{cases}$$

Recall that *T4 or the 'entering' tone is really a segmental rather than a prosodic category; *T4 is used to label those syllables that once ended in a voiceless stop. That is, *T4 syllables are checked syllables. In MC checked syllables were not further differentiated by tone. However, as the stop endings were lost (by APOCOPE, see section 7.1), the checked syllables merged with the open ones, and obligatorily assumed a distinctive pitch contour in accordance to one of the structural conditions of open syllables (see section 1.1). As Table 12 shows (for fuller details refer to Appendix A), the partition of tonally undifferentiated checked syllables into the existing tonal categories coincided roughly with the major subclasses of voiced initials; there was, however, considerable confusion in the way voiceless-initialed *T4 syllables realigned themselves along tonal divisions. This semi-regular diversification of *T4 is referred to in the literature as the 'tripartition of the entering tone' (*rù pài sān shēng*): tripartition, because *T4 words found their way into each of the three MC tones, *T1 (both A and B in Peking), *T2 and *T3.

A handful of examples will suffice to illustrate the various tonal changes discussed in this section:

(3.2)

MC		Peking		
tɑm	T1	tan	T1A	'single, alone'
sɑm	T1	san	T1A	'three'
ʔiam	T1	ian	T1A	'to submerge, drown'
dɑm	T1	t'an	T1B	'to talk'
nɑm	T1	nan	T1B	'male'
liɑm	T1	lan	T1B	'blue'
iam	T1	ian	T1B	'salt'
tiai	T2	ti	T2	'bottom'
li	T2	li	T2	'inside'
di	T2	ti	T3	'earth, ground'
ɕiuk	T4	ʂu	T1A	'uncle'
tsiuk	T4	tsu	T1B	'foot'
tɕiuk	T4	tʂu	T2	'to bid'
suk	T4	su	T3	'fast, quick'

MC Tones \ Env	Voiceless	Voiced	
		Sonorant	Obstruent
*T1	T1A	T1B	
*T2	T2		T3
*T3	T3		
*T4	T1A,1B,2,3	T3	T1B

Table 12

RC23 $\left.\begin{matrix}\text{APICAL} \\ \text{DIPHTHONG}_{i,u}\end{matrix}\right\} >$ APOCOPE

Consider the three pairs of words in (9.37):

(9.37)

'to rest' *siək	'to die' *si	'pen' *piət	'lowly' *pi	'grain' *kuk	'dog' *ku	MC
sik	-	pit	-	-	-	*RIMEM-IC
-	sï	-	-	-	-	APICAL
-	-	x	pei	x	kou	DIPH-THONG i,u, *CHAMEL
si	-	pi	-	ku	-	APOCOPE
ɕi	-	-	-	-	-	PALATAL

APICAL applies to /si/ but not to /sik/ because in the latter case /i/ does not stand in a syllable-final position. *pi and *ku undergo DIPHTHONG; /pit/ and /kuk/, on the other hand, are blocked by *CANON at point 'x' in the derivation, because if the last two entries were to diphthongize, impossible syllable types would result -- /peit*/ and /kouk*/ would have both an off-glide as well as a final stop, a segmental sequence prohibited by *CANON. It is true that the final stops eventually drop out, but at that later stage neither APICAL nor DIPHTHONG operates any longer. Hence RC23.

It is useful at this juncture to piece together an overall picture of the rise of the apical vowel /ï/ in modern Peking. The apical vowel /ï/ of modern Peking has come into existence not by one single process, but rather as a by-product of several, quite independently motiviated rules -- which are, as we have seen, APICAL, I-DELET, and MED-DISM -- operating in conjunction with the phonotactic condition referred to as *SYLLAB. Generally speaking, an apical vowel appears in lieu of a syllable-final /i/ adjacent to a sibilant initial -- which we will symbolize as /S/. However /i/ comes from three separate MC sources: from *i, *iai (includ-

Notice that whereas in (9.33) all the seven MC finals have remained distinct from each other -- if radically altered -- in the final output, the 7-way distinction has been reduced to a 3-way contrast in (9.34). Similarly, (9.35) has preserved intact the original oppositions among the 4 MC finals, (9.36), on the other hand, cuts the number of phonemic contrasts in half. It is typical of chain shifts, like GVS (and GCS, cf. (9.19) and section 4.6), that they resemble musical chair movements which permute the slots and fillers but preserve constant the total number of these elements. The mechanism of chain shifts reflects in part the principle of semantic polarity, which imposes certain limits to the amount of tolerable homophony (for further discussion cf. Chen 1974 and bibliography referred to therein).

Generally speaking, RC21 behaves in a sense like a derivational constraint: it keeps the derived apart from the primary forms. Thus APICAL applies to the original MC *-i but not to the secondary /-i/ derived either from RAISE (*ei, *iai) or, as we shall see presently (RC22), from APOCOPE (*iəC). Similarly, DIPHTHONG takes as input only the primary *-i and *-u, to the exclusion of the transforms of RAISE (*ei, *iai, *o, *io) or APOCOPE (*iəC, *uəC, *uC).

There is one wrinkle to the otherwise neat and symmetrical ordering relations among the individual rules of GVS. According to RC21, $\text{DIPHTHONG}_i > \text{RAISE}_i$; but there is evidence that DIPHTHONG_i must recur (perhaps as a PC?) at some later point after RAISE_i. Recall the word *śyai 'tax' already mentioned in (9.29). To this form DIPHTHONG_i is inapplicable; but after RAISE_i (and *DEGEMIN) the intermediate form /śyi/ or one of its later derivatives /śui/ or /s̱ui/ becomes subject to the second occurrence of DIPHTHONG_i, which we may symbolize as $\text{DIPHTHONG}_i\text{-2}$. This line of development seems perfectly regular, as MC *yai corresponds to Peking /-ei/ in 7 out of the 7 cases (see Appendix C). In order to account for this fact, I posit RC22:

RC22 $\quad \text{RAISE}_i > \text{DIPHTHONG}_i\text{-2}$

GVS is ordered not only internally, but also with regard to other aspects of post-MC changes. RC23 is one such -- others have been discussed already in connection with the medials and initials.

3.4 Notice that the tonal processes have been treated as tonemic mergers and splits; nothing is said about what actually happened in actual phonetic terms. The MC tones have eluded the efforts of linguists at uncovering their exact phonetic nature (cf., however, Mei 1970 and Hirayama 1975). This state of affairs has left the historical linguist little choice but to state the tonal changes simply as mergers and splits of categories rather than mutations of phonetic substance. Suppose, however, we make the minimal assumption, and accept at face value the traditional labels of MC tones such as 'even, ascending, departing, entering', and try to make some phonetic sense out of the impressionistic descriptions found in the historical documents, we might specify the MC tones in the following manner:

(3.3) MC tones in distinctive features

	*T1 'even'	*T2 'ascending'	*T3 'departing'	*T4 'entering'
rise	-	+	-	-
fall	-	-	+	-
long	+	+	+	-

I have chosen the feature 'long' over 'checked' or the like, as checked syllables are typically shorter than the free or open syllables, an observation which is well attested by dialectal materials as well as by typological evidence across languages (cf. Chen 1970 and Chen-Wang 1975). The durational difference between the two types of syllables was presumably an allophonic one, which became contrastive only after the disappearance of the final stops (by APOCOPE, see section 7.1). Notice that both 'rise' and 'fall' are contour features; neither one commits us to any decision regarding the pitch level the MC tones might have. We have thus skirted the issue whether MC *T1, for instance, was a high or a low level tone (as debated in Mei 1970). (3.4) is noncontroversial:

(3.4) Peking tones in distinctive features

	T1A 'level'	T1B 'rising'	T2 'dipping'	T3 'falling'
rise	-	+	+	-
fall	-	-	+	+

If we accept the feature specifications as given in (3.4), at least for the sake of discussion, we may restate the well-known tonal correspondences in the phonetic terms suggested below:

(T1-SPLIT') $\begin{bmatrix} -\text{rise} \\ -\text{fall} \\ +\text{long} \end{bmatrix} \rightarrow [+\text{rise}] \; / \; \#\,[+\text{voiced}]\_\_\_\_$

(T2-MERGE') $[+\text{rise}] \rightarrow \begin{bmatrix} +\text{fall} \\ <-\text{rise}> \end{bmatrix} / \; \# \left\langle \begin{matrix} +\text{voiced} \\ -\text{sonorant} \end{matrix} \right\rangle \_\_\_\_$

(T4-TRIPART') $[-\text{long}] \rightarrow \begin{cases} \begin{bmatrix} \alpha\text{fall} \\ -\alpha\text{rise} \end{bmatrix} / \; \# \begin{bmatrix} +\text{voiced} \\ \alpha\text{sonorant} \end{bmatrix} \_\_\_\_ & \text{(a)} \\ \begin{bmatrix} \alpha \text{ fall} \\ \beta \text{ rise} \end{bmatrix} / \text{ elsewhere} & \text{(b)} \end{cases}$

The above rules are to be interpreted in the usual way as outlined, for example, in Chomsky and Halle (1968). The notation implies that the vocalic element(s) is/are the locus of the tone; this assumption is reflected in the position occupied by the dash. The unbounded (i.e. not paired with anything else in the rule) variables in the second part of T4-TRIPART are intended to denote the unconditional split.

IV. INITIAL CHANGES

4.0 The number of initial consonants has been reduced exactly by one third, from 36 in MC to 22 in Peking. This simplification of the initial system has been achieved mainly through the disappearance (*ŋ, *ʔ) or vocalization (*m → m̩ → v → u) of certain consonants on the one hand, and the neutralization of the voicing contrast, on the other. The number of distinctive points of articulation was also reduced by the falling together of the MC palatal (*T̂,*S) and retroflex (*R) series. The combined effect of these processes was offset in part by the emergence of a new series of labiodentals (f, v) and by the split of velars and dental spirants into a palatalized and a non-palatalized group. I shall begin with processes affecting the manner of articulation, and then go on to the changes concerning the place of articulation.

4.1 DEVOIC [-sonorant] → [-voiced]

DEVOIC (devoicing) is both unconditional and exceptionless. Modern Peking has no voiced consonants except sonorants. The tonal split (T1-SPLIT) followed by the devoicing of the

-	-	-	-	-	pəi	pəi	DIPH-THONG$_u$
śie*	śie*	śie	sï*	-	pei*	pei	APOCOPE, *CHAMEL, PALAT
(xɤ)	(śia)		(śi)		(pi)		(correct output)

Turning now to the second component of GVS, one sees the necessity of the RC postulated in RC21 regarding U-UMLAUT. The relevant examples are given in (9.35):

(9.35)

'head'	'earth'	'many'	'otter'	
*t'u	*t'o	*tɑ	*t'ɑt	MC
t'əu	-	-	-	DIPHTHONG$_u$
-	t'u	-	-	RAISE$_u$
-	-	to	-	ROUND
-	-	-	t'at	A-MERGE
-	-	tuo	-	U-INSERT(b)
t'ou	-	-	t'a	APOCOPE, *CHAMEL

Equally devastating is the effect if the intricate ordering relations of U-UMLAUT are disturbed. This is amply demonstrated by (9.36):

(9.36)

'head'	'earth'	'many'	'otter'	
*t'u	*t'o	*tɑ	*t'ɑt	MC
-	-	ta	t'at	A-MERGE
-	-	-	-	ROUND
-	t'u	-	-	RAISE$_u$
t'əu	t'əu	-	-	DIPHTHONG$_u$
t'ou	t'ou*	-*	t'a	APOCOPE, *CHAMEL
	(t'u)	(tuo)		(correct output)

Furthermore in each instance the crucial ordering between two adjacent rules is of a counterfeeding variety, typical of 'drag-chains'.[5] Looking at I-UMLAUT, first, observe the derivations in (9.33)

(9.33)

1	2	3	4	5	6	7	Gloss (see key)
*xɑt	*xat	*xiat	*sei	*si	*pei	*pi	MC
-	-	-	-	-	-	pəi	DIPHTHONG$_i$
-	-	-	-	sï	-	-	APICAL, *SYLLAB
-	-	xiet	si	-	pi	-	RAISE$_i$, *DEGEMIN
-	xiat	-	-	-	-	-	SHARP
xot	-	-	-	-	-	-	ROUND
xɤ	śia	śie	śi	-	-	pei	APOCOPE, *CHAMEL, PALAT

Key to gloss: 1 'to cheer', 2 'blind', 3 'to rest', 4 'west', 5 'silk', 6 'closed', 7 'sad'.

I have included in (9.33) *xɑt and ROUND in order to show the full effect of a reversal of the ordering between each pair of adjacent rules, which looks like the following:

(9.34)

1	2	3	4	5	6	7	Gloss
*xɑt	*xat	*xiat	*sei	*si	*pei	*pi	MC
xat	-	-	-	-	-	-	A-MERGE
xiat	xiat	-	-	-	-	-	SHARP
xiet	xiet	xiet	si	-	pi	-	RAISE$_i$, *DEGEMIN
-	-	-	sï	sï	-	-	APICAL, *SYLLAB

initial obstruents has long served as a stock sample of 'phonemic reinterpretation' or 'réphonologisation' since Jakobson (1931 [1971]:216) — the original voiced/voiceless contrast being replaced by a secondary and intrinsic cue, namely the high/low register (cf. Mohr 1971 and Homber-Ewan-Ohala 1975) now assuming a phonological role. The trade-off balance between an impoverished consonantism and an enriched tonal system was already recognized by Haudricourt (1954 and 1961); more recently the same phenomenon has been discussed by Matisoff (1973).

4.2 ASPIR $\begin{bmatrix}\text{-sonorant}\\ \text{+voiced}\end{bmatrix} \rightarrow$ [+aspirated] /#___, in T1 syllables

Voiced obstruents are devoiced in all cases and, in addition, aspirated if belonging to an MC *T1 word. As a rule, aspiration is distinctive only for non-continuants (stops and affricates); the opposition between plain and aspirated fricatives is extremely rare, although it has been documented for a handful of Chinese dialects (cf. W. Wang 1971). We express the non-distinctiveness of aspiration for fricatives by means of a redundancy rule such as (4.1):

MC	Peking	*T1	*T2-4
*b	p	(2)	26
	p'	35	-
*d	t	(4)	52
	t'	43	-
*dz	ts, tś	-	32
	ts', tś'	27	-
*dẓ	tṣ, ṣ	-	12
	tṣ'	8	-
*d̂	tṣ	-	26
	tṣ'	28	-
*dź	ṣ	(3)	10
	tṣ'	3	-
*ź	ṣ	(4)	29
	tṣ'	16	(1)

Table 13.

(4.1) [+continuant]
↓
[-aspirated]

The immediate output of ASPIR, namely /z', v', ɣ'/, or in conjunction with DEVOIC, that is, /s', f', x'/ or the like, will automatically undergo (4.1) and become /s, f, x/ etc. The combined effects of DEVOIC, ASPIR together with the automatic redundancy rule (4.1) are shown in Table 13 (based on Appendix B). The pattern becomes even more obvious if we disregard the relatively small number of deviations in parentheses: the correlation between the 'even' (*T1) vs. 'oblique' (*T2-4) tonemic distinction and the aspirated vs. non-aspirated opposition is quite regular. The examples of (4.2) show the interplay of ASPIR, DEVOIC and (4.1).

(4.2)

MC		Peking		
bai	T1	p'ai	T1B	'to arrange, line up'
bai	T3	pai	T3	'defeat'
dɑi	T1	t'ai	T1B	'platform'
dɑi	T2	tai	T3	'to wait (on)'
dzɑi	T1	ts'ai	T1B	'material, lumber'
dzɑi	T2	tsai	T3	'in, on, at' (locative)
ɣɑi	T1	xai	T1B	'child'
ɣɑi	T2	xai	T3	'harm'

4.3 AFFRIC dź, dẓ, ź, (ẓ) → { affricate / in T1 syllables ; fricative / in T2-4 syllables }

That is, these MC initials (voiced palatal or retroflex sibilants) were realigned along the tonal division: fricatives became affricated in *T1 ('even' tone) syllables and, conversely, affricates became de-affricated into simple fricatives in *T2-4 ('oblique' tone) words. This realignment can be observed in examples like those given below:

(9.31)

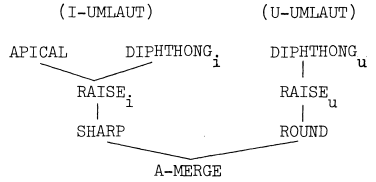
'friend' *iu	'rain' *io	'agreement' *ʔiak	MC
iəu	-	-	DIPHTHONG
-	iu	-	$RAISE_u$
-	-	ʔiok	VOCAL, COALESCE
-	y	ʔyok	LAB-ABS
-	-	yo	PROCOPE, APOCOPE
iou	-	ye	*CHAMEL

If RC20 were reversed, the three words would come out as /y*/, /yu*/, and /ie*/, respectively.

9.5 We now come to one of the most important sets of related events in the post-MC phonology, namely the Great Vowel Shift (GVS). Instead of treating each of the vowel changes individually, it would be expositorily easier and clearer to state the overall pattern. The two main components of GVS, namely the I-UMLAUT and U-UMLAUT, are perfectly symmetrical as can be seen in RC21 or, equivalently, (9.32):

RC21 { APICAL, $DIPHTHONG_i$ } > $RAISE_i$ > SHARP ; { $DIPHTHONG_u$ > $RAISE_u$ > ROUND } > A-MERGE

(9.32)



(The subscripts 'i, u' indicate the I- or U-UMLAUT counterparts of the designated rules)

COALESCE or ROUND. The retroflex initial can be either primary or derived (by RETROF-1,2). It follows that U-INSERT(b) must follow all these other processes, that is:

RC19 { COALESCE, ROUND, RETROF-2 } > U-INSERT(b)

as confirmed by a derivation such as:

(9.30)

'mistake'	'lock'	'to stab'	'to make a (chess) move'	
*ts'ak	*sɑ	*ʈ'ak	*ɖiak	MC
-	-	tś'ak	dźiak	FRICAT
ts'ok	-	tś'ok	dźiok	VOCAL, COALESCE
-	so	-	-	ROUND
-	-	-	dźok	MED-DISM
-	-	ts̤'ok	dz̤ok	RETROF-2
ts'uok	suo	ts̤'uok	dz̤uok	U-INSERT(b)
ts'uo	-	ts̤'uo	ts̤uo	APOCOPE, DEVOIC

Notice that since MED-DISM is a condition sine qua non of RETROF-2, MED-DISM must, a fortiori, precede U-INSERT(b).

RC20 { DIPHTHONG$_u$, RAISE$_u$, COALESCE } > LAB-ABS

DIPHTHONG$_u$ (i.e. the U-UMLAUT counterpart) and COALESCE bleed and feed LAB-ABS, respectively. LAB-ABS applies regardless of its sequencing before or after RAISE$_u$, though with different results. The examples given below will suffice to illustrate the need for RC20.

(4.3)

MC		Peking		
dz̤au	T1	ts̤'au	T1B	'nest'
dz̤i	T2	s̤ï	T3	'persimmon'
dźyan	T1	ts̤'uan	T1B	'boat'
dźiuk	T4	s̤u	T1B	'to redeem'
źiu	T1	ts̤'ou	T1B	'enemy'
źiu	T3	s̤ou	T3	'longevity'

AFFRIC reduced a four-way contrast in MC

(4.4)

	'even' tones (*T1)	'oblique' tones (*T2-4)
affricates: *dz̤,*dź	Yes	Yes
fricatives: *z̤, *ź	Yes	Yes

to a two-way opposition in Peking:

(4.5)

	Peking tones from *T1	Peking tones from *T2-4
affricates: ts̤'	Yes	No
fricatives: s̤	No	Yes

AFFRIC is at best a rough approximation of a highly irregular process which has left many exceptions not only in Peking but also in other dialects within and without the Mandarin group. Table 14 (based on Appendix B) records both exceptions (figures in parentheses) and regular correspondences. There are 17 exceptions out of 86, or 19.7%.[1]

Let me mention in passing that it has been claimed that while the segmental structure can influence tone and other prosodic features, the reverse is relatively uncommon (cf. Hyman 1973). In this respect ASPIR and AFFRIC constitute two potential counterexamples which either conform to the rule -- or call for some qualification of the putative universals.

4.4 FRICAT $\begin{bmatrix}-\text{nasal}\\+\text{palatal}\end{bmatrix} \rightarrow [+\text{fricated}] / \#\_\_\_\_$

The affected segments are: *ʨ, *ʨ', *d̂, and *ɲ́. The palatal stops (-continuant, -fricated) turned into the corresponding affricates (-continuant, +fricated) by changing only one feature (-fricated to +fricated). I am using the term 'fricated' to refer to both affricates and fricatives, in contrast to frictionless continuants (liquids and nasals). The two features fricated and continuant are quite adequate for the purpose of distinguishing the following following four classes of consonants:[2]

(4.6)

	stops	affricates	fricatives	frictionless continuants
continuant	-	-	+	+
fricated	-	+	+	-

Fricated palatal stops (→retroflex, by RETROF, see subsequent discussion in section 4.8) are exemplified below:

(4.7)

MC	Peking	
ʨi	tʂï	'to know'
ʨ'iu	tʂ'ou	'to pull, extract'
dʑiu	tʂ'ou	'silk'[3]

MC	Peking	*T1	*T2-4
*dʑ́	tʂ'	3	-
	ʂ	(3)	10
*dʑ	tʂ'	8	-
	tʂ	-	(9)
	ʂ	-	3
*ʑ́	tʂ'	16	(1)
	ʂ	(4)	29

Table 14.

or if MED-DISM > APOCOPE, an equally wrong output would result:

(9.28) 'style'

*śiəkᵘ	MC
śik	*RIMEMIC
śk	MED-DISM
śək	*SYLLAB(i)
śə	APOCOPE
ʂɤ*	RETROF-2, and *CHAMEL

RC18 RAISE > MED-DISM

If MED-DISM were to apply before RAISE, *śyai 'tax' and *śiai 'world' would become /śuai/ and /śai/ respectively, to which nothing else would apply except RETROF-2, yielding /ʂuai*/ and /ʂai*/, incorrect in both instances. The correct derivation of these two words is as follows:

(9.29)

'tax'	'world'	
*śyai	*śiai	MC
śyii	śiii	RAISE (both part (b) and (c))
śyi	śi	*DEGEMIN
śui	ś	MED-DISM
-	śï	*SYLLAB
ʂui	ʂï	RETROF-2
ʂuəi	-	DIPHTHONG (see discussion below)
ʂuei	-	*CHAMEL

Recall that there were two parts to U-INSERT; (b) inserts /u/ between a dental or retroflex initial and a labial vowel /o/. This /o/ originates either from

(9.25) 'bed'

*ts'iaŋ	MC
-	U-INSERT(a)
ts'aŋ *	I-DELET

RC17 I-DELET > APOCOPE > MED-DISM

alone will guarantee the correct output of both 'color' and 'style' (cf. (6.23)):

(9.26)

'color'	'style'	
*siək	*śiək	MC
sik	śik	*RIMEMIC
sk	-	I-DELET
sək	-	*SYLLAB (ii)
sək	-	DERET
sə	śi	APOCOPE
sɤ	-	*CHAMEL
-	ś	MED-DISM
-	śï	*SYLLAB (i)
-	sï	RETROF-2

If APOCOPE > I-DELET the rules would yield the wrong output instead:

(9.27) 'color'

*siək	MC
sik	*RIMEMIC
si	APOCOPE
s	I-DELET
sï*	*SYLLAB(ii)

With the qualifications and caveats given above, I will leave the rule FRICAT as it is.

Having dealt with the major changes affecting the manner of articulation, we can now proceed to considering the post-MC innovations having to do with the place of articulation.

4.5 LABDNT $\begin{bmatrix} p \\ p' \\ b \\ m \end{bmatrix} \rightarrow \begin{bmatrix} f \\ f' \\ v \\ u \end{bmatrix} / \_\_\_$ QMC *iəi, *io, *iɐi, *iu, *iuɐm/p, *iɐn/t, *i(u)ən/t, *iaŋ/k, *iuŋ/k, *ioŋ/k

LABDNT (labiodentalization or, alternately, dentilabialization) stands out as one of the major unsolved mysteries of historical Chinese phonology. We will not concern ourselves with the intermediate labiodental nasal /ɱ/ customarily posited between *m and Peking /u/ [w]; nor do we need to pay more than passing attention to the immediate output of LABDNT /f'/, as aspiration is non-distinctive in Peking, and /f'/ will be automatically readjusted to /f/ by (4.1) alluded to above in connection with the aspiration of voiced initials. The basic mechanism underlying LABDNT is not where the problem lies; what has puzzled generations of historical phonologists is what conditioned the change from MC bilabials to their modern correspondents in Peking (and, generally speaking, in virtually all Chinese dialects outside of the Mǐn group). Let us start with a detailed comparison of those MC finals in terms of which the condition for LABDNT can be stated. It is immediately apparent from Table 15 that all the finals in question begin with a palatal vowel /i, y/. The first four rime groups *O, *U, *UNG, *AM all contain a labial segment (either /u/ or /m,ɱ/), and therefore do not in principle admit of an 'open/closed' contrast in any environment -- with the exception of the pair *yam/p (closed) vs. *iam/p (open). This distributional restriction (*LAB-DISM) is part of the phonotactics of MC system, as we have observed in section 2.5. The other rime groups can exhibit the 'open/closed' contrast. If we look at the left-hand half of Table 15, the difference between the SMC finals that were conducive to LABDNT (marked as YES) and those others which were not (marked as NO) consisted of the presence of a labial element vs. the absence thereof, that is /u/ vs. zero and /y/ vs. /i/. One may, then, conclude that LABDNT took place in the environments enumerated below:[6]

(4.13) ... / ____y, io, ui, iu$_1$

The substance of this rule says LABDNT took place when the following final contained both a palatal and a labial element, without any restriction on whether these two elements occur simultaneously (as in *y), or sequentially and in any order (as in *io, *ui, *iu$_1$) -- as long as the two elements are contiguous to each other. LABDNT did not happen when the two elements were separated by a vowel as in *iau, *iɑu, or *uai, *uɑi: these finals did not trigger LABDNT.

(4.13) represents, in essence, the position taken by Karlgren about 60 years ago (cf. Karlgren 1948:415ff).[7] It is also the position implied in *Zì-huì*, which, like Karlgren, still distinguishes a full set of pairwise distinct 'open' and 'close' finals.[8] This position is no longer tenable, it would seem, in light of the now accepted reconstruction of the MC sound system. It has now been recognized that no two MC finals pairwise distinct solely on the basis of open/close opposition could both co-occur with labial initials (with the exception of QMC *iɐm/p vs. *iuɐm/p). This apparently well-established fact suggests that by the *Qiè-yùn* time (7th c.), the open/close contrast was well on its way toward complete neutralization when adjacent to a labial initial. This kind of contextual dissimilatory neutralization of phonological distinction is well known. In fact it is a special case of medial (both labial and palatal) dissimilation to be discussed further in section 5.3 below in connection with MED-DISM (medial dissimilation). This fact has been noticed by Maspéro (1920:74) and is now generally acknowledged.[9] But the recognition of this fact also means that (4.13), which makes LABDNT crucially conditioned on the open/close contrast, rests on a fundamentally false assumption, and that we must still look for a workable rule of LABDNT.

If the open/close distinction cannot serve to separate the positive from the negative environments for LABDNT, what can? Maybe there are finer distinctions in the *Qiè-yùn* MC subsequently lost in the Simplified MC which once conditioned LABDNT? The answer is yes. Columns 3 and 4 in Table 15 furnish us with a few examples. For instance, whereas LABDNT happened with bilabials followed by QMC *iəi, but not when followed by QMC *i, *ji, *ie or *je. All these QMC finals subsequently merged into SMC *i with the labiodentalizing QMC *iəi now disguised as SMC *ui in contradistinction to SMC *i, if it were possible to exploit this open/close contrast in the

The words 'mad' and 'thought' illustrate the bleeding relation of Y-SPLIT and APICAL vis-à-vis PALAT, while 'thousand' and 'shrimp' exemplify the feeding order of G4-MERGE and SHARP with respect to the same process. The two characters in (9.24) illustrate the alternative derivations of *tsei and *kei:

(9.24)

'crowded'		'chicken'		
*tsei		*kei		MC
tsiai	-	kiai	-	G4-MERGE
tsiei	-	kiei	-	RAISE (I-UMLAUT(b))
tsiii	tsii	kiii	kii	RAISE (I-UMLAUT(c))
tsi	tsi	ki	ki	*DEGEMIN
tśi	tśi	tśi	tśi	PALAT

Recall in this connection that MED-DISM > PALAT for the reason stated in RC12.

RC15 LABDNT > { SMC / MED-DISM }

If our formulation of LABDNT is correct, the process is conditioned by the finer distinctions (mainly of vowel quality) of QMC finals; it follows that LABDNT must have occurred before these distinctions were eliminated in SMC. Alternately, one could state the condition of LABDNT in terms of the 'open/close' (i.e. absence/presence of a labial glide) opposition of the SMC finals. Rule (4.13) expresses this alternate view. But this also means that (4.13) must precede MED-DISM(b) which has precisely the effect of voiding the 'open/close' contrast, whether real or hypothetical. We have examined the alternatives at some length in section 4.5. There is no need to go over the arguments here.

9.4 We now proceed to the ordering relations with respect to the rules affecting the medials.

RC16 I-DELET > U-INSERT(a)

is needed in order to insure the proper derivation of 'bed' already mentioned in section 5.1 (derivation (5.4)). If we allow the sequence to be reversed, the result would be erroneous:

RC14 Y-SPLIT, G4-MERGE, APICAL, RAISE$_1$, SHARP[1], PROCOPE > PALAT

($RAISE_1$ = part of I-UMLAUT) PROCOPE > PALAT so that the shortest derivation is (9.22)

(9.22)

'doubt'	'clothe'	
*ŋi	*ʔi	MC
i	i	PROCOPE

rather than a more circuitous route like *ŋi > /ńi/ > /i/, which would require a less natural class of inputs to PROCOPE (/ŋ, ʔ, ń/). Besides, it is not clear what a palatalized glottal stop would be before it gets deleted entirely.[4]

All the other processes which must precede PALAT either eliminate or create the palatal glides /i, y/; once the presence or absence of /i, y/ has been ascertained by the combination of these processes, the distribution of palatialized and non-palatalized (velar and dental) initials is automatic. PALAT may in fact be regarded as an allophonic distribution rule. In particular, consider the derivation below:

(9.23)

'mad'	'thousand'	'thought'	'shrimp'	
*k'yaŋ	*ts'en	*si	*xa	MC
k'uaŋ	-	-	-	Y-SPLIT
-	ts'ian	-	-	G4-MERGE
-	-	sï	-	APICAL (and *SYLLAB)
-	-	-	xia	SHARP
-	tś'ian	-	śia	PALAT

context of labial initials. To cite another example, SMC *iu has two sources: one, *iu_1 from QMC *iu, induced LABDNT, the other, *iu_2 from QMC *iĕu, did not. While it is apparent that the conditioning factor(s) of LABDNT is/are to be sought in the finer distinctions of the QMC categories, one is still at a loss to try to single out the common property that once characterized those labiodentalizing QMC finals (Table 15, column 3, marked YES) from all the others (including those listed in column 4, marked NO). Chao (1941:225) advanced a tentative generalization which he subsequently abandoned: 'all labials with high i followed by a central or back vowel become dentilabials.'[10] All the finals which triggered LABDNT do indeed fit the description -- but, unfortunately, so do some others which were not labiodentalizing, such as *iɐm/p (alongside *iɐn/t and *iɐi, which were) or *iəŋ/k (as contrasted with *iəi). More serious perhaps is the fact that the exact phonetic value of the nuclear vowels of the finely calibrated QMC finals is at best a matter of guesswork, based often precisely on their behavior with respect to certain diachronic

	Environment stated in terms of SMC (according to *Zì-huǐ*)		Environment stated in terms of QMC	
	YES	NO	YES	NO
*O	io	-	io	-
*U	iu_1	iu_2	iu	iĕu
*UNG	iuŋ/k	-	iuŋ/k ioŋ/k	-
*AM	yam/p	iam/p	iuɐm/p	iɐm/p, iäm/p, i̯äm/p
*I	ui	i	iəi	i, ji, ie, i̯e
*AI	yai	iai	iɐi	iɐ̂i, iei, iä̂i, i̯äi
*AN	yan/t	ian/t	i(u)ɐn/t	iän/t, iän/t
*EN	yən/t	iən/t	i(u)ən/t	iĕn/t, i̯ĕn/t
*ANG	yaŋ/k	-	iaŋ/k	-

Table 15.
The Environment of LABDNT

changes such as LABDNT. Thus, for instance, the QMC final *iĕu has been reconstructed with a fronted nuclear vowel /ĕ/ rather than, say, a central vowel /ə/, precisely because -- it was argued -- *iĕu did not induce LABDNT! (see Chao 1941:225). Cognizant of problems of such factual and logical nature, Chao (ib. p.226-7) resigned himself to a rule by simple enumeration: 'Thus we are left with no criterion,' admitted Chao, 'from the point of view of the phonological system of Ancient Chinese (= MC in our terminology), short of bare enumeration of an arbitrary list of miscellaneous finals ... to tell when dentilabialization occurs and when it does not.' The LABDNT rule as formulated at the outset does not pretend to anything beyond 'bare enumeration'. It merely paraphrases Chao's conclusion, and quite accurately reflects the state of our knowledge, or rather ignorance, regarding this matter even today.

We may sum up the two contrasting views on LABDNT sketched above by juxtaposing the two alternative derivations implied by them. If we condition LABDNT on the open/close opposition (i.e. absence/presence of a labial glide) in accordance to Karlgren's (1948) position adopted by *Zĭ-huĭ* (1962), MED-DISM (medial dissimilation, see section 5.3) cannot have been part of MC phonotactics, but must be ordered as a phonological rule after LABDNT.

Thus compare

(4.14)

'stele'	'to fly'	'whip'	'opposite'	
*pi	*pui	*pian	*pyan	SMC (*Zĭ-huĭ*)
-	fui	-	fyan	LABDNT(=(4.13))
-	fi	-	fian	MED-DISM
pei	fei	pian	fan	by other rules

with the following derivation, which does not require the open/close contrast but, instead, presupposes the finer distinctions suggested by the *Qiè-yùn* categories:

(Here, as elsewhere in this paper, relative height indicates relative chronology, with the lines symbolizing the rule orderings established in the text.) If we collapse the two instances of RETROF (and the MED-DISM in between), what we get is a relationship typical of chain shifts:

(9.19)
DERET
|
RETROF
|
PALAT

The combined effect of GCS is best illustrated by the **juxtaposition** of the triplet whose derivations have already been given in (9.11) and (9.17):

(9.20)

MC	Peking	
*ṣiu	sou	'to search'
*śiu	ṣou	'to guard, keep'
*siu	śiou	'shame'
*xiu	śiou	'to rest'

The last item is included to exemplify PALAT as applied to velar initials.

RC13 FRICAT > MED-DISM

is supported by

(9.21)

'twig'	'spider'	
*tśi	*ʈi	MC
-	tśi	FRICAT
tś	tś	MED-DISM
tśï	tśï	*SYLLAB(b,i)
tṣï	tṣï	RETROF-2

A reversal of FRICAT and MED-DISM could take *ʈi to /ʈ/ (by MED DISM), then /əʈ/ (by *SYLLAB(b,ii)) instead, which will eventually become /ʂ/ (by APOCOPE and *CHAMEL).

Until MED-DISM removes the inhibitory environment, namely the presence of the palatal glide /i/, neither RETROF-1 nor RETROF-2 can apply to *tśiaŋ. Finally, U-INSERT(a) > RETROF-2 is evidenced by (9.16):

(9.16) 'chapter'

*tśiaŋ	MC
tśaŋ	MED-DISM
tṣaŋ	RETROF-2
tṣuaŋ*	U-INSERT(a)
(tṣaŋ)	(correct output)

RC12 MED-DISM > PALAT

PALAT counterfeeds MED-DISM with other automatic consequences, as illustrated by the following example:

(9.17) 'shame'

*siu	MC
siəu	DIPHTHONG
śiəu	PALAT
śəu	MED-DISM
ṣəu	RETROF-2
ṣou*	*CHAMEL
(śiou)	(correct output)

More about the relationship between MED-DISM and PALAT in RC12. I have referred earlier to DERET, RETROF-1,2 and PALAT as the Great Consonant Shift (GCS) (cf. section 4.6). The demonstrable ordering relations among these processes are summarized below:

(9.18)

(4.15)

'stele'	'to fly'	'whip'	'opposite'	
*pi	*pi(u)əi	*piän	*pi(u)ɐn	QMC
-	piəi	-	piɐn	MED-DISM
-	fiəi	-	fiɐn	LABDNT
-	fi	pian	fian	various mergers
pei	fei	pian	fan	by other rules

Derivation (4.15) is implied in the MC system as reconstructed by Chao (1941), Nagel (1942), Li (1952), and others. The sequence of events suggested by (4.14) postulates a fairly recent date for MED-DISM, but calls for a relatively simple labiodentalization rule formulated as (4.13), and is neutral with regard to the timing of the various mergers which obliterated the finer distinctions of QMC finals. On the other hand, the historical sequence implied in derivation (4.15) gives an early date to MED-DISM, calls for a highly idiosyncratic rule of LABDNT, and requires that the controversial distinctions of QMC finals be maintained until a relatively late stage, that is after the application of LABDNT. A priori, (4.14) appears to be more appealing; but until convincing evidence can be produced to counter the arguments that Chao, Nagel and Li have put forward in support of the early appearance of MED-DISM perhaps already as part of MC phonotactics, all indications seem to force derivation (4.15) upon us.

Whatever its exact formulation, we need LABDNT (or alternately LABDNT'(4.13)) to account for such correspondences as:

(4.16)

QMC (Li)	SMC (*Zi-hui*)	Peking	
piəi	pui	fei	'to fly'
piuk	piuk	fu	'luck, happiness'
p'iɐn	p'yan	fan	'to overturn'
p'iuŋ	p'iuŋ	fəŋ	'bee'

biuɐt	byat	fa	'punishment'
biuən	byən	fən	'tomb'
mio	mio	u	'fog'
miaŋ	myaŋ	uaŋ	'to forget'

I will conclude this longish discussion on LABDNT with three remarks: (a) There are a handful of exceptions to LABDNT, including such extremely common words as QMC *piu 'not', *miu 'plot', *miuŋ 'dream', and *miuk 'eye', which would be expected to emerge in the normal course of events with either /f/ or /u/ as the initial segment; instead they have turned out as /pu/ 'not', /mou/ 'plot', /məŋ/ 'dream', and /mu/ 'eye'. (b) The fact that the environment of LABDNT can be stated only by reference to QMC categories puts LABDNT at a very early date, before the collapsing of QMC finals into the greatly reduced scheme of SMC, which is all we need for adequately describing virtually all other aspects of the subsequent evolution of MC phonology to modern Peking. More about relative chronology in section 10.

Finally, (c) the palatal glide /i/ of the LABDNT-triggering QMC finals always disappears. This fact leads us to believe that /i/-drop is part of LABDNT. More precisely, labiodentalization seems to have passed through an intermediate stage of yodization (palatalization). In other words, LABDNT should be reformulated along the line suggested below:

(4.17) LABDNT (revised)

$$\begin{bmatrix} p \\ p' \\ b \\ m \end{bmatrix} i \rightarrow \begin{bmatrix} pj \\ pj' \\ bj \\ mj \end{bmatrix} \rightarrow \begin{bmatrix} f \\ f' \\ v \\ w \end{bmatrix} / \# \_\_ \begin{matrix} \text{QMC } *əi, *o, *ɐi, \\ *u, *uɐm/p, *ɐn/t, \\ *(u)ən/t, *aŋ/k, \\ *uŋ/k, *oŋ/k \end{matrix}$$

(4.17) is ambiguous in a minor way. Take QMC *iuɐm, for illustration. /-iu-/ and /-y-/ are notational variants. If we rewrite (4.17) as (4.18), the residual ambiguity disappears, and the rule yields the correct output regardless of a sequential (-iu-) or a tautosegmental (-y-) representation:

(F = feeding, CF = counterfeeding) The crucial orderings of (9.12) are borne out by the examples given in derivation (5.4), which I will not reproduce here. Specifically: RETROF-1 > MED-DISM, because of (9.13).

(9.13) 'chapter'

*tśiaŋ	MC
tśaŋ	MED-DISM
tṣaŋ	RETROF-1
tṣuaŋ*	U-INSERT(a)
(tṣaŋ)	(correct output)

The value of (9.13) as evidence of RETROF-1 > MED-DISM is conditioned upon the feeding relation between RETROF-1 and U-INSERT(a), that is RETROF-1 > U-INSERT(a), which is in turn supported by (9.14):

(9.14) 'to collide'

*daŋ	MC
tśaŋ	FRICAT
-	U-INSERT(a)
tṣaŋ*	RETROF-1
(tṣuaŋ)	(correct output)

MED-DISM > RETROF-2, because otherwise the incorrect derivation (9.15) would obtain:

(9.15) 'chapter'

*tśiaŋ	MC
-	RETROF-1,2
tśaŋ*	MED-DISM
(tṣaŋ)	(correct output)

At the outset, the three lexical items share nothing in common except the fact that all begin with a retroflex initial. DIPHTHONG_u, I-DELET, and COALESCE (with the automatic PC's) have the effect of producing the neutral vowel /ə/ right next to the retroflex initial, thereby creating the appropriate strings to which DERET may apply.

RC10 DERET > RETROF-2

RC10 can be illustrated by the following pair of items:

(9.11) 'to guard, keep' 'to search'

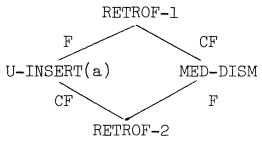
*śiu	*ṣiu	MC
śiəu	ṣiəu	DIPHTHONG_u
-	ṣəu	I-DELET
śəu	-	MED-DISM
-	səu	DERET
ṣəu	-	RETROF-2
ṣou	sou	*CHAMEL

A reversal of DERET and RETROF-2 would result in a merger of *śiu and *ṣiu into /sou/.

RC11 RETROF-1 > { MED-DISM / U-INSERT (a) } > RETROF-2

I had demonstrated earlier (section 5.1) the necessity of positing two occurrences of RETROF, the most compelling evidence being the fact that two other processes, namely MED-DISM and U-INSERT(a), are crucially ordered between these two instances of RETROF. This set of precedence relations is stated as RC11. These relations can be characterized as follows:

(9.12)



(4.18) LABDNT (revised)

$$\begin{bmatrix} p \\ p' \\ b \\ m \end{bmatrix}_1 \begin{bmatrix} +\text{high} \\ +\text{pal} \end{bmatrix} \rightarrow [+\text{pal}]_1 \; [-\text{pal}]_2 \rightarrow \begin{bmatrix} f \\ f' \\ v \\ m \end{bmatrix}_1 [-\text{pal}]_2 \; / \; \ldots$$

(4.18) produces the same output from the alternative inputs:

(4.19)

*piuɐm	*pyɐm	QMC
fØuɐm	fuɐm	LABDNT
fØØɐm	fØɐm	MED-DISM
fan	fan	by other rules

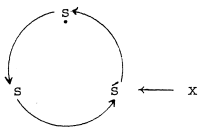
4.6 Besides LABDNT, the most notable modification the MC consonant system had undergone on its evolutionary path toward the modern dialect of Peking is what may be referred to as the Pre-Mandarin Great Consonant Shift (hereafter GCS). LABDNT must have occurred quite early in the post-MC era, as I pointed out in the foregoing section; in fact the effects of LABDNT can be seen in all major dialect groups of Chinese with the sole exception of the Mǐn branch. LABDNT came close to being pan-dialectal. In contrast, GCS, somewhat more restricted in its geographical diffusion, is pan-Mandarin, affecting all northern dialects collectively called Mandarin. GCS consists of three related subrules: RETROF (**retroflection**), DERET (**deretroflection**), and PALAT (palatalization). What these three processes do can be briefly stated using the fricatives /s, ṣ, ś, x/ as the representatives for the dental, retroflex, palatal and the velar series of initials respectively.

(4.20) Great Consonant Shift (GCS)

s ← ṣ		DERET
ṣ ← ś		RETROF
ś ← s, x		PALAT

The pattern of chain motions that underlies (4.20) can be made more apparent if we represent the relations that link these three processes together in a circle of musical chair movements:

(4.21) Great Consonant Shift (GCS)



Let us now examine in turn each of the concatenated shifts.

4.7 DERET retroflex → dental / ___ ə

Although MC retroflexes (*R) and palatals (*Ť and *Ś) have by and large collapsed together and followed the same course of evolution in Peking, DERET affected only the original MC retroflexes, to the exclusion of MC palatals (with two lone exceptions in the corpus of data provided by *Zǐ-huì*/DOC. This can be seen in the following tabulation:

(4.22)

Peking / MC	Dentals	Retroflexes	
Retroflexes	20	104	(16.1%)
Palatals	2	355	(.6%)

The exact conditions under which the MC *R series underwent DERET are not immediately apparent. A certain pattern of subregularities appeared only after a careful sorting of the environments. Table 16 indicates that in the majority of cases DERET took place when *R initial preceded a palatal glide, which in turn was followed by a central /ə/. SMC *ac was included in this environment, as *ac subsequently fell together with *iək by AN-MERGE (see section 7.3). Furthermore, the four finals singled out in Table 16 exhaust the list of MC finals that, at some given point in their derivation, carry a /ə/.[11] The palatal glide, however, does not appear in the environment of the rule DERET, because we have reason to believe that DERET applied after the deletion of the medial glide by I-DELET to be discussed in

p'au	T1B	tś'iu	T1B	DEVOIC
p'au*	T1B	tṣ'u*	T1B	other rules

9.3 All statements about RC in the preceding section involve tone rules. We next consider other temporal relations concerning the rules affecting the initials. RC8 calls for very little comment, as the RC reflects intrinsic orderings: DEVOIC, if applied first, would totally bleed both ASPIR and AFFRIC, since both of these latter processes only take voiced obstruents as input.

RC8 { ASPIR, AFFRIC } > DEVOIC

Consider next,

RC9 { DIPHTHONG$_u$, I-DELET, COALESCE } > DERET

RC9 can be shown by examples like

(9.10)

'to search'	'duty'	'to test'	
*siu	*tsac	*ts'iək	MC
-	-	ts'ik	*RIMEMIC
siəu	-	-	DIPHTHONG
səu	-	ts'k	I-DELET
-	-	ts'ək	*SYLLAB
-	tsaik	-	VOCAL, FUSION
-	tsek	-	COALESCE
-	tsək	-	*CHAMEL
səu	tsək	ts'ək	DERET
-	tsə	ts'ə	APOCOPE
sou	tsơ	ts'ơ	*CHAMEL

and oblique (*T2-4) tones. T4-TRIPART, on the other hand, has the effect of changing the membership of these two original classes of tones by distributing the MC *T4 (oblique) words among T1A, T1B (even) as well as T2 and T3 (oblique) of modern Peking. ASPIR and AFFRIC split along the original MC dichotomy, not according to the tonal categories of modern Peking. ASPIR and AFFRIC, therefore, must apply before T4-TRIPART. This can be seen in the examples given below:

(9.8)

'hail'		'to redeem'		
*bak	T4	*dźiuk	T4	MC
x		x		x: ASPIR not applicable
-		źiuk	T4	AFFRIC
bauk	T4	-		VOCAL
bauk	T1B	źiuk	T1B	T4-TRIPART
bau	T1B	źiu	T1B	APOCOPE
pau	T1B	śiu	T1B	DEVOIC
-		śu	T1B	MED-DISM
-		ṣu	T1B	RETROF-2

If RC7 were reversed and T4-TRIPART (together with APOCOPE)[3] applied before ASPIR and AFFRIC, the following derivation would obtain, resulting in erroneous outputs (marked, as before, by an asterisk to the upper-right of the phonetic transcriptions):

(9.9)

*bak	T4	*dźiuk	T4	
bauk	T4	-		VOCAL
bauk	T1B	dźiuk	T1B	T4-TRIPART
bau	T1B	dźiu	T1B	APOCOPE
b'au	T1B	dź'iu	T1B	ASPIR
-		dź'iu	T1B	AFFRIC (applied vacuously)

section 5.4. As stated, DERET accounts for 15 out of the 20 cases in which *R corresponds to a dental initial in modern Peking; furthermore, it is about 65.2% regular: it applied in 15 out of the 23 lexical items that fit the description of the rule.

Here are a few lexical items that have undergone DERET:

(4.23)

MC	Peking	
tṣac (→ tṣək)	tsʊ	'duty'
tṣ'iək	ts'ʊ	'to test'
ṣiəp	sʊ	'rough' (of taste)
ṣiəm	sən	'forest'
ṣiu (> ṣiəu)	sou	'to search'

It has been commonly assumed that the Peking Mandarin (and the Northeastern and Northwestern varieties like it)

Environment: before MC finals	lexical items to which DERET applied	out of a total of relevant items	
*iəC (> əC)	8	10	
*ac (> əC)	2	3	
*iəN (> əN)	2	4	$^{15}/_{23}$ = 65.2%
*iu (> əu)	3	6	
others	5	101	$^{5}/_{101}$ = 5%
total	20	124	$^{20}/_{124}$ = 16.1%

Table 16.
MC finals which conditioned DERET

differs from the other 'substandard' strands of the Mandarin stock in that the former has preserved intact the strict dichotomy of two separate initials, the retroflex and the dental, whereas the latter no longer differentiates the two types of initials. The ability to meticulously keep the retroflex and dental initials apart has been regarded as the 'shibboleth' of one's membership in the class of (quasi-) native speakers of the prestige National Language, which is based on the modern dialect of the capital of China. The facts do not bear out this popular belief. Some degree of fusion of the retroflex and dental sibilants has occurred in all Mandarin dialects; all dialects, including Peking, have shared one or another form of DERET.

4.8 RETROF palatal → retroflex /# ____ X
where X ≠ i or y

The significance of the negative environment attached to RETROF will become apparent when we come to the question of relative chronology (see section 9). For the moment suffice it to say that almost without exception, all MC palatals (both stops *T̂ and sibilants *Ŝ) unconditionally merged with the retroflexes. In the following examples, MEDDISM (to be discussed below, in section 5.3) must first apply so as to remove the inhibitory environment (i,y) which would otherwise prevent RETROF from applying:

(4.24)	MC	Peking	
	*t̂iu		'day' (vs. night)
	*tŝiu	tṣou	'broom'
	*tṣiu		'wrinkle'
	*t̂am		'to stand'
	*tŝam	tṣan	'to decapitate'
	*tṣam		'to dip in liquid'
	*ŝi		'poetry'
	*ẑi	ṣï	'to be' (copula)
	*ṣi		'lion'

inputs to T2-MERGE' and T1-SPLIT'. If one were to reverse the precedence relation stated in RC4, the two items would merge, whereas in fact they remain distinct, as 'rainbow' now carries T1B instead of T3. This incorrect order is illustrated in derivation (9.7) with the segmental portion omitted:

(9.7)

'rainbow'	'down'	
*T1	*T2	MC
[-rise, -fall]	[+rise, -fall]	
[+rise, -fall]	-	T1-SPLIT'
[-rise, +fall]	[-rise, +fall]	T2-MERGE'
T3* (T1B)	T3	Peking (correct output)

RC6 is predicated upon the assumption that matrix (3.3) represents an adequate phonetic description (i.e. not merely classificatory specification) of MC tones: in other words, RC6 is correct, only if one assumes that MC tones were differentiated by pitch contours alone, and that pitch levels were irrelevant. This is, in all likelihood, a counterfactual assumption. Matrix (3.3) takes no account of pitch level differences, for example, which could prevent *T1 from merging with *T2 even if T1-SPLIT' were to apply before T2-MERGE'. RC6 is, therefore, doubtful at best.[2] A question mark is added to RC6 to indicate its uncertainty.

It is noteworthy that whereas the tone rules must precede certain segmental rules, segmental rules are not, generally speaking, crucially ordered before the tone rules (see, however, discussion below on RC7). This fact no doubt partly reflects the early onset of the tonal changes, but it may equally well result from other totally irrelevant factors. We shall return to this topic when we discuss the relationship between rule ordering and relative chronology in general (section 9.7).

RC7 { ASPIR, AFFRIC } > T4-TRIPART

The phonetic splits formulated here as ASPIR and AFFRIC are conditioned by the MC distinction between even (*T1)

is correctly formulated is demonstrated by words like 'to move' /i T1B/, which never carried an initial consonant, voiced or voiceless. Part one of RC5 is supported by a thoroughly regular tonal correspondence (see correspondence chart (3.1)). Similarly, part two of RC5 is borne out by the partial regularity of tonal correspondences as given in (9.5):

(9.5)

MC	*T4	
Peking	*ʔ	*Ø
T1A	7	-
T2	1	-
T3	4	13

Whereas *T4 words beginning with a zero-initial in MC have now become T3 words in modern Peking, the majority of *T4 words which once started with a glottal stop end up, in the majority of cases, with T1A. In order to insure such a partial regularity, one must posit a derivation like the following:

(9.6)

'one'		'100 million'		
*ʔiət	T4	*iək	T4	MC
ʔit	T4	ik	T4	*RIMEMIC
ʔit	T1A	ik	T3	T4-TRIPART
ʔi	T1A	i	T3	APOCOPE
i	T1A	-		PROCOPE

If PROCOPE were to apply before T4-TRIPART, /ʔit/ would have become /it/, and therefore taken on T3, exactly like /ik/.

RC3-5 are demonstrable by the facts of tonal correspondences. R6 is somewhat more speculative, based on an assumption which is unsupported. If the tone rules are translated into distinctive feature notation along the lines suggested in section 3.4, one must order T2-MERGE' before T1-SPLIT', in other words,

?RC6 T2-MERGE' > T1-SPLIT'

Take 'rainbow' * ɣa T1 (Peking:/śia T1B/) and 'down' * ɣa T2 (Peking:/śia T3/), for instance. Both have a voiced obstruent initial, and therefore both are potential

MC *ń regularly turns out as /r/:

(4.24)

MC	Peking	
ńui	ruei	'bud'
ńio	ru	'as, like'
ńian	ran	'to burn'

By RETROF *ń → /ṇ/, which in turn becomes its corresponding liquid /r/ via a redundancy rule such as (4.25), which I will subsume under the general process of RETROF:

(4.25)

retroflex
↓
[-nasal]

That is, /r/ is the only non-nasal retroflex sonorant.

RETROF in conjunction with (4.25) no doubt telescopes several intermediate steps in the transition between *ńi and /r/, and camouflages a number of problems concerning the exact mechanism of the phonetic shift(s) in question. One plausible, if speculative, trajectory may be something like this: first of all, MC *ń dropped out leaving a glide or a semivocalic ingress, possibly with some slight audible friction (/j/). Subsequently, /j/ was strengthened to /ź/, which became a retroflex /ʐ/ or its free variant /r/ by RETROF. Observations like the following lend some measure of support to the hypothetical trajectory of evolution traced above: (a) *ń has /Ø/ as its principal reflex in 5 out of the 17 dialects recorded in *Zì-huì*; (b) Guǎng-zhōu (Cantonese) supplies the missing link /j/: in Guǎng-zhōu not only *ń but also *Ø correspond regularly to a weakly spirantized glide /j/; (c) the strengthening from /j/ to /ź/ or /dź/ is a fairly common process cross-linguistically; (d) if we posit a strengthening rule, we can at the same time account for the sporadic correspondences (4 out of 107) between MC *Ø and Peking /z~r/ (see Appendix B); (e) finally, the dialect of Cháo-zhōu (a South Mǐn variety) derives its /z/ [ź] not only from *ń (31 instances), but also from *Ø (9 instances), giving clear clues of the strengthening effect of the gliding ingress. Similar phenomena can be observed in a number of Wú dialects.

4.9 PALAT { dental spirant / velar consonant } → palatal / ____ i, y

This rule applies to all initials of the *K series, except those dropped by another rule (PROCOPE, see section 4.10). The dental palatalization is more limited in scope: it applies only to dental fricates (both affricates and fricatives) to the exclusion of dental stops, liquids and nasals. PALAT has the effect of partially collapsing dentals and velars, as shown below:

(4.26)	MC	Peking	
	syan	śyan	'to declare'
	ɣyan		'to hang'
	tsiai	tśi	'sacrifice'
	kiai		'to continue'
	dziak	tśiau	'to chew'
	giau		'palanquin'
	tiai	ti	'emperor'
	dian	tian	'electricity'
	liək	li	'strength'
	ni	ni	'oily'

The last four items are included to show the inapplicability of PALAT to non-fricated dentals. PALAT can trigger other automatic rules. (4.27) as a 'marking convention' has universal support (cf. Chomsky-Halle 1968:421ff). At any rate, the absence of palatal stops in Peking can be expressed as:

(4.27) [+palatal]
↓
[+fricated]

(4.27) further functions as a linking rule. Thus

applicable and as many times as possible.

We now turn to the ordering relations among P-rules.

9.2 As we have seen, all tone rules are conditioned by the manner of articulation of the initial segments, specifically by the voiced/voiceless distinction among the initials. It follows immediately that all tone rules must take place before the voicing contrast is neutralized by DEVOIC. This precedence relation is stated as RC3:

RC3 { T1-SPLIT / T2-MERGE / T4-TRIPART } > DEVOIC

Consider next,

RC4 T4-TRIPART > APOCOPE

MC *T4 syllables are characterized by a stop ending. This very defining trait of *T4 is obliterated by APOCOPE. Hence RC4.

While RC3 and RC4 follow from the nature of the phonetic processes in question, RC5 depends uniquely on historical accident.[1]

RC5 { T1-SPLIT / T4-TRIPART } > PROCOPE

PROCOPE could, in principle, apply before T1-SPLIT, but the outcome would have been different. Consider the following derivation:

(9.4)	'to cure'	'to move'	'doubt'	
	ʔi T1	i T1	ŋi T1	MC
	ʔi T1A	i T1B	ŋi T1B	T1-SPLIT
	i T1A	-	i T1B	PROCOPE

If one were to reverse the order between T1-SPLIT and PROCOPE, 'to cure' would have turned out as a T1B word instead. This is so because T1-SPLIT as we have stated it says that a T1-word assumes the B tone as long as it starts with a voiced element (including a vowel), not necessarily with a voiced initial consonant. That T1-SPLIT

If *CHAMEL were to apply before U-INSERT(b) and LAB-ABS, /tsọ/ and /sio/ would have become /tsɤ̯/ and /sie/ in conformity to the allophone distribution chart (2.14).

In sum, *CHAMEL can apply whenever applicable -- but not before the three P-rules referred to in RC1. As both U-INSERT(b) and LAB-ABS are fairly late rules in the history of Peking (see further discussion below), PC *CHAMEL must have entered into the phonological system of modern Peking at a rather recent date.

As for *PAL-DISM, this PC could not have been added to the phonology of pre-Peking before RAISE (I-UMLAUT(b-c)) and VOCAL, as can be demonstrated by the two lexical items given below:

(9.3)

'example'	'soldier'	
*liai	*piań	MC
liei	-	RAISE (I-UMLAUT(b))
liii	-	RAISE (I-UMLAUT(c))
li	-	*DEGEMIN (applied twice)
-	piań	VOCAL
-	piaiŋ	FUSION
-	pieŋ	COALESCE
-	piəŋ	*CHAMEL
-	piŋ	*RIMEMIC

Had *PAL-DISM applied before RAISE, *liai would have emerged as /lai/ instead. Similarly, VOCAL would have been prevented from applying to *piań had it been in force at that point. The chronological relationship between *PAL-DISM and the two aforementioned P-rules can be stated as RC2:

RC2 RAISE, VOCAL } > *PAL-DISM

On the other hand, *PAL-DISM must have been present in the language at the time SHARP and COALESCE were operative. This fact is explicitly mentioned in the statement of *PAL-DISM (section 2.6), as this PC achieves its effect by either blocking SHARP or triggering COALESCE, among other things (cf. discussion 6.8, esp. derivation (6.30)).

With the qualifications stated as RC1-2, all PC's operate random-iteratively, that is, applying whenever

(4.28)

k	k'	g	MC
c	c'	ɟ	PALAT
tś	tś'	dź	Redundancy rule (4.27)
tś	tś'	tś, tś'	other rules (DEVOIC, ASPIR)

(Where c, c', ɟ symbolize plain voiceless, aspirated, and voiced palatal stops respectively.) PALAT, together with its automatic consequences, is exceptionless; it is, as a matter of fact, an allophonic distribution rule not only for Peking, but also throughout the greater part of the Mandarin speaking areas.

4.10 The only remaining major change affecting MC initials is the loss of *ʔ and *ŋ. Syllables which once were differentiated by these initials now merged with the corresponding zero-initialed syllables. E.g.:

(4.29)

MC	Peking	
ʔɑi	ai	'love'
ŋɑi		'impediment'
ʔiań	iŋ	'infant'
ŋiań		'to encounter'
iań		'full'

Correspondences like the ones attested above can be summed up by the following rule:

PROCOPE ʔ, ŋ → ∅ / # ___

We have accounted for all the regular or semi-regular changes the MC initials have undergone. We need not concern ourselves with the handful of items (4 out of 72 in our data sheet, see Appendix B) of *ŋ that had shifted to a dental position /n/, thereby escaping PROCOPE. As for the 4 cases exhibiting the *ń : /∅/ correspondence, the pattern is completely predictable, and the matter will become clear in light of the ensuing discussion concerning the Great Vowel Shift (see I-UMLAUT, section 6.6).

V. MEDIAL CHANGES

5.0 We next come face to face with the more complex set of changes affecting the finals. We will subdivide this part of the exposition according to the three subcomponents of a final, namely the medial, the nucleus, and the coda, in that order. First, the medials.

It should be understood from the outset that whatever we shall say in the following sections about the medials holds true of their syllabic counterparts, namely the high vocalics /i, u, y/ which are not preceded by onglides. As I have pointed out before (cf. footnote 2 of section 2), there is no phonemic contrast between glides and vowels.

MC had three mutually contrasting glides or high vowels, namely /i, u, y/. The relevant post-MC changes increased or decreased the number of certain types of medials; let us call the former sort of changes 'replenishing', the latter 'depleting'. The cross-classification along these distinctions provides us with an overview of the phonological processes we will be concerned with in the present section 5:

(5.1)

	i	u	y
Replenishing	I-INSERT	U-INSERT	LAB-ABS
Depleting	MED-DISM	MED-DISM	MED-DISM
	I-DELET	U-DELET	Y-SPLIT

5.1 It would be best to consider I-INSERT in conjunction with other vowel shifts collectively referred to as I-UMLAUT (see sections 6.4-9). U-INSERT may be stated as follows:

$$\text{U-INSERT}\quad \emptyset \rightarrow u \;/\; \left\{ \begin{array}{ll} \text{Retroflex} \_\_\_\_ \text{an} & \text{(a)} \\ \text{Dental or retroflex} \_\_\_ o & \text{(b)} \end{array} \right\}$$

Notice that the retroflex (R) initial in modern Peking has two distinct sources in MC: one (R_1) from MC retroflexes (*R), the other (R_2) from MC palatals (*T, *Ś) via RETROF. R_1 and R_2 behaved differently with regard to U-INSERT. The curious asymmetry exhibited by the environment in which part (a) of U-INSERT took place may be diagrammed in the following way:

Of the PC's listed in section 8, all but two hold good throughout the entire history from MC down to modern Peking; they are therefore unordered both among themselves and with respect to all P-rules: they apply automatically each time a lexical item (at any stage of its diachronic derivation) meets their structural description. The two exceptions are: *PAL-DISM and *CHAMEL. These two must have arisen in post-MC times. *CHAMEL says, in effect, that there is only one mid vowel phoneme /ə/ with contextually predictable allophones. This is true only of a 5-vowel system like that of modern Peking (see section 2.10). That it could not have been part of MC phonology is evident from the fact that MC (even in its simplified version) has an 8-vowel system, where three mid vowel phonemes /e, ə , o/ stand in contrast (see section 1.3, esp. (1.5)). Furthermore, while *CHAMEL need not apply before any P-rule, a number of P-rules are crucially ordered before *CHAMEL. These are:

$$\text{RC1}\quad \left\{ \begin{array}{l} \text{G4-MERGE} \\ \text{U-INSERT(b)} \\ \text{LAB-ABS} \end{array} \right\} > \text{*CHAMEL}$$

(RC stands for 'relative chronology', and X > Y reads as 'X precedes Y', where X and Y are both rule labels; statements about RC are numbered for convenient reference.) G4-MERGE must precede *CHAMEL, otherwise the finals of rime group *AN, for instance, would have merged with those of *EN, whereas in fact these two sets of finals have remained distinct:

(9.1) *AN finals *en, *uen, *et, *uet → ian, yan, iat, yat, etc.
*EN finals *ən, *uən, *ət, *uət → ən, un, ət, ut, etc.

As for the relationship between U-INSERT(b), LAB-ABS and *CHAMEL, consider the following derivation:

(9.2)

'to catch'	'to pare'	
*tṣak	*siak	MC
tṣauk	siauk	VOCAL
tṣok	siok	COALESCE
tṣo	sio	APOCOPE
tṣuo	-	U-INSERT(b)
-	syo	LAB-ABS
-	sye	*CHAMEL
-	śye	PALAT

ENDINGS

7.0-2 WEAKEN
VOCAL ań, ac → aiń, aic
ak, ak → auk, auk

FUSION -m, p → n, t
-ń, c → ŋ, k

APOCOPE final stop → (ʔ →) ∅

7.3 COALESCE
ai, ai → e
au, au → o

Condition: when *CANON or *PAL-DISM are violated

IX. RELATIVE CHRONOLOGY

9.0 In the foregoing sections we have examined in some detail the phonological processes that must have taken place between MC and modern Peking. In this section I will address myself to the question: in what temporal sequence did the aforementioned processes occur? In attempting to answer this question, one may examine various sorts of evidence, the most important of which are: written records, the geographical distribution of the individual changes, and the ordering relations among the diachronic rules that can be inferred from the systematic correspondences between the protoforms and the modern reflexes (for more extensive discussion of this topic, see Chen 1976, in press). In what follows, I will restrict myself chiefly to the last type of evidence: we shall concern ourselves only with the kind of relative chronology that can be established purely on internal grounds. While trying to establish the ordering relationships among the rules we have obtained, we shall also have a better idea about how these rules interact with each other in general.

9.1 Before we proceed any further, it is important to point out one of the basic ways in which Phonotactic Conditions (PC) differ from the usual phonological rules (P-rules) with regard to their mode of operation. In contrast to P-rules, which represent specific innovations at a given point, roughly speaking, in time, PC's characterize one or another aspects of a more or less stable state. It goes without saying, a PC must enter the language at a certain time, and can fade out of the language at a given moment in its history. But as long as the PC is in force, it applies whenever applicable.

(5.2)

	*aŋ	*iaŋ
R_1 (< *R)	uaŋ (2)	uaŋ (10)
R_2 (< *T́,*ś)	uaŋ (2)	aŋ (29)

Needless to say, it is possible to render a summary of the facts by simply stating the regular correspondences in two separate rules like the ones suggested below:

(5.3) *aŋ → uaŋ / *R, *T́, *Ś ___

*iaŋ → uaŋ / *R ___

A statement of this sort would be unsatisfactory in several ways: (a) it fails to explicitly recognize the unity of the phonetic process underlying the two subparts of the rule; (b) the simple summary of correspondences tells us nothing about the phonetic motivation of the sound change in question. It is reasonable to assume that the prothetic /u/ owed its origin to the rounding effect of retroflex initials -- witness the labial glide in such English words as 'read' [rʷi:d] and 'write' [rʷajt].[1] Only by assuming lip-rounding, the secondary articulation of retroflex initials, as the factor that triggered U-INSERT, can we account for the fact that MC *R, *T́, *S behave as a natural class: these three series of MC initials merged into one single set of retroflexes in Peking. However, as I have just mentioned, there are two types of retroflexes in modern Peking: R_1 and R_2. An epenthetic labial glide accrued to *aŋ when this was preceded by either R_1 or R_2; *iaŋ on the other hand, acquired this medial /u/ only in the environment of R_1, not R_2. The asymmetrical correspondences of (5.2) have found their way into Peking through an intricate interplay of several phonetic processes. How the situation sketched in (5.2) had come about can be made clear by means of 4 lexical items exemplifying the 4 possible combinations of (R_1, R_2) and (*aŋ, *iaŋ).

(5.4)

'window' *ts'aŋ	'bed' *ts'iaŋ	'to collide' *d̂aŋ	'chapter' *t́siaŋ	MC
-	-	t́saŋ	-	FRICAT
-	ts'aŋ	-	-	I-DELET (see below)
-	-	tsaŋ	-	RETROF-1

tʂ'uaŋ	tʂ'uaŋ	tʂuaŋ	-	U-INSERT (a)
-	-	-	tʂaŋ	MED-DISM (see below)
-	-	-	tsaŋ	RETROF-2

FRICAT has been dealt with in section (4.4). I-DELET and MED-DISM will be the subject of discussion presently. The price we pay for a simple and, quite plausibly, an explanatory rule of U-INSERT(a) such as the one I have proposed is the need to posit two instances of RETROF: one (= RETROF-1) applying before U-INSERT(a), the other (= RETROF-2) thereafter. Actually the double application of RETROF follows from another, quite independently motivated, decision, namely to regard RETROF essentially as a process of depalatalization, and consequently (a) to regard an adjacent palatal /i,y/ as an inhibitory context, and (b) to make the absence of /i,y/ part of the (negative) condition of RETROF. Once we accept RETROF exactly as it is formulated including its negative environment, the multiple application of RETROF-1,2 is, in part, a consequence of the two separate processes (I-DELET and MED-DISM, to be given below) which removed at two separate points of the derivation the inhibitory context, thereby enabling RETROF-1,2 to automatically (re)apply. I will attempt to motivate I-DELET and MED-DISM as two separate rules, when we come to examining these two processes.

Part (b) of U-INSERT is of much more recent origin. The /o/ which became /uo/ by this rule has four different sources in MC: *ɑ by U-UMLAUT (see section 6.2), *ɑk and *ak via /ɑuk/ and /auk/ by VOCAL (vocalization, section 7.2) which collapsed together into /ok/ by COALESCE (section 7.3). In environments to be specified elsewhere *iak merged with *ak by the general rule of MED-DISM (section 5.3). The related rules U-UMLAUT, MED-DISM, VOCAL, COALESCE will be discussed in the appropriate sections. As for the retroflex initials which conditioned U-INSERT(b), they may be the direct, unmodified descendants of MC retroflexes *R, or may have come about from MC palatals *T́ or *Ś via RETROF. The convergence of these processes to 'streamline' the inputs to U-INSERT(b) is shown by the four lexical items below which exemplify the four MC sources of /o/, as well as the two origins of the retroflex initial:

5.2 LAB-ABS iu → y (a)
io → yo (b)

5.3 MED-DISM

$$\begin{bmatrix} V \\ +high \end{bmatrix} \rightarrow \begin{cases} [-palatal] \;/\; \begin{bmatrix} C \\ +palatal \end{bmatrix} \;\_\_ & \text{(a)} \\ [-labial] \;/\; \begin{bmatrix} C \\ +labial \end{bmatrix} \;\_\_ & \text{(b)} \end{cases}$$

5.4 I-DELET
V → [-palatal] / retroflex __

5.5 U-DELET
V → [-labial] / {velar, glottal} __ under certain conditions

5.6 Y-SPLIT
(a) yaŋ → uaŋ unconditionally and without exception
(b) iuŋ → uŋ / {dentals: (i) without exception; velars, glottals: (ii) in the majority of cases}
(c) yən → uən / dentals; over half of the cases
(d) y → u or i / certain conditions; sporadically

VOWEL SHIFT

6.1 G4-MERGE
e → ia
ue → ya

6.2-4 U-UMLAUT
(a) u → əu DIPHTHONG
(b) o → u RAISE
(c) a → o / {labial __ i, t, p, #; velars __ t, p, #; dentals __ #} ROUND

6.5-10 I-UMLAUT
(a) i → {əi / labial __ #; ø / dental sibilant __ #} (i) DIPHTHONG (ii) APICAL
(b) a → e / i, y __ x, where X ≠ N, u
(c) e → i / __ i RAISE
(d) a → ia / {velar, glottal} __ SHARP
(e) ɑ → a A-MERGE

3.2 T2-MERGE
*T2 → T3 / voiced obstruent

3.3 T4-TRIPART
*T4 → { T3 / sonorant initial (incl. ∅)
T1B / voiced obstruent
T1A, 2, 3 / voiceless initial }

INITIALS

4.1 DEVOIC
[-sonorant] → [-voiced]

4.2 ASPIR
[-sonorant, +voiced] → [+aspirated] / # __, in T1 syllables

4.3 AFFRIC
dź, dẓ, ź, (ẓ) → { affricate / in T1 syllables
fricative / in T2-4 syllables }

4.4 FRICAT
[C, +palatal] → [+fricated] / # __

4.5 LABDNT
[p, p', b, m] → [f, f', v, u] / __ QMC *iəi, *io, *iɐi, *iu,
*iuɐm/p, *iɐn/t, *i(u)ən/t,
iaŋ/k, *iuŋ/k, *ioŋ/k

4.6 DERET
retroflex → dental / __ ə

4.7 RETROF
palatal → retroflex / # __ X, where X ≠ i or y

4.8 PALAT
{dental spirant, velar consonant} → palatal / __i, y
{DERET, RETROF, PALAT} = GCS (4.21)

MEDIALS

5.1 U-INSERT
∅ → u / { retroflex __ aŋ (a)
dental or retroflex __ o (b) }

(5.5)

'many'	'mistake'	'to catch'	'weak'	
*tɑ	*ts'ɑk	*tṣak	*ńiak	MC
to	-	-	-	U-UMLAUT (to be given)
-	-	-	ńak	MED-DISM
-	-	-	rak	RETROF(and FRICAT)
-	ts'ɑuk	tṣauk	rauk	VOCAL (to be given)
-	ts'ok	tṣok	rok	COALESCE
tuo	ts'uok	tṣuok	ruok	U-INSERT(b)
-	ts'uo	tṣuo	ruo	by other rules

5.2 LAB-ABS iu - y (a)
io - yo (b)

Part (a) is an interpretive rule (cf.6.9); as for part (b), MC *ak and *iak constitute the only sources for /io/ (via VOCAL of the stop ending /-k/). The rule itself is self-explanatory: it has to do with the leftward movement or the absorption of the labiality feature by a neighboring segment.[2] The interaction between LAB-ABS and other processes, such as the PC *CHAMEL (cf. section 2.9), is shown by a couple of examples:

(5.6)

'to learn'	'to whittle away'	
*ɣak	*siak	MC
ɣio	sio	by rules to be given
ɣyo	syo	LAB-ABS
ɣye	sye	*CHAMEL
śye	śye	by other rules

5.3 So far we have examined two processes which are replenishing in the sense that they create new members to one or the other medials. There are also a number of depleting processes: I-DELET and U-DELET obviously fit

the description; Y-SPLIT is depletive in that it decreases the stock of palato-labial glide /y/ by either depalatalizing it to /u/ or by delabializing it to /i/. In addition to these processes, we have a rule of general applicability, namely MED-DISM. Let us look at MED-DISM first.

$$\text{MED-DISM} \begin{bmatrix} \text{V} \\ \\ \text{+high} \end{bmatrix} \rightarrow \begin{Bmatrix} \text{[-palatal]} \;/\; \begin{bmatrix} \overset{\text{C}}{\text{+palatal}} \end{bmatrix} \;\underline{\quad\quad} & \text{(a)} \\ \text{[-labial]} \;/\; \begin{bmatrix} \overset{\text{C}}{\text{+labial}} \end{bmatrix} \;\underline{\quad\quad} & \text{(b)} \end{Bmatrix}$$

MED-DISM typifies a well-known process commonly referred to as dissimilatory neutralization: contrasts of [±palatal] and [±labial] are neutralized in their respective contexts, namely when adjacent to a [+palatal] and a [+labial] segment respectively. To paraphrase this statement, the slot after a palatal or a labial initial is a 'neutralizing position' (Aufhebungsstellung) in Trubetzkoy's (1936) terminology; that is, in these positions, the phonological features of palatality and labiality assume an 'unmarked' value, and universal 'marking conventions' (cf. Chomsky-Halle 1968, and Postal 1968) will interpret these 'unmarked' values as negative.

In order to correctly apply MED-DISM, one must recall that there are only three high vowels (or glides), namely /i, u, y/, characterized by palatality and/or labiality; the fourth possibility does not exist. In other words, a high vowel which is neither palatal nor labial is interpreted as zero. We have then the following matrix:

(5.7)

i	u	y	ø	
+	+	+	+	high
+	-	+	-	palatal
-	+	+	-	labial

With these feature specifications in mind, we can state the input-output relations of MED-DISM in the following fashion:

(5.8)

i	u	y	input
ø	-	u	MED-DISM(a) = palatal dissimilation
-	ø	ø	MED-DISM(b) = labial dissimilation

(2.2) *SYLLAB (MC, Peking)

(a) # (C)C #
↓
[+syllabic]

(b) [C, +syllabic]
↓
{C + ï, if C = sibilant} (i)
{ə + C, elsewhere} (ii)

(2.3) *CANON (MC, Peking)
~VGC

(2.4) *DEGEMIN (MC, Peking)
X_i / X_i
↓
ø

(2.5) *LAB-DISM (MC, Peking)
PVU
?PVP
~UVP
~UVU

(2.6) *PAL-DISM (Peking only)
(a) [+high] (V) [+high, +palatal]
↓
[-palatal]
(b) blocks SHARP
(c) triggers COALESCE

(2.7) *RIMEMIC (MC, Peking)
G ə C
↓
ø

(2.9) *CHAMEL (Peking only)
[-high, -low] / [∝palatal, βlabial]
↓
[∝palatal, βlabial]

TONES

3.1 T1-SPLIT
*T1 → { T1A / voiceless initial
T1B / if syllable begins with a voiced segment }

two developments interacted in an intricate sort of way, and time was of the essence in the matter. If APOCOPE applied first, it would remove the final stop, thereby destroying the crucial condition which would have otherwise triggered COALESCE; if, on the other hand, the stop ending somehow resisted the attrition of APOCOPE, the lexical item would be subject to COALESCE in order to conform to the canonical form of a permissible syllable. Eventually APOCOPE applied in all cases. This partially 'bleeding' and partially 'counter-bleeding' relation between APOCOPE and COALESCE can be illustrated by means of the bifurcated developments of the originally homophonous pair of words 'white' and 'uncle', both of which were *pac in MC.

(7.9)

	'white'	'uncle'	
MC	*pac	*pac	MC
VOCAL	paic	paic	VOCAL
FUSION	paik	paik	FUSION
APOCOPE	pai	pek	COALESCE
COALESCE	-	pe	APOCOPE
*CHAMEL	-	po	*CHAMEL

The two phonological processes, APOCOPE and COALESCE intersected in time: at one stage of development, both were simultaneously applicable to an intermediate form like /paik/ (or [pai?]). In certain cases like 'white', APOCOPE preempted COALESCE; in others like 'uncle', the delayed onset of APOCOPE allowed COALESCE to work first. For a discussion of this type of chronologically intersecting, and therefore, competing changes, cf. Wang 1969 and Chen 1972.

VIII. SUMMARY OF RULES AND CONDITIONS

(In the following the numbers refer to the sections in which the rules and conditions are discussed)

PHONOTACTICS

(2.1) *MONOSYL (MC, Peking)
(a) ~VGV
~VV
(b) permissible: GV, VG, GVG, GG

Recall that in connection with LABDNT (section 4.5) we had occasion to point out the defective distribution of close finals (i.e. finals with a labial onglide /u/ or /y/). Such finals did not enter, as a rule, into combination with labial initials. The phonetic notation (*fǎn-qiè*) of *Qiè-yùn* is somewhat inconsistent in representing MC finals with or without a labial onglide. Li (1952) resolved this ambiguity by interpreting MC finals of the configuration *-(u)V- as simply *-V- throughout, -- with a couple of exceptions noted elsewhere.[3] *Zì-huì* (the principal source book used here), on the other hand, reflects this inconsistency in allowing close as well as open finals to combine with labial initials. Whatever may have been the actual phonetic realization of close finals preceded by labial initials, any possible phonological contrast between close and open finals in such environments was eliminated by MED-DISM(b). To illustrate the effect of MED-DISM(b), observe the following correspondences:

(5.9)

'half'	'board'	'generation'	'shell'	
*puɑn	*pan	*puɑi	*pɑi	MC (*Zì-huì* reconstruction)
*pɑn	*pan	*puɑi	*pɑi	MC (Li's reconstruction)
pɑn	-	puɑi	-	MED-DISM(b)
pan	pan	pei	pei	other rules

In contrast to part (b), part (a) of MED-DISM was definitely a post-MC innovation. Its effect is best illustrated by lexical items such as these:

(5.10)

MC	Peking	
t̂iam	tsan	'to stand'
tśiam	tsan	'to occupy'
dźyan	ts'uan	'boat'
d̂io	ts'u	'kitchen'
tś'iuŋ	ts'uŋ	'to wash away'

By the same process, /i/ drops out, and /y/ is depalatalized to /u/. The palatal initials which triggered MED-DISM(a) subsequently became retroflexes (by RETROF) once the inhibitory palatal glide was removed. The two processes are intimately related.

But MED-DISM simply stated as it is, cannot account for the correspondences summarized in (5.11).

(5.11)

	MC sources	*RIMEMIC	Intervening mergers	Peking
A	*i	----------	i	→ ï
	*iai	----------		
	*iəC	iC	iC	
	*iac	------		
B	*iən	in	in	→ ən
	*iəm	im		
C	*iəŋ	iŋ	iŋ	→ əŋ
	*iaŋ	------		

and typified by examples given below:

(5.12)

	MC	Peking	
A	*tśi	tsï	'paper'
	*źiai	sï	'oath'
	*d̂iək	tsï	'straight'
	*tś'iac	ts'ï	'yard, foot'
B	*śiən	sən	'body'
	*śiəm	sən	'deep'
C	*tśiəŋ	tsəŋ	'to steam'
	*źiaŋ	ts'əŋ	'town'

One way to render an account of the facts presented above is to (a) bar the application of *RIMEMIC; (b) derive the Peking /ï/ from MC *i by a completely unrelated rule (e.g. by a rule of apicalization -- e.g. roughly along the lines suggested in Chen 1975, 1976); and (c) build into MED-DISM(a) certain restrictions such as:

Consider, for instance, the five sets of (near)homophonous words in MC which have diverged into two separate types of finals in modern Peking:

(7.8)

MC	Peking Diphthong	Peking Monophthong	
*pac	pai		'white'
*pac		po	'(paternal) uncle'
*tsac	tsai		'narrow'
*tsac		tsɤ	'duty'
*pɑk	pau		'thin'
*bɑk		po	'learned, erudite'
*kak	tśiau		'horn'
*kak		tśye	'to feel'
*iak	iau		'medicine'
*ʔiak		ye	'agreement, treaty'

The distribution of the mid vowels /e, o, ɤ/is predictable by *CHAMEL. What had seemed puzzling at first was the apparently random split into the two types of reflexes, diphthongal and monophthongal. It is true in many instances, there exist alternate readings (only a few of which are actually recorded in *Zǐ-huǐ*). Furthermore, the variant pronunciations are sometimes stylistically and otherwise determined. For example, *pɑk 'thin' is pronounced today /pau/ in the colloquial form, and /po/ in the literary style. Likewise, *kak had split into two lexical items: /tśye/ 'to feel', but /tśiau/ as in /suei-tśiau/ 'to sleep'. Obviously, style, semantic specialization, and possibly dialectal interference[3] played a role -- large or small - in the bewildering evolution of the MC finals under discussion. But the kind of variation we are talking about has a more immediate explanation that does not appeal to extralinguistic factors. Recall that COALESCE was triggered by the phonotactic condition *CANON, which proscribed against 'ascending' diphthongs before a final stop; on the other hand, the final stop was already on the way out by APOCOPE. These

7.3 COALESCE ai, αi → e

au, αu → o

condition: when *CANON or *PAL-DISM are violated

Coalescence, as a general process, is alien to the phonological system of Peking. Diphthongs like /ai, au, ei, ou/ occur freely and frequently. COALESCE has a restricted scope of application: it is triggered only when a phonotactic condition is violated. Consider the derivation given above in (7.6). As a result of VOCAL and FUSION, *p'aǵ 'to cook' became /p'aiŋ/. This intermediate form violated the canonical form of a permissible syllable not only in MC but also in Peking: a closed syllable may not contain an 'ascending diphthong'; thus whereas (a) is permitted, (b) is ruled out as an impossible syllable type:

(7.7) *CANON

(a) G V C

(b) ~ V G C

(where G = /i, u, y/). COALESCE, then was one of the ways to bring a form like /p'aiŋ/ in line with the general requirement of the sound pattern of both MC and Peking. COALESCE reduced /p'aiŋ/ to /p'eŋ/, which became /p'əŋ/ according to *CHAMEL.

Recall, in this connection, the discussion in section 6.9 about the effect of SHARP on MC final *ai. When preceded by a velar or a glottal initial, *ai either remained resistant to SHARP, which was expected to operate in that environment, or became in accordance to SHARP /iai/, but in violation of *PAL-DISM. The resulting conflict was resolved by COALESCE, whereby /iai/ contracted to /ie/. The interaction of these forces was played out in the divergent lines of development typified by such forms as *kai → /tśie/ 'street' vs. *k'ai → /k'ai/ 'to wipe' which engaged our attention earlier on (see (6.30)).

We are now in a position to examine a most interesting phenomenon. Corresponding to MC *ac, *ɑk, *ak, and *iak, there are two types of regular reflexes, one with a diphthong /-ai, -au/, the other with a simple vowel /-e, -o, -ɤ/, (that is, discounting the onglide, if any).

(5.13) MED-DISM(a)

$$\begin{bmatrix} V \\ +high \end{bmatrix} \rightarrow [-palatal] \; / \; \begin{bmatrix} C \\ +palatal \end{bmatrix} \_\_ V$$

The requirement that there must be an adjacent vowel allows *śiən to become /śən/ (> /sən/), while preventing *tśi from losing the only vowel it has. In other words, the derivations of these two examples would look something like this:

(5.14)

'body'	'paper'	
*śiən	*tśi	MC
x	-	x: *RIMEMIC barred from applying
śən	-	MED-DISM
-	tśï	by a separate rule of Apicalization
s̩ən	ts̩ï	RETROF

But this is done at the cost of (a) by-passing an otherwise well-established phonotactic rule of MC which parallels the 'rimemic principle' implicit in the pattern congruity of modern Peking; (b) failing to bring out the basic unity between a process which apicalizes the nuclear vowel /i/ in *tśi and another one which depalatalizes the medial glide /i/ in *śiən; and finally (c) introducing into the rule of MED-DISM a constraint which is best stated elsewhere as part of a much more general principle. The force of the arguments presented here is considerably strengthened when we consider part (a) of MED-DISM in conjunction with part (b). Observe the following regular correspondences:

(5.15)

	MC sources	*RIMEMIC	LABDNT	Intervening mergers	Peking
A	*u	----------			
	*iu	-------	u		
	*uC	----------			u ----→ u
	*iuC	-------	uC		
	*yəC	yC	uC		

B	*uən	un	----------→	ən	
	*yən	yn	un	----------→	ən
C	*uŋ	----------→	əŋ		
	*iuŋ	-------	uŋ	----------→	əŋ

The regularity of these correspondences can be seen in Appendix C. A few instances will suffice for the purpose of illustration:

(5.16)

	MC	Peking	
A	*po	pu	'cloth, fabric'
	*p'uk	p'u	'to lurch forward'
	*bio	fu	'to hold, support'
	*biuk	fu	'to lie low, prostrate'
	*myət	u	'thing'
B	*buən	pən	'stupid'
	*p'yən	fən	'fragrance'
C	*muŋ	məŋ	'to cover'(also 'Mongolia')
	*piuŋ	fəŋ	'wind'

Recall that /-iu/ or /-y/ were reduced to /-u/ as part of the process of LABDNT (see section 4.5). Cases of the A type in (5.16) calls for the same additional restriction suggested for part (a). Thus (5.13) may be revised as (5.17):

(5.17) MED-DISM(a,b)

$$\begin{bmatrix} V \\ +high \end{bmatrix} \rightarrow \left\{ \begin{array}{ll} [-palatal] & / \begin{bmatrix} C \\ +palatal \end{bmatrix} \\ [-labial] & / \begin{bmatrix} C \\ +labial \end{bmatrix} \end{array} \right\} / \_\_V \quad \begin{array}{l} (a) \\ (b) \end{array}$$

But this revision alone will not make MED-DISM work, since *buən [bun] and *p'yən [p'yn] (> /fun/ by LABDNT) did undergo MED-DISM(b) despite the fact that the requirement of an adjacent vowel was not met. Of course, one can bar *RIMEMIC

recoding of phonemic distinctions was effected by means of VOCAL, whereby the palatal vs. velar contrast was shifted leftward to the vocalic portion, with the endings assuming the 'unmarked' value. This process can be more revealingly represented roughly in the following way:[1]

(7.5) VOCAL (restated)

$$\begin{bmatrix} V \\ +low \end{bmatrix}_1 \; \emptyset_2 \; \begin{bmatrix} C \\ \alpha\ palatal \\ \beta\ velar \end{bmatrix}_3 \rightarrow \begin{bmatrix} V \\ +low \end{bmatrix}_1 \begin{bmatrix} V \\ \alpha\ palatal \\ \beta\ velar \end{bmatrix}_2 C_3$$

Universal redundancy rules will furnish the features of [high] and [labial] (i.e. rounding) for the derived offglide, where the value for [high] is '+', and labiality agrees with velarity in specification. By the same token, the unmarked (or, more accurately, 'de-specified') consonantal ending will be realized phonetically as a velar. It has been observed (Chen 1973) that at least for China as a linguistic area, the 'unmarked' nasal/stop in syllable final position is a velar: if only one nasal ending exists in a modern Chinese dialect, it is nearly without exception /-ŋ/; likewise, the sole final stop, if any, is typically /-k/.[2] The interplay of VOCAL and FUSION/APOCOPE can be seen in the derivation (7.6) of the four items given previously in (7.4):

(7.6)

'white'	'hail'	'to cook'	'stick'	
*bac	*bak	*p'ań	*baŋ	MC
baic	bauk	p'aiń	-	VOCAL
baik	-	p'aiŋ	-	FUSION
bai	bau	-	-	APOCOPE
-	-	p'eŋ	-	COALESCE(see next section)
-	-	p'eŋ	-	*CHAMEL
pai	pau	-	paŋ	by other rules

and (7.3) that of APOCOPE:

(7.3)

MC	Peking	
*liəp	li	'to stand up'
*liət		'chestnut'
*liək		'strength'
*liac (> liək)		'calendar'
*dep	tie	'butterfly'
*det		'to fall, trip'
*tṣ'ap	ts'a	'to insert'
*tṣ'at		'to inspect'
*kuət	ku	'bone'
*kuk		'grain'
*piək	pi	'to force (into)'
*piac (→ piək)		'jade'

7.2 With the sole exception of DEVOIC whereby the voiced and voiceless distinction was lost, FUSION/APOCOPE contributed more than any other changes to the reduction of the inventory of distinct syllable types by a ratio of 3 to 1: from 3,617 in QMC to about 1,200 in modern Peking. However, FUSION/APOCOPE brought about less than a wholesale merger. Consider the following correspondences:

(7.4)

MC	Peking	
*bac	pai	'white'
*bak	pau	'hail'
*p'aŕ	p'əŋ	'to cook'
*baŋ	paŋ	'stick, bat'

The original distinction between a palatal and a velar ending has been re-encoded in the vocalic portion. This

from applying just in those cases where MED-DISM was to apply. The derivation that one might consider, though improbable as it is, would look like this:

(5.18)

*buən	*p'yən	
x	x	x: *RIMEMIC barred from applying
-	fuən	LABDNT
bən	fən	MED-DISM(b)
pən	fən	by other rules

Even with the revisions and the apparently unmotivated provision to block *RIMEMIC, MED-DISM remains unsatisfactory. It would not cover cases under the C category in (5.15-16). It is not possible to derive the vowel /ə/ in Peking /məŋ/ and /fəŋ / by simply blocking *RIMEMIC, as the vowel /ə/ was never part of the original input. As a consequence, the change from *muŋ to Peking /məŋ/ and from *piuŋ (via /fuŋ/ by LABDNT) to /fəŋ/ will require another rule, roughly:

(5.19) $uŋ \rightarrow əŋ \; / \; \left[\begin{smallmatrix} C \\ +\text{labial} \end{smallmatrix}\right] \_\_\_$

By positing rule (5.19), or its like, one completely misses the obvious generalization that exactly the same labial dissimilatory neutralization is at work both here with type C words and elsewhere with lexical items of the B variety in (5.15-16).

We must look elsewhere for a more explanatory statement. Suppose we let *RIMEMIC stand as an MC phonotactic rule, that is, allowing *RIMEMIC to apply whenever applicable. Furthermore, we accept the most general form of MED-DISM(a,b) as I proposed at the outset, without the restrictions imposed on it by (5.13) or (5.17). A sample derivation would yield the output given below:

(5.20)	'paper'	'body'	'cloth'	'stupid'	'to cover'	
	*tśi	*śiən	*pu	*buən	*muŋ	MC
	-	śin	-	bun	-	*RIMEMIC
	tś	śn	-	-	-	MED-DISM(a)
	-	-	p	bn	mŋ	MED-DISM(b)
	ṭṣ*	ṣn*	p*	pn*	mŋ*	other rules

(The asterisks in /ṭṣ*/ etc. serve to mark off the incorrect outputs; the same convention will be used elsewhere) It becomes immediately obvious that what is common to all these illegitimate outputs is that all of them violate the universal syllabicity condition (*SYLLAB) I have alluded to in section 2.2. We have seen earlier other instances in which a phonotactic condition interacts with a phonological process like a 'linking rule', an 'output condition', or perhaps like an 'adjustment rule' (cf. Chomsky-Halle 1968). The strategy employed by the Peking dialect to preserve the syllabicity -- as a matter of fact, the pronouncability -- condition, despite the evolutionary processes that tended to erode just those segments that happened to carry the sonority peak of a syllable, is quite simple. For convenience let me reproduce here *SYLLAB stated earlier in section 2.

(5.21) *SYLLAB: # (C)C # → [+syllabic]

which is interpreted, in phonetic terms, by means of

(5.22) *SYLLAB

[C, +syllabic] →

- C + /ĭ/ if C = sibilant (a)
- ə + C, elsewhere (b)

Now, let us allow *SYLLAB to function as a 'linking rule' operating directly on the output of derivation (5.20). (5.20) continues as follows:

FUSION -m, p → -n, t

-ń, c → -ŋ, k

APOCOPE final stop → (ʔ →) ∅

7.1 Setting aside VOCAL for the moment, FUSION and APOCOPE combined to effect the change diagrammed below:

(7.1)

m	n	ń	ŋ	p	t	c	k	MC
↘		↘		↘		↘		
n		ŋ		t		k		FUSION
				↘				
				(ʔ)				
				∅				APOCOPE

(7.1) is part of a very general pattern of syllable final weakening (cf. Chen-Wang 1975). In all likelihood, APOCOPE proceeded through the intermediate step of the reduction of all final stops to the minimal stop, namely the glottal catch /ʔ/, as can be seen in a fairly large number of dialects even within the Mandarin branch. Among the Mandarin dialects, Peking is conservative with respect to the nasal endings. Other Mandarin dialects have evolved further along an analogous path exhibited by the stop counterpart: in some cases, /-n/ and /-ŋ/ collapsed together, in others, the nasal ending completely disappeared leaving a trace of nasality in the preceding vowel. (7.2) illustrates the effect of FUSION:

(7.2)	MC	Peking	
	*t'ɑm	tan	'to covet'
	*t'ɑn		'shore'
	*siəm	śin	'heart'
	*siən		'new'
	*bań	p'əŋ	'to swell'
	*bəŋ		'friend'
	*ʔiań	iŋ	'shadow'
	*ʔiən		'duty'

(6.34)

Broad phonetic representation	Narrow phonetic representation
an	an
aŋ	ɑŋ
ən	ən
əŋ	ʌŋ
in	in
iŋ	ɪŋ

6.10 Finally, all the low vowels which were unaffected by either U-UMLAUT or any of the subrules of I-UMLAUT discussed so far merged into one undifferentiated vowel phoneme /a/; I have labeled this process A-MERGE. Here are a few examples:

(6.35)

MC	Peking	
*pɑu	pau	'to praise'
*pau		'to wrap'
*kuɑn	kuan	'official'
*kuan		'to close, lock'

VII. THE WEAKENING OF CONSONANTAL ENDINGS

7.0 The four nasal endings in MC, *m, *n, *ń, *ŋ, have been reduced to two /n, ŋ/ in modern Peking. The weakening of the stop endings has been even more drastic: all MC voiceless stops, *p, *t, *c, *k, disappeared altogether. These processes of attrition, however, did not completely obliterate the original distinctions among the syllable endings. The original contrast between the palatal *ń, *c and the velar *ŋ, *k was partially preserved in the development of a corresponding palatal /-i/ or velar /-u/ offglide through vocalization. On the other hand, the emergence of an offglide in closed syllables triggered another by-process: the resulting /ai/ and /au, ɑu/ coalesced into /e/ and /o/ respectively. We shall treat the first three processes as one block of closely related changes, referring to them collectively as WEAKEN (weakening).

VOCAL ań, ac → aiń, aic

ɑk, ak → ɑuk, auk

(5.23)

*tśi	*śiən	*buən	*muŋ	MC
ṭṣ	ṣn	pn	mŋ	by previously given derivation (5.20)
ṭṣ	sn	pn	mŋ	*SYLLAB (5.21)
ṭṣï	-	-	-	*SYLLAB (5.22a)
-	ṣən	pən	məŋ	*SYLLAB (5.22b)

Notice that *SYLLAB would yield from an unacceptable output /p*/ (from MC *pu, 'cloth') an equally unacceptable /əp*/. We have two options. Either we extend the interpretive convention (5.22a) to cover cases like this, so that (5.22a) would be revised as something like

(5.24)

$$\begin{bmatrix} C \\ +\text{syllabic} \end{bmatrix} \rightarrow \begin{cases} C + \text{homorganic release /ï/, if C = sibilant, or} & \text{(a)i} \\ C + \text{homorganic release /u/, if C = labial} & \text{(a)ii} \\ ə + C, \text{ elsewhere} & \text{(b)} \end{cases}$$

The derivation of *pu would look like this

(5.25) *pu

p MED-DISM(b)

pu *SYLLAB (5.24aii)

Alternately, *SYLLAB can block MED-DISM(b), as the application of this rule to *pu and the like would result in a violation of a fundamental phonotactic condition of both MC and Peking. *SYLLAB preempts MED-DISM(b) by a very general convention which can be stated as:

(5.26) No rule can apply which results in a violation of a phonotactic condition, unless the output of this rule can be subsequently rectified.

Since MED-DISM(b) would result in a violation of *SYLLAB, and the output of MED-DISM(b), if applied, namely /p*/ cannot be further readjusted to an acceptable form by any

other phonotactic rule (that is, if we stick to (5.22a) instead of its revision as (5.24aii)), MED-DISM(b) is blocked. So, in this alternative analysis, the derivation of *pu is as follows:

(5.27) *pu

x x: MED-DISM(b) blocked by convention (5.26)

I will choose this second alternative; if nothing else, derivation (5.27) is shorter than (5.25). Besides, (5.24aii) has scant support, unlike (5.24ai), to which I will return presently.

To summarize the conclusion reached so far;

(I) MED-DISM remains in its most general form, namely as stated at the outset of this section;

(II) *SYLLAB blocks the application of MED-DISM(b) to such forms as *pu, *biu, etc. by a very general convention, stated as (5.26);

(III) The output of MED-DISM is automatically subjected to conditions stated as (5.21-22), which spell out the specific modes of meeting condition *SYLLAB.

(I) is by itself a plus in our analysis. (II) is a familiar blocking device;[4] its effect will show up in another part of our analysis (see section 6.7). As for (III), each of the modes of implementation is perfectly natural and has some independent support. The apical vowel which shows up in the phonetic realization of /tsï/ 'paper' and /sï/ 'oath', etc. has been treated in traditional as well as more recent (à la generative) analyses as a simple 'vocalized prolongation of the preceding consonant' (Chao 1934:43) and, therefore, can be regarded as 'zero symbol' (ib.). As a matter of fact, this apical vowel /ï/ is represented by a zero symbol in the National Phonetic Script, so that /tsï, ts'ï, sï/ etc. are represented as /ts̩, ts̩', s̩/ instead (see more extended discussion in section 2.8).

As for the syllabification of /C/ as /əC/, there are several types of confirmatory evidence. First, syllabic nasals exist in many Chinese dialects, e.g. Xiàmén, in which

k'aik	kaiŋ	ɣiaiŋ	FUSION (see section 7.1)
k'ek	keŋ	ɣieŋ	COALESCE (coalescence, see section 7.3)
k'ək	kəŋ	ɣiəŋ	*CHAMEL
-	-	ɣiŋ	*RIMEMIC
k'ə	-	-	APOCOPE (see section 7.1)
k'ɤ	-	-	*CHAMEL (see (2.18))
-	-	ɕiŋ	DEVOIC and PALAT

The irregular development of MC finals *ai, *ań and *ac are due to the complex relationship between SHARP and *PAL-DISM which typifies the kind of 'competing' changes and tendencies explored in recent literature (Wang 1969; cf. Chen 1972). The two conflicting tendencies must have intersected in time and competed for dominance. As a result, some lexical items followed one rule, while others obeyed another.

One last detail about SHARP. MC *aŋ and *ak became /iaŋ/ and /iak/ respectively by SHARP when preceded by an initial of the velar or the glottal series (i.e. *K). This generalization is true in the majority of cases (12 out of 18 relevant items); there is a residue of six forms, in which SHARP failed to apply, contrary to our expectation. For instance, we have *kan : /kan/ 'harbor' side by side with *kaŋ : /tɕiaŋ/ 'river'. Similarly, we have free variants /k'ɤ/ (from an intermediate form /k'ok/, which in turn was derived from /k'auk/) and /tɕ'iau/ (from /k'iauk/), both ultimately from MC *k'ak 'husk'. Dialect mixture, lexical diffusion, stylistic variation, etc. have been adduced at various times to explain this irregularity. Let me venture one more hypothesis: by an extension of *CHAMEL stated earlier as (2.19) in section 2.9, the velar endings /ŋ, k/ exercised some velarizing influence not only on the preceding mid vowel, but also on the low /a/, thereby causing /aŋ, ak/ to go back in the direction of /ɑŋ, ɑk/ and to fuse with the MC *ɑŋ, and *ɑk. The velarization of *aŋ, and *ak would, it goes without saying, remove these finals from the scope of SHARP. Evidence for the velarizing effect of /-ŋ, k/ is available from modern Peking. Compare the phonetic realization of the following finals:[13]

In the first case, that of 'street', SHARP applied, resulting in a violation of the nascent *PAL-DISM, but subsequently made to conform to the firmly established PC by being subjected to COALESCE. In the second case, on the other hand, *PAL-DISM exercised an inhibitory influence on the process of SHARP, preempting the form from undergoing any subsequent rules.

Actually *PAL-DISM has a broader application. This PC, still in force in modern Peking, ruled out not only (6.29) but also (6.31).

(6.31) $\sim \begin{Bmatrix} i \\ y \end{Bmatrix} (V) \begin{Bmatrix} ń \\ c \end{Bmatrix}$

Let us now examine MC finals *ań and *ac in light of (6.31). These two finals -- like any MC final beginning with /a/ -- are expected to become by virtue of SHARP /iań/ and /iac/ respectively, when they were preceded by a velar or a glottal initial. Subsequently, by COALESCE (to be given, section 7.3), *ań and *ac merged unconditionally with *əŋ and *ək respectively. MC *ań and *ac, then, should come out as /iŋ/ and /ik/ (→ /i/ by APOCOPE). Instead, we observe the following reflexes:

(6.32)

MC finals preceded by *K		*ań	*ac
Peking reflexes	iŋ	6	
	əŋ	8	
	i		-
	ɤ		6

The Peking reflexes /əŋ/ and /ɤ/ are obtained by blocking SHARP. In all cases COALESCE applied, which triggered other automatic consequences. Here are some examples:[12]

(6.33)

'guest' *k'ac	'to till' *kań	'apricot' *ɣań	MC
x	x	ɣiań	SHARP; x = blocked by *PAL-DISM
k'aic	kaiń	ɣiaiń	VOCAL (vocalization, see section 7.2)

/kŋ/ 'bright', /nŋ/ 'two', etc. have phonetic variants /kəŋ/, /nəŋ/ and so on. But the most striking support comes from within the history of the Peking dialect itself. MC *ńi emerged as /ər/ in modern Peking. There are four such cases in *Zǐ-huǐ*:

(5.28)

MC	Peking	
*ńi	ər	'son'
*ńi	ər	'but, then' (conjunction)
*ńi	ər	'ear'
*ńi	ər	'two'

They represent the only instances where /r/ occurs as the syllable coda. /r/ as a regular reflex of MC *ń presents no problem (see sections 4.4 and 4.8); it is this peculiar position that /r/ occupies that has puzzled some phonologists. L. Wang, for instance, speculated that *ńi (via /zï ~ rï/ by RETROF, see section 4.8) became /ïr/ (then /ər/ by metathesis (see L. Wang 1958:165). Notice that no instance of metathesis has been attested for Mandarin Chinese to my knowledge.[5] It would be fortuitous to appeal to metathesis just in order to account for the *ńi : /ər/ correspondence. The alternative route of evolution proposed by Karlgren (1948:341-2) almost certainly comes closer to the truth. Karlgren suggested the following successive stages: *ńi (or *ńźi, according to Karlgren's reconstruction) → /źi/ → /zï ~ rï/ → /r/ → /ər/. The sequence of events sketched by Karlgren very nearly coincides with the derivation suggested by our rules, namely:

(5.29)

*ńi	MC
źi	FRICAT (section 4.4)
ź	MED-DISM(a)
ẓ ~ r	RETROF (section 4.8)
r̩	*SYLLAB (5.21)
ər	*SYLLAB (5.22)

No ad hoc rule of metathesis need be posited; the existing rules automatically account for the origin of /ər/. The emergence of syllable type /ər/ in modern Peking strongly suggests the well-foundedness of our analysis making use of the PC *SYLLAB.

I have devoted considerable space to a full and detailed discussion of MED-DISM because I regard this rule -- in conjunction with *SYLLAB -- as pivotal in the evolution of the Peking system of finals. We must now turn to other processes affecting MC medials.

5.4 I-DELET V → [-palatal] / Retroflex ___

The palatal /i/ drops out (and /y/ depalatalizes to /u/) after a palatal initial; the same phenomenon can be observed with retroflex initials. Consider the following mergers:

(5.30)

MC		Peking	
*si	}	*sï (= /ṣ/)	'teacher'
*śi	}		'poetry'
*tṣiu	}	*tṣou	'wrinkle'
*tśiu	}		'broom'
*tṣ'io	}	*tṣ'u	'beginning'
*d̂io	}		'to exclude'
*ṣiəm	}	*ṣən	'to seep through'
*śiəm	}		'to judge'

It is natural for one to seek to collapse these two processes into one rule. I have chosen to represent these two processes by two separate rules, one by MED-DISM, the other by I-DELET, mainly for two reasons. Firstly, although both rules produce the same end result, the underlying mechanisms of change are quite different: in MED-DISM the [±palatal] contrast is neutralized or the palatality of the adjacent vowel is absorbed into the palatal initial; in I-DELET, the palatal element is forced

(6.26-28) cast some doubts on the QMC *ä : /ie/ as opposed to *äi : /ai/ correspondence; within the limited corpus of data we have, QMC *äi is just as likely to emerge as /ie/ as *ä, and conversely *ä turns out to be /ai/ in just as many cases -- proportionally speaking -- as *äi. I tend to agree with L. Wang (1958:153) that QMC *ä and *äi must have merged together into *ai (as in SMC) early on. The spontaneous split of this fused category SMC *ai into Peking /ai/ and /ie/ probably came about under the growing influence of an emergent phonotactic condition which marked sequences like $\{^{i}_{y}\}$ (V) i/ as increasingly unacceptable, until such configurations completely disappeared from modern Peking. This PC has been referred to earlier as *PAL-DISM (section 2.6). To recapitulate what I said in that section, this PC can be met in three ways: (a) either by depalatalizing the palatal onglide, where such a segment already existed in MC or arose by a later development, e.g. via SHARP; or (b) by preventing a configuration like

(6.29) $\sim \{^{i}_{y}\}$(V) i

from coming into existence through a process like SHARP operating on *ai, *ań or *ac; or, finally, (c) by coalescing (COALESCE, section 7.3) the offglide with the nuclear vowel: /ai/ → /e/. These three alternative strategies used to implement the PC *PAL-DISM had been spelled out in section 2.6 as (2.7). The remarkable thing about COALESCE (part (a)) is that this rule changed /-ai/ to /-e/ just in those environments where this sequence violated the PAL-DISM. Similar sequences not in violation of the said PC were not affected by COALESCE. Thus whereas *kai 'street' → /kiai/ → /kie/ (→ /tśie/), *mai 'to bury' remained unchanged. We are now in a position to derive both /ai/ and /ie/ from SMC *ai. Let us reconsider the quasi-minimal pair alluded to above:

(6.30) 'street''to wipe'

*kai	*k'ai	SMC
kiai	x	SHARP; x=blocked by *PAL-DISM(b)
kie	-	COALESCE, triggered by *PAL-DISM(c)
tśie	-	PALAT

implicit espousal of this view.[11] To verify this putative regular correspondence, let us look at the distribution of the Peking reflexes of SMC *ai, now differentiated into the two QMC categories *ä and *äi:

(6.26)

Peking reflex \ QMC final	*ä	*äi
ie (← iä)	4	6
ai	1	2

The distributional pattern does not alter appreciably even if one includes additional lexical items found in the expanded word list compiled by Ding and Li (1958). The larger sample looks like this:

(6.27)

Peking reflex \ QMC final	*ä	*äi
ie (← iä)	6	16
ai	3	6

A few examples will suffice for illustration:

(6.28)

Peking reflex \ QMC final	*ä	*äi
/-ie/	*kä:/tśie/'street'	*käi:/tśie/'stair,step'
	*ɣä:/śie/ 'crab'	*ɣäi:/śie/'weapon,ammunition'
/-ai/	(*ŋä:/ai/ 'to bear')	*k'äi:/k'ai/'to wipe, sponge'
	*ʔä:/ai/ 'short' (opp.of 'tall')	(*ɣäi:/xai/ 'skeleton')

(The parenthesized items are taken from Ding-Li 1958.)

out by the disfavored coarticulation between a retroflex and a palatal segment.[6] The former change is of a functional nature, the latter is primarily an articulatory adjustment. But a stronger reason for positing an I-DELET apart from MED-DISM derives from the simple fact that otherwise we cannot account for the different outcomes as shown below:

(5.31)

MC	Peking	
ṣiəp	ṣɤ (= /sə/)	'acrid' (of taste)
ṣiət		'a stringed musical instrument'
ṣiək		'color'
śiəp	ṣï (= /s/)	'wet'
śiət		'bedbug, louse'
śiək		'style'

If we were to use MED-DISM to delete the palatal medial in all these cases, the derivation would look like the following, using the pair *ṣiək and *śiək for illustration:

(5.32)

*ṣiək	*śiək	MC
ṣik	śik	*RIMEMIC
ṣk	śk	MED-DISM
ṣək	śək	*SYLLAB
ṣə	śə	APOCOPE (to be given below)
sɤ	ṣɤ*	by other rules

After MED-DISM (together with the automatic *SYLLAB), there is no plausible way to restore a high vowel to the intermediate form /śək/ in order to derive /ṣï/ from *śik; as a consequence, instead of /ṣï/ 'style', we get /ṣɤ*/. (The contrast between /s/ and /ṣ/ is due to other processes discussed elsewhere, namely DERET and RETROF, and not germane to the problem at hand.) If, however, we posit two separate depalatalizing rules, the correct derivation would be something along the line suggested below:

(5.33)	*ʂiək	*ɕiək	MC
	ʂik	ɕik	*RIMEMIC
	ʂk	-	I-DELET
	ʂək	-	*SYLLAB
	ʂə	ɕi	APOCOPE(to be given, see section 7.1)
	-	ɕ	MED-DISM
	-	ɕï	*SYLLAB
	sɤ	ʂï	by other rules

At the crucial step I-DELET (together with the automatic *SYLLAB) *ʂiək and *ɕiək parted ways, the former having acquired a mid-vowel /ə/, which was to surface as /ɤ/, the latter having retained the high vowel /i/, which would eventually turn up as /ï/ via MED-DISM (and *SYLLAB). It goes without saying, in order to derive the correct output I-DELET and MED-DISM must be crucially ordered -- the former before APOCOPE, the latter thereafter.

Recall in this connection the discussion apropos of U-INSERT, in particular the derivation (5.4). If I-DELET and MED-DISM were collapsed into one single rule, it would be impossible to correctly derive /tʂ'uaŋ/ from *tʂ'iaŋ 'bed' as opposed to /tʂaŋ/ from *tɕiaŋ 'chapter'. Instead, we would not be able to avert an incorrect derivation like the following:

(5.34)	*tʂ'iaŋ	*tɕiaŋ	MC
	tʂ'aŋ	tɕan	MED-DISM + I-DELET
	-	tʂaŋ	RETROF
	tʂ'uaŋ	tʂuaŋ*	U-INSERT
		(tʂaŋ)	(correct output)

Notice that it is not possible to maintain the difference between /-uaŋ/ (for 'bed') and /-aŋ/ (for 'chapter') by simply ordering RETROF <u>after</u> U-INSERT, thereby preventing

automatically adjusted to simply /i/ by *DEGEMIN: neither MC or Peking admits of either consonant or vowel geminates. How RAISE operates can be seen in the four words given below:[9]

(6.24)

'to write'	'sacrifice'	'age'	'crowded'	
*sia	*tsiai	*syai	*tsei	MC
sie	tsiei	syei	-	RAISE(i)
-	tsiii	syii	tsii	RAISE(ii)
-	tsi	syi	tsi	*DEGEMIN(see section 2.4)
-	-	sui	-	*PAL-DISM(see section 2.6)
ɕie	tɕi	suei	tɕi	other rules

6.9 The environment 'velar/glottal' specified for SHARP includes, as usual, the zero initial. The effect of SHARP is demonstrated by examples such as:

(6.25)	MC	Peking	
	*ka	tɕia	'family, home'
	*xa	ɕia	'shrimp'
	*ŋa	ia	'tooth'
	*ʔa	ia	'mute'

We would expect SHARP, as it is formulated here, to apply to other cases as well. Specifically, we expect *ai to become /iai/ when preceded by an initial of the MC *K series. However, we do observe words like *kai : Peking /tɕie/ 'street' side by side with *k'ai : Peking /k'ai/ 'to wipe, sponge'; the former shows the effect of SHARP (and other processes to be given presently), the latter does not. The apparently spontaneous split of this near-minimal pair is attested by a fair number of other similar lexical items. MC *ai turns up in modern Peking as /ai/ in 3 cases, and as /ie/ in 10.[10] It has been suggested that the two Peking reflexes are traceable to two distinct QMC finals, a distinction which is not made in the SMC system used in our account. According to this proposal, Peking /ai/ descended directly from QMC *äi, whereas the modern day /ie/ was derived from QMC *ä via SHARP. R. Li's (1952) reconstruction of QMC *äi vs. *ä is an

remains, then, to state the deletion (and subsequent apicalization by *SYLLAB) of the primary *i adjacent to dental sibilants. APICAL takes care of these cases. The divergent developments of the minimal pair of words *ṣiək 'color' and *śiək 'style' was given in (5.33) in section 5.4. Here is a complete derivation of the eight items listed above in (6.21):

(6.23)

1	2	3	4	5	6	7	8	Gloss
*si	*siai	*siək	*ṣi	*ṣiək	*śi	*śiai	*śiək	MC
-	-	sik	-	ṣik	-	-	śik	*RIMEMIC
s	-	-	-	-	-	-	-	APICAL
sï	-	-	-	-	-	-	-	*SYLLAB
-	si	-	-	-	-	śi	-	RAISE
-	-	-	ṣ	ṣk	-	-	-	I-DELET
-	-	-	ṣï	ṣək	-	-	-	*SYLLAB
-	-	-	-	sək	-	-	-	DERET
-	-	si	-	sə	-	-	śi	APOCOPE
-	-	-	-	sɤ	-	-	-	*CHAMEL
-	-	-	-	-	ś	ś	ś	MED-DISM
-	-	-	-	-	śï	śĭ	śĭ	*SYLLAB
-	-	-	-	-	ṣï	ṣĭ	ṣĭ	RETROF-2
-	śi	śi	-	-	-	-	-	PALAT

6.8 RAISE operated in two steps: (i) the low /a/ became a mid /e/, and (ii) the mid /e/ became a high /i/. The negative environments specified for step (i) are necessitated by such examples as *kiau 'proud' and *dzian 'wall' which were not affected by RAISE(i), but retained their low vowel, as they are pronounced today /tśiau/ and /tś'ian/, respectively. As for part (ii) of RAISE, its input is /iei/ or /ei/, and output /iii/ or /ii/, both

'chapter' /tśaŋ/ from becoming /tṣuaŋ*/. That this is so can be demonstrated by comparing the following derivation of *tśiaŋ 'chapter' and *d̂aŋ 'to collide' with the derivation given in section 5.1 as (5.4):

(5.35) *d̂aŋ	*tśiaŋ	MC
dźaŋ	-	SPIRANT
-	tśaŋ	MED-DISM
-	-	U-INSERT
dẓaŋ	tṣaŋ	RETROF
tṣaŋ*	tṣaŋ	by other rules
(tṣuaŋ)		(correct output)

By reversing U-INSERT and RETROF we succeed in preventing *tśiaŋ from becoming /tṣuaŋ/; but by the same stroke we fail to derive /tṣuaŋ/ from *d̂aŋ.

In light of the converging kinds of evidence presented here, the status of I-DELET as a separate process from MED-DISM appears to be firmly established. It remains to briefly consider two minor rules. These rules are minor, both because they affect a relatively small portion of the lexicon, and because they are only semi-regular, leaving a large residue.

5.5 U-DELET V → [-labial] / $\left\{\begin{matrix}\text{velar}\\ \text{glottal}\end{matrix}\right\}$ ___ under certain conditions

This rule is interpreted according to the feature matrix given in (5.7), so that the input /-u-/ (+labial, -palatal) comes out as zero (-labial, -palatal). U-DELET has a limited scope; within our corpus of data the disappearance of a labial glide is observed only with three finals, in all cases only when the initial is a velar or a glottal (including the zero initial), that is when the initial belongs to the series *K. These facts are summarized below:

(5.36)

MC finals / *K ___	Peking with u-glide		without u-glide	
*uɑ	uo	10	ɤ	7
*ui	uei	34	i	2
*uaŋ (>uəŋ)	uŋ	1	əŋ	2

and exemplified by items such as

(5.37)	MC	Peking	
	*k'uα	k'ɤ	'a lesson'
	*χuα	xɤ	'grain (stalk)'
	*ŋuα	ɤ	'false, erroneous'
	*ui	i	'to leave behind, bequeath'
	*ɣuaŋ	xəŋ	'horizontal'

MC *α became /o/ by a general rule (U-UMLAUT, to be given below). The switch from /o/ to /ɤ/ in the examples given above (5.37) is merely a special case of the PC *CHAMEL. Aside from the fact that all instances of U-DELET occurred after a velar or a glottal initial, I have failed to discover any general condition which can predict the application or non-application of this sporadic rule.

5.6 Y-SPLIT

(a)	yaŋ → uaŋ		unconditionally and without exception
(b)	iuŋ → uŋ	/ {dentals; velar/glottals}	(i) without exception; (ii) in the majority of cases
(c)	yən → uən	/ dentals	over half of the cases
(d)	y → u or i	/ certain conditions	sporadically

We have seen that the labiopalatal /y/ (or, equivalently /iu/) is subject to such changes as (a) depalatalization to /u/ by MED-DISM(a) when preceded by a palatal initial, or by I-DELET when preceded by a retroflex; (b) delabialization to /i/ by MED-DISM(b) when following a labial consonant; (c) both depalatalization and delabialization through the combined operation of MED-DISM and LABDNT, e.g. *piuŋ 'wind' → /fuŋ/ (by LABDNT) → /fəŋ/ (by MED-DISM(b), in conjunction with *SYLLAB). The two remaining types of initials, namely dentals (*T, *S) and velars/glottals (*K), do not interact, generally speaking, with the contiguous vocalic elements in the aforementioned fashion. Yet even in these environments, the labiopalatal /y/ sometimes became decomposed and turned up as either /u/ or /i/ under conditions which defy a general statement. The related facts are given in Table 17. Y-SPLIT, as formulated

might tempt one to extend the environment of APICAL to cover not only dental but all sibilants (i.e. dental, retroflex, and (alveo)palatal fricates). The situation is a lot more complicated. There exist in modern Peking three types of high front vowel /i/, from three distinct historical sources: the primary /i/, the direct descendant of the original MC *i; the secondary /i/ from *iai via RAISE, to be discussed presently; and the tertiary /i/ from *iəC [iC] by APOCOPE.[7] Observe the reflexes of these three types of /i/ as conditioned by the three series of sibilants:

(6.21)	MC	Peking	
1.	*si	sï	'silk'
2.	*siai	śi	'west'
3.	*siək	śi	'regret'
4.	ṣi	ṣï	'teacher'
5.	ṣiək	ṣɤ	'color'
6.	śi	ṣï	'poetry'
7.	śiai	ṣï	'world'
8.	śiək	ṣï	'style'

The systematic correspondences can be made easier to see by a cross-classification like the following:[8]

(6.22)

source / environ.	Primary i < *i	Secondary i < *iai	Tertiary i < *iəC
Dental	ï	i	i
Retroflex	ï	-	ɤ
Palatal	ï	ï	ï

It becomes apparent that only the primary *i emerged with an apical vowel in all three environments. However, the dropping of a palatal /i/, regardless of its origin, has already been accounted for by I-DELET for retroflex sibilants, and by MED-DISM for palatal initials, together with the automatic application of condition *SYLLAB. It

nor, finally, by any finer distinctions that once existed among the QMC finals. In the cases that are relevant here, the SMC final *i comprises four distinct QMC finals, namely *ie, *i̯e, *i and *ji. (6.18) given below goes to prove that whatever minute differences there may have been in QMC, they were not responsible for the /i ~ ei/ correspondents in modern Peking:

(6.18)

QMC finals \ Peking reflexes	i	ei
*i	4	-
*ji	2	5
*ie	4	2
*i̯e	4	2

We must satisfy ourselves with just a couple of (near-) homophones in QMC which show up with different finals in modern Peking:

(6.19)

QMC	Peking	
*bie	p'i	'spleen'
*pie	pei	'humble, lowly'
*bi̯e	p'i	'skin'
*bi̯e	pei	'coverlet, quilt'
*pji	pi	'base, despicable'
*pji	pei	'sad, grief'

6.7 Turning now to APICAL, observe that examples like

(6.20)

MC	Peking	
*si	sï	'silk'
*s̱i	s̱ï	'teacher'
*śi	s̱ï	'poetry'

here, is no more than an enumeration of the facts assembled in the table. To try to recast Y-SPLIT into a rule with a more familiar appearance would be to disguise the highly idiosyncratic and irregular nature of the process. Suffice it to illustrate Y-SPLIT with a handful of examples:

(5.38)

MC	Peking	
*yaŋ	uaŋ	'king'
*liuŋ	luŋ	'dragon'
*kiuŋ	kuŋ	'to supply'
*tsyən	tsuan	'to obey, observe'
*ɣyan	śian	'county, district'
*xyat	śie	'blood'

The last three MC finals in Table 17, namely *yai, *yań, and *yac, involve some extra complications in their development. Each of these finals stood in violation of a phonotactic condition which must have arisen some time between MC and the modern dialect of Peking. In section 2.6 we had occasion to observe that in Peking the nuclear vowel may not be both preceded and followed by a palatal element; the same restriction is imposed on the co-occurrence of labial elements at both ends of the syllable. This phonotactic condition was referred to as *PAL-DISM in section 2.6. One of the ways to make MC syllable types conform to the new phonotactics of Peking is to depalatalize the medial glide. This can be stated as follows (= (2.7a)).

(5.39) *PAL-DISM

$$[+\text{high}] \; (V) \; \begin{bmatrix} +\text{palatal} \\ +\text{high} \end{bmatrix}$$
$$\downarrow$$
$$[-\text{palatal}]$$

Accordingly, *yai became /uei/ by a derivation which involves other rules to be given. As for *yań and *yac, there was a subtle interplay between *PAL-DISM and COALESCE (coalescence) (to be given below, section 7.3) which merged *ań/c with *əŋ/k, and as a consequence would potentially destroy the condition under which

MC final	Environment	-y-		-u-		-i-	
*y	*T	y	6				
	*S	y	7				
	*K	y	32				
*ya	*K	ye	1	u	2		
*yan	*S	yan	5				
	*K	yan	28			ian	2
*yən	*T			uən	2		
	*S	yn	3	uən	2		
	*K	yn	15	uən	1	in	1
*yaŋ	*K			uaŋ	5		
*iuŋ	*T			uŋ	3		
	*S			uŋ	4		
	*K	yŋ	8	uŋ	12		
*yat	*T					ie	1
	*S	ye	2				
	*K	ye	7			ie	1
*yət	*T	y	1				
	*K	y	2				
*yək	*K	y	1				
*iuk	*T	y	1				
	*S	y	1				
	*K	y	10				
*yai	*S			uei	2		
	*K			uei	2		
*yaŕ	*K	yŋ	3	uŋ	2	iŋ	3
*yac	*K	y	1			i	1

Table 17.

(6.15)

MC	Peking	
*pui	fei	'to fly'
*mui	uei	'tail'
*tsui	tsuei	'drunk'
*śui	şuei	'water'
*kui	kuei	'turtle'

On the other hand, the 'breaking' of /i/ into /əi/ ([ei] by *CHAMEL) when preceded by a bilabial was a highly irregular process. Appendix C shows that after a bilabial, MC *i → Peking /ei/ in 9 out of 23 cases. Here we seem to have before us a case of 'unconditional split'. The split of *i into /i/ and /ei/ in this environment was not conditioned by the manner of articulation of the bilabial initials, as demonstrated by (6.16):

(6.16)

MC initials \ Peking reflexes	i	ei
p	5	3
p'	3	1
b	6	2
m	-	3

nor by any prosodic feature, as made evident from the distribution of /i, ei/ in the following tabulation:

(6.17)

MC tones \ Peking reflexes	i	ei
T1	4	6
T2	3	2
T3	7	1

APICAL, RAISE (for both parts (b) and (c)), SHARP and A-MERGE, as indicated above. Notice that DIPHTHONG and RAISE have been used also to refer to the corresponding subrules in U-UMLAUT; the coincidence is intentional. In general no confusion will arise. Where a distinction is called for, I will use such terms as I-DIPHTHONG vs. U-DIPHTHONG, or the like. I have chosen SHARP (sharpening) as a descriptive label for part (d) of I-UMLAUT to make explicit the similarity between it and its counterpart in U-UMLAUT labeled ROUND. APICAL (apicalization) is appropriate because, as we shall see, the vowel-less sibilants which lost their /i/ by this process would be syllabified as /sibilant + apical vowel/ in accordance to *SYLLAB. I-UMLAUT, again, will be retained as a collective term.

In order to bring out more clearly the relationships among these individual subrules of I-UMLAUT as intermediate steps in a chain shift, let me restate I-UMLAUT, this time with the environments omitted:

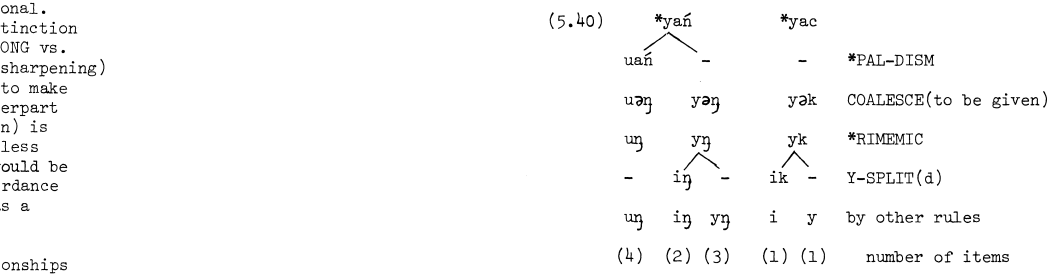
(6.14) I-UMLAUT

$\left[\begin{matrix}\text{ə}i\\ \text{ɨ}\end{matrix}\right] \left.\begin{matrix}\\ \emptyset\end{matrix}\right\} \leftarrow i$	DIPHTHONG APICAL
$i \leftarrow ei$	RAISE(c)
$\left\{\begin{matrix}i\\ y\end{matrix}\right\} e \leftarrow \left\{\begin{matrix}i\\ y\end{matrix}\right\} a$	RAISE(b)
$ia \leftarrow a$	SHARP
$a \leftarrow \alpha$	A-MERGE

6.6 Let us now examine each of these components of I-UMLAUT. The environment of DIPHTHONG specifies a preceding labial segment. This segment can be 1. a labial glide /u/; 2. a labiodental /f, v/; or 3. a bilabial /p, p', b, m/. DIPHTHONG is exceptionless with regard to the first two types of environments, as /-ui/ and /fi/ are impossible sequences in modern Peking, these being obligatorily realized as [-uei] and [fei] respectively. Here are a handful of examples:[6]

*PAL-DISM applied. The interaction between the three phonological processes can be represented schematically as follows:

(5.40)



Actually the relationship between *PAL-DISM and COALESCE is much more complex and of considerable interest. We will return to this question when we consider the structural pressure which appears to have triggered the COALESCE (section 7.3).

VI. THE GREAT VOWEL SHIFT

6.0 MC had eight distinct vowels:

(6.1) MC Vowel System:

i		y	u
	e	ə	o
	a		ɑ

whereas modern Peking has only five vowel <u>phonemes</u>:

(6.2) Peking Vowel System:

i		u
	ə	
	a	
	y	

We have no reason to posit any other surface vocalic segment in addition to the 8 vowels listed in (6.1) for MC. On the other hand, as we have seen in section 2.8, Peking has 4 principal vowel <u>allophones</u> besides the 5 vowel phonemes given in (6.2). If we

include the allophones (enclosed between brackets), the Peking Vowel System looks like this:

(6.3) Peking Vowel System: [ï] i y u

[e] ə [o] [ɤ]

a

To repeat for convenience what we said in section 2.8, it is best to analyze [ï] as a zero vowel. As for the four mid vowels, they are all allophones of the vowel phoneme /ə/; this /ə/ is phonetically realized variously as [e, ə, o, ɤ] according to its respective contexts specified by the general phonotactic rule referred to as *CHAMEL (section 2.9).

Since [ï] and [e, o, ɤ] have a derived status, and are entirely predictable by *CHAMEL, the main task confronting us is to discover the pattern of changes which combined to reduce the MC system (6.1) to the system of modern Peking (6.2). Before getting into the details of the individual changes which, together, transformed the MC vowel system into what it has come to be in modern Peking, it is important first to bring out in broad outlines the overall contour of the related shifts. Underneath the many bewildering, seemingly random and disparate, movements of the elements in the vowel space, two parallel upward shifts are recognizable: the front *a moved clockwise, becoming raised and palatalized (i.e. fronted) while the back *ɑ shifted counter-clockwise, becoming labialized (i.e. rounded) and raised in the process, with the remaining low vowels merging into a single phonemic unit which I will write simply as /a/. These two upswing motions will be referred to as I-UMLAUT and U-UMLAUT, respectively. I-UMLAUT displaced the original MC *i into an apical position [ï]. More accurately, the syllable-final MC *i was forced out when preceded by a sibilant; the vowel-less sibilant then was syllabified as sibilant + ï, the apical vowel [ï] being a vocalic homorganic release of the initial sibilant. Alternately, the originally high vowels *i and *u underwent DIPHTHONG (dipthongization) and became /əi/ and /əu/ respectively under the structural pressure of the general upward chain movements affecting the whole vowel system. Eventually, /əi/ and /əu/ emerged as [ei] and [ou], again in conformity to the PC *CHAMEL that had come into force in the meantime. The emergence of *CHAMEL as a phonotactic condition in pre-

as it stands. The output of ROUND is, needless to say, subject to the PC stated as *CHAMEL. Thus:

(6.12)

'song'	'fruit'	'ash'	'shell'	
*kɑ	*kuɑ	*xuɑi	*pɑi	MC
ko	kuo	xuoi	poi	ROUND
kɤ	kuo	xuei	pei	*CHAMEL

Other instances of ROUND can be seen in (6.13):

(6.13)

MC	Peking	
*yɑp	xɤ	'closed'
*kɑt	kɤ	'to cut'
*tɑ	tuo	'many'
*tsɑ	tsuo	'left'
*puɑi	pei	'cup'
*muɑi	mei	'plum'

APOCOPE accounts for the absence of the syllable final consonants in the first two items. The third and fourth items show the joint effects of ROUND and U-INSERT(b). The last two items illustrate ROUND, MED-DISM(b) and *CHAMEL.

6.5 I-UMLAUT

(a) i → { əi / labial ___ # } (i) DIPHTHONG
{ ∅ / dental sibilant ___ # } (ii) APICAL

(b) a → e / i, y ___ X, where X ≠ N, u
(c) e → i / ___ i
} RAISE

(d) a → ia / { velar / glottal } ___ SHARP

(e) ɑ → a A-MERGE

Again, for both mnemonic as well as typographical reasons, I will refer to the subrules of I-UMLAUT as DIPHTHONG,

(6.9) iu = y

The effect of RAISE can be seen in such lexical items as:[5]

(6.10)

MC	Peking	
*po	pu	'cloth, fabric'
*to	tu	'stomach'
*yo	xu	'lake'
*nio	ny	'woman'
*sio	śy	'beard'
*k'io	tś'y	'district'

6.4 ROUND is much more complicated. The distributional pattern of the MC low back vowel *α can be seen in the following table. (6.11) exhausts the environments in which this *α occurred:

(6.11)

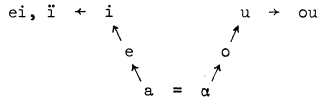
preceding segment \ following segment	#	t	p	i	u	k	N
labials	+	+	+	+	-	-	-
velars	+	+	+	-	-	-	-
dentals	+	-	-	-	-	-	-

In (6.11) # stands for syllable boundary, and N for any nasal ending. The labials include both labial consonants and the labial onglide /u/. Velars include the glottals and zero; that is, velars = *K. A plus '+' signifies that the environment is positive for ROUND, and a minus '-' marks a negative environment. It is obvious that the precise scope of ROUND must be stated in terms of both contiguous segments on each side of the vowel *α. The formulation of ROUND reflects this fact. It is obvious that ROUND is unsatisfactory in the way it is formalized. Elsewhere (Chen 1974) I devoted a long section to the question of how one could formally capture the 'naturalness' of the three classes of labializing environments. I will not repeat myself here, but simply leave the factual statement ROUND

Peking obliterated in effect whatever phonemic contrast there might have been between the mid vowels [e, o, ə, ɤ] regardless of their historical sources.

The complex sequence of events sketched above may rightfully be called the MC Great Vowel Shift (henceforth GVS), as it has not only played a pivotal role in reshaping the sound pattern of all contemporary Mandarin dialects, but has also left its marks on all dialects of China today. (6.4) represents in a diagram the MC GVS in its broadest outlines:

(6.4) The MC Great Vowel Shift (GVS)



6.1 Before we proceed to examining in detail each of the individual links of the chain of events collectively called the MC Great Vowel Shift, it will simplify the exposition to deal first with a related process, which I call G4-MERGE (grade 4 merge).

G4-MERGE[1] e → ia
ue → ya

MC *e unconditionally merged with /ia/. This rule had the effect of collapsing 'grade 4' (G4) finals together with their corresponding 'grade 3' (G3) finals. Recall that G4 finals were characterized by a mid nuclear vowel /e/, whereas G3 finals carried a palatal glide /i, y/. As a consequence of G4-MERGE, these two classes of MC finals fell together -- in the direction of G3 finals, as can be seen by the list below, which exhausts the occurrences of G4 finals:

(6.5)

Rime group	Grade	MC final	Output of G4-MERGE
*AI	3	*iai, yai	iai, yai
	4	*ei, uei	
*AM	3	*iam, iap	iam, iap
	4	*em, ep	

*AN	3	*ian, iat; yan, yat	ian,iat; yan,yat
	4	*en, et; uen, uet	
*AŃ	3	*iań, iac; yań, yac	iań,iac; yań,yat
	4	*eń, ec; ueń, uec	

From this point on the G4 finals followed exactly the same path of evolution as their corresponding G3 finals. Whatever original distinction might have existed between them, it has left no trace in modern Chinese -- with the exception of two lone Wú dialects; for all other Chinese dialects, G3 and G4 have exactly the same reflex in the present day pronunciation.[2] This suggests an early onset of this sweeping merger. For the rest of this paper, whatever I say about G3 finals should be interpreted as a valid statement about their G4 counterparts, and vice versa. Specifically, in all subsequent discussion, G4-MERG should be understood to have applied at the outset of all derivations. Thus, a statement like '*iai became /i/' should be interpreted as '*iai and *ei became /i/' and so on.

We can now return to the main question of GVS. We will begin with U-UMLAUT and then go on to I-UMLAUT.

6.2 U-UMLAUT

(a) u → əu — DIPHTHONG

(b) o → u — RAISE

(c) α → o / { labial ___ i, t, p, # ; velars ___ t, p, # ; dental ___ # } — ROUND

For convenience I will refer to U-UMLAUT (a), (b), and (c) individually as DIPHTHONG (for diphthongization), RAISE (raising), and ROUND (rounding or labialization), respectively. U-UMLAUT will continue to serve as a collective name for the three related processes taken together. DIPHTHONG and RAISE were unconditional shifts; ROUND, on the other hand, operates under severe restrictions. MC *o had a highly restricted distribution: it occurred only in two MC finals, *o and *io. RAISE is, therefore, unambiguous. However, the *u which underwent DIPHTHONG was the nuclear vowel /u/, not the labial on- or off-

glide. Thus, whereas *u and *iu became /əu/ and /iəu/ respectively, neither *uV nor *Vu (where V = a nonhigh vowel) was subject to the change. For example, *ua, *au, etc. did not change into /əua*/ or /aəu*/ or the like. By the same token, *ui did not become /əui*/, but rather /uəi/ by the corresponding diphthongization subrule of I-UMLAUT, to be given below (section 6.6). The illegitimate triphthongs /əua*, aəu*, əui*/ share one thing in common, namely they violate the *MONOSYL (monosyllable) condition stated in section 2.1. According to the Peking (and presumably universal) syllabification rule, a monosyllable may have as many as three vocalic segments, provided that the high vowels occupy the peripheral positions. That is, whereas (6.6) is possible as a monosyllabic sequence (subject to *PAL-DISM and other conditions), (6.7) is not.

(6.6) { i ; u ; y } V { i ; u ; y } where V = nonhigh vowel

(6.7) ~ V { i ; u ; y } V where V = any vowel

(6.7) is automatically interpreted by a (universally valid) syllabification rule as two syllables. With this understanding, it is not necessary to complicate DIPHTHONG by building into it such (universal) constraints in addition to the PC stated as *MONOSYL. The output of DIPHTHONG /əu/ emerged as /ou/ via *CHAMEL, as can be seen in the examples given below (6.8).[3]

(6.8)

MC	Peking	
*mu	mou	'someone, something'
*tu	tou	'bean'
*k'u	k'ou	'mouth'
*tsiu	tśiou	'to save, rescue'
*giu	tśiou	'maternal uncle'

6.3 As for RAISE, the intermediate /iu/ from *io is realized phonetically as /y/ by an interpretive convention such as (6.9).[4]