Phonological History of Wu

By

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A.B. (Tufts University) 1958

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Linguistics

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, BERKELEY

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Degree conferred DEGREE CONFERRED JUNE 14, 1969

Date

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Preface

I wish to express my appreciation for the assistance of various persons and groups in the preparation of this work.

My three committee members, Professor W. L. Chafe, Professor Chang Kun, and my chairman, Professor Wm. S-Y Wang, have contributed many suggestions for revisions and have been very helpful in discussions of the theoretical and factual issues involved many times during the last three years. Professor Chang Kun has been especially helpful in bibliographic matters; Professor Chafe has been a major influence all during my graduate education, especially with respect to my concepts of the nature of language and linguistic description. Professor Wang must be singled out both with respect to his constant encouragement of my research and with respect to his continuous stimulation and constructive criticism of my ideas.

My thanks also go to Professor Y. R. Chao, who has generously on several occassions made helpful and illuminating suggestions, especially with respect to the chapter on Proto-Wu.. Professors Anne and Mantaro Hashimoto, with whom I have had many constructive and provocative discussions, very kindly read the work during its production and made many detailed and helpful comments.

I also wish to thank the various sources of financial assistance during the last three years: the National Science Foundation (Graduate Fellowship), the University of California, Berkeley (Research Grant), and the Chinese

Linguistics Project, Princeton University, especially for pre-publication of earlier versions of portions of the study.

Finally, I want to thank my wife, Joan, for her constant encouragement and support. To her this work is dedicated with love.

Chapter I

Phonological Models

1.0 Introduction

The purpose of this chapter is to review some recent models of synchronic and diachronic phonology and to suggest modifications or reinterpretations of them. 1.1 outlines the basic generative model of phonology and makes two suggestions with respect to it: 1) it may contain three levels, not two, and, 2) there should be a fourth level, the new phonemic. 1.2 discusses some aspects of the relationship between generative (competence) phonology and performance; 1.3 sets forth some models of historical change and the relationship of these models to my extension of the generative model. These two sections also suggest that the notions 'systematic phonemic level,' and, therefore, 'lexical level' are invalid. 1.4 presents an hypothesis that the set of all possible historical changes equals the set of all possible phonological rules, suggests a revision of the hypothesis, and proposes a proof for it. 1.5 is concerned with an organic model of phonology that attempts to rectify some false dichotomies and to reinforce some old but forgotten ones.

1.1 The Basic Model

The basic model for this study is derived from the outline of generative phonology in Paul Postal's book, Aspects of Phonological Theory.[1] Since I wish to extend some of his concepts in ways with which he would probably disagree, I shall begin with some exposition of phonology as Postal sees it.

Postal describes generative phonology as follows:

> At the start let us stress certain features of the description of a sentence in systematic phonemic terms. Within such a theory, a sentence has two crucial types of phonological structure, one the systematic phonemic, a labelled bracketing and syntactic feature analysis of the string of systematic phonemes with appropriate boundaries. Such structures are at once both the final output of the transformational part of the syntax and the input to the phonological rules. The other crucial type of structure is a universal phonetic representation providing a theory of the instructions required by the speech apparatus to produce utterances which will be tokens of the sentence. The phonetic representations are the final output of the entire set of phonological rules. The rules which connect systematic phonemic and phonetic structure form a partially ordered series..., each rule operating on the output generated by the previously applied rule. This means that, besides the two crucial structures, each sentence has a very large number of representations, roughly one for each operation of each rule of the phonology which must be applied in the derivation of its phonetic representation.[2]

Or, as Noam Chomsky has more succinctly put it,

> The phonological component is a system of rules that relate a surface structure to the phonetic representation of a string.[3]

The two levels are connected in two ways. One is through the phonological rules, the other is by the Naturalness Condition. Postal finds this hard to define, but comes close to a definition in the following statement:

> In general then systematic phonological representation makes a set of indirect claims, claims that the phonetic form of a particular systematic representation must be such and such unless there are special phonological rules which determine otherwise.[4]

Postal views the systematic phonetic level as a fully specified set of instructions for the proper state of each part of the articulating apparatus; it contains sets of n-ary specifications (i.e., relative points in continua) for each phone. Chomsky says of this level:

> The final output of the system of phonological rules will be a phonetic matrix for the sentence as a whole in which columns stand for successive segments (phones) and rows define phonetic distinctive features, regarded now as scales, the entry indicating where a segment falls along a scale.[5]

Postal proposes that at some point in a grammar (as determined by that grammar) binarily marked distinctive feature matrices will be converted by Detail Rules (D-rules) into n-arily marked articulatory instructions. The range of values for any n-ary scale will be determined by a cross-language examination of all possible contrasting phonetic points in that continuum.[6]

For our purposes we will also need a definition of the concept 'level of representation.' Chomsky defines it as follows:

> That is, if we mean by the phrase 'level of representation' a system of representations that appears at some well-defined point in the process of sentence-generation, then the grammar provides no level of phonemic representation (it is difficult to imagine what other sense might be given to this expression).[7]

The two essential criteria for a level are:

1) that there be a system of representations; and

2) that the system appear at some well-defined point in sentence generation.[8]

1.11 Two Levels at the Top?

It has been suggested in recent generative literature that there may be a level in phonology above the systematic phonemic level. In one place Chomsky says:

> The input to the phonological component I will call a phonological representation.

He footnotes this statement as follows:

> Alternatively, we might restrict the term 'phonological representation' to the representation that we have at the point at which all grammatical formatives other than boundary symbols are eliminated in favor of matrices, so that what we have is a string of phonological matrices and boundary symbols...with IC structure...marked. This is what is called "systematic phonemic representation" in Chomsky (Current Issues in Linguistic Theory)....9

The level that Chomsky calls the phonological representation contains all the items listed in the lexicon. The system it represents will contain the same elements as the lower systematic phonemic level (and therefore fulfills condition 1) above), but a good deal happens between the two levels. The major operation to occur in that portion of the phonology is all of the strictly morphologically conditioned morphophonemics, i.e., of the

sĪ / Past ⟶ sɔ̄

type. In addition, all grammatical formatives that have phonologically conditioned allomorphs are replaced by phonological matrices. The systematic phonemic level, then, would be that level of representation that occurs after the last rule in the phonology that replaces some formative with a phonological representation (readjustment rules) and before the first rule in the phonology that operates on a string composed entirely of phonological matrices, IC structure and boundary symbols. The phonological level (which I shall call the lexical level to avoid confusion) would occur just after the lexical insertion rule and just before the operation of the first rule in the phonology. (This constitutes its fulfillment of condition 2) above.) In other words, sentences may have phonological representations on three levels: the lexical, the systematic phonemic, and the systematic phonetic.[10]

1.12 Two Levels at the Bottom?

Postal argues at length against a fourth level, 'autonomous phonemics' (old phonemics). His major argument is that a phonemic level necessitates grammars that are uneconomical (require unnecessary rules) or unmotivated (require *ad hoc* rules). He refers to Halle's classic example from Russian to show that old style phonemics would require a voicing rule to apply at two different places in the phonology, i.e., that a rule would have to be repeated. Chomsky[11] and others have also referred to this particular example to prove their point about old phonemics. Their argument is valid in showing that an old style phonemic solution of Russian with the condition of 'biuniqueness' would obscure the true nature of obstruent voicing in Russian. However, their claim by no means proves that *no* phonemic level is possible, especially if different constraints are allowed to operate in the theory. In fact, a close examination of Halle's solution will show that his solution itself obscures aspects of Russian phonology and that it may very well not be the optimal description.

Halle covers predictable obstruent voicing in Russian with the following phonological rules and definitions:

> In order to state the voicing rules in a simple fashion, it is necessary to set up the following classes:
>
> Sonorants; i.e., vowels, liquids, the glide, and the nasal consonants.
>
> Obstruents; i.e., all other morphonemes except {*v} ....
>
> Rule P 1b. Unless followed by an obstruent, {c} , {č} and {x} are voiceless....
>
> A single obstruent or several consecutive obstruents occurring in sequence regardless of intervening preposition or word boundaries will be termed an obstruent cluster....(Italics in original)
>
> Rule P 2. If an obstruent cluster is followed by a word boundary or by a phonemic phrase boundary, all segments in the cluster are voiceless.
>
> Rule P 3a. If an obstruent cluster is followed by a - (dash) boundary or by a sonorant, then with regard to voicing the cluster conforms to the last segment; if it is voiced, so are all other segments in the cluster; if it is voiceless, so is the entire cluster. 12

The first difficulty to note in Halle's solution is that Rule P 1b is not a P-rule in current practice; the voicelessness of these sounds is covered by marking theory. According to that theory the optimum obstruent is voiceless, so that the three consonants {c} , {č} and {x} will be [u voiced] before the marking conventions apply and [- voiced] after they apply. (According to marking theory, all segments must be marked for every feature by the time the phonological rules apply, i.e., these three obstruents will be [- voiced] even in contexts where Halle left them unmarked after the application of Rule P 1b.)

If the reader will now try substituting the definition of obstruent cluster for the words 'obstruent cluster' in Rule P 2, he will find the next difficulty. Apparently some boundaries are in a sense absolute, that is, voicing assimilation stops there. It is not clear from Halle's rules and definition just what this boundary is, but since he does not use the boundary symbol '#' in his description of Russian, I shall now use that symbol to indicate this absolute barrier to voicing assimilation. Stating Rule P 2 formally:

$$2)\quad [+\text{ voiced}] \rightarrow [-\text{ voiced}] \;/\; [\underline{\quad\quad}]\;\;([\text{Obs.}])_0^n[\#]$$

This rule is commonly referred to as the devoicing of final obstruents.

Rule P 3a says, in effect, that in an obstruent cluster preceding anything except //#//, the obstruents preceding the last one assimilate to it in voicing. Formally:

$$3)\quad [\text{Obs.}] \rightarrow [\alpha\text{voiced}] \;/\; [\underline{\quad\quad}]\;\; \begin{bmatrix}\text{Obs.}\\ \alpha\text{ voiced}\end{bmatrix} \begin{bmatrix}\text{Any env't}\\ \text{except } \#\end{bmatrix}$$

Rule P 3a appears to be a neat alpha rule. There is that messy problem of stating negative environments formally, as opposed to verbally, but a way can usually be found around that problem. But is the rule really that neat? What exactly does it do? Since the voiceless obstruents are all marked as such by the marking conventions, the only effect that this rule will have on them is to voice them when they precede voiced obstruents. Note that the class of voiceless obstruents includes sounds like $\{t\}$ and the defective series $\{c\}$, $\{\check{c}\}$ and $\{x\}$. Rule P 3a also devoices the voiced obstruents in the opposite environment, i.e., before voiceless obstruents. Sounds like {d} , for example, will become voiceless. This means that part of the devoicing of the voiced series is put into Rule P 2 and part of it is put into Rule P 3a. Moreover, by so doing, it makes it appear that the voicing of {c} , {č} and {x} is the oddity in Russian phonology, when really it is the special devoicing of the voiced series.

Just what exactly goes on in Russian? At the deepest level, some morphemes are distinguished by final voiced and voiceless stops. For example, //Xd// ≠ //Xt//. No morphemes, however, are distinguished by distinctive voicing in the three obstruents //c//, //č// and //x//. For example, there is //Xč// but no //*Xǯ//. That is a fact about Russian. The next fact to note is that the voiced and voiceless contrasts in morpheme final position are neutralized in certain contexts. This means, in effect, that phonemic merger occurs; the only way in these contexts to find the underlying forms is by examining the other allomorphs of the morphemes. The third fact to note is that the voicing of obstruents is predictable on the basis of phonetic environment under certain conditions. This means that certain phonetic features in Russian are phonetically redundant and therefore reveal nothing about underlying form. The neutralization and the phonetic redundancy are two different phenomena and should be distinguished in any phonological description of the language.

Halle's solution can be improved with some of the modifications to generative theory that are proposed in this paper. Rule P 2 may be reformulated as follows:

2) $\begin{bmatrix}\text{Obs.}\\ +\text{voiced}\end{bmatrix} \longrightarrow [-\text{voiced}]\ /[\underline{\quad}]\ [\{\text{Obs.}, \#\}]$

For example, $\text{Xd} \longrightarrow \text{Xt}/\underline{\quad}\ \{\text{Obs.}, \#\}$. This rule now performs the phonemic merger between the voiceless and voiced obstruents in the appropriate contexts. The Prague school would call this neutralization and would prefer to establish an archiphoneme. In generative theory that would require either a third entity or a ternary feature system; therefore, the theory requires a merger of the voiced series into the voiceless series. This merger is supported by marking theory in that the expensive member of the contrast, [m voiced], has now become the cheap member, [u voiced]. Also, some systematic phonemic //d// will become /t/ only to be revoiced in certain contexts to [d]. Therefore, this solution still seems to contain non-Russian artifacts of generative theory.

Rule P 3a will be revised as follows:

3) $[\text{Obs.}] \longrightarrow [+\text{voiced}]\ /\ [\underline{\quad}]\ \begin{bmatrix}\text{Obs.}\\ +\text{voiced}\end{bmatrix}$

for example, $\text{t}, \check{\text{c}} \longrightarrow \text{d}, \check{\text{ʒ}}\ /\ [\underline{\quad}]\ \begin{bmatrix}\text{Obs.}\\ +\text{voiced}\end{bmatrix}$

That is, an obstruent will assimilate in voicing to a final voiced obstruent in a cluster. There is no need to use an alpha rule because all obstruents in a position to assimilate are already voiceless. The only operation to occur is the voicing of voiceless obstruents in certain phonetic environments.

But now 2) is a P-rule and 3) appears to be a D-rule. If we choose to list the representations of forms after all P-rules have been applied and before the D-rules have applied we would have the following typical developments:

I	II	III
Systematic Phonemic		Systematic Phonetic
Xt# Xd#	Xt#	Xt#
XtObs. XdObs.	XtObs.	XtObs. -voiced XdObs. +voiced
Xtli	Xtli	Xtli
Xdli	Xdli	Xdli
Xč#	Xč#	Xč#
XčObs.	XčObs.	XčObs. -voiced XǰObs. +voiced
Xčli	Xčli	Xčli

The column marked II is now an economical and motivated level between the systematic phonemic level and the systematic phonetic level.

Postal's second argument against phonemics is that any other theory of phonemics that he has considered does not include such properties as the Naturalness Condition, the Marking Conventions, or any of the other advances of generative phonological theory. It goes without saying that earlier phonemic theories were weaker for not incorporating these concepts and that any future theory must incorporate them, or something like them. It is also true that no theory of language will be compatible with speech perception and production unless extensive grammatical prerequisites are allowed in phonology. But there does not seem to be any a priori reason why a phonological theory could not have some sort of level intermediary between systematic phonemics and systematic phonetics, and still incorporate the best aspects of present theory.

In fact Postal's model of phonology contains the basis for another level of representation between his systematic phonemic and systematic phonetic levels. P-rules (phonological rules) operate with binarily valued inputs and outputs. The lowest binary output of the grammar enters D-rules which convert the binary code into values on n-ary scales. That the lowest binary output has always been considered a system is evidenced by the fact that almost all (if not all) generative phonologies have called this level the systematic phonetic level, even though the latter has been described as being at some lower point. Thus Chomsky has the rule:

(24) Consonant → [+voiced] in the environment
/____ [+voiced]

and later says of the rule

> The grammar containing rule (24) thus converts phonological to phonetic representations...[13]

This comment contrasts with his earlier statement about phonetic scales. In other words, generativists have usually constructed their grammars on the basis of a final output of systematic representations, which coincide with this, the lowest level at which the rule output is binarily coded. A discussion of the differences between the two kinds of rules, P-rules and D-rules, will show that this level of representation also occurs at a well-defined point in the process of sentence generation.

P-rules are those rules which relate morpho(pho)nemes to the lowest binary output of the phonology. Their major formal characteristic is that they deal with binary values.[14] Their function is to change entities into already existing ones (phonemic merger) or to create new entities from old ones (phonemic split). Many of these rules will be ordered (partial ordering). P-rules also specify allomorphy. Many, in fact, require extensive grammatical information for their formulation.[15] P-rules, in short, perform operations, i.e., are process rules.

D-rules, on the other hand, involve changes in the character of an entity rather than merger or split of entities. Ordering is artificial or impossible, so that the rules should be considered to apply simultaneously. Simultaneity of rules implies that they are not process rules, but relational statements.

Thus, P-rules and D-rules differ greatly in the values they operate with, the ways in which they operate and in their internal relationships (ordered versus simultaneous, respectively). Their interface constitutes a well-defined point in the grammar. In addition, all forms in a language must have a representation at this level in their generation; this allows for systemic phonological analysis of all of the entities involved in these representations. Therefore, the lowest binary output of the phonology fulfills both conditions and it must be considered to be a level in the Chomskyian sense. I shall call this level the New Phonemic level. It would appear to be approximately equivalent to Column II in the chart on page 14.

1.13 The Function of Levels

I shall now consider what functions this four-level model may have in our understanding of performance (1.2), of historical change (1.3), and of the nature of phonological rules (1.4).

1.2 Four Levels and Performance

1.21 Some Advantages of New Phonemes

The new phonemic level will allow for a useful distinction between the modus operandi of P-rules and D-rules. For example, the simultaneious nature of D-rules may allow us to assign some operations to them in order to avoid the arbitrary ordering that would be required if they were considered to be P-rules. Suppose that in a language we have the following two rules:[16]

	Sample Derivation:		Sample Derivation:
	XZ		XZ
1) $X \rightarrow Y/\underline{\quad}Z$	YZ	1) $Z \rightarrow A/X\underline{\quad}$	XA
2) $Z \rightarrow A/Y\underline{\quad}$	YA	2) $X \rightarrow Y/\underline{\quad}A$	YA

If these operations are to be considered to be ordered P-rules they would occur in either of the two orders above (which involve changes in the specification of the environment), but would have to occur in one order. Not only are there no criteria for choosing between these alternate formulations, but it seems intuitively true that we do not want to be forced to make a choice. If the changes are formulated as D-rules with binary specifications for all of the structural description for both rules, and if the rules are applied simultaneously, the ordering problem is eliminated.

In addition, D-rules may also be required to clarify situations involving free variants. In S. E. Pomo (from a discussion by Julius Moshinsky) an epenthetic vowel, V_a, is subject to (in part) the following two rules where the first is optional:

$$3.\ c.\ V_a \rightarrow e/\_\_Ce$$

$$d.\ V_a \rightarrow i/\_\_ \left\{ \begin{matrix} y \\ C \left\{ \begin{matrix} i \\ e \end{matrix} \right\} \end{matrix} \right\}$$

so that phonetically we have both eCe and iCe but only iCi. It seems likely that a better solution would be to have one P-rule of the form

$$V_a \rightarrow V_1/\_\_CV_1$$

allowing for the sequences iCi and eCe; and then to have an optional D-rule to the effect that:

$$e \rightarrow i/\_\_Ce$$

In fact, it seems likely that most free variation is better explained as a D-rule than as an optional P-rule. It seems quite plausible to say that a given segment may be mapped by a D-rule onto a possible series of values rather than onto one locus. Thus, if the D-rule relating binary features to the vowel height continuum is of the form

$$\begin{array}{ccccc} & \begin{bmatrix}+\text{High}\\-\text{Mid}\end{bmatrix} & \begin{bmatrix}+\text{High}\\+\text{Mid}\end{bmatrix} & \begin{bmatrix}-\text{High}\\+\text{Mid}\end{bmatrix} & \begin{bmatrix}-\text{High}\\-\text{Mid}\end{bmatrix} \\ & \downarrow & \downarrow & \downarrow & \downarrow \\ F_{ht} & 0 & 1 & 2 & 3 \\ & [\text{i}] & [\text{e}] & [\text{ɛ}] & [\text{æ}] \end{array}$$

then the rule above might be

$$\begin{bmatrix}+\text{High}\\+\text{Mid}\end{bmatrix} \rightarrow [0/1\ F_{ht}]$$

with the meaning: F_{ht} has the value 0 or 1 or any value in between. This seems to accord nicely with the intuitive nature of free variants.

1.22 Some Advantages of a Mixed Lexical Level and a Weak Systematic Phonemic Level

William S-Y Wang has questioned some aspects of systematic phonemic representations as now posited by the generativists.[17] First, many forms occur in too abstract a shape. For example, 'man' and 'cat,' which exhibit no allomorphy, are nevertheless represented with an underlying back vowel that is shifted to the front along with other low back vowels that do exhibit allomorphy, e.g., the third vowel in 'telegraph' versus 'telegraphy.'[18] This leaves us with no convenient way to deal with such variations as $[\text{p}^{\text{h}}\text{ǽtiow}] \overset{f}{\sim} [\text{p}^{\text{h}}\text{ɑ́tiow}]$ for 'patio' and $[\text{plɑ́zə}] \overset{f}{\sim} [\text{plǽzə}]$ for 'plaza.'

Second, some types of representation may not be allowed at the systematic phonemic level, but the phonetic forms manifesting them may give no clue as to what the underlying shape should be. Thus, in English, the systematic phonemic level contains no schwa and no syllabic liquids, so that a form like 'table' must be represented with some basic vowel between the //b// and the //l//. If the 'table' we have in mind is approximately equivalent to 'chart,' then the underlying vowel is //u//, as revealed by the allomorphy in 'tabular' and 'tabulate.' But what about the 'table' that means the piece of furniture, where there is no allomorphy? Some diphthongs present similar problems. On the basis of 'righteous,' 'right' is of the underlying form //rixt//. 'Rite,' on the other hand, is of the underlying shape //rite// becuase of the vowel reduction in 'ritual.' What about 'night,''light,' 'quite' and 'white'? (Note that in some American usages 'night' and 'light' are spelled as 'nite' and 'lite,' respectively.) If the systematic phonemic representation of 'produce' contains a //kt// cluster, ('production'), does 'misuse' contain one as well? If 'linear' and 'alignment' reveal the underlying forms of 'line' and 'align,' what about 'sign' and 'sine'? The phonetic [z] of 'phase' reveals an underlying //s//; the phonetic [s] of 'face' reveals an underlying //k//. What about the alternates [véys] , [véyz] and [vɑ́z] for 'vase'? (I say [véys] but [véyzɨz] .) Or [gríys] $\overset{f}{\sim}$ [gríyz] for the verb 'grease' or the adjective 'greasy'?

The classic example of the Mandarin palatals illustrates another aspect of the problem of indeterminate underlying representation. Phonetically Mandarin has syllables of the following shapes:[19]

pa	ta	tsa		ka
pu	tu	tsu		ku
pi	ti		tçi	

There have been three standard views on how this system ought to be analyzed: (a) represent [tçi] as //tsi//; (b) represent [tçi] as //ki//; (c) represent [tçi] as //tsi// and //ki// depending on the historical origin of each of the morphemes involved.[20] Now, we know historically, and would strongly suspect synchronically, that the palatals derive from both *tsi and *ki, the two gaps in the system above. We may note that the two palatalizations were separate historically. The first change gave rise to the system

pa	ta	tsa	ka
pu	tu	tsu	ku
pi	ti	tsi	tçi

i.e., velar palatalization preceded affricate palatalization. Both complementary distribution and linguistic universals tell us that we need no systematic phonemic //tçi//; but, Mandarin contains almost no allomorphy to reveal which of the underlying shapes, //tsi// or //ki// are to be associated with which morphemes.[21] If, however, we can represent the affected morphemes in the lexicon with a new phonemic shape /tçi/; and if we structure the phonology so that the systematic phonemic level contains the potential shapes *//tsi// and *//ki// with rules palatalizing both, we will have a better and more complete description of the language. This solution avoids an arbitrary phonemicization of [tçi] as //tsi// or //ki//, as well as the attendant ahistorical rule *ts >k >tç or *k >ts >tç; and we will not be forced to go outside of modern Mandarin to assign the proper underlying forms to the morphemes involved.

On the basis of such examples Wang has suggested that we need to be able to represent some forms on an intermediary level in order to account for the phonological facts where there is no allomorphy. The lexical level will then contain representations of forms with various degrees of abstraction.

This leads us to ask other questions about the systematic phonemic level. If we examine individual performance, to what extent can it be shown that every speaker of a language knows every P-rule (and every form in an underlying as opposed to a new phonemic shape) that may be posited when the language is considered as a whole? In fact, on the basis of dictionaries, extensive literature, etc., in a language, we can probably posit lexical strata, base forms and rules of an extent that may be known completely by no speaker of the language. Would such a phonology characterize the competence of a given speaker? On this subject, Wallace L. Chafe has made the following point:

> How deeply speakers delve in this direction is open to serious question. Almost certainly they do not assimilate everything that a historical linguist would internally reconstruct (comparative evidence is, of course, inaccessible to them). In all probability, too, there is variation among

> individuals. But the psychological validity of some underlying forms and processes of this sort is well established. 22

If we assume the validity of the new phonemic level, we can assume that a homogeneous linguistic community has the same D-rules, i.e., the same new phonemic inventory. This will be true because, from the point of view of language acquisition, it seems correct to assume that a child begins mastery of his language by eliminating redundancy which is purely phonetic and that he constructs some low level binary phonemic system equivalent to our new phonemes. This would account for a child's speaking "without accent" while continuing to make morphophonemic "errors." Then the complete phonology for that community contains all the rules and underlying forms used by anybody in that community. A description of a given speaker's competence, on the other hand, will be that set of rules which relates his underlying forms to the new phonemic forms of the language, in addition to the base forms in his lexicon that are in the less abstract new phonemic shape and undergo no phonological rules.

In other words, we are going to allow for lexical representations that occur at a well-defined place in the grammar but that do not constitute a system. Forms (morphemes) will be represented by mixed strings of new phonemes and of deeper, more abstract segments (morphophonemes) that are provably subject to phonological rules. In addition there will be no systematic phonemic level in a strong sense because there will be lexical forms that will by-pass this level of representation.[23]

1.3 Four Levels and Historical Phonology

1.31 Wang and Moulton on Historical Phonology

William G. Moulton has recently presented a traditional view of phonological change.[24] In some places he suggests that phones drift towards each other to produce phonological change; in other places his remarks point to 'jump' changes.[25] He points to dialectal evidence to indicate that there can be systems with no change, systems with a change completed, and systems in between which display much alternation. Individually, changes may be either drift or jump changes, but their effect on systems is to produce fluctuation between new and old forms.

Wang has lately proposed a model of change to resolve the problem of fluctuation. His first assumption is that:

> sound changes take varying periods of time for their operation. For lack of precise information, let us say that a sound change may take anywhere from a decade to many centuries for its operation. 26

With reference to the ideas behind Moulton's 'gradual,' 'fluctuation,' and 'drift,' he says of sound change through time:

> The dimension of time may be studied along each of three relatively independent parameters: (1) from sound X to sound Y, (2) from morpheme to morpheme in the relevant part of an individual's vocabulary, and (3) from speaker to speaker in the same dialect.
>
> With respect to the first of these parameters we have in mind the familiar controversy of whether the change from X to Y is gradual or abrupt.... 27

Some changes (at least) are jump changes. That is, some changes are of the form

$$[+F_1] \rightarrow [-F_1]$$

where no drift occurs. But changes do not at once affect all of the words in the lexicon to which they may apply. Rather the change becomes gradually more pervasive in the lexicon and the process may take centuries. Wang contends that at a later time a new, competing change, which may also apply to the possible inputs to the first change where it has not been completely carried out, may enter the language. Thus in Wang's model phonemic split can occur without the Polivanov factor:[28]

> But if we accept the fact that a sound change (conditioned or unconditioned) may not complete its course due to other competing changes, then clearly we must recognize incomplete sound changes as a cause of splits. 29

A problem from the Wu dialects may prove amenable to this analysis of split. The following correspondences illustrate the difficulty.

Middle Chinese[30]	some *juo/P___ *juo/T,K___ *uo/K___ some *uo/P,n,l___	some *juo/P___ *uo/TS___ some *uo/P,T___
Proto-Wu	*u	*ou
Su Zhou	u	u
Wen Zhou	u	ey

Now if we assume, as Karlgren did,[31] that all of the modern day Chinese dialects except Min are descendants of Middle Chinese, then it appears that after labials, the finals *juo and *uo have merged and then split unconditionally in Wu. For example:

	1.布	2.部	3.普	4.步	5.鋪
MC	puo 去	bhuo 上	phuo 上	bhuo 去	phuo 平
PW	pu 534	bu 23	phu 45	bou 213	phou 42
SZ	pu 513	bu 331	p'u 41	bu 331	p'u 44
WZ	pu 42	bu 24	p'u 54	bey 11	p'ey 44

	6.谱	7.府	8.麸	9.扶	10.夫
MC	puo 上	pfjuo 上	phfhjuo 平	bhvjuo 平	pfjuo 平
PW	pou 45	fu 45	fu 42	vu 31	fou 42
SZ	pu 41	fu 41	fu 44	vu 24	fu 44
WZ	pey 54	fu 54	fu 44	vu 11	fey 44

	11.符
MC	bhvjuo 平
PW	vou 31
SZ	vu 24
WZ	vey 31

For items 1, 5 and 7 either the two sources for the Wen Zhou material disagree (one showing u, the other ey) or one source gives two readings (not distinguished as literary and colloquial). Moreover, for forms 5 and 6 there is data from another Wen Zhou sub-dialect that shows that u is its reflex for both PW *u and PW *ou.[32]

It may be that the u/ey distinction represents a change, u > ey, in Wen Zhou and not a difference in the proto-system. It did not affect PW *u after *n, *l, or the velars. It affected all PW *u after dentals and the plain dental affricates. But it affected only some of the PW *u after labials. This interpretation conflicts with the strict neo-grammarian proto-system containing two finals, *u and *ou. At present I have no way to substantiate an incomplete u > ey shift. However, it would account for the discrepancy between Proto-Wu and Middle Chinese. Such a procedure would also have the advantage of accounting in part for the fact that Proto-Wu is more complex than any derivative dialect.

Wang's approach also lends additional support to the concept of a mixed lexical level and a weak systematic phonemic level. If a change sets up morphophonemic alternation, then as soon as it affects several items, those items must receive a deeper underlying representation and be made subject to a P-rule, whereas the unaffected lexical items will remain in a less abstract new phonemic shape until the change spreads to them.

1.32 Chafe on Historical Phonology

Chafe has examined the notion of ordering of synchronic phonological rules in detail.[33] I shall outline some of his ideas that concern us here.

Synchronic rules may be sequentially or randomly ordered.[34] A rule is ordered sequentially with another rule if it interferes with that rule, and randomly if it does not. Even among sequentially ordered subsets of these rules there will be some which do not need to be ordered with respect to other subsets. Thus, rules 1), 2) and 3) and rules 4), 5) and 6) might be strictly ordered subsets, but not be ordered with respect to each other. If both subsets must precede rule 7), then the two subsets are randomly ordered with respect to each other, but strictly ordered with respect to rule 7). Chafe proposes to describe this relationship by saying that there are four depths of ordering reflected herein, rule 7) being at depth I, rules 3) and 6) at depth II, etc., with only random order between rules at any given level. Thus, graphically

Level:	Rule No.:
IV	1,4
III	2,5
II	3,6
I	7

In addition to these partially and strictly ordered subsets, there will be many rules that are in partial or strict order with no other rules; they could be considered to apply at any level in the phonology. They are considered to be randomly ordered with respect to each other and with respect to all other rules, but Chafe has questioned whether this captures all that is significant about their lack of any ordering. On the one hand, if application of rules must be sequential, and if these rules are randomly ordered within a speaker's grammar, then it would appear that he could and would apply them in different orders at different times. On the other hand, if each speaker has a fixed order, it would have to be arbitrary across the language population because there would be no principles that would lead speakers to the same ordering. Therefore, it seems quite plausible to assume that they apply simultaneously. Chafe says

> It would involve the not unlikely psychological assumption that it is easiest for people to apply

> rules at the same time whenever they can, that sequential ordering has a greater psychological cost.[35]

Even so, we could still assume that they are all applied simultaneously with rule 1) and 4) at level IV, or at any other level, for that matter, and there still would be no principle for choosing any one alternative.

There is some evidence for supposing that these completely random rules should be applied at level I. In the first place, they all directly affect the phonetic output of the phonology because they have not been interfered with and hence ordered by another rule.[36]

> There is thus a progression from maximum concreteness (in terms of most direct phonetic relevance) in the bottom layer to maximum abstractness (least direct phonetic relevance) in the top layer.[37]

Secondly, if the hypothesis that new changes tend to enter at level I is correct,[38] then it would be a matter of chance for a new rule to create an ordering problem with some slightly older rules already stored at level I.

Thirdly, if randomly ordered rules were applied anywhere in a grammar, and if the application of any one of them occurred prior to the time when an output had been derived from all of the sequentially ordered rules, then the output of that rule would have to be stored somewhere, which would considerably complicate the performance model of language.

This leaves a set of P-rules that are all partially ordered (i.e., every rule is in strict order with some other rule but not every rule is in strict order will all other rules) in a series of depths, or layers. One of the most interesting aspects of modern process-oriented phonologies is that these rules often reflect historical changes that are known to have affected the language, and that the order between strictly ordered subsets often reflects the order in which the changes appeared in the language. The deeper the level at which a rule must occur, the older is the change historically. As P-rules are pushed deeper, they do less work in the sense that they affect fewer forms and in the sense that they become increasingly less obvious from the output of the phonology.[39] When rules become sufficiently obscure they, like the Cheshire cat, having faded to aught but a smile, disappear altogether.[40]

1.33 Wu Examples of the Interference of the Systematic Phonemic Level with Historical Phonology

I shall now use the Halle Russian voicing type of example to show that systematic phonemicization may necessitate historically uneconomical or obscurantist grammars.

In two of the Wu dialects, we find the following new phonemic vowel plus nasal syllable finals systems:

4.CZS			3.CS		
in	yɤn	uɤn	iŋ		uɤŋ
	ɤn	oŋ		ɤŋ	oŋ
	ɑŋ		ã		ɑ̃

At the systematic phonemic level, these presumably might be

4.CZS			3.CS	
in	yn	un	iŋ	uŋ
	ɤn	on	ɤŋ	oŋ
	an		aŋ	ɑŋ

The following P-rules would convert the systematic phonemic to the new phonemic representations:

4.CZS	3.CS
1. n → ŋ /o___	1. aŋ,ɑŋ → ã,ɑ̃
2. {y,u} n → {y,u} ɤn	2. uŋ → uɤŋ

Now historically, the 4.CZS and 3.CS new phonemic nasals developed as follows:

4.CZS	3.CS
iŋ, eŋ > in	iŋ, eŋ > iŋ
oŋ > oŋ	oŋ > oŋ
uɤŋ > uɤn	uɤŋ > uɤŋ
ɑŋ > ɑŋ	ɑŋ > ɑ̃
aŋ > ɑŋ	aŋ > ã
ɤŋ > ɤn	ɤŋ > ɤŋ
yɤŋ > yɤn	yɤŋ > ioŋ
ioŋ > ioŋ	ioŋ > ioŋ

From a comparison of the two, it is easy to see what has happened. In 4.CZS, the proto-Wu final velar nasal appears as [n] after [i] and [ɤ] ; it remains a velar after [ɑ] and [o] . In 3.CS, it remains a velar everywhere except after the compact vowels where it appears as nasalization of the vowel. Formally, the historical rules relating proto-Wu to the new phonemic level are

4.CZS	3.CS
ŋ > n/i,e,ɤ ___	aŋ,ɑŋ > ã, ɑ̃

But if we write out rules affecting nasals that derive the systematic phonemic level from Proto-Wu, we get:

4.CZS

ŋ > n/___

3.CS

ŋ > ŋ /___

But we have already shown that this solution contains for 4.CZS the rule

$$n \rightarrow ŋ \quad /o\_\_\_$$

Thus by allowing the intrusive systematic phonemic representation to enter the picture, the rules for 4.CZS contain:

Historical: ŋ > n/____
Synchronic: n → ŋ /o___

This is clearly uneconomical, as well as contrary to the Naturalness Condition. Not only have unnecessary rules been included in the grammars (one in the historical grammar, one in the synchronic grammar), but also an entity has been forced to change into something else and then back into itself.

Another problem that arises in some Wu dialects with any synchronic level above the new phonemic is with the palatal affricate syllable initial consonants. In several Wu dialects, as in Pekingese, the historical dental affricate series (TS) and the historical velar series (K) both palatalize (TÇ) before [i] and [ĭ] . In 13.WL, this palatalization occurred before several vowels diphthongized into ĭ + V. In present day 13.WL then, we have syllables of the following types:

de
tse
he

tie
die
tçie
dʑie
ʑie
kie
ɦie

ɦiɛ
sɛ
hɛ

tçiɛ
kiɛ

tɤ
tsɤ
sɤ

tçiɤ

One possible analysis of these forms gives the following systematic phonemic shapes:

de	tie	ɦlɛ	tsiɛ	tɤ	tsiɤ
tse	die	sɛ	kiɛ	tsɤ	
he	tsie	hɛ		sɤ	
	dzie				
	zie				
	kie				
	ɦie				

And the rule:

TS → TÇ/___ie, iɛ, iɤ

The first difficulty with this solution is that the system is still unbalanced, in that there are de/tie, tse/tsie, he/kie and sɛ/tsiɛ, hɛ/kiɛ contrasts but only a tsɤ/tsiɤ contrast, i.e., there are no tɤ/tiɤ, kɤ/kiɤ contrasts. Moreover, when we examine the situation historically, we find that

1) we now need historical rules like *K > TS (and TS → TÇ, synchronically) which seem very unlikely, and rules like *dʑ > dz, (and synchronically, dz → dʑ), which seems redundant, and

2) no historically plausible stage corresponds as a level to the systematic phonemicization of the data.[41]

Without the systematic phonemic level, the data are accounted for as follows: the following historical P-rules apply to the appropriate proto-forms to yield new phonemes (ordering is indicated in Chafe's manner):

III ai > ã   ɤu > iɤu/K___   a > e/___i
Vn > Ṽ   ian > ien

II õ > ẽ/ɦ,ʔ ___

I Ṽ > V   ɤu > ɤ   K,TS > TÇ/___i,i-
l > ɦl   e > ie/ɦ,ʔ ___#,~
a > ia/Kstops___~   a > ɛ /{___~ / T,TSi___#}

The following sample derivations illustrate the points made above. The first column contains a Chinese gloss and a proto-form; the numbered columns provide the output after the application of all the rules in a given level. The column labeled I is the new phonemic level. The column on the far right is the systematic phonemic solution presented above.

		Proto-form	III	II	I	Systematic Phonemic
1.	袋	*dai	de	de	de	de
2.	栽	*tsai	tse	tse	tse	tsə
3.	改	*kai	ke	ke	kie	kie
4.	海	*hai	he	he	he	he
5.	店	*tian	tiẽ	tiẽ	tie	tie
6.	前	*zian	ziẽ	ziẽ	ʑie	zie
7.	纏	*dʑiə/an	dʑiẽ	dʑiẽ	dʑie	dzie
8.	電	*dien	diẽ	diẽ	die	die
9.	箭	*tsien	tsiẽ	tsiẽ	tɕie	tsie
10.	繭	*kien	kiẽ	kiẽ	tɕie	tsie
11.	旱	*ɦon	ɦõ	ɦẽ	ɦie	ɦie
12.	籃	*lan	lã	lã	ɦlɛ	ɦlɛ
13.	三	*san	sã	sã	sɛ	sɛ
14.	間	*kan	kã	kã	kiɛ	kiɛ
15.	鹹	*ɦan	ɦã	ɦã	ɦɛ	ɦɛ
16.	姐	*tsia	tsia	tsia	tɕiɛ	tsiɛ
17.	斗	*tɤu	tɤu	tɤu	tɤ	tɤ
18.	走	*tsɤu	tsɤu	tsɤu	tsɤ	tsɤ
19.	搜	*sɤu	sɤu	sɤu	sɤ	sɤ
20.	狗	*kɤu	kiɤu	kiɤu	tɕiɤ	tsiɤ

Not only does the column on the right not match any other column as a whole, but also some forms in the right hand column do not match any form to their left. Note especially forms 10 and 20 which illustrate a putative *k > ts shift, and form 7 which illustrates the redundant dʑ > dz > dʑ effect of systematic phonemicization.

1.4 Four Levels and the Hypothesis of a Universal Set of P-Rules

1.41 The Hypothesis and its Proof

It has been alleged by Paul Kiparsky that Halle has claimed that the set of all possible synchronic P-rules equals the set of all possible historical changes (qua added rules).[42] The truth of the allegation will not be discussed here; but the claim is an interesting one--after all, an examination of any fairly large number of historical and synchronic phonologies will reveal quite a few rules which appear in both types of phonologies.

If the claim were true, how would we prove it? Mathematically, the proof would consist of showing that any arbitrarily-chosen member of Set A is included in Set B, and vice versa. The problem for linguistics is essentially how to describe the two sets so that, given any phonological rule, we can determine whether it is a possible historical or synchronic rule, i.e., whether it has the properties that allow it to be classed as a member of one set or the other. In short, just what is a phonological rule, historically or synchronically?

I shall now propose a definition of membership in either the synchronic set or the historical set in such a way that it will be seen that the question is not really whether the two sets are equivalent, but instead whether there is only one universal set of all possible phonological rules. A P-rule is one which has the following properties:

1) It is a process- or rewrite-statement to the effect that A is changed into (rewritten as) B.
2) The values encoded on both the left and the right hand side of the rule must be on the same phonological level. In generative terms, this means that the input and output of the rule must be binarily-coded distinctive feature matrices.
3) The rule must change one entity into another. That is, it must create new contrasting phonological entities (phonemic split) or erase previously existing contrasts (phonemic merger).[43]

Detail rules must be excluded from the set for two reasons. In the first place, phonetic drift in the D-rules will not become important historically until it is sufficient to be converted into a P-rule. In the second place, D-rules involve factors such as the nature of the articulatory mechanism, and the nature of economy in human speech. Changes that affect these factors must be said to occur in evolutionary time and are related more to the universality of the phenomenon of human language than they are to the diversification of different human languages.

Rules between the Lexical level and the Systematic Phonemic level must also be excluded. Two English rules of this type will show why:

1) sĪ + Past → sɔ̄

2) Past → D/elsewhere

There is no reason why any other language should have rule 1) since both 'sĪ' for 'see' and the presence of a unit 'Past' in the language are both part of the arbitrariness of language. As for rule 2), even if some other language has 'Past' there is no reason why its regular realization should be //D//, e.g., cf. Latin 'bā.' In short, these rules are only semiphonological in that, unlike the P-rules, they operate with a binary output but not a binary input.

1.42 Why Counter Examples Don't Count

It is easy to see that defining the set is the central problem and that counter examples are not relevant to the issue. In the first place, there are two ways to define sets, one by listing all the members and the other by listing the defining qualities that allow membership in the set. If we could list all possible synchronic P-rules and all possible diachronic P-rules now, the theoretical question could be answered forthwith; since we deal in an unfinished empirical science, complete listing is not possible. Hence there is always the possibility that a rule in one set or the other that at present does not appear to have a counterpart in the other set may actually be given one in the future when more is known about more languages. But even more important, our understanding of the best possible formulation of the rules in either set is so deficient at present that we could never be sure that a rule with no evident correlate in the other set is not just poorly composed. Therefore, at the present time, we must establish the set by definition rather than by listing all possible members.

Three brief counter-examples to the hypothesis that have been proposed deserve mention here.[44] The first concerns a language with personal prefixes to the verb with the alternant forms CV and VC (where CV is singular and VC is plural). It has been proposed that the best synchronic description of these facts is a metathesis of one prefix into the other. This solution, however, raises more questions than it answers. First, is the metathesis a phonological rule, a grammatical rule, or a re-adjustment rule? Second, if metathesis is the best solution, on what grounds will one order be chosen to be metathesized into the other? Third, why is metathesis to be chosen over deletion (i.e., CVC → CV,VC) or insertion (i.e., V → CV,VC)? None of these questions can be answered until more is known about the language in question, both synchronically and historically, and until more is known about phonology. It is true that the present tenets of phonology incline us to feel that metathesis of true vowels and consonants does not occur historically, but this prefix system cannot be justifiably regarded as a counter-example to the hypothesis.

The second counter-example is the collapsing of rules in a given description in a way that does not find its counterpart in some other description. Thus, a rule essentially of the form k → s is presently being posited for synchronic English morphophonemics, but there are at present no known cases of such a direct shift in historical grammars. Rather, a more likely historical pattern is

$$k > tʃ > ʃ > s$$

or something of the sort, but there is no evidence in modern English for such a chain of small changes.[45] The question that arises is this: If synchronically we are motivated to posit just k→ s , but historically always the longer chain, does this not constitute a clear case where the sets are not equivalent? First, it is always possible that some language will turn up an historical k > s rule. Second, this type of counter-example would be of theoretical value only if the shorter form were essential, i.e., if the longer form would interfere with other rules in the phonology. Until this is shown to be the case, I shall assume that the longer and shorter rules are equivalent. A short rule will be said to be equivalent to a longer chain of rules when:

1) The highest left side and lowest right side of the longer chain of otherwise motivated rules are the same as the left side and the right side of the short rule, and
2) the longer chain is closed in the sense that the leftmost input is the unique source for the rightmost output, and that no quantity in the longer chain of rules gives rise to an entity other than the rightmost output.

These matters are discussed from another point of view and in greater detail in 3.22.

A third type of linguistic change that has been proposed and that would invalidate the set hypothesis is rule reversal. If there is an historical rule that relates two dialects by reversing the order of two rules in one of them, then that reversal rule would not belong to the set of possible synchronic rules. Kiparsky felt that such a change had occurred in some German dialects.[46] These dialects have the underlying morpheme 'spāt' which can occur before juncture and before certain umlauting suffixes (herein symbolized as # and X, respectively). Dialect A has the two following rules:

1) umlaut before X giving the forms spāt#, spǟtX
2) ā → ɔ̄ " spɔ̄t#, spǟtX

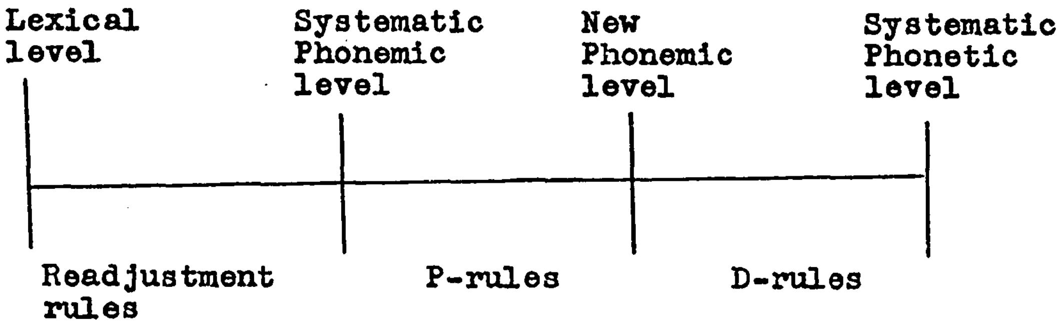
Dialect B has the rules in the reverse order:

1) ā → ɔ̄ giving the forms spɔ̄t#, spɔ̄tX
2) umlaut before X " spɔ̄t#, spɔ̈̄tX

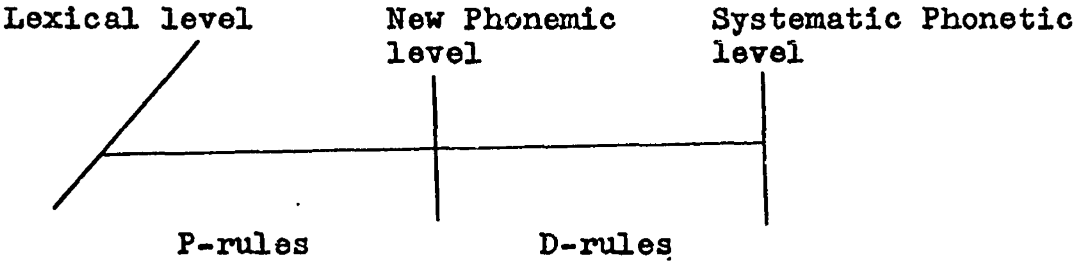
However, it appears to be more plausible to assume that the second dialect has merely dropped the first rule and restructured the lexicon.[47] This seems especially true in view of the fact that these two sets of rules proposed by Kiparsky are supposed to be synchronic rules, when in fact rule 1) in Dialect B is recoverable only in comparison with other dialects, and not internally.

1.43 A Composite Model

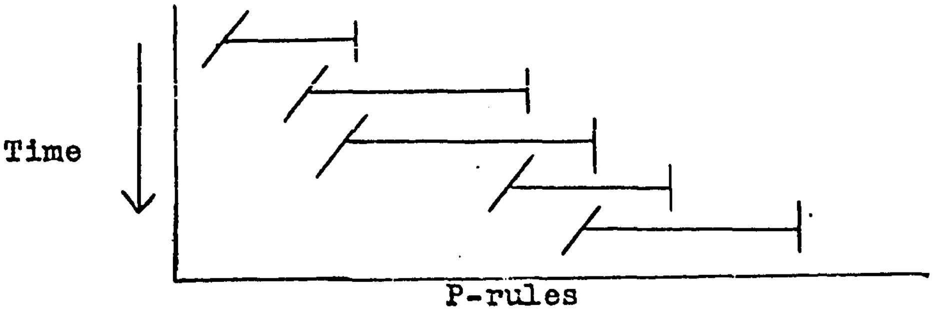
The modified synchronic model presented in 1.1 is of the form:


Lexical level
Systematic Phonemic level
New Phonemic level
Systematic Phonetic level
Readjustment rules
P-rules
D-rules

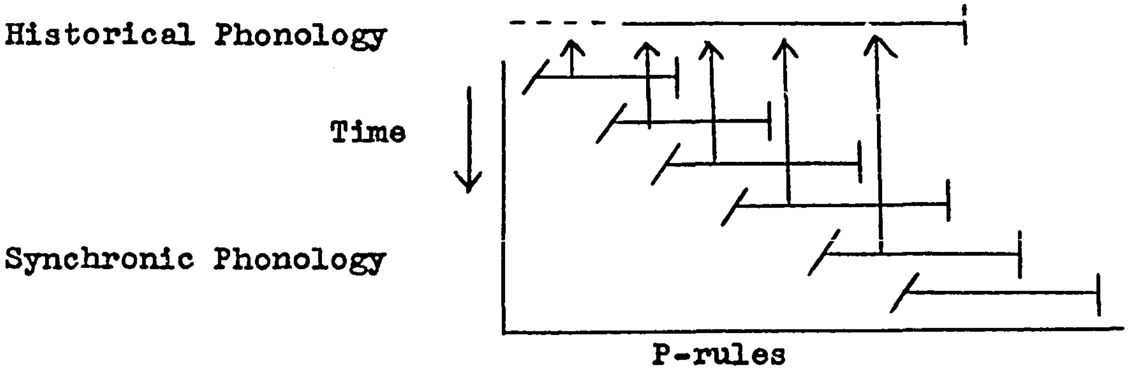
In 1.2 and 1.3 I suggested that there are difficulties in considering abstract representations of the systematic phonemic type as constituting a level. To emphasize their mixed nature and the semi-phonological nature of the readjustment rules, I propose to revise the diagram above as follows (this revision will be further justified in 1.5 and 1.6):


Lexical level
New Phonemic level
Systematic Phonetic level
P-rules
D-rules

Now, if through time, new P-rules enter a language at the new phonemic level either directly (jump change) or via the D-rules (drift change) and are dropped from the deeper layers of the phonology, it would seem that a synchronic phonology is continually deleting and adding rules. Graphically:


Time
P-rules

As rules are droopped, they are 'picked up' by the historically recoverable phonology, the number of rules in which is limited only by how much we know about the language.[48] Graphically:



The only difference between the various sets of P-rules will be what data are examined, i.e, not only will historical P-rules and synchronic P-rules not differ in kind, but synchronic P-rules will be seen as the tail-end of the historical P-rules.[49]

1.5 Towards an Organic Model of Phonology

We have pushed this revision of the standard generative model about as far as it will go. Moreover, this new model still has several flaws and it does not explain why the older model created some artificial problems.

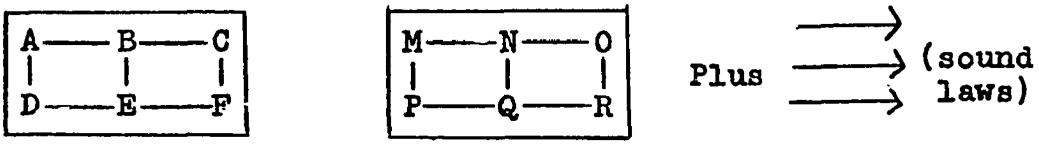
1.51 Synchrony versus Diachrony

1.512 The False Dichotomy

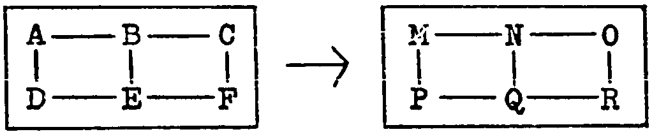
Before Saussure there was essentially no place in linguistics for synchrony. Language was described in terms of change in positive entities. Graphically:

$$\begin{tikzcd}
A \arrow[d] & B \arrow[d] & C \arrow[d] & D \arrow[d] & E \arrow[d] & F \arrow[d] \\
M & N & O & P & Q & R
\end{tikzcd}$$

Saussure and later structuralists developed the concept of a system, the members of which were defined solely by their interrelations. In other words, systems contained negative oppositions and were not inventories of positive entities. Synchronic analysis pertained to static systems at various time depths; diachronic analysis was a separate field altogether. Graphically:



In the process of evolving his notions of system, Saussure made two useful and valid dichotomies. These were the dichotomy between synchrony and diachrony and the dichotomy between paradigm and syntagm, or relation and process. He made one false move, however, and that was to solidly identify diachrony with process and syntagm, and synchrony with relation and paradigm. This was further extended by later linguists to mean that by comparing genetically related languages and making up proto-reconstructions and rules of change they were dealing with process through time and not at any given time. Moreover, synchronic systemization of a language was viewed as proceeding with an analysis based solely on internal data in order to establish relationships between elements in the system. In this view one entity could not change into another synchronically, just as diachronically change affected elements in linear contexts (the syntagm) and not in systems. The generativists rectified this view by allowing for syntagmatic process statements (change rules) in synchronic analyses. Modern process phonologies based on this notion contain in theory two or more synchronic systems which are interrelated by semi-historical phonological rules. Graphically:



But the generativists kept the false notion of analyses based solely on internal evidence and they excluded explicit, discrete paradigmatic analysis altogether. This led to the difficulties with the 'systematic phonemic level' mentioned earlier in this chapter.

1.512 The Real Dichotomy

It can readily be shown that all synchronic phonologies no matter what the orientation of the linguist are in fact determined by comparative criteria. One of the main efforts of modern linguistic investigation has been towards finding universal criteria of the nature of the phonological system in language, as opposed to a language. These criteria have always been used in forming 'synchronic' analyses. It should be obvious, then, that 'synchronic' analyses can in no way be said to be based solely on internal criteria. What we must recognize is the different kinds of comparison involved and the uses to which they are put. It then becomes obvious why change, syntagm and the dynamic view of phonology are appropriate for synchronic phonology. This is one valid aspect of language whether viewed over a period of time or whether viewed only at one point in time. Excluding time as a factor in the analysis does not exclude the internal use of time in a grammar. The relaxation of the diachronic/synchronic dichotomy which this model represents was a necessary step in advancing our knowledge of phonology.[50]

But linguists must not now overlook the importance of the older static, relational view of phonological structure. There is also a valid need in phonology to be able to express the relationships of elements in the phonological system without reference to allomorphy and the like. It is my hope that system can now be reincorporated in its proper place, i.e., in the systemic analysis of the new phonemic level. This is a real level at which such notions as paradigm, system, marking conventions, and traditional phonemicization should be applied. Thus on the one hand we can say with respect to the Mandarin palatals problem presented above that there is little 'internal' evidence on which to settle the question of a deeper underlying representation for the morphemes with palatals; but equally we can say that the palatals represent a reduction of the four way /p-t-ts-k/ contrast to a /p-t-$\genfrac{}{}{0pt}{}{\text{ts}}{\text{k}}$/ contrast in certain environments. Syntagmatically we may also say that this situation arose due to palatalization of both the dental affricates and the velars; this statement is based on 'internal' and general comparative evidence.

In effect, this merely divorces the problem of the relationship of allomorphs and underlying representation of forms from the problem of finding the invariant phonological elements of a language and their relationship to each other.

And, if we are going to put both syntagm and paradigm back into synchronic phonology, we must also return paradigm to diachronic phonology as well. Thus, historically, we can say that a phonetic change entered Mandarin which changed a new phonemic system containing a /p-t-ts-k/ contrast in all environments to one containing a /p-t-ts-k/ contrast in some environments versus a /p-t-ts-tç/ contrast in others. The underlying system and representations, of course, remained the same. Then, the change was generalized to include [ts] as well and we now have /p-t-ts-k/ versus /p-t-tç/.[51]

1.52 More False Contradictions

1.521 Process versus Relation

Battles have raged among linguists for years over this issue. The difference has sometimes been depicted as Item and Arrangement versus Item and Process, and sometimes as Generative Phonology versus Stratificational Phonology. In every case it has been a matter of saying that the phonological pie must be cut up one way or the other, i.e., re-insisting on the Saussurian identification of dichotomies. As we have seen, however, phonology has both a static, paradigmatic aspect and a dynamic, syntagmatic aspect, both at any point in time and through time. The difference between the two could be said to be similar to the difference between a digital clock and a round, two-handed traditional clock. The makers of neither clock, of course, should maintain that time is their way of representing it. Or, as Zeno of Elea put it in his paradox #7:

> So long as anything is in a space equal to itself, it is at rest. An arrow is in a space equal to itself at every moment of its flight and therefore also during the whole of its flight. Thus the flying arrow is at rest.

We might paraphrase this by saying that the flying phonology is at rest.

1.522 Jump versus Shift

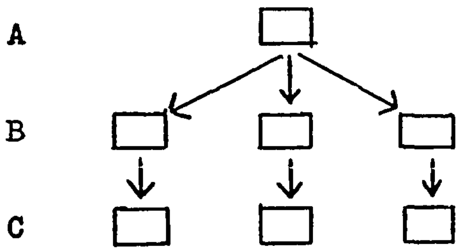
As we noted above, Moulton holds that most sound change is gradual. On the other hand, H. Hoenigswald in a talk at Princeton on February 21, 1968, pointed out that phonemic change from the structuralist point of view must be jump change. A system containing a //kn// versus //n// contrast (knot ≠ not), no matter how 'weak' the velar allophone before //n//, is different from a system with no such contrast; the velar may weaken as a result of phonetic drift but its loss of contrast with a plain dental nasal must be a 'jump.'

However, the controversy over 'jump' versus 'drift' change is due to just the difference in point of view we have been propounding in this section. The phoneme as a paradigmatic, structural unit is defined by its relationship to other elements in the structure. When phonemes are viewed at two different points in their trajectory along a path of sound change, it will appear that the difference between the earlier stage and the later stage is a jump change. On the other hand, defining the motion of the phoneme along its change path as we do in present day generative phonologies obscures the exact state (systemic relationships) of the phoneme at any given point in time. In other words, the dynamic state and the static, structural state are merely two extreme ways of looking at the same phenomena. This may be one reason why generative phonology with its essentially dynamic viewpoint finds the notion of a system of contrasting elements so difficult to accomodate. On the other hand, exclusive concentration on system, as in stratificational theory, requires sound change to be stated in the rather ad hoc fashion of changes in a network; these network changes have no particular motivation, i.e., they operate in a way that makes change appear to be entirely external to the system.

Perhaps the ideal way to express change would be to write rules that trace a continual curve through an infinite number of points--an integral calculus of phonology. The phonology would consist of an array of a number of such formulae that would express the dynamics of each trajectory and its ever changing relationship to every other trajectory in the phonology. Now the only 'natural' point at which some such dynamic set of rules would automatically present in a given language a 'system' in the structuralist sense would be at the new phonemic level, i.e., at the point where all trajectories are stopped by time as in a still photograph. We can also see why in generative phonology with its emphasis on tracing trajectories, the upper ends of each of the trajectories do not form a system in the synchronic analysis of one language because the ability that the linguist has to specify longer and deeper trajectories is dependent not on knowing a point in time but on the accidental preservation of trajectories in a language.

1.53 The Syntagmatic Model and Historical Phonology

Using the framework of syntagmatic phonology within this organic model, we might compare the phonologies of a set of genetically related languages. This would give us, schematically:



where B (underlying phonological forms) to C (new phonemic level) represents the usual process phonology of a distinct language and A (proto-system) to B represents the greater historical depth we can reach by comparison.

This model accounts for historical change in various ways. One way is for small, gradual, but accumulative changes to occur in the exact n-ary value of a new phoneme in some continuum until it interferes with the n-ary value of another new phoneme. Another way would be for a language to start operating the D-rules in such a way that two of them would have to be strictly ordered, with the result that one would enter an upper level as a P-rule, i.e., become a systemic change. A third would be for some new rule to enter directly at level I. A fourth would be for a rule to drop with consequent restructuring of the lexicon.[52] Chafe has also mentioned another kind of change: conversion of a transient rule into a persistent rule. The total effect is for changes to enter at or near C, to move towards B and then to drop off into A-B. This syntagmatic model also accounts for the hypothesis of the universal set in that it shows why historical P-rules must be the same as synchronic P-rules.

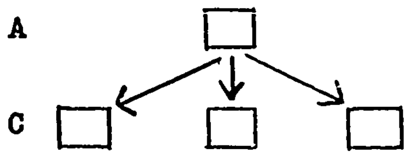
1.6 Conclusion

I have questioned at length the extent to which the systematic phonemic level constitutes a real linguistic level. In a description based on a widespread corpus from a language of a civilization with extensive literacy and a large literature, the systematic phonemic level cannot be regarded as necessarily valid for any given speaker of that language. It seems more likely to be the case that some speakers, if not all, will have representations of some morphemes in a shape no more abstract than the new phonemic. This set of morphemes will be idiosyncratic to each speaker.[53] In addition, the systematic phonemic level may cause us to make statements about a language that are historically invalid, and may, indeed, complicate our description of how the modern language developed from some ancestor. The problems with its relationship to performance and history arose when it was forced to become more than it really is. Even though the putative systematic phonemic level appears at a well-defined place in sentence generation, it is not a system. It contains more or less haphazard relics of an older system (or older systems),[54] that is, items of various depths, so that it is not a level. It follows that the lexical level is also not a valid level.

I have also shown how these problems and confusions arose. We must isolate the two aspects of phonology, syntagm and paradigm, and give each its due. Syntagmatic phonologies will deal with process rules that describe linguistic change and that may be preserved as morphophonemic alternation in a language. Paradigmatic phonologies will deal with the occurring phonological elements and their relationships, as well as the relationship of the phonology of a language to universal norms of system.

We must therefore conclude that since the systematic phonemic level in terms of performance is too abstract, psychologically unreal, arbitrary and indeterminate, and since in terms of historical phonology it is uneconomical and obscurantist, it must not be a linguistic reality. What we can say is that some morphemes in a language have underlying shapes which are more abstract than the underlying shapes of other morphemes. The rules that relate these more abstract forms to their surface shapes belong, in part, to a universal set. These rules explain synchronically the current relationships between entities in the surface system; historically, they are the most recent changes that have occurred in the language.

The result is that, just as the generativists have shown that there is no level between the systematic phonemic and systematic phonetic levels to accomodate the earlier phonemic level, in the same way there is no natural point in a syntagmatic phonology where we can show absolutely that prior to that point we have diachrony and following it, synchrony. We can further simplify the diagram on page 49 to:



where C is the new phonemic level. A is itself arbitrary as a level (the limits on its depth are extra-linguistic, i.e., dependent on the choice of data). A form in a phonology will have a representation on level C and may have a deeper underlying form. But there is no synchronic level between A and C that contains elements of which all forms in the language must be composed.

1. Postal, Paul M., Aspects of Phonological Theory, Harper and Row, New York; 1968.

2. Ibid., p. 33.

3. Chomsky, Noam, Topics in the Theory of Generative Grammar, Mouton and Co., The Hague; 1966. p. 76

4. Postal, op. cit., pp. 64-65.

5. Chomsky, op. cit., pp. 76-77.

6. Detail Rules have the property of local determinacy; i.e., they belong to some specifiable universal set and are restricted in their application such that given a binarily marked segment, there will be only one, or a small number of, Detail Rules that may apply to it; likewise, a given phone can only be the result of the application of one, or of a small number of, Detail Rules. In other words, since Detail Rules supply redundant phonetic information, abstraction of binarily marked segments from phones is often possible merely by examining the phonetic data without taking into consideration any grammatical information. (Postal, op. cit., p. 66 ff.)

   From this it would appear that the English stress rules proposed by Chomsky and Halle which deal with integral values on a continuum cannot be regarded as Detail Rules.

7. Chomsky, op. cit., p. 80.

8. One of the points being made in Chomsky's definition is that the representation reached in the generation of sentence X after the application of, say, phonological rule 28 is not a level of representation of that sentence because it fails the two criteria. It is not a system and the point in the generation, though easily defined, is not well-defined. 'Well-defined' is probably equivalent, in this context, to 'motivated.'

9. Chomsky, op. cit., p. 77.

10. There is, of course, the physical phonetic level, but I am only concerned with phonological levels.

11. Chomsky, op. cit., p. 80.

12. Halle, Morris, "The Sound Pattern of Russian," Description and Analysis of Contemporary Russian, Jakobson and Van Schooneveld, eds., Mouton and Co., 's-Gravenhage; 1959, Vol. I. pp. 63-64.

13. *Ibid.*, pp. 79-80.

14. Some P-rules in some languages may deal with n-ary values, e.g., rules governing stress in English.

15. From the learner's (or the linguist's) point of view, the rules can only be formulated by identifying allomorphs; moreover, the fact that a given rule has applied in the case of a given allomorph is deducible only if the form is perceived to be related to another allomorph of the morpheme *and* if the proper base form that entails the application of the rule is posited. Thus, from the allomorph 'table' it will not be possible to infer the rule

$$u \rightarrow ə$$

unless some allomorphy has been identified as exhibiting the relationship *and* if the form *tabul-* (as in 'tabular') has been identified as *an* allomorph of 'table.'

16. Just this situation occurs in one of the Wu dialects. In Wen Zhou tone sandhi, the combination 平 + 去 yields the tones [213 + 43] . At the time that this rule occurs in a generative phonology of Wen Zhou 平 is [22] and 去 is [42] . As P-rules, the changes would be stated as follows:

Either: 1) $22 \rightarrow 213/\_\_\_\ 42$
2) $42 \rightarrow 43/213\ \_\_\_$

Or: 1) $42 \rightarrow 43/22\ \_\_\_$
2) $22 \rightarrow 213/\_\_\_\ 43$

(Neither order affects the rest of the phonology). However, as unordered D-rules, they would be:

$$\begin{bmatrix} +\text{High} \\ +\text{Falling} \end{bmatrix} \rightarrow 43/ \begin{bmatrix} -\text{High} \\ -\text{Rising} \\ -\text{Falling} \end{bmatrix} \begin{bmatrix} \_\_\_\_ \end{bmatrix}$$

$$\begin{bmatrix} -\text{High} \\ -\text{Rising} \\ -\text{Falling} \end{bmatrix} \rightarrow 213/ \begin{bmatrix} \_\_\_\_ \end{bmatrix} \begin{bmatrix} +\text{High} \\ +\text{Falling} \end{bmatrix}$$

The second solution accounts for the data with a minimum of theoretical artifact.

17. Wm. S-Y Wang in class on April 3, 1967, at the University of California, Berkeley. In particular, he cited the following reasons for the necessity of a phonological level between the systematic phonemic and the systematic phonetic levels:
Internal: 1) for many morphemes, a systematic phonemic representation is too abstract, and 2) many morphemes through lack of allomorphy have non-unique systematic phonemic representations.
External: 1) many facets of language acquisition cannot be understood without such a level, and

2) poetic devices such as homonomy, rhyme and assonance cannot be explained in terms of a systematic phonemic representation because it is too abstract, nor in terms of a systematic phonetic representation because it is too detailed.

18. Wang has pointed out to me personally that 'man' may have an allomorph in such forms as 'postman.' It is not clear to me that the two forms 'man' and '-man' should be regarded as the same morpheme in a synchronic description of modern English; but if they should, I stand 'pat' on 'cat.'

19. Mandarin also has forms such as [tʂa] and [tʂu], but the syllable [tʂʅ] may be //tʂi// phonemically so that the retroflexives are not involved in this simplified version of the problem with the palatals.

20. It has been suggested that with zero markings allowed for distinctive features the /tçi/ type phenomena can be phonemicized without commitment to any of these possibilities. As a matter of fact, all such solutions I have seen really amount to either (a) or (b).

21. There are a few morphemes that do reveal the changes through alternative readings:

港 [kɑŋ] $\overset{f}{\sim}$ [tçiɑŋ]　　俊 [tsuən] $\overset{f}{\sim}$ [tçüən]
嚇 [xə] $\overset{f}{\sim}$ [çiɑ]　　遜 [suən] $\overset{f}{\sim}$ [çüən]

I am indebted to Mantaro Hashimoto for these forms.

22. Chafe, Wallace L., "The Ordering of Phonological Rules," Project on Linguistic Analysis Reports, Second Series, No. 2; October, 1967. Phonology Laboratory, Department of Linguistics, University of California, Berkeley. p. C-4.

23. These revisions of the typical generative model, though drastic, are derived entirely from problems and logic internal to the generative model. Wang has proposed an alternative solution for some other problems in English phonology that seems to be relevant here. For such irregular pairs as obese/obesity (cf. opaque/opacity), he has proposed that forms in the lexicon be marked as to whether a given rule is to be applied or not. In other words, some marking system would prevent the second vowels in obese, obesity from indulging in the [ey] / [æ] alternation of opaque, opacity. This proposal would appear to compete with mine for some of the examples cited above. However, it does not really seem to say anything different from my proposal; it is a considerably more complex notion; and it will not handle the Mandarin palatals or the problem of excessively abstract representations. Why not let exceptions just be

recorded in the lexicon in a new phonemic shape? Of course, where there is a small but significant *set* of exceptions all sharing the same property (such as the strong verbs in English) some other factors are involved.

24. Moulton, Wm. G., "Types of Phonemic Change," *To Honor Roman Jakobson*, Mouton and Co., The Hague; 1967. pp. 1393-1407.

25. Thus, Moulton, *op. cit.*, p. 1398:

> ...This allophone become more and more similar to an allophone of some other allophone until the two become phonetically identical....

And again, on p. 1395:

> ...two phonemes move toward each other until they merge....

As against, p. 1396:

> Short and long consonants thereby merged phonemically even though they did not (yet) change phonetically....

Or, p. 1396:

> In early OE, [f] and [ƀ] contrast both medially and finally. But then medial [f] is voiced to [v] , *and final* [ƀ] is unvoiced to [f] ....

And to sum up, p. 1405:

> Of the ten types of phonemic change discussed above, it seems to me that nearly all must be gradual in nature, involving a considerable period of fluctuation before the new system clearly replaces the old. The only phonemic changes which may truly be 'sprunghaft,' and actually take place in one jump, are those based on morphophonemic analogy.

There seems to be a problem here with the word '*gradual.*' On the one hand, Moulton could mean to indicate just phonetic drift. On the other hand, he may mean drift and/or the systematic fluctuation mentioned just a bit later.

26. Wang, Wm. S-Y, "Competing Changes as a Cause of Residue," *Project on Linguistic Analysis Reports*, Second Series, No. 2; October, 1967. Phonology Laboratory, Department of Linguistics, University of California, Berkeley. p. W-2.

27. *Ibid.*, p. W-5.

28. This is opposed to Moulton's view:

> ...such phonemic splits seem never to result from phonetic change of the phones involved... but rather from some second, quite independent change....

Moulton, _op_. _cit_., p. 1394.

29. Wang, _op_. _cit_., p. W-14.

30. This row represents Dong Tong-he's reconstruction of Middle Chinese, based, primarily, on philological materials.

31.

> But the Koine [Middle Chinese] was sufficiently widespread...to have become the ancestor of nearly all of the present dialects (except the Min dialects in Fukien and adjacent regions).

Karlgren, Bernard, _Compendium of Phonetics in Ancient and Archaic Chinese, The Museum of Far Eastern Antiquities, Stockholm_, Sweden, Bulletin No. 26; 1954. p. 212, footnote 2.

32. In addition a very old grammar (Montgomery, P. H. S., _Introduction to the Wenchow Dialect, Kelly and Walsh, Ltd., Shanghai-Hongkong-Singapore_; 1893) has the _u/ey_ phonetic distinction, but some words in the grammar are not given the same final my data indicate.

33. Chafe, _op_. _cit_.

34. In addition there is the question of simultaneous order. Simultaneous order probably occurs historically in the sense that two unrelated changes may occur in a language at the same time, but there appears to be no way at present to determine historically or synchronically if two rules must be applied simultaneously unless they are collapsed into one rule, such as an alpha rule, where flip-flop is involved.

35. Chafe, _op_. _cit_., p. C-23.

36. The description of this set is suspiciously like the description of the D-rules mentioned above. If most of the operations covered by these randomly ordered rules really should be covered by D-rules, then we can see why they affect the phonetic output directly, appear to be simultaneously ordered, and should be considered to apply at level I. We can also see why speakers can be assumed to know all of them--they all have direct, observably phonetic effect.

37. Chafe, _op_. _cit_., p. C-24.

38. "I would like to assume that phonological change normally takes place through the addition of a new rule to depth I."
Chafe, op. cit., pp. C-27-28.

39. As Chafe puts it:

> Obviously many old rules are sooner or later lost. Loss of a rule is not directly dependent on its degree of depth, however, but probably rather on something which can be roughly referred to as the amount of work it does in the language.

Chafe, op. cit., p. C-28.

40. Of course, the rule may be recoverable from comparison with other languages (or from dictionaries, etc.) but this does not prove that it is an active synchronic rule. (It is probably a moot point to decide at just what time the rule, like the Cheshire cat's smile, has disappeared synchronically.)

41. Chafe says of underlying forms:

> Let us pretend at first that there is a complete correlation between underlying phonological forms and historically earlier forms in a language, and between the phonological rules which lead from such underlying forms to phonetic forms and the historical changes which led from earlier forms to those presently in use.

Chafe, op. cit., p. C-4.

42. Kiparsky, Paul, "Linguistic Universals and Linguistic Change," Universals in Linguistic Theory, Bach, E. and Harms, R., eds., Holt, Rinehart and Winston, Inc.; 1968. p. 182.

43. Nothing in the above statements refers to environments. It may be possible to make statements concerning some of them at some future time, but at present most appear to be so random, accidental, and language-specific, as to be impossible to include in a universal theory.

44. The first two counter-examples are from Wm. S-Y Wang.

45. It turns out that the counter-example is slightly fictitious anyway. English was never subject to a historical k > s change; it borrowed the rule from French when it borrowed the forms revealing the rule. French was subject to an overall k > s shift and the investigation of the intermediate steps involved (if any) must be resolved in Romance philology.

46. Kiparsky, op. cit.

47. This in brief is Chafe's solution to the same problem. Chafe, *op. cit.*, pp. C-30 ff.

48. As Chafe points out, this does not mean that the historical phonology and the synchronic phonology of the same language differ only in size. In the first place, the readjustment rules represent semi-regular historical change. Moreover, Postal suggests that synchronic phonologies must include *exception rules*, which in general are morphological properties written as instructions to the grammar to violate some rule with respect to certain morphemes. Those rules have an only partially equivalent historical counterpart in that it is frequently possible to posit a proto-form for some morphemes where some of the compared languages show irregular forms that would indicate a proto-form of a different shape. In other words, they may be said to apply an exception rule to given morphemes to the effect that they are irregularly shifted from their correct correspondence to another one. In addition, ordering in the historical phonology will be internally determined and will not necessarily reflect the order in the synchronic phonology or the order of loss.

49. Note that the system can be interfered with when a rule enters a language through large scale borrowing instead of through internal processes. Since these borrowings will presumably be excluded from historical consideration, the borrowed rule may not fit into this overall pattern of synchronic   diachronic rule loss.

50. Chafe says:

> It is my view that general historical factors, factors of language change which are familiar to all linguists, suffice to show why non-phonetic structures must be recognized in language, why they should be of a particular kind, and why they should be related to each other and to phonetic structure in a particular way. Only an unfortunate over-emphasis of the distinction between synchronic and diachronic linguistics was for some time able to obscure the otherwise rather obvious consequences which 'sound change' has for the nature of phonological structure.

Chafe, *op. cit.*, pp. C1-2.

51. I have restricted myself in Chapters II and III to dynamic rules and descriptions. I discussed paradigm in phonology in a paper to the Winter LSA meetings in New York City, December 28, 1968. Notions in this area of phonological theory are extremely vague at the moment. The basic rationale, however, is clear and forceful.

52. As Chafe puts it:

> One kind of phonological change, then, is the loss of a phonological rule and an accompanying change in some underlying forms.

Chafe, *op. cit.*, p. C-30.

53. In the sense that there will be no universally valid way for the linguist to show that the speakers have been exposed to the necessary data to give them the opportunity to form a morphophonemic rule covering the forms, and/or give the morpheme a more abstract underlying shape.

54. In proto-languages it may be possible to posit a certain phonetic relationship among elements A, B and C, and another relationship between X, Y and Z, but it will often be impossible to prove that the relationships A-B-C and X-Y-Z must have co-existed in one system. The same holds true of the systematic phonemic level.

Chapter II

Proto-Wu

2.0 Introduction

The reconstructed phonology to be discussed in this chapter is based on 13 Wu dialects. The phonological systems of each of the dialects, the bibliographical references for the source material, and a map showing the geographical locations of the dialects will be presented in Chapter III. 2.1 is devoted to the reconstructed Proto-Wu phonology; 2.2 discusses the correspondences in detail and presents the arguments for the reconstructions chosen; 2.3 suggests ways in which the historical ambiguities and indeterminacies may point towards a simpler (older?) underlying system.

2.01 Principles of Reconstruction

The proto-language presented is not presumed to be a real linguistic system for several reasons. First, some reconstructions are little more than arbitrary devices to indicate given correspondences, i.e., their phonetic quality is in doubt.[1] Second, there is no proof that all reconstructed contrasts co-existed at any point in time. For example, there is no way to prove that the *ien/*ian distinction co-existed in the same system with, say, the *o/*u/*ou contrast. Third, the phonological character assigned to any particular reconstruction can only approximate some features of the proto-contrast, and it can say little with respect to the problem of which features were redundant at earlier stages in the language. What I have done is to follow essentially a neo-grammarian approach in establishing the minimum number of contrasts required. Then I have tried to assign as many of the features that appear in the dialectal variants as seem likely to be preservations of older contrasts.[2] A feature is, generally speaking, regarded as a preservation if it fits into an interlocking set of developments affecting a class of sounds in any given dialect. Please note that I have made *no* attempt to 'phonemicize' the proto-system on the basis of complementary distribution, but only on the basis of systematic relationships between correspondences. In other words, complementary distribution was ignored whenever the dialectal evidence supported keeping any two correspondences different (but not distinct?) in more ways than the complementary distribution would necessitate. This approach is the historical counterpart of the position I took in Chapter I to the effect that the putative systematic phonemic level was in fact not a uniform system.

2.02 Notes on Notation

Except for 10.JH, the notation is as given in the source material and is in the system generally used by Chinese linguists. The material for 10.JH was given in a special romanization system that I have attempted to convert to the phonetic transcription used elsewhere. The conversion particularly in doubt is the one listed in the charts as [ə] . Its phonetic value may vary in some contexts, particularly after [u] and [y] , where it may be [ɛ] . 10.JH and 12.YK have a distinction between such nuclei as [u:a] ≠ [ua:] . I have used the IPA notations [VV̆] and [V̆V] to mark this difference for these dialects. Where it was not possible to determine the prominent vowel in these clusters in 12.YK, neither segment is marked.

Some symbols may present some difficulties. The symbol [ʋ] used in 9.WZ.2.3 indicates a high back vowel with lip spread and protrusion and a great deal of [β] -like friction giving the acoustic effect of rounding. The so-called strident vowels are transcribed in Karlgren's symbols. These are:

ɿ ʮ ʯ

The first two are non-retroflex; the last one is retroflex. The second and third are rounded; the first is not. These vowels occur only after affricates and the feature of retroflexion for the vowel is always marked with the same value as for the initial affricate. These have sometimes been described as syllabic fricatives. The vowel quality lies in the ɨ--ẹ range for the unrounded vowel and ʉ--ø̣ for the rounded ones. These vowels are always accompanied by a great deal of [z] -like friction.

The symbols [c, ch, ɟ] and [ç] designate palatal stops and fricatives; [tɕ, tɕh, dʑ, ɕ] and [ʑ] designate palatal-alveolar affricates and fricatives. The retroflexives (tʂ, tʂh, dʐ, ʂ, ʐ) are palatal-alveolar affricates and fricatives with the tongue in a wedge shape (in a cross cut view) and with the tongue tip curled back. I use [h] for aspiration in Proto-Wu and 10.JH. The voiced initials may in some dialects have aspiration. [h] and [ɦ] as initials mean voiceless and voiced glottal fricatives.[3]

Capital letters are used throughout to indicate the whole series of initials (unless otherwise indicated) in a given position of articulation, e.g., P = p,ph,b,m,f,v.

2.1 Proto-Wu Phonology

Proto-Wu will be discussed on the basis of a tripartite division of the syllable into Initial (consonants), Finals (remaining segmentals), and Tones.

2.11 Initials

The Proto-Wu initials are as follows:

Labials	Dentals	Affricates	Palatals	Velars	
p	t	ts	tç	k	ʔ
ph	th	tsh	tçh	kh	
b	d	dz	dʑ	g	
f		s	ç	h	
v		z	ʑ	ɦ	
m	n		ȵ	ŋ	
	l				

No voiceless or syllabic nasals or laterals were reconstructed. Even though most dialects have both synchronically, they show up in words in different correspondences. Thus, very few words in the Proto-Lexicon show exclusively a voiceless (i.e., high register tone) or a syllabic nasal or lateral reflex in all dialects, though several words do show one in some dialects.

Since there is no synchronic or diachronic contrast in the Wu dialects between aspirated and non-aspirated voiced initials, the voiced sounds in the proto-system are neutral vis-a-vis this feature.

The fricatives *f and *v are of very limited distribution, but there is no evidence in Wu of a stop provenience for them.

*h and *h may have been either [h], [ɦ], or [x], [ɣ] depending on the interpretation of the data from the dialects. I have used *h,ɦ to symbolize these correspondences because all the dialects that have /ɦ/ show only [ɦ] and because only a very few dialects show [x] for *h.

*ʔ is frequently just the zero-initial, and many dialects appear to lose it entirely, but I have written it into the proto-phonology to avoid listing a confusing zero initial symbol in morphemes and charts.

The most perplexing initials are the palatals. It is clear from the data that some sort of affricate series should be reconstructed here but its nature was difficult to determine. Two modern dialects, 2.WH and 3.CS, show retroflexives as reflexes of this series; in addition 1.SZ is said to have had retroflexives in the recent past. However, a few other dialects show some palatals for this series, and most dialects merely show plain dental affricates as the main reflex. The choice for palatals was made on the basis of the following considerations. Ancient Chinese probably had both palatals and retroflexives as well as plain dentals. In Wu the two non-dental series fell together and cannot now be clearly distinguished. However, after many discussions with Y. R. Chao, Mantaro Hashimoto, Anne Hashimoto and Paul Kratochvil (none of whom may be held responsible for my statements) I concluded that the palatal affricate represented the most unmarked sound in the palatal region. That is, the normal palatal is [+strident] and [+sharp] (in the Chinese area). The retroflexives are in the same position of articulation ([-diffuse]), but they seem to be [+flat] and redundantly [-sharp] . Y. R. Chao suggested that the IPA symbol [tʃ] might be the best choice to represent this non-differentiated Proto-Wu series, but he later informed me of some dialects in Western Shantung province that show a distinction between plain dentals from Ancient Chinese plain dentals, retroflexives from A.Ch. retroflexives, and a [Tʃ] series from A.Ch. palatals; in addition A. Ch. velars become, in turn, palatals in certain environments. It seems that the palatals created from velars put pressure on the pre-existent palatals. What any given dialect did in this situation varied a great deal; in Shantung at least the A.Ch. palatals were forced forward, but maintained a contrast with plain dentals.[4] Wu, however, supports only one affricate series besides the dentals. Since we can assume that for Wu palatals merged into retroflexives or that retroflexives merged into palatals, I chose palatals on the basis of their being the most unmarked non-dental affricate.

2.12 Finals

The Proto-Wu finals may be divided into three classes: open, nasal and stop. The open finals are:

i	y	ɨ, ɨ1, ɨ2	u o	ou	ai, uai ei, uei, yei
	a, ia		ɑ		au, iau, ɑu eu, ieu, ɤu

*ou classes with the simple vowels *u and *o, not with the other -u off-glide finals. Barred ɨ stands for the strident vowel.[5]

The nasal finals are reconstructed as follows:

ien	ɤn, uɤn, yɤn	on
an, ian, uan		
iŋ, eŋ, ieŋ	ɤŋ, uɤŋ, yɤŋ	oŋ, ioŋ
	ʌŋ, uʌŋ	iɔŋ
aŋ, iaŋ, uaŋ	ɑŋ	, uɑŋ, yɑŋ

The stop finals are:

iet	ɤt, uɤt, yɤt	ot
at, iat, uat		
ik, ek, iek	ɤk, uɤk, yɤk	ok, iok
	ʌk, uʌk	ɔk, iɔk
ak, iak, uak		

2.13 Distribution of Initials and Finals

The following chart depicts the overall initial/final distribution in Proto-Wu.

	*i	*y	*u	*ou	*o	*a	*ia	*ɑ	*eu	*ɤu
*P	x		x	x	x	x		x		
*T	x	x	x	x	x	x	x		x	x
*TS	x	x	x	x	x	x	x	x	x	x
*TÇ	x	x					x			
*K	x	x	x		x	x	x	x		x

	*ieu	*ai	*uai	*ei	*uei	*yei	*ɑu	*au	*iau	*iŋ
*P				x			x	x	x	x
*T	x	x		x			x	x	x	x
*TS	x	x			x	x	x	x	x	x
*TÇ	x								x	x
*K	x	x	x		x	x	x	x	x	

	*eŋ	*ieŋ	*oŋ	*ioŋ	*iɔŋ	*ʌŋ	*ɤŋ	*yɤŋ	*ɑŋ	*uɑŋ
*P			x			x	x		x	
*T			x			x	x		x	
*TS	x		x		x	x	x		x	
*TÇ	x			x	x			x		x
*K		x	x	x	x		x	x	x	x

	*yaŋ	*aŋ	*iaŋ	*an	*ian	*ien	*on	*ɤn	*yɤn	*ik
*P		x		x		x		x		x
*T		x	x	x	x	x	x	x		x
*TS		x	x	x	x	x	x	x	x	x
*TÇ	x		x			x			x	x
*K	x	x	x	x	x	x	x	x	x	

	*ek	*iek	*ok	*iok	*ɔk	*iɔk	*ʌk	*ɤk	*ak	*iak
*P			x		x			x	x	
*T			x	x	x		x			x
*TS	x		x	x	x	x	x	x	x	x
*TÇ	x			x		x				x
*K		x	x	x	x	x	x		x	x

	*at	*iat	*iet	*ot	*ɤt	*yɤt
*P	x		x		x	
*T	x	x	x	x	x	
*TS	x	x	x		x	x
*TÇ			x			x
*K	x		x	x	x	x

*K only: uan, uat, uɤn, uɤt, uaŋ, uak, uʌŋ, uʌk, uɤŋ, uɤk, yɤk

*TS only: ɨ *TÇ only: ɨ1, ɨ2

2.14 Tones

There are four Proto-Wu tone classes, *I, *II, *III and *Stop. I have assigned the following features to each of the tones:[6]

*I: Falling *II: Rising *III: Falling-Rising *Stop: Rising

2.15 Proto-Wu Rules

The data point towards the reconstruction of two rules for Proto-Wu as well as an inventory of reconstructed sounds. The two rules are concerned with velar fronting and allotony.

From general phonetic evidence and from several historical considerations, it seems likely that Proto-Wu had a front allophone for velars (less *ɦ and *ʔ) before finals in *i, i-, y, y-. One dialect, 12.YK, shows just this palatal; all the rest have, in addition, changed the front velar into an affricate. Therefore, the rule

$$\text{k, kh, g, h, ŋ} \rightarrow [+\text{sharp}] \;/\; [\underline{\quad}] \begin{bmatrix}\text{Vowel}\\ -\text{grave}\\ +\text{diffuse}\end{bmatrix}$$

holds for all of Wu. Except for 12.YK, the rule

$$\begin{bmatrix}\text{Velar}\\ +\text{sharp}\end{bmatrix} \rightarrow [+\text{strident}]$$

will apply at some lower level as well.

Almost all Wu dialects show either four phonetically paired high register and low register tones, or have evidence supporting an underlying system composed of four paired tones with one of each pair being a lowered tone in syllables with voiced initials. On this basis, we can posit the following allotony for Proto-Wu:

Toneme:	*I	*II	*III	*Stop
With voiceless initial:	Ia	IIa	IIIa	Stopa
With voiced initial:	Ib	IIb	IIIb	Stopb

where 'a' indicates [+high register] and 'b' indicates [-high register] . Formally, the rule becomes:

$$\text{Tone} \rightarrow [-\text{high}] \;/\; \# \; [+\text{voiced}] \; [\underline{\quad}]$$

I have reconstructed the following phonetic values for the eight allotones:

	*I	*II	*III	*Stop
a	42	45	534	45
b	31	23	213	23

2.2 Wu Correspondences

This section presents the correspondences for each reconstruction and discusses the general developments in Wu and the substantiation of differences and relationships among the reconstructions.[7]

2.21 Initials

2.211 Labials and Dentals

The Proto-Wu labials and dentals remain pretty much as such in the modern dialects. The only important shifts seem to be:

1) *p > m and *t > n in 12.YK. The *t > n shift seems to occur in some other dialects near 12.YK on which I have only very scanty data.

2) *f > x (9.WZ.1), > h (9.WZ.2.3), and *v > ɦ (9.WZ.1.2.3).

3) Palatalization of *n before high front vowels in all dialects except 10.JH.

4) The appearance of voiced aspiration with nasals and laterals in 9.WZ.2.3 and 13.WL.

5) The shift of *m, *n, and *l in 13.WL to the high register allotone of *II and the consequent appearance of ʔ .

Table 1
Labial and Dental Correspondences

Initial Final	p iŋ, ɑŋ, an, ɤŋ	f,v oŋ, ɑŋ, at	p,ph,b f,v,m else.	t iŋ,oŋ, ɤŋ, ʌŋ, an,aŋ	n i,i-,y	t,th,d n,l else.
1.SZ.1	p	f,v	p,ph,b f,v,m	t	ȵ	t,th,d n,l
.2	"	"	"	"	"	"
2.WX	"	"	"	"	"	"
3.CS	"	"	"	"	"	"
4.CZS	"	"	"	"	"	"
5.HM	"	"	"	"	"	"
6.SHS	"	"	"	"	"	"
7.JD	"	"	"	"	"	"
8.SJ	"	"	"	"	"	"
9.WZ.1	"	x̯,ɦ	"	"	"	"
.2	"	h,ɦ	"[1]	"	nɦ	"[1]
.3	"	h,ɦ	"[1]	"	ȵɦ	"[1]
10.JH	"	f,v	"	"	n	"
11.SX	"	"	"	"	ȵ	"
12.YK	m	"	"	n	"	"
13.WL	p	"	"[2]	t	"[3]	"[2]

1. m,n,l > mɦ,nɦ,lɦ
2. m,n,l > ʔm,ʔn,ʔl/___*II
 > ɦm,ɦn,ɦl/___elsewhere
3. a. ʔn/___i#*II b. ɦn/___i#else. c. ʔȵ/___*IIelse.
 d. ɦȵ/___elsewhere

2.212 Affricates

As can be seen in Table 2 the plain dental affricate has been subject to only sporadic palatalization in Wu. The column headed dz,z,dʑ,ʑ is given to indicate which dialects have a contrast in the voiced affricate/fricative area. The most interesting developments affecting the plain affricates are in 9.WZ where palatalization occurs before on-glide *i- and *y- but not before the proto-vowels *i and *y themselves. 9.WZ has shifted the high front vowels out of the high front area when they are syllabic nuclei and so did not develop palatals.

Table 2
Plain Dental Affricate Correspondences

Initial Final	TS 1	TS 2	TS 3	TS y	TS else.	dz,z dʐ,ʐ
1.SZ.1	TS[4]	TS	TS	TS	TS	z,z
.2	"	"	"	"	"	"
2.WX	"	"	"	"	"	"
3.CS	"	"	"	"	"	dz,z
4.CZS	"	"	"	"	"	"
5.HM	TÇ	TÇ	"	TÇ	"	"
6.SHS	TS	TS	"	TS	"	z,z
7.JD	"	"	"	"	"	"
8.SJ	"	"	"	"	"	"
9.WZ.1	TÇ[5]	"	TÇ	"	"	dz,z
.2	"[6]	"	--	"	"	"
.3	"[6]	"[7]	--	"	"	"
10.JH	TS	"	TS	TÇ	"	"
11.SX	TÇ	TÇ	--	TS	"	dz$\overset{f}{\sim}$z
12.YK	"	--	--	--	"	dz,z
13.WL	"	TÇ	--	TÇ	"	"

1. iau, ian, iat, iaŋ, iak, ieu, yɤn, yɤt, ien, iet
2. eŋ, ek, iŋ, ik, i, ia
3. iɔŋ, iɔk, iok
4. TÇ/___iau
5. ʐ >ɦ
6. ʐ >j
7. TÇ/___iŋ

The palatal affricates (Table 3) appear as plain affricates in most environments in most of the dialects. 9.WZ shows a similar split of the palatals before high front glides versus high front vowels as with the plain affricates. 2.WX and 3.CS usually show a retroflexive affricate for the Proto-Wu palatals. Apparently there was a tendency towards glide absorption after palatals and when no more glide existed phonologically the series was forced to become a plain affricate, or in the case of 2.WX and 3.CS a more marked retroflex initial. 10.JH, 12.YK and 13.WL show the greatest preservation of palatals. All of the dialects tend to lose the palatal/plain contrast before *i, *ɨ1 and *ɨ2, which have become strident vowels. I have not given any correspondences for *ȵ since it is so irregular that each word must be checked for which reflex it may have. All of the dialects show many variants, such as n, ȵ, ʑ, ʐ, z and ɦ. I have listed some examples of *ȵ- words in Table 4.

Table 3
Palatal Affricate Correspondences

Initial	TÇ	TÇ	TÇ	TÇ	TÇ	TÇ	TÇ
Final	i	ɨ1	ɨ2	ia	y, iŋ, eŋ, ek, ik	iau, ieu, yɤŋ, yɤt, iet, iaŋ	ien, yɤn uɑŋ, yɑŋ ioŋ, yɤn iak, iok
1.SZ.1	TS	TS	TS	TS	TS	TS	TS
.2	"	"	"	"	"	"	"
2.WX	TS̢	TS̢	TS̢	TS̢	TS̢	TS̢[1]	"
3.CS	"	"	TS	TS	"	"	TS̢
4.CZS	TS	TS	"	"	TS	TS	TS
5.HM	"	"	"	"	"	"	"
6.SHS	"	"	"	"	"	"	"
7.JD	"	"	"	"	"	"	"
8.SJ	"	"	"	"	"	"	"
9.WZ.1	"	"	"	"	"	TÇ	TÇ[2]
.2	"	"	"	"	"	"	"[2]
.3	--	"	"	"	"[3]	"	"[2]
10.JH	TS	"	"	TÇ	TÇ	TÇ	TÇ
11.SX	"	"	"	TS	TS[4]	TS	TS
12.YK	--	--	"[5]	TÇ	"	TÇ[6]	TÇ[7]
13.WL	--	--	"	TS	TÇ[8]	"[9]	"

1. tç,tçh,ç / ieu> tçiɤɯ,etc. dʑ,ʑ / ieu > ʑEi
2. TS/___uɑŋ
3. TS/___eŋ,ek,y; TÇ/___iŋ, (ik?)
4. TÇ/___y#
5. Stops / ɨ2 > TSɿ ; ç,ʑ / ɨ2 > ç,ʑ i
6. TÇ/___iaŋ, yɤt
7. TS/___iok, iɔk; TÇ/___ien, yɤn, uɑŋ
8. Correspondence for *y only one known.
9. Correspondences for yɤŋ, iet, y ɤt only ones known.

Table 4
Examples of *ɲ- Words

	日	人	忍	認	壤	讓
	449	1836	1838	1841	2026	2027
*Wu	ɲek	ɲeŋI	ɲeŋII	ɲeŋIII	ɲiaŋIII	ɲiaŋIII
1.SZ.1	zɤʔ23	ɲin24	zən331	ɲin331	ɲiaŋ331	ɲiaŋ331
.2	ɲiəʔ2	ɲiŋ13	zəŋ31	ɲiŋ31	ɲiã31	ɲiã31
2.WX	ɲiəʔ2	ɲin14	ʑən213	nin213	ʑã213	ɲiã213
3.CS	ɲiəʔ2	ɲiŋ33	ʑəŋ213	ɲiŋ213	ɲiã213	ɲiã213
4.CZS	ɲiəʔ2	ɲin213	zən45	zən24	zɑŋ24	ɲiɑŋ24
5.HM	ɲiəʔ2	ɲin14	zən31	ɲin213	zɑ̃213	ɲiã213
6.SHS	ɲiəʔ2	ɲiŋ13	zəŋ13	ɲiŋ13	ɲiã13	ɲiã13
7.JD	ɲiəʔ3	ɲiŋ31	zəŋ13	ɲiŋ13	zɑ̃13	ɲiã13
8.SJ	ɲiɪʔ3	ɲiŋ31	zəŋ13	ɲiŋ13	zã13	ɲiã13
9.WZ.1	zai12	zaŋ31	ɲiaŋ24	ɲiaŋ11	ɦi31	ɲi11
.2	ɲɦe$\underline{212}$		ɲɦaŋ$\underline{34}$			
.3	ɲɦe$\overline{212}$		ɲɦaŋ$\underline{34}$			
10.JH	niʔ$\overline{212}$	nin213	ʑyən312	nin241		niaŋ241
11.SX	ɲieʔ$\underline{12}$ zeʔ$\overline{12}$	ɲiŋ231 zə̃ 231				
12.YK	ɲiə$\overline{13}$	zəŋ22				
13.WL	ɦɲiʔ1					

2.213 Velars

An examination of Table 5 shows that except for an *h > [f] , *ɦ > [v] shift in 8.SJ and 9.WZ, and some spotty palatalization before various finals, the Proto-Wu velars *k,*kh,*g,*h and *ŋ , as a group, palatalize before the *i,i-,y,y- type finals. 9.WZ shows a shift of *Ki > [TSɿ] , but this probably went through a palatal stage. Note that 10.JH preserves the palatalized *ŋ but not the non-palatal. 13.WL shows a plain velar before *y. Elsewhere, the dialects generally preserve these Proto-Wu velars as such. Very few cases of *g before non-palatal finals can be reconstructed on the basis of regular correspondences, though quite a few words show a present day [g] for some irregular correspondences.

Some dialects lose *ɦ entirely (10.JH); others lose it in some contexts (in 1.SZ.1 before palatal finals). Many preserve *ɦ as such in all contexts. One dialect, 5.HM, shows *ɦ > [h] as the most common derivation.

*ŋu is an erratic syllable as a whole, showing up as a syllabic nasal, as [ŋ] plus some vowel, or as [ɦ] plus some vowel depending on dialect. *ʔu- shows a shift to [v] in 8.SJ. Otherwise *ʔ is either [ʔ] or zero in all dialects. The difference between which dialects show [ʔ] and which show zero may be due to real phonetic absence (9.WZ.2.3) or it may be due to the analysis in the texts upon which this study is based.

Table 5
Velar Correspondences

Initial Final	h,ɦ 1	Klessh i	K yei, yaŋ	K i,y, i-,y- else.	K else.	ɦ i,i-	ɦ y
1.SZ.1	h,ɦ	K	K	TÇ	K	0	0
.2	"	"	"	"	"	h	h
2.WX	"	"	"	"	"	"	"
3.CS	"	"	"	"	"	"	"
4.CZS	"	"	"	"	"	"	"
5.HM	"2	"	"	"	"	"	"
6.SHS	"	"	"	"	"	"	"
7.JD	"	"	"	"	"	"	"
8.SJ	"3	"	"6	"	"	"	"
9.WZ.1	f,v4	TÇ	TÇ	"7	"11	"	"
.2	" 4	"	"	"7	"11	j	--
.3	" 4	"	"	"8	"11	j	z
10.JH	x,0	--	K	"	"(x)	0	0
11.SX	h,ɦ5	--	"	"	K	ɦ14	ɥɦ
12.YK	"	--	"	C9	K(x)12	ɦ15	ɥ
13.WL	"	--	"	TÇ10	K13	ɦ16	ʔ

1. u, o, yei, uei, uɤŋ, uan, uaŋ, uak, uai
2. ɦ > h/___o
3. h,ɦ > f,v/___u,o; ɦuei > vi occassionally
4. yei only for h
5. ɦ >v/___u
6. h > f/___yaŋ

Table 5 Continued

Initial Final	ɦ yaŋ,u- less those above	ɦ else	ʔ	ŋu	ŋ i,i-, y,y-	ŋ else
1.SZ.1	ɦ	ɦ	Ø	ŋ ə u	ɲ	ŋ
.2	"	"	"	"	"	"
2.WX	"	"	"	ɦu,ŋu	"	"
3.CS	"	"	"	ŋɤɯ	"	"
4.CZS	"	"	"	ɦu	"23	"
5.HM	"	h	"	ɦu, ŋu	"	"
6.SHS	"	ɦ	"	ɦu, ŋu	"	"
7.JD	"	"	"	ŋu	"	"
8.SJ	"17	"	"21	"	"	"
9.WZ.1	"	"	"	ŋ̍	"24	"26
.2	"	"	"	ŋɦ	"24	ŋɦ27
.3	"	"	"22	"	"24	" 27
10.JH	Ø	Ø	"	u	"	Ø
11.SX	ɦ	ɦ	ʔ	ɦu, ŋ̍	--	ŋ
12.YK	"	"19	ʔ	--	--	--
13.WL	"18	"20	ʔ	ŋ̍	ɲ25	ŋ28

7. TS/___i
8. TS/___i,y
9. C = c,ch,ɟ,ç
10. K/___y,yɤt
11. h > ç/___uɤŋ, uʌk, uʌŋ
12. h > ç/___a
13. K > TÇ/___ɤu
14. jɦ/___i#
15. ɦ > ɥ/___iɔŋ; ɦ > j/___iak
16. ɦ > ʔ/___ieu
17. ɦu- > v/___at
18. ɦ > ʔ/___ua
19. ɦ > j/___a
20. ɦ > ʔ/___on sometimes
21. ʔu-> v/___
22. ʔyei > zɥ in a high register tone
23. ŋ > ɦ/___y, yɤn, iok
24. ŋ, ŋɦ/___ieu
25. ʔɲ/___*II; ɦɲ/___elsewhere
26. ŋ > ɦ/___ɤn; ŋo > ŋ̍
27. ŋo > ŋ̍ɦ
28. a. ʔɲ/___anII; b. ɦɲ/___an else.; c. ʔŋ /___IIelse.;
    d. ɦŋ /___elsewhere

2.22 Finals

2.221 Open

*i is [i] in most sites but shifts to [ei] in 9.WZ. This pattern is repeated for 9.WZ in the finals *iŋ and *ik, except that for *iŋ, the presence of the nasal inhibits the development of an off-glide. The *i >[ei] shifts reveal the origin of *TÇi. Note that 9.WZ.3, 10.JH, and 12.YK suggest the possibility that at least some *i are derived from an earlier **ie. 3.CS is the only site to separate *ɨ1 and *ɨ2. *y shows a spotty tendency in awkwardly stated sets of environments to lose its rounding. *a is backed and *ɑ is raised in the dialects 1.SZ-8.SJ. *TÇia demonstrates the loss of on-glides after palatals that occurs in dialects 1.SZ-8.SJ, 11.SX and 13.WL quite generally. In addition *Kia demonstrates the optional *ia > a shift in the finals *ia, *ian, *iat after velars in most of these same sites. *u,*ou and *o tend to collapse into one or two contrasts in most sites. 9.WZ is the main dialect that distinguishes *ou from the other two; 10.JH and 12.YK are the main indicators of the *o distinction.

Table 6
Open Vowel Correspondences

Final Initial	i P,T, TS,K	i TÇ	ɨ TS	ɨ1 TÇ	ɨ2 TÇ	y TÇ
1.SZ.1	i̲	ʮ	ɿ	ʮ	ʮ	ʮ
.2	"	"	"	"	"	"
2.WX	"	ʮ	"	ʯ	ʯ	ʯ
3.CS	"	"	"	"	ɿ	"
4.CZS	"	ɿ	"	ɿ	"	ʮ
5.HM	"	"	"	"	"	ɿ
6.SHS	"	"	"	"	"	"
7.JD	"	"	"	"	"	"
8.SJ	"	"	"	"	"	y
9.WZ.1	ei1	ei	"	"	"	ɿ
.2	ei2	"	"	"	"	--
.3	i 3	--	"	"	"	ʮ
10.JH	" 4	ɿ	"	"	"	y
11.SX	"	"	"	"	"	"
12.YK	" 5	--	"	--	"6	"
13.WL	"	--	"	--	--	y

Table 6 Continued

Final Initial	y l,n,TS K	a P,T, TS,K	ia T,TS, h	ia k	ia TÇ	ɑ P,TS K
1.SZ.1	y7	ɒ	iɒ	ɒ	o	o
.2	y8	ɑ	iɑ	ɑ(iɑ)	o	o
2.WX	y8	"	"	iɑ,u,ɑ	ɑ	u
3.CS	"9	"	"	ɑ,iɑ	o	"21
4.CZS	"	"	"	o,iɑ	ɑ	o
5.HM	i	"	"	ɑ,iɑ	uo	uo
6.SHS	y10	"	"	"	o	o
7.JD	"	"	"	"	uo	uo
8.SJ	"	"	"	"	o	o
9.WZ.1	"11	a	ɔi15	o	ei	"
.2	"12	"	" 15	"	"19	"
.3	"13	ɛ	--	"	g	"
10.JH	"	a	ǐa16	uă	ia20	ǔa22
11.SX	"	"	i̯a	--	o	o
12.YK	"	iă14	ǐa17	--	ia	uǎ
13.WL	"	a	iɛ18	--	o	o23

Final Initial	u P,K	u l,n,TS	ou P	ou m	ou T,TS	o P	o T,TS,K
1.SZ.1	u24	əu	u	o	əu	u32	əu
.2	"24	"	"	"	"	"32	"
2.WX	"25	ɤɯ	ɤɯ28	ɤɯ	ɤɯ	ɤɯ	ɤɯ
3.CS	"39	"	u	o	"	u32	"
4.CZS	"	u26	"	ɤɯ	u29	ɤɯ	"
5.HM	"	"	"	u	"	u	u
6.SHS	"	"	"	"	"	"	"
7.JD	"	"	"	"	"	"	"
8.SJ	"	"	"	o	"	"32	"
9.WZ.1	"	əu	ey	ey	ey	"32	"33
.2	ʅ	ɤʅ	øy	øy	øy	ʅ	ɤʅ 34
.3	ʅ̣	o27	ʅ̣	ʅ̣	ʅ̣ 30	ʅ̣	o35
10.JH	u	u	u	uə	u	uo36	uə
11.SX	"	"	"	--	"	o̯	o37
12.YK	"	--	--	uə̆	"31	uə̆	uə̌
13.WL	"	u	--	--	"	--	u38

1. i/n,ɦ,ŋ,ʔ___
   ɿ/k,kh,g,h___
2. i/ɦ,ŋ,ʔ___
   ɿ/k,kh,g,h___
3. i/ɦ,ŋ,ʔ___
   ɿ/TS,k,kh,g,h___
4. iɛ/Tlessl,TS___
5. iə̆/Tless l,TS___
6. ç,ʑɨ2 > çi,ʑi
7. i/TS___
8. i/l,TS___
9. i/n___
10. i/l___
11. ey/l___;u/ɦ___
    ɿ/TS___
12. øy/l___
13. ɥ /TS,K-;øy/l_
14. a/l___
15. i/ɦ___
16. iă/H___
17. iă/ɦ___
18. ia/ɦ___
19. o/tç,tçh,dʑ___
20. iă/ç,ʑ___
21. o/m,TS___
22. uă/K___
23. uo/K less ŋ ___

24. ɔu/K___
25. ɤɯ/p,ph,b___
26. ɥ/TS___
27. ʋ/l___
28. u/f,v___
29. ɥ/TS___
30. ɥ/TS___
31. o/l___
32. o/m___
33. əu/l___
    u,o/TS___
    Ø/ŋ___
34. o/TS___
    ʋ/Kless ŋ___
    Ø/___
35. ʋ/Tless l,
    Kless ŋ,___
    Ø/ŋ___
36. uə/m___
37. u/K less ŋ___
38. ɯ/K___
39. ɤɯ/ŋ___

The low vowels with -u off-glides lose them in 9.WZ, but the mid vowels retain the glide. Dialects 1.SZ-8.SJ tend to preserve the low/mid distinction, but also tend to lose the glides. Though *au and *ɑu merge in most dialects as either a front or a back vowel, 9.WZ clearly makes a front/back distinction for the two. *ɤu and *eu are distinguished in only 9.WZ and 10.JH and in a rather peculiar way. 9.WZ keeps *Teu distinct form *Tɤu by merger of the former with *ieu; 10.JH keeps *TSeu and *TSɤu distinct in a similar fashion. This makes it seem extremely likely that the same final in fact underlies both reconstructions and that the apparent distinction is based on some sort of irregularity or unconditioned split. Note in this connection the diphthongization of *ɤu after velars in 13.WL; this shift occurred before velar palatalization. Since it would seem that *eu would be more likely to diphthongize than *ɤu, the evidence in 13.WL tends to support the possibility that *eu and *ɤu are in fact the same final.

Table 7
Vowel Plus -u Off-glide Correspondences

Final	ɑu	au	iau	iau	ɤu	eu	ieu	ieu
Initial	P,T TS,K	P,T TS,K	P,T TS,K	TÇ	T,TS K	T,TS	t,l TS,TÇ	n,K
1.SZ.1	æ	æ	iæ	æ	øʏ	øʏ	øʏ	iøʏ
.2	"	"	"	"	ʏ	ʏ	ʏ	iʏ
2.WX	ʌ	ʌ	iʌ	ʌ	Ei	Ei	Ei7	iɤɯ
3.CS	ɔ	ɔ	iɔ	ɔ	E	E	iɤɯ 8	"
4.CZS	ɐɯ	ɐɯ	iɐɯ	ɐɯ	ei	ei	ei9	"
5.HM	ɔ	ɔ	iɔ	ɔ	ɤɯ	ɤɯ	iɤɯ 8	"
6.SHS	"	"	"	"	ɤ	ɤ	iɤ 10	iɤ
7.JD	"	"	"	"	"	"	y	y
8.SJ	"	"	"	"	"	"	iɤ 10	iɤ
9.WZ.1	uɔ1	ɜ	iɛ	iɛ	au	au3	iu	iau12
.2	uɔ	ə	"	"	aʊ	aʊ 4	eʊ 11	aʊ
.3	uɔ	"	yə	yə	"	" 5	"	"
10.JH	au	au	iau	--	əu	əu6	iu	iu
11.SX	ɒ	ɒ	iɒ	ɒ	ɤ	ɤ	iɤ 10	iɤ
12.YK	au	au	iau	--	əu	əu	iəu	iəu
13.WL	ɔ	ɔ	iɔ	--	ɤ2	ɤ	iu	iu

1. ɔ/TS,n___
2. iɤ /K___
3. iu/T___
4. ɤʊ /T___
5. eʊ /T___
6. iu/TS___
7. iɤɯ /tç,tçh,ç__
8. ɤɯ/TÇ___
9. iɤɯ/TS___
10. ɤ /TÇ___
11. ɤʊ /T___
12. au/ŋ ___
13. It is interesting to note that a dialect near 12.YK, 仙居 , shows 求 1413 *gieu > dẓieu, i.e., just the reconstructed final *ieu is preserved in the modern language. In addition, 12.YK's [iəu] is phonetically close to [ie> u] , and when Y. R. Chao investigated 10.JH in the late 1920's, it still had [ieu] , [eu] .

The presence of an -i off-glide in 5.HM and 4.CZS distinguishes the *Vi finals. *ai is distinct from *ei as lower vowel to higher vowel in 3.CS, 5.HM, 6.SHS and 7.JD. *ei in 9.WZ lowers and retains the off-glide; this is true for all mid vowels in 9.WZ. *ai on the other hand, raises and loses the glide; this too holds for most of the compact vowels plus glides and nasals in 9.WZ. *yei is distinguished from *uei primarily by its shift to [y] in 9.WZ. *uai was reconstructed on the basis of preservation though highly defective of *ai like features.

Table 8
Vowel Plus -i Off-glide Correspondences

Final	ai	uai	ei	uei	uei	yei	yei
Initial	T,TS,K	K	P,T	TS	K	TS	K
1.SZ.1	E	uɒ	E	E	uE	E	uE
.2	"	uE,uɑ	"	"	"	"	"
2.WX	"	uɑ	"	"	"	"	"
3.CS	ɛ	uɑ,uɛ	"	"	"	"	" 5
4.CZS	æI	uɑ	æI	uæI	uæI	uæI	uæI
5.HM	EI	uɑ,uEI	eI	eI	ueI	eI	ueI
6.SHS	ɛ	uɑ,uɛ	e	ø	ue	ø	ue
7.JD	"	"	ie3	ɤ	"	ɤ	"
8.SJ	e	uɑ	e	ø	"	ø	" 6
9.WZ.1	E	a	ai	ai	ai	ɿ	y 7
.2	e	--	ai	ai	ai	--	--
.3	e	ɛ	ai 4	ai	ai	ɥ	ɥ 8
10.JH	ai	ua	ai	ei	uei	ɛi,y	uei
11.SX	E 1	ua	E	E	uE,y	E	uE
12.YK	əi	ua	əi	--	uəi	--	uəi
13.WL	e 2	--	--	--	--	y	y

1. E,jE/k,kh___
2. ie/k,kh___
3. ɤ/T___
4. e/m___
5. uE, y/ʔ ___
6. ue, i/ɦ___
   e/ʔ ___
7. u/ɦ,ʔ___
8. ʔ only known

2.222 Nasal

Since few Wu dialects[8] show a contrast in final nasals a note on the procedure for reconstructing two final nasals (and two final stops) is in order. Since 11.SX shows nasalization in some form for all of the nasal correspondences, the reconstructed finals must contain some nasality. Because of the large number of these nasal correspondences, either the reconstructed vowels or the nasals must be proliferated. Now, it turns out that the nasal finals are divided into two classes by the structural pattern of the development of these finals in the dialects. The difference is essentially this: there is a class of nasal finals where 11.SX shows just nasalization and where every other dialect shows no nasal at all.[9] There is another class of nasal finals, where most dialects show either a nasal consonant or a nasalized vowel. A sketchy check with other Chinese dialect groups indicated that the difference originally lay roughly in an *-n/*-ŋ contrast between the first and second groups, and that solution was chosen for the reconstructed language.

*an and *uan show very little change in the dialects except for the loss of the nasal. *ian, however, tends to merge with *ien except after some velars where it may lose the on-glide and merge with *an. Only two of the dialects shown, 10.JH and 12.YK, distinguish *ian from *ien and there the distinction is just lower head vowel to higher head vowel. The same pattern holds for *iat/*iet. There is another dialect in central Chekiang, 义烏 , on which I have very little material that also reflects this as a vowel height distinction, namely *ien > ie, and *ian > iɛ . Most dialects lose the *on/*ɤn distinction, but in those that make a distinction, such as 5.HM and 8.SJ, they are kept distinct by just the feature rounding, whereas in others, such as 7.JD, there is fronting for *ɤn as opposed to *on. 10.JH and 12.YK seem to point towards an *o-vowel for both, and show parallel diphthongization in this final to the open final *o. The correspondence of these finals to the Middle Chinese reconstructed by Dong Tong-he is quite regular, where the difference is not in the vowel but in the final nasal, namely an *m/*n contrast. However, the Wu data would not seem to support that kind of distinction between the finals for Proto-Wu. I have reconstructed a rounded glide for *yɤn to account for the reflexes of this final in 9.WZ, 12.YK and to some extent 10.JH, and dialects 5.HM-8.SJ.

Table 9
Vowel Plus -n Correspondences

Final Initial	an P,T TS,K	uan K	ian T,TS	ian k,h, ɦ,ŋ	ien P,T TS,K	ien TÇ	on T,TS K
1.SZ.1	E	uE	I	I,E	I	ø	ø
.2	"	"	iI	iI,E	iI 10	"	"
2.WX	ɛ	uɛ	"	iI,ɛ	"	o	o
3.CS	"	"	iE	iE,ɛ	iE	ɤ	ɤ
4.CZS	"	"	iI	iI,ɛ	iI	"	"
5.HM	" 1	"	ie	ie,ɛ	ie	ø	ø
6.SHS	"	"	i	i,ɛ	i	"	"
7.JD	"	"	ie	ie,ɛ	ie	ie	ɤ
8.SJ	"	" 4	i	i,ɛ	i	e	ø
9.WZ.1	a	a 5	i	a	"	i	" 11
.2	"	" 6	"	"	"	"	" 11
.3	"	" 6	" 9	"	"	"	"
10.JH	"	ŭa 7	ǐa	"	iɛ	yə	ə
11.SX	æ̃ 2	uæ̃	iẽ	jẽ,æ̃	iẽ	--	ɤ̃ 12
12.YK	a	ŭa 8	iǎ	--	iə	iə̆	ɯə̆
13.WL	ɛ 3	uɛ	ie	ɛ	ie	--	ø 13

Final Initial	ɤn P	ɤn T,TS	ɤn K	uɤn K	yɤn TS	yɤn TÇ	yɤn K
1.SZ.1	ø	ø	ø	uø	I	ø	iø
.2	"	"	"	"	iI	"	"
2.WX	o	o	o	o	"	o	io
3.CS	ɤ	əŋ 14	əŋ	uɤ	iE	ɤ	iɤ
4.CZS	"	ɤ	ɤ	"	iɤ	"	"
5.HM	ie	ie 15	ie 16	ue	ie	ø	yø
6.SHS	ø	ø	ø	"	i	"	Y
7.JD	ie	ie	ie	"	ie	ie	yɤ
8.SJ	e	e	e 17	"	i	e	yø
9.WZ.1	ø	ø	y,ø 18	y	y	y	y
.2	"	"	ø	"	"	"	"
.3	"	"	"	--	"	"	"
10.JH	uə	a,ə	ə	ŭa 19	iɛ	yə	yə
11.SX	ɤ̃	ɤ̃,ẽ	ẽ,jẽ	uɤ̃,uẽ	--	--	--
12.YK	uə̆	ɯɤ̆	--	ŭa	yə	yə̆	yɤ̆
13.WL	--	--	--	uø	--	--	yø

1. ɛ, ø/T,TS___
2. æ̃,jæ̃/K,ŋ ___
3. a/f,v___
   iɛ /k,kh,ŋ ___
   (ɛ /ɦ,ʔ ___)
4. ɛ /ʔ ___
5. ua/ʔ ___
6. ɿ a/ʔ ___
7. uă/ɦ___
8. uă/ʔ ___
9. i,ie /T,n,l__
10. iI/l___
11. y/K___
12. ɤ̃/K___
13. ie/K___
14. əŋ, ɤ,oŋ /TS___
15. e/TS___
16. ø/ŋ ___; e/ʔ ___
17. ø/ŋ ___
18. y,ø/K___;y/ŋ ___
    ø/ʔ ___
19. uă/h,ɦ__

The correspondences *iŋ/*eŋ/*ieŋ show systematic lowering in 9.WZ. Since these correspondences and *ɤŋ show many distribution gaps that are to some extent complementary, and since several dialects, such as 2.WX and 12.YK, show (optionally) an epenthetic schwa between the [i] and the nasal of *iŋ it may be that these finals can be reduced to, perhaps, **eŋ, **ieŋ . Note that *yɤŋ shows even greater retention of the rounded glide than *yɤn, but in different dialects. *aŋ and *ɑŋ differ primarily in showing front versus back reflexes in most of the dialects. Note the reflex [ai] for *aŋ in 12.YK; M. Hashimoto thinks this may be a trace of a final palatal nasal. The *uɑŋ/*yɑŋ distinction is made to account for the 9.WZ and 13.WL reflexes of these finals; elsewhere they merge. Note the retention of an on-glide after initials other than velars in 4.CZS. *ʌŋ and *uʌŋ are peculiar in that they look like *ɤŋ and *uɤŋ in most dialects except 9.WZ, 11.SX, 12.YK and 13.WL where they seem closer to *ɤn, *uɤn. The *ɤŋ/*ʌŋ distinction parallels the *oŋ/*ɔŋ distinction in the loss of final nasal for the lower member of the pair in 9.WZ. I chose *o-/*ɔ- instead of *u-/*o- for this pair for that reason and because only two dialects show [u] for any of these correspondences, whereas the rest show [o] .

Final Initial	iŋ P,T TS	iŋ TÇ	ieŋ K	eŋ TS	eŋ TÇ	ɤŋ P,T TS,K	ʌŋ P,T TS
1.SZ.1	in	ən	in	in	ən	ən	ən
.2	iŋ	əŋ	iŋ	iŋ	əŋ	əŋ	əŋ
2.WX	in	ən	in	in	ən	ən	ən
3.CS	iŋ	əŋ	iŋ	iŋ	əŋ	əŋ	əŋ
4.CZS	in	ən	in	in	ən	ən	ən
5.HM	"	"	"	"	"	"	"
6.SHS	iŋ	əŋ	iŋ	iŋ	əŋ	əŋ	əŋ
7.JD	"	"	"	"	"	"	"
8.SJ	"	"	"	"	"	"	"
9.WZ.1	eŋ	eŋ	iaŋ	aŋ	aŋ	aŋ	ø
.2	"	"	aŋ 1	"	"	"	"
.3	"	"	" 1	"	"	"	"
10.JH	in	in	in	in	in	ən	ən
11.SX	iŋ	əŋ	iŋ	iŋ	ẽ	ən 2	ø̃,ẽ
12.YK	"	iŋ	"	əŋ	əŋ	əŋ 3	ɯə̌ 5
13.WL	in	--	in	--	--	ɤŋ 4	øn

Final Initial	uʌŋ K	uɤŋ K	yɣŋ TÇ	yɤŋ K	oŋ T,P TS,K	ioŋ TÇ	ioŋ g,ɦ,ɦ
1.SZ.1	uən	uən	ən	yən	oŋ	oŋ	ioŋ
.2	uəŋ	uəŋ	əŋ	yəŋ	"	"	"
2.WX	uən	uən	ən	yən	" 7	"	"
3.CS	uəŋ	uəŋ	əŋ	ioŋ	" 8	"	"
4.CZS	uən	uən	uən	yən	" 7	"	"
5.HM	"	"	ən	in	"	"	"
6.SHS	uəŋ	uəŋ	əŋ	ioŋ	"	"	"
7.JD	"	"	"	iŋ,yəŋ	"	"	"
8.SJ	"	"	"	yŋ,ioŋ	"	"	"
9.WZ.1	y	aŋ	yoŋ	yoŋ	oŋ	yoŋ	yoŋ
.2	y, ʔaŋ 6	"	oŋ	oŋ	"	oŋ	oŋ
.3	y,ʔaŋ6	"	"	"	"	"	"
10.JH	uən	uən	yən	yən	uŋ	yoŋ	yoŋ
11.SX	uẽ	uẽ	--	iø̆	Uŋ	Uŋ	iUŋ
12.YK	uəŋ	--	--	yəŋ	oŋ	--	yoŋ
13.WL	uən	--	yn	yn	uŋ	--	--

1. iaŋ /ʔ___
2. ẽ/P___
3. iŋ /T___
4. ən/P___
5. uə /P___
6. ʔ only known
7. ioŋ /n___
8. oŋ ,ioŋ /n___

Final Initial	aŋ P,T TS,K	iaŋ T,TS K	iaŋ TÇ	uaŋ ɦ	ɑŋ P,T TS,K	uɑŋ TÇ	uɑŋ K
1.SZ.1	aŋ 1	iaŋ	aŋ,ɒŋ	uaŋ	ɒŋ	ɒŋ	uɒŋ
.2	ã	iã	ã,ɑ̃	uã	ɑ̃	ɑ̃	uɑ̃
2.WX	"	"	ã	"	"	"	"
3.CS	"	"	ã,ɑ̃	uɑ̃	"	"	"
4.CZS	ɑŋ 2	iɑŋ	ɑŋ	uɑŋ	ɑŋ	uɑŋ	uɑŋ
5.HM	ɑ̃ 3	iɛ̃	ɑ̃	uɑ̃	ɑ̃	ɑ̃	uɑ̃
6.SHS	ã	"	ã,ɑ̃	uã	"	"	"
7.JD	"	"	"	"	"	"	"
8.SJ	"	"	"	uɑ̃	"	"	"
9.WZ.1	iɛ	i	i	iɛ	uɔ 4	uɔ	uɔ
.2	"	iɛ	--	iɛ	"	"	"
.3	ɛ	"	iɛ	ɛ	"	"	"
10.JH	aŋ	iaŋ	iaŋ	uaŋ	aŋ	yaŋ	uaŋ
11.SX	"	"	--	--	ɒŋ	ɒŋ	uɒŋ
12.YK	ai	"	iaŋ	--	aŋ	yaŋ	uaŋ
13.WL	--	iã	--	uã	ɔ̃	--	uɔ̃

1. oŋ /m___ 2. oŋ /m___ 3. ɑ̃, ən/TS___ 4. ɔ /T,TS___
ə n/TS___

Final Initial	yɑŋ TÇ	yɑŋ K	iɔŋ TS,K	iɔŋ TÇ	iɔŋ h
1.SZ.1	ɒŋ	uɒŋ	oŋ	oŋ	ioŋ
.2	ɑ̃	uɑ̃	"	"	"
2.WX	"	"	"	"	"
3.CS	"	"	"	"	"
4.CZS	uɑŋ	uɑŋ	"	"	"
5.HM	ɑ̃	uɑ̃	"	"	"
6.SHS	"	"	"	"	"
7.JD	"	"	"	"	"
8.SJ	"	"	"	"	"
9.WZ.1	yɔ	yɔ	yɔ	yɔ	yɔ
.2	"	"	--	"	"
.3	"	"	yɔ	yə	"
10.JH	yaŋ	uaŋ	uŋ	yoŋ	yoŋ
11.SX	ɒŋ	--	Uŋ	Uŋ	iUŋ
12.YK	--	--	--	--	yoŋ
13.WL	--	yɜ̃	--	--	yuŋ

2.223 Stop

The most striking evidence for the *t/*k distinction is the parallel in effect on the vowel in comparison with the *n/*ŋ distinction. The only other structural difference between *t and *k themselves is the much greater tendency of *t to be lost with a shift to tone *III in 10.JH.

The *at and *et finals are very similar to their *an and *en counterparts. Since *at is the only source of a non-rounded compact vowel in the Stop tone class in many dialects, it shows a greater tendency to shift to a grave position than *an. *iet and *iat after the parallel merger we saw for *ian and *ien have further lost their identity in many of the dialects by merger with the *ik, *ek, *iek type finals. Where 10.JH does not shift *iet and *iat to tone *III, it too loses the distinction, unlike the situation for *ien and *ian. The primary evidence for the * t/*ot distinction lies in the rather sporadic retention of a rounded vowel in some dialects for *ot. In other respects, the *ɤt/*ot correspondences show great similarity, but do not show the tendency towards fronting evidenced by their relatives with a final dental nasal.

Table 11
Vowel Plus -t Correspondences

Final Initial	at P,T TS,K	uat K	uɤt K	iat T,TS	iet P,T TS,K	iet TÇ
1.SZ.1	aʔ	uaʔ	uɤʔ	iɤʔ	iɤʔ	ɤʔ
.2	"	"	uəʔ	iəʔ	iəʔ	əʔ
2.WX	" 1	"	"	"	"	"
3.CS	ɑʔ	uɑʔ	uoʔ	"	"	"
4.CZS	" 2	"	uəʔ	"	"	"
5.HM	aʔ	uaʔ	"	"	"	"
6.SHS	ɑʔ 2	uɑʔ	"	"	"	"
7.JD	" 2	"	"	"	"	"
8.SJ	ɛʔ 3	uɛʔ 9	"	iIʔ	" 14	"
9.WZ.1	a 4	c 10	o	i	i	i
.2	"	" 11	--	"	"	"
.3	" 5	" 11	--	" 13	"	"
10.JH	ŭa 6	uǎ 12	uǎ	ǐa	iɛ	yə,yəʔ
11.SX	æʔ 7	uæʔ	--	ieʔ	ieʔ15	e ʔ
12.YK	uǎ	ŭə	--	iǎ	iɜ̌	--
13.WL	iəʔ 8	uəʔ	--	iʔ	iʔ	iʔ

Table 11 Continued

Final Initial	ot T	ot K	ɤt P,T TS,K		yɤt TS	yɤt TÇ	yɤt K
1.SZ.1	ɤʔ	ɤʔ	ɤʔ	16	iɤʔ	ɤʔ	yɤʔ
.2	əʔ	əʔ	əʔ	17	iəʔ	əʔ	yəʔ
2.WX	"	"	"		"	"	"
3.CS	oʔ	oʔ, əʔ	"	17	"	"	ioʔ
4.CZS	əʔ	əʔ	"	18	iəʔ,yəʔ	uəʔ	yəʔ
5.HM	"	"	"		iəʔ	əʔ	ioʔ
6.SHS	oʔ,əʔ	"	"	19	"	"	"
7.JD	oʔ	oʔ, əʔ	"		"	"	"
8.SJ	əʔ	əʔ	"		iIʔ,iəʔ	"	yIʔ
9.WZ.1	ø	Y	ø		y	y	y
.2	ø,ai	y,ø	"		--	"	"
.3	"	ø	"		--	"	"
10.JH	əʔ	ə	ə	20	y,yəʔ	yəʔ	yəʔ
11.SX	--	eʔ	eʔ	21	eʔ,øʔ	iøʔ	iøʔ
12.YK	--	--	iə̆	22	y̆ə	y̆ə	y̆ə
13.WL	--	--	--		yʔ	yʔ	yʔ

1. aʔ ,iɑʔ /K__
2. ɑʔ ,iɑʔ /K__
3. ɛʔ ,iɛʔ /K__
4. o/P__
5. uɔ /P__
6. uă/K__
7. æʔ,Iæʔ/K__
8. ɛʔ /ɦ__(only known)
ɛʔ, əʔ/ ʔ__
9. ɛʔ/ɦ,ʔ__
10. ua/ʔ__
11. ɔa/ʔ__
12. ŭaʔ /ɦ__
ŭa/ʔ__
13. i,iɛ /T__
14. iIʔ ,iəʔ /__
15. ieʔ ,eʔ /P,n__
16. əʔ /n,z__
17. oʔ , əʔ /P__
18. ɑʔ /z__
19. əʔ , ɑʔ/n,z__
20. uə/P__
əʔ/d__
aʔ /n__
aʔ , əʔ /K__
21. øʔ ,eʔ /d__
22. ɯə̆/K__

The velar stop finals are also parallel in many respects to their velar nasal relatives. One major difference lies in the *ik,*ek finals where the apparently epenthetic schwa that appears in many dialects may be even more indicative of an underlying *iek reconstruction for all of these finals than was the case with the velar nasal. Also it is noteworthy that, as was not the case with the velar nasal *oŋ/*ɔŋ type finals, the *ok/*ɔk finals in 3.CS, 7.JD and 8.SJ show just the reconstructed vowels for these correspondences. 12.YK also retains more evidence of an earlier palatal stop final than was the case with the velar nasal; note its reflexes for *ik, *ʌk and *ak.

Table 12
Vowel Plus -k Correspondences

Final Initial	ik P	ik T,TS	ik TÇ	iek K	ek TS	ek TÇ	ɤk P,TS	ʌk T,TS,K
1.SZ.1	iɤʔ	iɤʔ	ɤʔ	iɤʔ	iɤʔ	ɤʔ	ɤʔ	ɤʔ
.2	iəʔ,əʔ	iəʔ	əʔ	iəʔ	iəʔ	əʔ	əʔ	əʔ
2.WX	"	"	"	"	"	"	"	"
3.CS	"	"	"	"	"	"	"	"
4.CZS	"	"	"	"	"	"	" 4	"
5.HM	iəʔ	"	"	"	"	"	"	"
6.SHS	iəʔ,əʔ	"	"	"	"	"	"	"
7.JD	iəʔ	"	"	"	"	"	"	"
8.SJ	iəʔ,əʔ iIʔ	"	"	"	"	"	"	"
9.WZ.1	ei	ei	ei	iai	ai	ai	ai	E
.2	"	"	"	ai 3	"	"	"	e
.3	--	(i̲) 1	--	" 3	"	"	"	"
10.JH	iʔ,iɛ	iʔ,ǐa	iʔ	iʔ	iʔ	iʔ	əʔ	əʔ
11.SX	ieʔ,eʔ	ieʔ	--	ieʔ	--	--	eʔ	eʔ
12.YK	ə	iə, əi̲ 2	əi	ǐə	--	--	ə	əi
13.WL	--	iʔ	--	iʔ,yuʔ	--	--	--	ɤʔ

Final Initial	uʌk K	uɤk K	yɤk K	ak P,TŚ,K	iak n,l, TS,K	iak TÇ	uak ĥ
1.SZ.1	uɤʔ	uɤʔ	yɤʔ	ɒʔ 5	iɒʔ 11	ɒʔ	oʔ,uoʔ
.2	uəʔ	uəʔ	yəʔ	ɑʔ	iɑʔ 11	ɑʔ	uəʔ
2.WX	"	"	"	" 6	" 11	"	"
3.CS	uoʔ	uoʔ	ioʔ	"	"	ɑʔ,oʔ	uoʔ
4.CZS	uəʔ	ɔʔ	yəʔ	" 7	"	ɑʔ	uəʔ,ɔʔ
5.HM	oʔ,uəʔ	uəʔ	ioʔ	"	" 12	"	uəʔ
6.SHS	uəʔ	oʔ	ioʔ	" 8	"	"	"
7.JD	"	uɜʔ	"	" 9	"	ɑʔ,ɔʔ	"
8.SJ	"	oʔ	"	"	" 13	ɑʔ	oʔ
9.WZ.1	y	ai	iai	a	ia 14	ia	a
.2	"	"	--	"	a 15	a	"
.3	--	"	--	ɛ	" 15	"	"
10.JH	uəʔ	uəʔ	yəʔ	aʔ 10	ǐaʔ 16	iʔ,yoʔ	ŭaʔ,uəʔ
11.SX	ueʔ,uøʔ	oʔ,uoʔ	iøʔ	aʔ	iaʔ	--	--
12.YK	ŭə	--	y̆ə	ai	iau	--	--
13.WL	--	--	yʔ	--	iaʔ	--	--

Table 12 Continued

Final Initial	ok P,T TS,K	iok l,TS	iok TÇ	iok K	ɔk P,T TS,K	iɔk TS	iɔk TÇ	iɔk K
1.SZ.1	oʔ	oʔ	oʔ	ioʔ	oʔ	oʔ	oʔ	ioʔ
.2	"	"	"	"	"	"	"	"
2.WX	ɔʔ	ɔʔ	ɔʔ	iɔʔ	ɔʔ	ɔʔ	ɔʔ	iɔʔ
3.CS	oʔ 17	oʔ	oʔ	ioʔ	" 22	oʔ	oʔ,ɔʔ	ioʔ
4.CZS	ɔʔ	ɔʔ	ɔʔ	iɔʔ	"	ɔʔ	ɔʔ	iɔʔ
5.HM	oʔ	oʔ	oʔ	ioʔ	oʔ	oʔ	oʔ	ioʔ
6.SHS	"	"	"	"	"	"	"	"
7.JD	"	"	"	"	ɔʔ 23	"	ɔʔ	"
8.SJ	" 17	"	"	"	" 23	"	"	"
9.WZ.1	u 18	iu	iu	iu	o	yo	yo	yo
.2	ɿ 19	ɤɿ	eɿ	eɿ	"	--	o	o
.3	"	eɿ	"	"	"	--	"	"
10.JH	oʔ	oʔ	yoʔ	yoʔ	oʔ	oʔ	yoʔ	yoʔ
11.SX	" 20	--	--	--	"	--	o̯ʔ	i̯oʔ,iøʔ
12.YK	o	--	u	y̆o	au	--	ŭə	y̆o
13.WL	oʔ 21	--	oʔ	yoʔ	--	--	--	yoʔ

1. *TSik only known
2. ə i/l___
   iə /else.
3. iai/ʔ___
4. əʔ,yəʔ/TS___
5. ɤʔ/ŋ___
6. ɑʔ,əʔ /TS___
   aʔ /ŋ___
7. ɔʔ /P___
   əʔ, ɑʔ /TS___
   əʔ/ŋ___
8. əʔ, ɑʔ /Klessŋ,TS___
9. əʔ/Klessŋ___
10. əʔ/Klessŋ___
11. iaʔ /n___
12. iəʔ /n___
13. iɛʔ /n___
14. iɛ /l___
15. iɛ /l___
    ia/ʔ___
16. iaʔ,yoʔ /K___
    yoʔ /ʔ___
17. ɔʔ/m___
18. əu,o/l,s,z___
    g/m
19. ɤɿ /T,TS___
20. uoʔ /ʔ___
    oʔ,ioʔ /K___
21. uoʔ /k___
22. oʔ, ɔʔ/TS___
23. oʔ /P___

2.23 Tones

Words with nasal or lateral initials shift to the voiceless allotone of tone *II in 4.CZS, 10.JH and 13.WL. The voiced allotone of *II merges with the voiced allotone of *I in 13.WL, and with the voiced allotone of *III in 1.SZ, 6.SHS and 7.JD. Other sites show irregular shifts for both allotone of *II into the comparable allotone of *III on irregular subsets of *II words.

The stop tone loses its final stop in 9.WZ and 12.YK. In 12.YK it merges completely, tonally, with *II. In

10.JH there is a partial shift of the stop tone to *III with loss of the final dental stop.

Table 13
Tonal Correspondences

	I	I	II	II	III	III	Stop	Stop
	a	b	a	b	a	b	a	b
	42	31	45	23	534	213	45	23
1.SZ.1	44	24	41	331	513	331	4ʔ	23ʔ
.2	"	13	52	31	412	31	5ʔ	2ʔ
2.WX	55	14	324	33	35	213	"	"
3.CS	53	33	423	31	324	"	"	"
4.CZS	55	213	45 [1]	24	423	23	"	"
5.HM	53	14	23	31	34	213	"	"
6.SHS	"	13	34	13	34	13	"	"
7.JD	"	31	"	"	"	"	"	3ʔ
8.SJ	"	"	44	22	35	"	"	"
9.WZ.1	44	"	54	24	42	11	23	12
.2	"	"	45	34	"	22	323	212
.3	"	"	"	"	"	"	"	"
10.JH	33	213	434 [1]	312	52	241	3ʔ [2]	212ʔ [2]
11.SX	51	231	335	113	33	11	45ʔ	12ʔ
12.YK	44	22	35	13	52	241	35 [3]	13 [3]
13.WL	33	31	42 [1]	31	55	13	5ʔ	1ʔ

1. Words in nasal, lateral *II show up here except
   10.JH m,n,l > 434; ȵ, ŋ > 312
2. Some words with a final dental nasal shift to III.
3. Stop a,b merges with II a,b.

The phonological features were assigned to the Proto-Wu tones on the basis of the following considerations:[10]

First, the results of the type of dialectological comparison to be discussed in Chapter III established subgroupings of the dialects in such a way as to clarify where tonal developments were similar and where they were not.

Second, the occurring tone values in the various subgroups established some notions concerning the direction and nature of tone change. For example, in 9.WZ, 10.JH and 12.YK, tone *IIIa loses its falling component with consequent shift of the falling tone Ia to a level tone; the merger in 6.SHS and 7.JD of IIb and IIIb can be explained as being due to the similarity of the original values for these tones; or, finally, comparison of the values of *IIa in 10.JH, 3.CS and 1.SZ in that order suggested that non-turned tones may become turned (*45 > 434: 10.JH), one portion of the tone may then become emphasized over the other (*45 (> 434) > 423: 3.CS), and the turned tone may be reduced to a non-turned tone by loss of its final portion (*45 (> 434 > 423) > 42: 1.SZ).

Third, the Proto-Wu tones as reconstructed illuminate tone sandhi in at least two dialects in rather interesting ways.

In 13.WL, forms with the tonemes 33 and some with 31 become 15 when subject to a tone sandhi rule that creates a diminutive of the form. Forms with the other tonemes and some with 31 become 51 by the same process. The present day 13.WL tonemes offer no clues as to the natural classes involved here. The forms with the toneme 31, indeed, fall into two morphotonemic classes. An examination of the proto-system, however, shows that the rule can be stated as:

$$\begin{array}{l}[-\text{Rising}] \rightarrow 15\\ [+\text{Rising}] \rightarrow 51\end{array} \quad \text{or} \quad [\alpha \text{R}] \rightarrow \begin{bmatrix}-\alpha\text{Rising}\\ \alpha\text{Falling}\end{bmatrix}$$

An examination of the tonal history of 13.WL shows that three level I rules

34 > 55 (*23 >) 312 > 31 442 > 44 (>33)

have erased the rising components of the II,III words and caused the merger of (*31 >) 31 and (*23 > 312 >) 31. In other words, the rule above holds in 13.WL except that some very late changes have obscured the underlying tonemic system.

9.WZ.2 has extensive and rather opaque tone sandhi. If we limit our view to two syllable tone sandhi groups, we find that the combination of the present day tonemes to the left in the chart below results in the toneme sequence to the right:

1. 44,31 / 44 → 22 / 33
2. 45,34,42,22 / 44 → 42 / 33
3. 323,212 / 44 → 21 / 33
4. 44,31,323,212,42 / 31 → 22 / 2
5. 44,31,45,34,42,22 / 45,34 → 43 / 34
6. 323,212 / 45,34 → 21 / 34
7. 44,31 / 42,22 → 22$\overset{f}{\sim}$213 / 43
8. 45,34,42,22 / 42 → 42 / 21
9. 45,34,22 / 31 → 42 / 21
10. 323,212 / 42 → 21 / 42
11. 45,34,42,22 / 22 → 42 / 22
12. 323,212 / 22 → 21 / 22
13. 44,31,45,34,42,22 / 323,212 → 43 / 12
14. 323,212 / 323,212 → 21 / 12

I have tried to solve this tone sandhi problem elegantly for several years without satisfying results. The tonal reconstruction, however, led to interesting insights into the underlying tonal forms and the nature of the tonal alternations involved. For example, 44 shows an important alternant, 42, in first position. In addition, 22 is always a falling tone in first position. If, however, present day 44 and 22 are both analyzed on this basis as having a falling component in their underlying form, then it seems likely that present day 42,22 must be distinguished from present day 44,31 in some other way as well. The results are similar to those in 13.WL: if the proto-system is assumed to be the underlying system, the tone sandhi rules become:

IVa

$$[X] \rightarrow \begin{Bmatrix} [+\text{High}] & / & 1 \\ [-\text{High}] & / & 2 \end{Bmatrix} \quad (X = \text{a syllable with any tone})$$

$$\begin{array}{ll} \overline{1:} & \overline{2:} \\ \# \; \overline{\begin{bmatrix}\text{Cons.}\\ -\text{Vcd.}\end{bmatrix}} \; \# & \# \; \overline{\begin{bmatrix}\text{Cons.}\\ +\text{Vcd.}\end{bmatrix}} \; \# \\ \# \; \overline{\begin{bmatrix}\text{less}\\ \text{Stop}\end{bmatrix}} \; [X] \; \# & \# \; [X] \; \overline{\begin{bmatrix}+\text{Ris.}\\ -\text{Fall.}\end{bmatrix}} \; \# \\ \# \; \begin{bmatrix}+\text{Fall.}\\ -\text{Ris.}\end{bmatrix} \; \overline{\begin{bmatrix}+\text{Fall.}\\ +\text{Ris.}\end{bmatrix}} \; \# & \overline{\begin{bmatrix}+\text{Ris.}\\ \text{Stop}\end{bmatrix}} \; [X] \; \# \end{array}$$

i.e., any tone becomes [+high register]
    with voiceless initials, on any tone except Stop
    in first position in tone sandhi; and
    213 → 534/42,31___
any tone becomes low register
    with voiced initials, on any tone before II or Stop
    tones, and on Stop tones in first position

IVb

$$[+\text{Ris.}] \rightarrow [-\text{Ris.}] \; / \; \overline{\begin{bmatrix}+\text{High}\\ +\text{Fall.}\end{bmatrix}} \; \begin{bmatrix}-\text{High}\\ +\text{Fall.}\\ -\text{Ris.}\end{bmatrix} \#$$

i.e., 534 → 42/___31

IVc

$$[\text{-Fall.}] \rightarrow [\text{+Fall.}] \;/\#\begin{bmatrix}\overline{\text{+Ris.}}\\ \text{less}\\ \text{Stop}\end{bmatrix}\;[\text{X}]\;\#$$

i.e., 45, (34) → 534/___X

IIIa

$$[\text{+Fall.}] \rightarrow [\text{-Fall.}] \;/\left\{\begin{array}{l}\#\,[\overline{\text{-Ris.}}]\quad[\text{+Fall.}]\;\#\\ \#\,[\text{X}]\quad\begin{bmatrix}\overline{\text{-Ris.}}\\ \text{+High}\end{bmatrix}\;\#\\ \#\,\begin{bmatrix}\overline{\text{-Ris.}}\\ \text{+High}\end{bmatrix}\;\#\end{array}\right\}$$

i.e., 42 → 44/___42,534,31; in second position in tone sandhi, and in isolation.

IIIb

$$[\text{+Ris.}] \rightarrow [\text{-Ris.}] \;/\; \begin{bmatrix}\overline{\text{+Fall.}}\\ \text{+High}\end{bmatrix}$$

i.e., 534 → 42 everywhere

IIIc

$$[\text{+Ris.}] \rightarrow [\text{-Ris.}] \;/\#\begin{bmatrix}\overline{\text{-Fall.}}\\ \text{Stop}\end{bmatrix}\begin{bmatrix}\text{+Fall.}\\ \text{-Ris.}\\ \text{-High}\end{bmatrix}\#$$

i.e., 23 → 22/___31

IIa

$$[\text{+High}] \rightarrow [\text{-High}] \;/\left\{\begin{array}{l}\#\begin{bmatrix}\overline{\text{-Ris.}}\\ \text{-Fall.}\end{bmatrix}\quad[\text{X}]\;\#\\ \#\begin{bmatrix}\text{-Ris.}\\ \text{+Fall.}\\ \text{+High}\end{bmatrix}\begin{bmatrix}\overline{\text{-Ris.}}\\ \text{+Fall.}\end{bmatrix}\#\end{array}\right\}$$

i.e., 44 → 22 in first position; 42 → 31/42___

IIb

$$[+\text{Contour}] \rightarrow [-\text{Contour}] \;/\; \begin{bmatrix} \overline{+\text{Ris.}} \\ +\text{Fall.} \\ -\text{High} \end{bmatrix}$$

i.e., 213 → 22 everywhere

NB: A marking convention ($[-\text{Cont.}] \rightarrow \begin{bmatrix} -\text{Ris.} \\ -\text{Fall.} \end{bmatrix}$) is used as a linking rule here to change the values for Rising and Falling.

IIc

$$[-\text{Fall.}] \rightarrow [+\text{Fall.}] \;/\#\; \begin{bmatrix} \overline{+\text{Ris.}} \\ \text{Stop} \end{bmatrix} \begin{Bmatrix} \#, & [X] \end{Bmatrix}$$

i.e., 45 → 323; 23 → 212

Ia

$$[+\text{Fall.}] \rightarrow [-\text{Fall.}] \;/\#\; \begin{bmatrix} -\text{High} \\ -\text{Ris.} \\ -\text{Fall.} \end{bmatrix} \begin{bmatrix} \overline{-\text{Ris.}} \\ -\text{High} \end{bmatrix} \#$$

i.e., 31 → 22/22___

Ib

$$[+\text{Ris.}] \rightarrow [-\text{Ris.}] \;/\#\; \begin{bmatrix} \overline{+\text{Fall.}} \\ -\text{High} \end{bmatrix} [X] \;\#$$

i.e., 212 → 31/___X

Ic

$$[X] \rightarrow \left\{ \begin{array}{l} [+\text{Mid}] \;/\; \begin{bmatrix} \overline{+\text{Ris.}} \\ -\text{Fall.} \\ -\text{High} \\ \text{less Stop} \end{bmatrix} \\ \\ [-\text{Mid}] \;/\; \begin{bmatrix} \overline{+\text{Ris.}} \\ -\text{Fall.} \\ -\text{High} \\ \text{Stop} \end{bmatrix} \end{array} \right\}$$

i.e., 23 → 34 everywhere, but 23 → 12 in the only remaining environment: final position in a tone sandhi group

D-Rules:

$31 \rightarrow 21$

$44 \rightarrow 33/X\_\_\_\#$

$22 \rightarrow 2/22\_\_\_\#$

$42 \rightarrow 43/\_\_\_ \begin{bmatrix}+\text{Ris.}\\-\text{Fall.}\end{bmatrix}$

$(22 \rightarrow 213/\_\_\_42)$

In tone sandhi groups

Rule IVa represents the incomplete application of the Proto-Wu allotony rule in certain tone sandhi environments. Rue IVb shows the tendency of *534 to become a purely falling tone with concomitant pressure on *42--hence the merger of the two in certain tone sandhi environments. Rule IVc shows the frequent tendency in the Chinese area to merge tones II and III. Rule IIIa is the incomplete application in certain environments of the *42 > 44 shift, and rule IIIb completes the historical *534 > 42 shift. The lowering of 44 (part of rule IIa) may be due to dialectal borrowing. Finally IIb is also purely historical.

The tone sandhi rules in 9.WZ.3 are almost the same. However, rule IVa is altered so that the stop tones of rule IVa merge with the II tones of IVc; 9.WZ.3 lacks rule IIIc and alters rule IIIb to shift *534 to 44 after 42(31); it also lacks the D-rule $(22 \rightarrow 213/\_\_\_42)$ since the appropriate environment does not occur due to the change in rule IIIb.

In short, tone sandhi in 9.WZ clearly retains relics of the various tonal changes that derive its present day tones from Proto-Wu and provide a rather interesting confirmation of the Proto-Wu tonal reconstructions.

2.3 Historical Indeterminacy

Three kinds of historical indeterminacy will be discussed in this section: the type of residue or incomplete changes posited by Wang and discussed in Chapter I (2.31), weak areas in the Proto-Wu phonology (2.32), and the evidence in the correspondences for alternate reconstructions (2.33).

2.31 Possible Cases of Unconditioned Phonemic Split

Wang's mechanism for historical change and how it may account for unconditioned phonemic split (i.e., split without the Polivanov factor) was discussed in Chapter I. I also dealt at length with one possible case of this in Proto-Wu, namely the *u/*ou distinction. Other areas where a similar situation may occur are in the *ɤu/*eu, *iŋ/*eŋ/*ieŋ/*ɤŋ and *ik/*ek/*iek/*ɤk distinctions.

I pointed out above that the *ɤu/*eu distinction seems very odd. On the basis of the diphthongization of *ɤu in 13.WL, we may posit *eu for both of these correspondences with incomplete change in 9.WZ, 10.JH and 13.WL accounting for the apparent differences between these two correspondences.

It was noted above that *ie was in complementary distribution with both *i and *e before velar nasals and stops. Moreover, we noted that vowel epenthesis and the close relationship of these finals to *ɤŋ, *ɤk may indicate a reduction in the number of finals in this area. The most likely possibility seems to be to hypothesize *ie for most or all of the *i,*e,*ie finals with velar nasal and stop, and *e for the *ɤ finals. The parallelism between *iŋ, *ik, *ieŋ, *iek versus *eŋ, *ek and *ieu versus *eu suggests in particular that *iŋ, *ik may be derived from an earlier *ieŋ, *iek.

2.32 Weak Areas of Wu Phonology

Certain distinctions in Wu seem weak, i.e., they are more subject to change and irregularity than other distinctions, whether this weakness is attributed to reduced load, articulatory ease, phonetic drift, outside influence, or what have you.

Some of these phenomena in Wu might also be described as general, areal changes that are fairly common to the Chinese dialects as a whole. However, this explanation does not predict which areal changes Wu will accept; why areal influences should produce long-standing and irregular change; or why Wu has extended some areal changes in a logical (but irregular) fashion to suit its own phonology.

The fricative/affricate distinction for voiced affricates is weak in several respects. First, few dialects distinguish the two phones. Second, the reconstructed initials *dz, *z, *dʐ and *ʐ have a very defective but irregular pattern of distribution with respect to the finals. Moreover, many of the morphemes reconstructed with these initials are to a great extent irregular in some of the dialects. Chang Kun has pointed out to me a number of philological sources that seem to indicate the lack of such a contrast in the Wu area in the Sui-Tang period. He suggests that the apparent contrast may just be due to dialect mixture.

Y. R. Chao has pointed to the dzero pronunciation of 'zero' in Tennessee to suggest that the [z] / [dz] contrast may be universally unstable.[11] On the basis of these considerations we may posit the lack of this contrast in Proto-Wu with the note that in this area, there is a strong tendency to alternate between an affricate and a fricative. It is difficult to determine, however, whether this non-contrastive entity should be reconstructed as an affricate or as a fricative.

I have pointed out that *g, of all the velars, occurs in very few words with non-palatal finals. This may be indicative of the general shift of Archaic Chinese *g to Ancient Chinese *ɣ. It is not possible, however, to posit *g for all of the morphemes reconstructed with *ɦ, so we may merely note that in the underlying system it is likely that *g had a fuller distribution than the present reconstructions indicate.

The most difficult of these weak areas to explain is the toneme *II. 1.SZ, 6.SHS and 7.JD show regular collapsing of *II into *III, but in a variety of subsets of *II words, any one or more of the four dialects 2.WX, 5.HM, 8.SJ and 10.JH may shift *II to *III. In addition there are fewer words reconstructable as *II than as *I or *III in general; and aside from the shifty words, the number of exceptional items to regular tonal correspondences is small indeed. I have looked for an explanation of the shifts in borrowing, and indeed 2.WX and 5.HM show reflexes of *IIIa that phonetically are quite close to the phonetic reflex of *IIa in some neighboring non-Wu dialects, but this leaves unexplained 8.SJ, 10.JH, the phenomenon of *IIb > *IIIb, and why these two dialects should borrow phonetic tones for these and just these words and not for all *IIa words, or for words in any other tones. There is also the apparent affinity in some dialects between *II and the Stop tone. This association is another indication that *II is a weak point in the tonal system towards which the Stop tones could migrate with minimal influence on the basic system of contrasts. Note that the reconstructed tonal values clearly explain these *II-*III, *II-Stop affinities, but they do not explain why it is usually *II that suffers at the expense of its near tonal relative, or why the *III-*Stop affinity is so rarely exploited.

2.33 Evidence for Alternate Reconstructions

Two sorts of evidence support an alternate reconstruction of *ie for *i#. One is the trace of a two-vowel nucleus in 10.JH and 12.YK, which seems to be related to the *ien,*iet/*ian,*iat contrast. The other is the close relationship between *i and *ia in 9.WZ, which again parallels the *ien,*iet/*ian,*iat contrast. Moreover, if the *u/*ou/*o contrast is reduced to an *o/*ou contrast, a revised reconstruction of *ie for *i would make the simple vowel system considerably more like the vowel plus glide, nasal or stop systems.

I pointed out the possible traces of palatal nasals and stops in 12.YK above. Since 9.WZ shows *ik > [ei], it may also be possible to posit a lack of a velar/palatal contrast after the high front vowels.[12] Unfortunately, the data is not conclusive since 9.WZ also shows an *ɤk > [ai] shift when on the basis of 12.YK, it would seem to be *ʌk that might come from a palatal stop final.

Though internally Wu shows no clear evidence for a final *-m, the close relationship of *ɤn to *on; the diphthongization for *ɤn in 10.JH and 12.YK; and the fact that there is a regular correspondence between the final *ɤn and Middle Chinese *-m after *T,*TS and *K initials, all seem to indicate that the Proto-Wu *ɤn/*on distinction may come from an earlier *om/*on distinction (with *ɤn as *on after *P). In general, the same conclusions are true of *ɤt and *ot, but there the data are less clear.

1. Y. R. Chao informs me that Karlgren had similar views vis-a-vis his Ancient Chinese.

2. I am attempting, by using this procedure, to follow suggestions made by Søren Egerod in a paper to the First Meeting on Sino-Tibetan Reconstruction, October 3-4, 1968, at Yale University. He pointed out in his talk that this is the only way to ensure that we capture all useful information for later comparisons. using the reconstructions. As he put the point in question here:

   > What is today's redundancy is very likely
   > to have been yesterday's fundamentals.

   This historical position is equivalent to a full matrix position in synchronic description, i.e., where there are no zero markings for any features and no redundancy rules.

3. In 12.YK, 10.JH and 9.WZ.1 the sources show [x] for [h], but this seems to be a notational device only. [x] is still glottal (cf. 9.WZ.2.3) phonetically and is structurally parallel to [ɦ].

4. Mantaro Hashimoto interviewed an informant, one Li Hong-de, from Penglai in Shantung and found the contrast. His data shows that Ancient Chinese developed in the following ways in this dialect:

   *ʃ(ç) > [ʃu] (書)　　*ʂ > [ʂu] (梳)
   *s > [su] (蘇)　　*x > [çü] (序)

   In addition, a report on the Pingdu dialect in Shantung appeared in 方言与普通话集刊, Vol.2, pp.22-29, Peking, 1958, 文字改革出版社. It also shows the plain dental/alveolar-palatal/retroflexive/palatal contrast.

5. *TÇɨ1 is distinct from *TÇɨ2 only in 3.CS where the difference lies in the initial. The only plausible difference to reconstruct, accordingly, is *Tʂɨ versus *TÇɨ, which would create a new initial series with just one possible final. This seemed sufficiently unbalanced to warrant designating the distinction in the purely formulaic fashion chosen until the prehistory of Wu can be clarified.

6. I am greatly indebted to Mantaro Hashimoto for assistance in reconstructing these tonal values.

7. Examples of all reconstructions and correspondences are contained in three Appendices of data on which the present work is based. Fifteen copies of these Appendices are on file at the Phonological Laboratory, University of California, Berkeley, California.

8. Or none. I pointed out in Chapter I that this depends upon the phonemicization used.

9. It is interesting to note that Y. R. Chao's report on 10.JH still shows some nasalized vowels for some of these correspondences. Paul Kratochvil in a report' to the Chinese Linguistics Seminar, Princeton, on February 3, 1969, showed on the basis of spectographic analysis that in Peking Mandarin when a final dental nasal is lost in rapid speech, a trace of its presence remains in certain changes in the amplitude curve of the vowel. It may very well be that some such trace of nasalization is preserved in some of the dialects where segmental *-n has been entirely lost. At any rate, I am assuming that the 11.SX evidence supports a *-n > vowel nasalization > loss of nasal series of changes for all of the Wu dialects.

   Mantaro Hashimoto informs me that in Mandarin a syllable final -Vn when the retroflex diminutive suffix is added loses all trace of the nasal, but when the syllable final -Vŋ is so suffixed, the vowel becomes nasalized.

10. The two major obstacles to tone reconstruction to date have been a lack of knowledge of the phonetic nature of tones and a lack of experience in doing such reconstructions. It was assumed in the past (cf. Wm. S-Y Wang, 'Phonological Features of Tone,' IJAL, Vol. 33, No. 2, April, 1967; pp. 93-105) and in the reconstruction of the Proto-Wu tones that tones are adequately described by specifying the pitch level and contour of the base frequency; but Paul Kratochvil has recently suggested that amplitude may be an important factor. If that turns out to be the case, my reliance on pitch alone in the reconstruction of the proto-tones, as well as the stages of development for the dialects will have to be modified. But it is my conviction that we must try to do this sort of reconstruction for tones in order to begin to get an idea of what tonal histories might be like.

11. Mantaro Hashimoto has told me of similar phenomena in other Chinese dialects.

12. Note the change of *k, the Germanic reflex of Indo-European *g, to *c or *ch after *i and *e.

Chapter III

Structural Dialectology and Wu

3.0 Introduction

Section 3.1 reviews the theoretical background of modern structural dialectology and posits a new model of dialectal comparison. 3.2 suggests some of the theoretical products of this model. In 3.3 I present descriptions of the modern Wu dialects; and in 3.4 I show their comparative f-rule systems and discuss the relationships of the dialects to each other.

3.1 Dialectology

3.11 'Dialect'

The term 'dialect' has been used in a variety of meanings. Dialects have been specified as such on the basis of such criteria as: degree of mutual intelligibility, genetic relationship, non-conformity to a language norm, geographical separation of idiolects, different social status of idiolects, and what have you. In order to avoid these multiple meanings, Gumperz and Ferguson[1] posited 'suggestive descriptions' for three terms: variety, dialect and language. These are as follows:

> A variety is any body of human speech patterns which is sufficiently homogeneous to be analyzed by available techniques of synchronic description and which has a sufficiently large repertory of elements and their arrangements or processes with broad enough semantic scope to function in all normal contexts of communication.
>
> A language consists of all varieties which share a single super-posed variety having substantial similarity in phonology and grammar with the included varieties or which are mutually intelligible or are connected by a series of mutually intelligible varieties.
>
> A dialect is any set of one or more varieties of a language which share at least one feature or combination of features setting them apart

> from other varieties of the language, and which may appropriately be treated as a unit on linguistic or non-linguistic grounds.

Dialectology may be defined with these terms as the comparison of a set of varieties that share a feature or combination of features which set them apart from other varieties of the same language.

Specifying the shared features in such a way as to include some varieties and exclude others within a dialectal continuum may be theoretically arbitrary, but may have extra-linguistic justification. The Wu dialects[2] may be defined as those varieties of Chinese in which the two feature axes, voicing and aspiration, are required in the representation of the initial stop series, i.e., the combination of features that sets them apart from other varieties of Chinese. This leaves out many dialects in Jiangsu north of Shanghai that are in some ways like Wu and in some ways like Mandarin. But the speakers of the varieties within this definition accept each other as Wu speakers and enjoy a high degree of mutual intelligibility. The varieties to the north would seem to represent some sort of transition zone between Wu and Mandarin; the best way to study them is to analyze the core of the Wu area and then to expand that study to cover this surrounding band of varieties. Ultimately, the only rigorous way to define dialect groups is to specify the rules which will reveal both the differences between the dialects and their historical development from a common parent language. Then, if a tree diagram were to be drawn showing the continual branching off of various groups from the Ursprache down to the daughter varieties, a term such as the Wu Dialect would merely be a name for one particular node in that tree.

In the meantime, we must first compartmentalize the work artificially and then expand our knowledge of how a linguistic area evolved. The only ultimate limits will be that we lack sufficient information to push back further in time, or that we lack the conceptual and theoretical tools to achieve our aims with a particular body of data. Thus by setting up small closed domains as separate studies, we can determine with an ever greater degree of thoroughness the synchronic and historical systems that have descriptive adequacy for a dialect group, and can gain insights into phonological processes in a microcosm that can be extended to the macrocosm.

3.12 Weinreich, Moulton and Stankiewicz on Structural Dialectology

In the past, dialect comparison was concerned mainly with comparing precise phonetic qualities across dialects. More recently, there have been attempts to study structural dialectology, i.e., to compare phonological elements and systems, as well as phonetic entities. However, Uriel Weinreich[3] pointed out serious theoretical difficulties in this endeavor:

> If structuralism were carried to its logical extreme, it would not allow for the type of comparisons suggested here; it could only study relations within systems; and since in a perfect system all parts are interrelated ("tout se tient"),

> it is hard to see how systems could even be conceived of as partially similar or different; one would think that they could only be wholly identical or different.... Structural linguistics requires that the forms of the constituent systems be understood first and foremost in terms of those systems, since the formal units of two non-identical systems are, strictly speaking, incommensurable.... In other words, existing dialectology usually compares elements belonging to different systems without sufficiently stressing their intimate membership in those systems. In the domain of sounds, this amounts to a non-phonemic approach.

Weinreich proposed the use of diasystems to resolve this problem, but he pointed out that:

> Differences in distribution cannot be directly inferred from a comparison of the differences in inventory.

Moulton[4] illustrated this problem of phonemic inventory versus phonemic incidence with the following diasystems for the phonemic vowels of two Swiss German dialects:

$$_{\text{LU,AP}}/\!\!/\, i \approx e \approx \text{ɛ} \approx \text{æ} \approx a \approx \text{ɔ} \approx o \approx u \approx \ddot{u} \approx \ddot{o} \approx \ddot{\text{ɔ}} \,/\!\!/$$

Thus, in terms of phonemic inventory, the dialects appear to have exactly the same vowel system. But, if lexical correspondences are taken into consideration, the diasystem becomes:

$$_{\text{LU,AP}}/\!\!/\, \frac{i_0 \sim e_1 \sim \text{ɛ}_2 \sim \text{æ}_{3,4}}{i_{0,1} \sim e_{1,2} \sim \text{ɛ}_3 \sim \text{æ}_4} \approx a \approx \frac{\text{ɔ}_2 \sim o_1 \sim u_0 \sim \ddot{u}_0 \sim \ddot{o}_1 \sim \ddot{\text{ɔ}}_2}{\text{ɔ}_2 \sim o_{1,2} \sim u_{0,1} \sim \ddot{u}_{0,1} \sim \ddot{o}_{1,2} \sim \ddot{\text{ɔ}}_2} \,/\!\!/$$

(where the subscripts indicate corresponding phonemes at specific vowel heights), and the two vowel systems seem to be almost totally different. Both diasystems, Moulton asserts, give an incorrect picture of the actual dialectal relationship between LU and AP.

In a similar vein, Stankiewicz[5] notes that

> Extreme formal structuralism questions the possibility of comparing parts of systems on the ground that patterns are closed and unique configurations.

To resolve the difficulty he suggests that super-systems be devised for a dialect group on the basis of the distinctive features common to all the varieties subsumed under it. Dialects can then be seen as continuous in that they all share the use of certain features, and as discrete in the way they utilize them. Each phonemic system is determined only by its own internal relationships, but the axiomatically defined distinctive features are directly comparable from system to system. However, the assignment of features in each dialect is in part motivated by such systemic criteria as distribution, alternation and natural classes, but also in part by phonetics. And it is the phonetic aspect of the features which makes them comparable and the dialects continuous, not the systemic aspect of how particular features are used. Stankiewicz still has not solved the problem of identifying systemic units across dialects.

3.13 A New Model of Structural Dialectology

If we restrict ourselves to studying genetically related dialects, the new model of phonology proposed in Chapter I will avoid these dilemnas. The problem of 'identity' disappears when the lexical level for each dialect coincides with the reconstructed Ursprache. And, since the lexical items are identical across the dialects, differences in inventory versus incidence cannot occur by definition.

It should be observed, however, that the reconstructed Ursprache is no more a systemic level than the synchronic lexical level. It too represents chance preservation of contrasts of various time depths. The diachronic variation of the dialects is in fact perfectly parallel to allomorphy. Just as in a synchronic description the underlying form of a morpheme is revealed by its alternate shapes in various strings, so the reconstructed morpheme is the underlying form that is revealed by its alternate shapes in various dialects. Using Gumperz' term 'variety' we may coin the term 'variomorphy' to cover this phenomena. 'Allomorphy' will be restricted to mean alternate shapes in one variety; variomorphy will include alternate shapes in different varieties, whether that refers to style, social dialects (sociomorphy), or geographical dialects (geomorphy).

3.2 The Functions of Structural Dialectology

3.21 Phonological Plausibility

In a recent article[6] Noam Chomsky pointed out the need for theoretical constraints on rule content:

> A general theory of rule plausibility is clearly needed as a supplement to the theory of generative phonology,.... This matter leads us into an entirely new and relatively unexplored domain--namely, into consideration of the system of substantive (not formal) constraints on phonological rules,...

One function of these plausibility constraints is to evaluate alternative formulations of phonological systems.

Thus if a language to be analyzed on the basis of the syllable has two nasal syllable finals, namely

[əŋ] [ɑ̃]

there are at least two alternative phonological descriptions:

	Systematic Phonemic	Rule	Systematic Phonetic
A.	//əŋ//, //ɑŋ//	ɑŋ → ɑ̃	[əŋ], [ɑ̃]
B.	//ə̃//, //ɑ̃//	ə̃ → əŋ	[əŋ], [ɑ̃]

Most linguists would prefer analysis A because the rule in A 'makes more sense.' This preference rests in part on intuition and in part on some notion of linguistic universals, i.e., plausibility.

Chomsky and Halle's marking conventions are also available for use in evaluating alternative phonemic systems. If a language has a nasal prefix that always assimilates to a following oral stop in position of articulation, the preferred representation of the nasal at the systematic phonemic level would be as a dental nasal. But there is also a need for an evaluation metric to choose between a complex phonemic inventory and fewer rules and a simple phonemic inventory with more rules. Several of the Wu dialects contain phonetic finals of the following shapes:

A. [i#] [y#] [u#] [in] [yən] [uən]

[ɑ#] [ɑ̃]

[iəʔ] [yəʔ] [uəʔ]

[ɑʔ]

and they do not have the forms:

** [yn] ** [un] ** [iʔ] ** [yʔ] ** [uʔ]

The marking conventions would consider a uniform

B. //i#,in,iʔ // //y#,yn,yʔ // //u#,un,uʔ //
//ɑ#,ɑn,ɑʔ //

system as more highly valued (cheaper) than the occurring phonetic system, A. They alone do not weigh system B plus the rules

1. i → iə /___ʔ
2. y → yə /___n,ʔ
3. u → uə /___n,ʔ
4. ɑn → ɑ̃

against system A. Thus the notion of rule plausibility must be extended to include the notion of 'occurring at all' as well as 'occurring in what form.'

The comparison of geomorphical P-rule systems acts as just this sort of constraint on rule content and underlying system. The principle is that the rule systems of related varieties should be a similar as possible in both content and order. By making the rules similar and therefore more plausible in content we can continually improve the reconstructed phonology--we are in effect treating the proto-forms as phonologically plausible ones. By increasing the similarity of ordering we are making our statements about the timing of various changes as plausible as possible. And we are led to avoid writing ahistorical rules for any given dialect. This clarifies why complementary distribution must be treated with care--it may lead us into writing mechanical, artifactual statements that may turn out to be both implausible and ahistorical.

An additional result of this procedure is that it becomes very unlikely to posit a 'rule reversal.' Wang has shown the possibility that as time goes on and a change becomes more widespread in the lexicon, it may happen that a historical rule of the form

$$A > B$$

will be more economically stated as

$$B \rightarrow A$$

in some late synchronic grammar. In other words, at some point in time, the few remaining cases where A has not changed to B may appear to be the odd few that require a rule as opposed to the regular majority. By comparing phonologies, however, it becomes very unlikely that the direction of a change may be obscured by later developments, i.e., to posit the complement of a plausible rule. An example of this occurred in the 9.WZ tone sandhi presented in 2.23. If the modern value for tone Ia (44) were taken as basic, we might posit a rule

$$44 \rightarrow 42/\text{in certain tone sandhi environments}$$

Since comparison of the dialects revealed that the underlying form was probably 42, and that a rule 42 > 44 is historically correct for 9.WZ, I posited instead rule IIIa (p. 96),

$$42 \rightarrow 44/\ldots.$$

which is essentially the complement of the rule above, and which is, presumably, the plausible rule.

3.22 General and Specific Constraints on P-Rules

As Wang has pointed out,[7] changes spread through a lexicon gradually by becoming more generalized in application. In addition they tend to accumulate so that the more time elapses, the more change occurs both in inventory of phonological units and in the lexicon. To the linguist it appears that, through rule collapsing and through maximizing rule application, related simple changes are combined into more complex rules. But each variety does this differently to some extent, so that by comparing the dialectal phonologies, it is possible to break down the more complex changes into simpler ones again. In other words, the P-rules can be rewritten to cover simple sound changes that, when arranged in a chain, reveal the cumulative effects of a given complex change.

Two examples of this phenomenon from Wu are worth examining at this point. The proto-finals *ien and *ieu have reflexes in the dialects indicated as follows:

	*ien	*ieu		*ien	*ieu
1.SZ.1	I	i͡Y	6.SHS	i	iɤ
.2	iI	iY	7.JD	ie	y
2.WX	iI	iɤɯ	9.WZ.1	i	iau
3.CS	iE	iɤɯ	10.JH	iɛ	iu
5.HM	ie	iɤɯ	12.YK	iə	i ə u

From the comparison of the individual dialectal systems, we can derive the following plausible chains for these two finals:

$$\text{*ien}\ \begin{array}{l} > \left\{\begin{array}{l}\text{i}\\ \text{iI}\end{array}\right. > \ \text{I} \\ > \ \text{ie} \ > \left\{\begin{array}{l}\text{iE}\\ \text{iɛ}\end{array}\right. \\ > \ \text{iə} \end{array}$$

*ieu > iøy > i^{ø}Y > y
> iau
> iɤu > { iɤɯ
iɤ
iu
iəu

*ien loses its final -n and then the head vowel raises with subsequent monophthongization or lowers. *ieu becomes a more natural cluster by lowering the head vowel, backing it with subsequent loss, or by rounding and fronting the entire cluster with subsequent monophthongization. The interplay of P-rules and D-rules should be noted in these chains. This will be discussed in the next section.

This concept of a chain of rules has the appearance of being uneconomical. A rule of the form *ien > i would presumably be more economical in some sense than

*ien > ie > iI > I > i

The dialectal evidence supports the following hypothesis to cover such situations: Where no evidence is available, the rule must be formulated as *ien > i , but that 'implausible' rule is to be regarded as a schematic abbreviation for a chain of plausible P-rules, each of which covers a change in the binary value for just one feature at a time. For example, in the case of *ien discussed above, the loss of the final -n might be just the change

[+ segment] → [- segment]

On the basis of these considerations, we may propose one type of plausibility metric as follows: A P-rule can change only one feature value at a time, but several rules on the same level can apply to the same segment if all but one of the rules applies to some other segment as well, i.e., rules can overlap but not completely merge. (Without the restriction the principle would be vacuous.) The marking conventions as linking rules can also apply to the same segment without destroying the principle. It now seems to be true, in fact, that the linking rules derived from the marking conventions in many cases delimit a plausible chain, and that in any given change situation, a language may change along the path described by the linking rule but may only go part way. In other words the linking rule specifies the direction of change in many cases, while the specific rule for one language may just block the change at some point along its trajectory. Extensive research, especially in dialectology, should make it possible to establish a class of those features which may change their values in which co-occurrences with other features. Evaluation of alternative rule formulations will take the shape of establishing which set of changes leads from the known input to the known output by the most economical route (least number of changes) where each change occurs in the set of all possible changes.[8]

Two specific evaluative criteria that I would like to propose on the basis of the Wu material are as follows:

1) The mid-vowels [e] and [o] may diphthongize. If they do we expect to get [ie] or [ei] from [e], and [ou] or [uo] from [o].

2) The optimal affricate is non-diffuse and tends to be [+ sharp] as well ([tç]). The next least marked affricate is the diffuse, dental [ts] . If there is a non-sharp non-diffuse affricate, it will tend to be the retroflex [tʂ] , i.e., [+ flat] . Finally, if a language has utilized both [+ sharp] and [+ flat] for the non-diffuse affricate, it may also have a

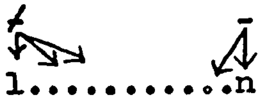
$\begin{bmatrix}-\text{sharp}\\-\text{flat}\\-\text{diffuse}\end{bmatrix}$ affricate, the alveolar [tʃ] .

3.23 D-Rules and Structural Dialectology

D-rules provide useful procedures for analyzing and describing phonetic shifts, i.e., phonetic as opposed to phonemic change. Postal represents the relationship expressed by D-rules in the following way:[9]

Phonological Feature F_i

Phonetic Feature F_i

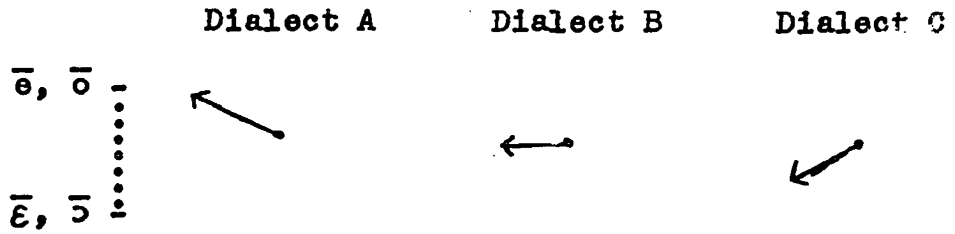


With this model, phonetic shift can be expressed as the movement of the arrows over the range of numerical values.[10]

Moulton has described a dialect continuum in Switzerland in which geographical variation in the phonetic height of the phonological mid, long vowels can very roughly be depicted as follows:

Dialect A		Dialect B		Dialect C	
$\bar{e}$	$\bar{o}$	$\overset{f}{\bar{e}\sim\bar{\varepsilon}}$	$\overset{f}{\bar{o}\sim\bar{ɔ}}$	$\bar{\varepsilon}$	$\bar{ɔ}$

Identical systematic phonemic and new phonemic mid vowels can be posited for all three dialects. The D-rules, however, would be as follows:

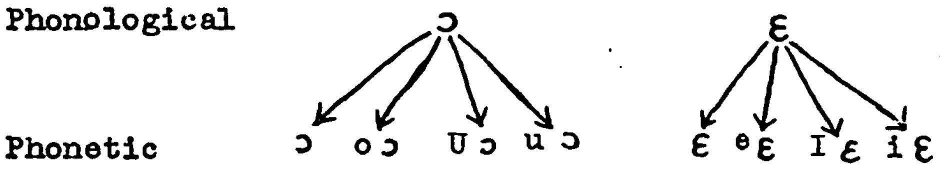


And it is readily apparent that they very neatly express the gradual shift.

In one of the Wu dialects, 9.WZ.2, there are two low-level rules of the form

ɔ > uɔ   ɛ > iɛ

However, the finals /uɔ/ and /iɛ/ show a large range of phonetic values. [uɔ] can vary, depending on the context, with [ɔ], [oɔ], and [Uɔ]; similarly, [iɛ] can vary with [ɛ], [eɛ] and [Iɛ]. If the rules ɔ > uɔ and ɛ > iɛ are considered to be D-rules, they become



It seems likely that this represents a D-rule with an unstable arrow--one which has recently shifted a great deal.[11]

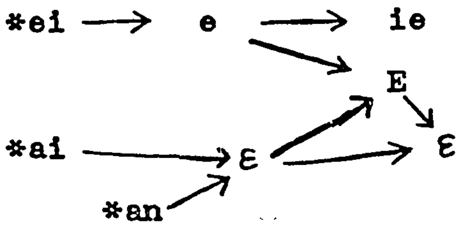
It turns out, however, that this illustration provides evidence for the effects of D-rules over time. Due to the fact that ordering requires that the rules be P-rules, the variation in the modern dialect merely provides evidence that the change represented by the P-rule is the result of gradually accumulated phonetic shift. We saw in the discussion of the developments affecting the final *ien above that whereas some dialects even today show that a phonetic shift of the form *ie > iI is still only a D-rule, in 9.WZ, again, the shift has become antecedent to a phonological change *ie > i , and here the dialect preserves no present day alternation to show the shift. The change *øy > y in 7.JD for the final *ieu illustrates exactly the same phenomena as evidenced by the results in 1.SZ. Another case of the same sort occurs with the following finals:

	*ei	*ai	*an
1.SZ	E	E	E
3.CS	E	ε	ε
6.SHS	e	ε	ε
7.JD	ie	ε	ε

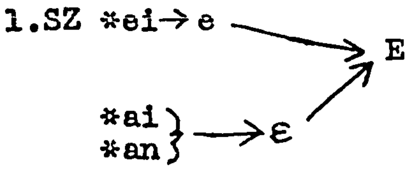
The report on 6.SHS, in fact, states that there is some sub-dialectal variation in this area for various speakers as follows:

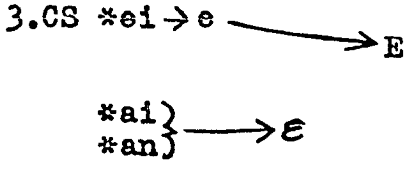
	*ei	*ai	*an	
I	e	ε	ε	(6.SHS above)
II	e	E	ε	
III	ε	ε	ε	
IV	e	e	ε	

From the comparative evidence, the chain becomes:



By dialects, the following portions of the chain apply:





6.SHS

I
$$\begin{tikzcd} {*ei} \arrow[r] & e \\ {\left.\begin{matrix}*ai\\ *an\end{matrix}\right\}} \arrow[r] & \varepsilon \end{tikzcd}$$

II
$$\begin{tikzcd} {*ei} \arrow[rr] & & e \\ & & E \\ {*ai} \arrow[r] & \varepsilon \arrow[ur] & \\ & {*an} \arrow[r] & \varepsilon \end{tikzcd}$$

III
$$\begin{tikzcd} {*ei} \arrow[r] & e \arrow[dr] & \\ & & E \arrow[d] \\ {\left.\begin{matrix}*ai\\ *an\end{matrix}\right\}} \arrow[rr] & & \varepsilon \end{tikzcd}$$

III
$$\begin{tikzcd} {*ei} \arrow[rrrr] & & & & e \\ & & & E \arrow[ur] & \\ {*ai} \arrow[r] & \varepsilon \arrow[urr] & & & \\ & {*an} \arrow[r] & \varepsilon & & \end{tikzcd}$$

7.JD
$$\begin{tikzcd} {*ei} \arrow[r] & e \arrow[r] & ie \\ {\left.\begin{matrix}*ai\\ *an\end{matrix}\right\}} \arrow[r] & \varepsilon & \end{tikzcd}$$

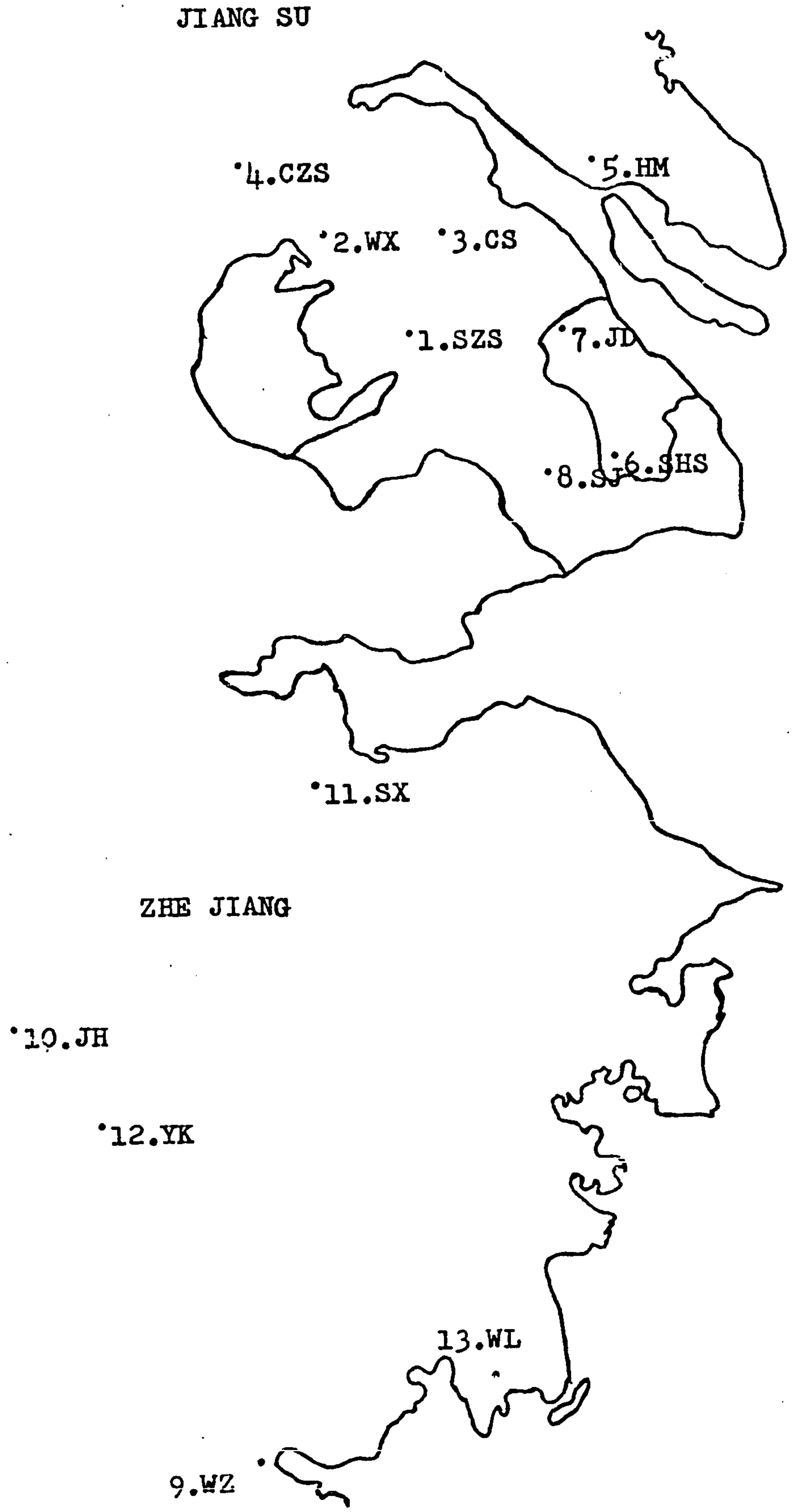
This illustrates how D-rule shifts accumulate in time to produce phonological change and how dialectal comparison reveals the processes involved.

3.3 The Wu Dialects

3.31 The Dialects

The sites covered in this study are shown on the following map. Below is a list of the sites with their Chinese names:

1.SZ	Su-Zhou-Shi	苏州市	8.SJ	Song-Jiang	松江
2.WX	Wu-Xi	无锡	9.WZ	Wen-Zhou	温州
3.CS	Chang-Shou	常熟	10.JH	Jin-Hua	金华
4.CZS	Chang-Zhou-Shi	常州市	11.SX	Shao-Xing	紹兴
5.HM	Hai-Men	海門	12.YK	Yong-Kang	永康
6.SHS	Shang-Hai-Shi	上海市	13.WL	Wen-Ling	温岭
7.JD	Jia-Ding	嘉定			


JIANG SU
4.CZS
5.HM
2.WX
3.CS
1.SZS
7.JD
8.SJ
6.SHS
11.SX
ZHE JIANG
10.JH
12.YK
13.WL
9.WZ

3.32 The New Phonemic Systems

This section presents a descriptive comparison of the new phonemic systems for the 13 Wu dialects in this study. 3.321 is concerned with the initials; 3.322, the finals; and 3.323, the tones. In all three cases a more meaningful and rigorous comparison must await the development of a theory of paradigm.

A decimal number after the site designation refers to a sub-variety within the dialect. The bibliographic sources for the dialectal data are listed for each site below.

Site	Bibliography Item Number
1.SZ.1	40
1.SZ.2	41
2.WX-8.SJ	41
9.WZ.1	40
9.WZ.2.3	27,28
10.JH	
Segmentals	26
Tones	2
11.SX	23
12.YK	25
13.WL	24

3.321 Initials

All of the dialects studied have at least the following initials:

p	t	ts	tç	k	ʔ/zero
ph	th	tsh	tçh	kh	
b	d		dʑ	g	
f		s	ç	h	
v		z		ɦ	
m	n		ȵ	ŋ	
	l				

except that 10.JH lacks the two initials, [ɦ] and [ŋ]; it does retain traces of them in that it shows words with the zero initial in lower register tones.

1.SZ, 6.SHS, 7.JD and 8.SJ have just this system. All of the other dialects except 2.WX add [dz] to this system and 4.CZS and 9.WZ.1 add just that. 2.WX shows a retroflex series ([tʂ, tʂh, ʂ, ʐ]), as does 3.CS ([tʂ, tʂh, ʂ, dʐ, ʐ]). The source for 1.SZ.2 states that some older speakers still retain a retroflex series in some words. For example:

	Older Speakers	Younger Speakers		Older Speakers	Younger Speakers
遭	tsæ 44	tsæ 44	僧	səŋ 44	səŋ 44
招	tʂæ 44	tsæ 44	升	ʂəŋ 44	səŋ 44
扫	sæ 52	sæ 52	村	ts'əŋ 44	ts'əŋ 44
少	ʂæ 52	sæ 52	春	tʂ'əŋ 44	ts'əŋ 44
早	tsæ 52	tsæ 52	存	zəŋ 13	zəŋ 13
沼	tʂæ 52	tsæ 52	純	ʐəŋ 13	zəŋ 13

In all of the dialects except 12.YK and 9.WZ.2.3, the palatal affricates are to some extent in complementary distribution with the velars. In 5.HM, 9.WZ, 10.JH, 11.SX, 12.YK and 13.WL they are in complementary distribution with the plain dental affricates; hence these dialects also add [ʐ] to the overall system. 12.YK has an additional initial series, [c, ch, ɟ, ç, j] which is in complementary distribution with the velars. The details of this complementary distribution are as follows:

1.SZ, 2.WX, 3.CS, 4.CZS, 6.SHS, 7.JD and 8.SJ show palatal affricates before the i,i-,y,y- finals, [n] and velars elsewhere. 1.SZ.1 has just the palatal (not dental) affricates [tç, tç'] before one final, [ia], and it loses [ɦ] before the i,i-,y,y- finals. The rest of the sites in this group have [ɦ] in all cases. 10.JH operates in essentially the same manner except that [n] remains [n] in all environments and the dental affricates alternate with palatal affricates before [y#].

5.HM's palatal affricates are in complementary distribution with the dental affricates, as well, in the same environments, i.e., i,i-,y,y- finals show palatals; [n], dental affricates and velars occur elsewhere. 11.SX is similar to 5.HM except that it has no y- on-glide finals, and except that it shows [TSy] but no [Ky].

The situation with the other dialects is somewhat more complex. 9.WZ.1 shows palatals before the i,i-,y,y- finals, but [n] and velars before [y#], as well as elsewhere--there is no [TSy]. 9.WZ.2.3 have lost most i- and y- onglides. As a result of this and other changes, the palatal affricates contrast in many environments with the velars, dental affricates, or both. For example:

9.WZ.2	tsi	tçiɛ	kiɛ
	--	tçy	ky
	--	tçi	ki
	tsau	tçau	kau
but only:	--	tçyɔ	--

Thus for 9.WZ.2.3, the palatal affricates must be said to be contrastive at the new phonemic level.

12.YK's palatal stop series is in complementary distribution with the velars before the i,i-,y,y- finals; the palatal affricates (including [n]), with the dental affricates plus [n] and [ŋ] before the same finals.

In 13.WL, the palatal affricates are in complementary distribution with the velars before the i,i-,y- finals except as noted below (the data are not clear with respect to [y#]), and the dental affricates plus [ŋ] before i,i-,y,y-. The dental nasal appears as such before [i#], but only [ȵ] occurs before the i-,y,y- finals. There are three finals with i- on-glides, i.e., [ie] ,[iɛ] and [iɤʔ], that occur after velars only (not palatals) and there are no [e] , [ɛ], [ɤʔ] finals after velars.

5.HM shows some voiceless [h] initial words in the b allotones; these are in complementary distribution with [ɦ], namely, [ɦ]/___i,i-,y,y-,u-, [h]/___elsewhere. 6.SHS and 8.SJ have some speakers who show [f^{f}~h], [v^{f}~h]/___[u] and [hu-]>[f], [ɦu-]>[v]. 11.SX shows alternation of [ɦ] and [v] before [u]. 11.SX also shows free variation of [dz] and [z], [dʑ] and [ʑ].

3.322 Finals

Unlike the initials, comparison of the final systems and tone systems is extremely difficult without a theory of paradigm. Some general descriptive statements are possible but for the most part I shall simply list the new phonemic final systems.

All of the dialects show the simple vowels

i y ɨ u
a o

except that 5.HM lacks the [i]/[y] contrast and has only [i]. Note that [o] is [uo] in 5.HM and 7.JD, and that [u] is in complementary distribution with [ɤu] in 1.SZ, [u]/P___, [ɤu]/___elsewhere.

Dialects 1.SZ-8.SJ have [iɑ, uɑ]. 9.WZ, 11.SX and 13.WL have [ia, ua]. 10.JH and 12.YK show [iă, ǐa, uă, ǔa]. In addition 1.SZ shows [ia] and 3.CS-8.SJ show [ua].

Various subsets of dialects also show [e, ie, uo]and [ø, iø, yø, uø] type finals, but no dialect shows more [ø] than [e] finals and several show more [e] than [ø] finals.

Some historically related finals pattern rather neatly in some of the modern dialects:

Mid Vowel plus -u:

^{ø}Y, i^{ø}Y	Y, iY	ɤu, iɤu	ɤ, iɤ	ɤu, iu
1.1	1.2	2,3,4,5 12	6,8,11 13	10

Low Vowel plus -u:

ɔ,iɔ	ʌ ,iʌ	ɑu, iɑu	au, iau
3,5,6,7 8,11,13	2	4	9, 10, 12

The complete open finals systems are:

1.SZ

i y ɨ,ʉ u
e ø o
a ɑ

ia, iø, iɑ
ue, uø, uɑ
ɤu
for .1 add: I, ^{ø}Y, i^{ø}Y
for .2 add: ie, Y, iY
NB: u/P___
ɤu/___elsewhere

2.WX

i y ɨ,ʉ u
e o
a ʌ ɑ

ie, iɑ, iʌ
ue, uɑ
ɤu, iɤu
ei

3.CS

i y ɨ,ʉ u
e ɤ o
a ɑ ɔ

ie, iɑ, iɔ, iɤ
ue, ua, uɑ, uɤ
ɤu, iɤu

4.CZS

i y ɨ,ʉ u
ɤ o
a ɑ

ie, iɑ , iɤ
ua, uɑ , uɤ
ɤu, iɤu, ɑu, iɑu
ai, uai, ei

5.HM

i		ɨ	u
e	ø		
a		ɑ	ɔ

ie, iɑ, iɔ
ue, ua, uo, uɑ
yø
ei, uei, ai, uai
ɤu, iɤu

6.SHS

i	y	ɨ	u
	Y		
e	ø	ɤ	o
a		ɑ	ɔ

iɑ, iɤ, iɔ
ue, ua, uɑ

7.JD

i	y	ɨ	u
		ɤ	
a		ɑ	ɔ

ie, iɑ, iɔ
ue, ua, uo, uɑ
yɤ

8.SJ

i	y	ɨ	u
e	ø	ɤ	o
a		ɑ	ɔ

iɑ, iɤ, iɔ
ue, ua, uɑ
yø

9.WZ.1

i	y	ɨ	u
e	ø		o
ɛ		ʌ	ɔ
a			

iu, ia, iɛ
ua, uɔ
yo, yɔ
ei, ai, iai
au, iau, ɤu
øy

NB: uɔ/Cons. less TS,n____
ɔ /___elsewhere

9.WZ.2.3

i	y	ɨ	u
e	ø		o
ɛ		ʌ	
a			

ia, iɛ
ua, uɔ
yɔ
ai, iai
au, iau, eu
for.2 add: ei, øy, ɤu, uiɛ
for.3 add: u, yɤ, uɛ

NB: Some speakers in .2 keep
*aŋ>ɛ>eɛ distinct from
*iau>iʌ>iɛ

10.JH

i	y	ɨ	u
		ɤ	o
a			

ię, i̯ă, ĭa, iu
ua, ua, uɤ
yɤ, yo
au, iau, ɤu
ei, uei, ai, uai

11.SX

i	y	ɨ	u
e		ɤ	o
a			ɔ

ie, ia, iɤ, iɔ
ue, ua

12.YK
i y ɨ ɯ u
ɤ
a

iă, ǐa, iɤ̆
uă, ŭa, uɤ̆
y̆a, yɤ̆

ai, uai, ɤi, uɤi
au, i̯au, ɤ̯u, iɤu
NB: o, ĭɤ , ŭɤ , y̆ɤ , y̆o
only in tone II and
only from *Stop

13.WL
i y ɨ ɯ u
e ø ɤ o
ɛ ɔ
a

ie, ia, iu, iɛ , iɔ , iɤ
ua, uo, uø, uɛ
yø
NB: ie/K__only; e/__elsewhere
iɛ /K̄__only; ɛ7___else.
iɤ /P,TÇ___only;
ɤ /T,TS___

The core of the nasal systems is

i$\overset{n}{ŋ}$:1-13

ɤ$\overset{n}{ŋ}$:1-13

iã, iaŋ : 1,2,5-13
ã, aŋ : 1-3, 6-13
uã, uaŋ : 1-3,7,9-13

uŋ :10,13

oŋ : the rest

ɑŋ, ɑ̃; uɑŋ, uɑ̃ : 1-8,11
ioŋ : 1-8, 11
yoŋ : 9,10,12
yuŋ : 13

All but 11.SX have [uɤ$\overset{n}{ŋ}$]. Some sites show high front rounded nasal finals:

y$\begin{matrix}\text{n: 1.1, 13}\\ \text{ŋ: 8}\end{matrix}$ yɤ$\begin{matrix}\text{n: 2,4,10}\\ \text{ŋ: 1.2,7,12}\end{matrix}$

The complete nasal systems are:

1.SZ.1
in yn
ɤn oŋ
aŋ ɑŋ

iaŋ, ioŋ
uaŋ , uɤn, uoŋ

1.SZ.2
iŋ
ɤŋ oŋ
ã ɑ̃

iã, ioŋ
uã, uɤŋ, uɑ̃
yɤŋ

2.WX
in
ɤn oŋ
ã ɑ̃

iã, ioŋ
uã, uɤn, uɑ̃
yɤn

3.CS
iŋ
ɤŋ oŋ
ã ɑ̃

iã, ioŋ
uɑ̃ , uɤŋ

4.CZS
in
ɤn oŋ
ɑŋ
ioŋ , iɑŋ
uɤn, uɑŋ
yɤn

5.HM
in
ɤn oŋ
iã, ioŋ
uɤn, uɑ̃

6.SHS
iŋ
ã ɤŋ ɑ̃ oŋ
iã, ioŋ
uɑ̃, uɤŋ

7.JD
iŋ
ã ɤŋ ɑ̃ oŋ
iã, ioŋ
uã, uɑ̃, uɤŋ
yɤŋ

8.SJ
iŋ yŋ
ã ɤŋ ɑ̃ oŋ
iã, ioŋ
uɑ̃, uɤŋ

9.WZ
eŋ oŋ
aŋ
iaŋ
for .1 add: yoŋ
for .2.3 add: uaŋ , $(\frac{i}{y})$oŋ

10.JH
in uŋ
ɤn
aŋ
iaŋ
uaŋ , uɤn
yaŋ , yoŋ , yɤn

11.SX
iŋ
ẽ ø̃ ɤŋ oŋ
œ̃
aŋ
iẽ, iø̃, iæ̃
ioŋ , iaŋ , iɑŋ
uẽ, uø̃, uæ̃
uaŋ , uɑŋ

12.YK
iŋ
ɤŋ oŋ
aŋ
iaŋ
uɤŋ, uaŋ
yaŋ , yoŋ , yɤŋ

13.WL
in yn uŋ
øn ɤn,ɤŋ
ã ɔ̃
iã
uɤn, uã, uɔ̃
yuŋ , yɔ̃
NB: ɤn/P___
ɤŋ/___elsewhere

The basic stop final system is:

iʔ /ieʔ /iɤʔ : 1-13

ɤʔ : 1-8,10,11,13   oʔ : 1-3,5-13

ioʔ : 1,3,5,6,7,8,9
yoʔ : 10,13,(12)
iɔʔ : 2,3,4

aʔ : 9,10,11,13   ɑʔ : 3,4,5,6,7
iaʔ : "   iɑʔ : "
uaʔ : " ,5   uɑʔ : 3,4,-,6,7
both: 1,2,8

The complete stop final systems are:

1.SZ

ɤʔ oʔ
aʔ ɑʔ

iaʔ, ioʔ, iɑʔ
uaʔ, uɤʔ
yɤʔ

add for .1: iɤʔ /TÇ___
iʔ /P,T,TS___
add for .2: iɤʔ /TÇ___
ieʔ /P,T,TS___

2.WX

ɤʔ oʔ
aʔ ɔʔ

iaʔ, ieʔ, iɑʔ, iɔʔ, iɤʔ
uaʔ, uɤʔ
yɤʔ

iɤʔ /TÇ___
ieʔ /P,T,TS___

NB: For 1.SZ and 2.WX, *ŋiak>ȵiɑʔ, *niak>ȵiaʔ, and this is the only occurrence of [iaʔ].

3.CS

ɤʔ oʔ
ɑʔ ɔʔ

iɤʔ, iɑʔ, iɔʔ, ioʔ
uoʔ, uɑʔ

NB: ɑʔ is a recent merger of ɑʔ and aʔ.

4.CZS

ɤʔ ɔʔ
ɑʔ

iɤʔ, iɑʔ, iɔʔ
uɤʔ, uɑʔ
yɤʔ

5.HM

ɤʔ oʔ
aʔ ɑʔ

iɤʔ, iɑʔ, ioʔ
uaʔ

6.SHS

ɤʔ oʔ
ɑʔ

iɤʔ, iɑʔ, ioʔ
uɤʔ, uɑʔ

7.JD
ɤʔ oʔ
ɑʔ ɔʔ

ieʔ , ioʔ , iɑʔ
uɑʔ , uɤʔ

8.SJ
ɤʔ oʔ
aʔ ɑʔ ɔʔ

ioʔ , iaʔ , ieʔ , iɤʔ , iɑʔ
uaʔ , uɤʔ
yeʔ

ieʔ $\overset{f}{\sim}$ iɤʔ

NB: * ŋiak>ɲiɑʔ , *niak>ɲiaʔ
and this the only occurrence of [iaʔ]

9.WZ.1
i y u
ʏ
e ø o
a

iu, ia, iɛ
ua
yo
ei, iai
ɤu

u/l,s,z___
ɤu/___elsewhere

iɛ /l___
ia /___elsewhere.

9.WZ.2
i y u
e ø o
a

ai, ei
ia, iai, ua} /ʔ __only
eu, ɤu

u/P___
eu/TÇ___
ɤu/T,$\overline{TS}$,K___

9.WZ.3
i y ɨ u
e ø o
a

ai, eu, yɤ , iɛ , uɔ
ia, iai, ua} /ʔ __only

eu/TÇ___
u/___elsewhere

iɛ /l___only
uɔ /P___only

10.JH
iʔ
ɤʔ oʔ
aʔ

ĭaʔ , iăʔ
ŭaʔ , uăʔ , uɤʔ
yoʔ , yɤʔ

11.SX
eʔ øʔ ɤʔ oʔ
œʔ
aʔ

ieʔ , ioʔ , iøʔ , iaʔ
ueʔ , uoʔ , uøʔ
uaʔ , uœʔ

12.YK has no stop tone class of finals, but some finals occur only in II and come from *Stop, as noted above.

13.WL

iʔ yʔ
øʔ ɤʔ oʔ
aʔ

iaʔ , iɤʔ
uaʔ , uoʔ , uɤʔ
yoʔ

3.323 Tones

Besides the stop tones, six of the dialects have just two or three sets of phonetically paired (High register/Low register) tones:

Level, Falling, Rising	8,9,11,12
Level, Falling-Rising, Rising	2
Falling, Rising	7

Two other dialects have one or two pairs with one tone left over:

Rising, Falling-Rising, ⌿ High Level	4
Rising, ⌿ High Falling	6

Three dialects have one pair of tones, one triplet of tones (High, Mid, Low) with one tone left over:

Falling (2), Falling-Rising (3),⌿ Low Rising	3
Falling (2), Rising (3), ⌿ Low Falling-Rising	5
Falling (2), Falling-Rising (3), ⌿ High Level	10

Finally, two dialects have just one pair of tones and three odd tones:

1: Falling, ⌿ High Level, Low Rising, High Falling-Rising
13: Falling, ⌿ High Level, Mid Level, Low Rising

If 3.CS, 5.HM and 10.JH are re-analyzed so that one member of their triplet tones is paired with their extra tone, they become:

Falling, Falling-Rising, Rising	3,5
Falling, Falling-Rising, Level	10

Similarly, if the data in 4.CZS and 6.SHS is taken to indicate the disappearance of the odd tone's Low member into one of the other pairs, it can be said that their systems point towards the pairs:

Rising, Falling-Rising, Level	4
Rising, Falling	6

As a result all of the dialects except 4.CZS, 10.JH, 1.SZ and 13.WL show evidence for at least two pairs of tones, Rising and Falling. All but these same dialects point to one other tone, namely:

Falling-Rising	2,3,5
Level	8,9,11,12

Since 4.CZS and 10.JH show both of these and lack either a Falling or a Rising tone pair, we might assign one of their Level or Falling-Rising tones to the missing Rising, Falling members, and we get:

$$\underbrace{\text{Rising, Falling,}}_{6,7} \left\langle \begin{array}{ll} \text{Level} & 8,9,11,12 \\ \text{Falling-Rising} & 2,3,5 \end{array} \right\rangle 4,10,\ (1)$$

1.SZ appears to operate like 4.CZS and 10.JH only even less clearly, and so it is listed after 4.CZS and 10.JH above in parentheses.

In almost all dialects, the Stop tones are simply High (5) and Low (2), or High and Low Rising (9.WZ.1, 11.SX).

The complete tonal systems are as follows:

1.SZ

44	42	534	5ʔ	
13		31	23ʔ	:.1
			2ʔ	:.2

2.WX

44	435	34	5ʔ
13	22	213	2ʔ

3.CS

42	423	534	5ʔ
13	31	213	2ʔ

4.CZS

44	45	534	5ʔ
213		13	2ʔ

5.HM

42	23	34	5ʔ
13	31	213	2ʔ

6.SHS

42	34	5ʔ
13		2ʔ

7.JD

42	34	5ʔ
31	13	2ʔ

8.SJ

42	44	34	5ʔ
31	22	13	2ʔ

9.WZ.1

44	45	53	23
31	24	22	12

9.WZ.2.3

44	45	53	323
31	23	22	212

10.JH

44	435	53	5ʔ
213	312	31	212ʔ

11.SX

42	45	44	45ʔ
31	23	22	23ʔ

12.YK

44	45	53
22	23	31

13.WL

44	42	55	5ʔ
31		13	2ʔ

3.4 Comparison of the Wu P-Rule and D-Rule Systems

3.41 Flow Chart

The following flow chart lists the P-rules and D-rules for each dialect for each of five Chavian levels of ordering.[12] The tonal P-rules are shown on a separate chart. I have eliminated from the chart and listed separately any rule in the dialects that is rare and sporadic in occurrence, or that would suggest an isogloss supported by just that rule. The symbol " means that the rule to its left is repeated in that dialect; i.e., it indicates horizontal, not vertical, repetition of content. The parenthesized rules are optional in application. The number to the right on each line of rules has the sole function of identifying that line of rules and will be used for the dialectal comparison in 3.42.

The method used in constructing these phonologies was essentially that described by Gumperz and Ferguson.[13] First the P-rule systems for each of the dialects was constructed in isolation and then the P-rule sets were compared. To the greatest extent possible rules and rule ordering were made to be similar for all of the dialects, and an attempt was made for them to share as many rules as possible. In this way the phonologies became more and more comparable, but they remain essentially internally motivated.

The flow chart allows for rather exact and precise comparison of the similarities between the dialects. There are several problems with ordering that should not be regarded as definitively resolved in the chart. For example, with respect to palatalization, it was found to be expedient to put all of the palatalization on one level, but 9.WZ with its palatalization of [h] before [ø] and 13.WL with its palatalization of the velar and dental nasals before certain finals both provide some evidence that palatalization for those two dialects has begun to be pushed up to Level II. The shifts in 9.WZ of [Ki] and other forms to [TSɿ] would seem to support this possibility. But the evidence, though suggestive, was not regarded as conclusive.

In another case, 9.WZ shows the two ordered rules:

1. ɤu > eu
2. eu > au

whereas most of the other dialects have only

ɤu > eu   or   eu > ɤu

or both. However, it appears that the rules in 9.WZ must occur in Level IV and III, respectively, whereas the rule in the other dialects comparable to 9.WZ's rule 1. should occur on Level III. It is assumed that this kind of anamoly in the phonologies has not received its full explanation and it will be investigated further.

Level V P-Rules

11	13	9	10	12	No.
ʌŋ > ɤn	ʌŋ > œŋ/C___	ʌŋ > ɤn/C___	--	ʌŋ > ɤn/C__	1
--	--	uʌŋ > ɤn	--	--	2
ʌk > ɤt	--	uʌk > yɤt	--	--	3
--	a > ɑ / {u__t (ʔ__t)}	a > ɑ / {Culess _t ʔu P___t}	a > ɑ /C___t	a > ɑ /___t	4
--	--	.1.3: eù > ieu/T__ .1.2.3: ieu > eu/ŋ__	eu > ieu/TS__	--	5
--	--	--	ɤ > ɑ/u__n	"	6
--	--	hu,ɦu > i,v/__ ei, aŋ, ɤŋ, ak, an	--	--	7
--	--	uɤ > ɤ /Cless ʔ___ ŋ,k	--	--	8
--	--	.2.3 (ot > ɤ k/T__)	--	--	9

Dialects 1-8: No Level V P-Rules

Level IV P-Rules

9	10	12	No.
.1.2: i > e/P,T TS,TÇ__#	i > e/Tless 1 TS __#	"	1
.1.2: ou > øy/__ .3: ou > øy/TS__	ou > o/m__	"	2
au > ɛ , ɑu > ɔ	ɤ > o/P__n	ɤ > o/C__n	3
a,ɑ, ɔ / ŋ > Ṽ	ɤ > o/P__t	ɤ > o/K__t	4
aŋ > ɛŋ , ɑŋ> ɔŋ	--	ɤ > e/else__t	5
ua > a/__ŋ	ɑ > a/u__n __t	ɑ > ɤ/u__t a/u__n	6
ia > e/T,TS,ɦ__#	--	--	7
.1: ia > e/TÇ__# .2: ia > e/ç,ʑ__# ɑ/tç,tçh,dʑ_# .3: ia > ɑ/tç,tçh,dʑ_#	--	--	8
ia > ɑ/k__#	"	?	9
ian > an/k,h ɦ,ŋ__	"	?	10
ɤ > e/C,u__ __u,k	ie,e > i/__ŋ	"	11a
--	(i > e/P__k)	i > e/__k	11b
ieu > iu/Cless K __	ieu > iu	--	12
ʌ > ɤ /__,k	ʌ > ɤ /__ ŋ,k	"	13
.2: io > o/l,TS__k	iɔ > ɔ/TS__ŋ Klessn__ŋ	--	14
--	i > ɨ/TÇ__#	?	15
ɨ1,ɨ2 > ɨ	"	"	16
--	--	--	17

1	2	3	4	5	No.
--	--	--	--	--	1-7
a > ɑ /TÇi__#	--	ɛ > ɑ /TÇi__#	--	--	8
.1: ia > a/k__# .2: (ia > ɑ /k__#)	(ia > a,ɑ /k__#)	ia > a/k__#	(ia > ɑ /k__#)	"	9
(ian > an/$\substack{k,h \\ \hat{n},ŋ}$ __)	"	"	"	"	10
e,ie > i/$\substack{Cless \\ TÇ}$ __ŋ i > e/TÇ__ŋ,k i,e > iə/$\substack{Cless \\ TÇ}$ __k	"	"	"	"	11
ieu > eu/$\substack{TS \\ Tlessn}$ __	ieu > eu/ Tlessn,TS,ç,ʑ__	--	ieu > eu/ T less n__	--	12
ʌ > ɤ/__ŋ,k	"	"	"	"	13
$\substack{iɔ \\ iɔ}$ > $\substack{o \\ ɔ}$/$\substack{Cless \\ K}$ __ŋ,k iɔ > ɔ/Klessh__ŋ	"	"	"	"	14
i > ɨ/TÇ__#	"	"	"	"	15
ɨ1,ɨ2 > ɨ/__	"	"	"	"	16
TÇi > TÇ/__V	" less ieu	"	"	"	17

Level IV P-Rules Continued

6	7	8	11	13	No.
--	--	--	--	--	1-7
--	--	--	a > ɑ /TÇi__#	"	8
(ia > a/k___#)	"	"	?	?	9
(ian > an/$\genfrac{}{}{0pt}{}{\text{k,h}}{\text{ɦ,ŋ}}$ __)	"	"	"	iɛn > an/ɦ__ (else. ?)	10
e,ie > i/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{TÇ}}$ ___ŋ	"	"	"	ie > i/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{TÇ}}$ ___ŋ ?	11a
i > e/TÇ___ ŋ,k i,e > ie/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{TÇ}}$ ___k			" i > ie/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{TÇ}}$ ___k	?	11b
--	--	--	--	ieu > iu/___	12
ʌ > ɤ/___ ŋ,k	"	"	--	ʌ > ɤ/___ŋ,k	13
$\genfrac{}{}{0pt}{}{\text{io}}{\text{iɔ}}$ > $\genfrac{}{}{0pt}{}{\text{o}}{\text{ɔ}}$/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{K}}$ ___ ŋ,k iɔ > ɔ /Klessh___ŋ	"	"	? "	? ?	14
i > ɨ/TÇ___#	"	"	"	?	15
ɨ1,ɨ2 > ɨ/___	"	"	"	"	16
TÇi > TÇ/___V	"	"	"	" (less *iet ?)	17

Level III P-Rules

9	10	12	No.
.1.2: ɛ̃ > iɛ̃	e > ie/ (P)___k TS Tlessl ___#	e > ie/ C__t Tlessl___k TS Tlessl__#	1
.1: ɔ̃ > uɔ uɔ̃ /Cless__# TS,n .2.3: ɔ̃ > uɔ uɔ̃ /C___#	o > uo/ ___# P___n,t	o > uo/Cless l ___# ____n,t	2
ek > ei	ɑ > ua/___#,t	"	3
.1.2: e > ei/P,T TS,TÇ___#	--	a > ia/Cless l ___#	4
i > y/___ɔ			
i > e/___ŋ,k			
e > i/ɦ___#			
uɤn > on			
.1: (o > ou/l,s,z___k) .2: o > ou/T,TS,___k			
.1.2: f,v > h,ɦ/___ oŋ,ɔ .3: f,v > h,ɦ/___ oŋ,ɔ,ɑt	--	--	5
o > u/i___k			
.1: o > u/Tless l Pless m K ___k .2: o > u/P,K___k .3: o > u/___k			
Vn > Ṽ	"	"	6
ɔ > o/___l	ɔ > o/___ŋ,k	"	7

9	10	12	No.
yei > y/___	y > u/(K,TS)___ei K___ɑŋ	y > u/(K,TS)___ei	8
.1.2: ia > ie/___n,t .3: ia > ie/$\overset{\text{Cless}}{\text{T}}$ ___n,t	--	--	9
--	yɤ > ie/TS__n,t	yɤ > ie/TS___t	10
--	a > ɑ /Kless ŋ_k Ki,u,ʔi	a > ɑ /i___k	11
a > e/C___i	e > a/C___i	a > e/C___i	12
.1.3: y > u/TÇ___#	--	--	13
--	--	--	14
e > a/___i, ŋ,k	--	--	15
ai > a	uai > ua	"	16
eu > au	eu > ɤ u	"	17
--	o > ɤ /___t	?	18
--	--	--	19
--	--	--	20

1	2	3	4	5	No.
--	--	--	--	--	1-5
Vn > Ṽ	"	"	"	"	6
ɔ > o/___η,k	ɔ > o/___η o > ɔ/___k	ɔ > o/___η i___k (TS,TÇ__k)	ɔ > o/___η o > ɔ/___k	ɔ > o/___η,k	7
y > u/(TS,K)___ei (K)___ɑη	"	"	"	"	8
ia > ie/___n,t	"	"	"	"	9
yɤ > iɤ /TS__n,t	"	"	yɤ > iɤ /TS___n (TS___t)	yɤ > iɤ /TS__n,t	10
a > a/ni___k > ɑ/else__k	a > a/ni,η__k > ɑ/else__k	a > a/ni___k > ɑ/else__k	"	"	11
a > e/C___i	"	--	e > a/C___i	--	12
y > ʉ/TÇ___#	"	"	"	"	13
(ie > e/P__k)	"	"	"	--	14
e > ɤ /TÇ__n,η	"	"	"	"	15
.1: uai > ua .2: (uai > ua)	uai > ua	(uai > ua)	uai > ua	(uai > ua)	16

1	2	3	4	5	No.
ɤu > eu	ɤu > eu/__ eu > ɤu/i__	ɤu > eu/___ eu > ɤu/$\genfrac{}{}{0pt}{}{\text{i\_\_}}{\text{TÇ\_\_}}$	ɤu > eu/___ eu > ɤu/i___	eu > ɤu	17
o > ɤ /T,K__t	"	(o > ɤ /K___t)	o > ɤ /T,K__t	"	18
TÇ^{u}_{y} > TÇ/___V	"	"	TÇy > TÇ/__ɤn $\genfrac{}{}{0pt}{}{\text{TS}}{\text{TÇ}}$y > $\genfrac{}{}{0pt}{}{\text{TS}}{\text{TÇ}}$u/___V	TÇ^{u}_{y} > TÇ/___V	19
--	oŋ > ioŋ /n__	(oŋ > ioŋ /n_)	oŋ > ioŋ /n___	--	20

Level III P-Rules Continued

6	7	8	11	13	No.
--	--	--	--	--	1-5
Vn > $\tilde{V}$	"	"	"	"	6
ɔ > o/__ŋ,k	ɔ > o/__ŋ P,i__k	"	ɔ > o/___ŋ,k	"	7
y > u/(TS,K)__ei (K)___ɑŋ	"	"	"	yei > y	8
ia > ie/___n,t	"	"	"	"	9
yɤ > iɤ/TS__t	"	"	"	?	10
a > a/ni___k > ɑ/else__k	"	"	--	?	11
--	--	a > e/C___i	"	"	12
y > u/TÇ___#	"	--	--	--	13
(ie > e/P__k)	--	(ie > e/P__k)	"	?	14
e > ɤ/TÇ__n,ŋ	"	"	e > ɤ/TÇ___ŋ	?	15
(uai > ua)	"	uai > ua	"	"	16
eu > ɤu	eu > ɤu/C___i	eu > ɤu	"	"	17
o > ɤ/K____t (T___t)	(o > ɤ/K__t)	o > ɤ/T,K__t	o > ɤ/K__t	?	18
TÇu,y > TÇ/___V	"	"	"	?	19
--	--	--	--	--	20

9	10	12	No.
.1.2: e > ei/P,T, TS,TÇ___k	--	e > ei/l,TÇ___k	1
iɛ uɔ > VV̆ yɔ	ia ua > VV̆___#,~,t	ia ua > VV̆/___#,~,t ie uo > VV̆/___#,~,t yɤ > VV̆/___~	2
i > ɨ/k,kh,g,h___# .3: i > ɨ/TS___#	u > y/TÇ___ɑŋ	"	3
--	ɑ > a/___u	"	4
yɤ > yo/___ŋ	--	--	5
TSu > TS/___V	"	?	6
ɑ > o/___#	--	--	7
--	TÇ > TS/___ɨ	--	8
ɤ̃ > õ õ > ø/K___	--	--	9
ɤ > ɤ/y___t > o/else___t o > ø/K___t	--	--	9a
--	--	--	10
.1.2: u > ou/T,TS___# .3: u > o/Tlessl,TS___# .1: o > u/Plessm___# Tlessl (TS___#) > ou/l___# .2: o > u/P,K___# > ou/T___# .3: o > u/P,K Tlessl___# .1: y > ʉ/TS___# .3: y > ʉ/TS,K___#	--	--	11
.3: ou > u/P,T___#	ou > u/ ___#	ou > o/l___# u/Tlessl,TS_#	
--	--	--	12-14

1	2	3	4	5	No.
--	--	--	--	--	1-3
ɑ > a/___u	a > ɑ /___u	"	"	"	4
--	--	y ɣ > io/__ ŋ,t,k	--	y ɣ > y/__ŋ io/__t,k	5
TSu > TS/___V	"	"	--	TSu > TS/___V	6
a > ɑ /___# ɑ > o /___#	"	"	"	"	7
TÇ > TŞ ɨ > ʉ/TÇ__#	TÇ > TÇ/__i- > TŞ/else. ɨ > ʉ/TÇ___	TÇ > TŞ ɨ > ʉ/TÇ__#	TÇ > TS	"	8
ɣ̃ > ẽ/i___# > õ/else___#	ɣ̃ > ẽ/i___# > õ/else__#	ɣ̃ > ẽ/i___#	--	ɣ̃ > õ/Ky, TÇŋ __# > ẽ/else__#	9
y > i/K___ɣ̃	"	"	"	--	10
u > ou/T,TS,K_# o > ou/T,TS,K_# o > u/Plessm_# ou > o/m__# ou > u/Plessm_#	u > ou/T,TS_# o > ou/___# ou > u/f,v__#	u > ou/T,TS, _# o > ou/T,TS,K_# o > u/Plessm_# ou >o/m___# ou >u/Plessm_#	u > ʉ/TS___# o > ou/___# ou > ʉ/TS__# ou > u/m,TS__#	-- o > u/___# ou > u/___#	11
(a > ɑ /TÇ__ ŋ)	"	a > ɑ /u__ŋ (TÇ__ŋ)	a > ɑ /___ŋ	"	12
--	(ŋ > ɦ/__u#)	--	ŋ > ɦ/__u#	(ŋ > ɦ/__u#)	13
--	(at > iat)	--	(at > iat)	--	14

6	7	8	11	13	No.
--	--	--	--	--	1-3
a > ɑ/__u	"	"	"	"	4
y ɤ > io/__ŋ,t,k	(y ɤ > y/__ŋ) y ɤ > io/__t,k	y ɤ > io,y/__ŋ y ɤ > io/__t	--	y ɤ > y/__ŋ	5
ue > ø/TS__i	ue > ɤ /TS__i e > ɤ /T__i	ue > ø/TS__i	TSu > TS/__V	?	6
a > ɑ/__# ɑ > o /__#	"	"	ɑ > o/__#	"	7
TÇ > TS	"	"	TÇ > TS/__y#	TÇ > TS/__ɨ,ɑ	8
ɤ̃ > ẽ/Ku__# > õ/else__#	ɤ̃ > ẽ/__#	ɤ̃ > õ/Ky,ŋ__# > ẽ/else.__#	ɤ̃ > õ/P,Ky__# > ẽ/TÇ,ŋ__# > ẽ,õ/__else.	ɤ̃ > õ/Ku,Ky__# > ẽ/K__#	9
--	--	--	ɤ > o,e/TÇ,u__t > e/else.__t	--	9a
--	--	--	y > i/K__ɤ̃	--	10
o > u/__#	"	o > u/$\overset{\text{Cless}}{\text{m}}$__#	o > u/Klessŋ__#	o > u/T,TS__# > ɯ/K__#	11
ou > u/__#	"	"	"	ou > u/T,TS__#	
(a > ɑ/TÇ__ŋ)	"	a > ɑ/TÇ,u__ŋ	--	--	12
(ŋ > ɦ/__u#)	--	--	ŋ > ɦ/__u#	--	13
(at > iat)	"	"	--	--	14

Level I P-Rules

9	10	12	No.
ø > y/K___~,t K > TS/___ɨ .3: K > TS/___ɥ h > ç/___ø ŋ, n > ɲ/___i# ɦ > j/___i-,y,y- .1: ʑ > ɦ .2.3: ʑ > j ua > a/___i,k uɑ > o/___t ɛ > ʌ /i___non-nas. a > ɛ/li___k ɤ > e/___k	uo > uɤ /ClessP_# m___# ___~,t ɑ > a/____ iă > iă/ç,ʑ,ɦ_# > ĭa/else. uă > ŭa/Cless h,ɦ ___~ Cless K ___#,t > uă/else.	uo > uɤ/___# P___~,t > ɯɤ /P___~,t π iă > ĭa/T,TS__# uă > ŭa/Cless ʔ ___~	1-2
h,ɦ > f,v/___u# .1.2: y > øy/l___# .3: y > u/l___# .1: ɑ > o/P___t .3: ɑ > uɔ /P__t .2.3: i > e/__u#,uk	--	--	3
Ṽ > V	"	"	4
--	--	--	5
-t,k > zero	-t > zero III -k > ʔ	-t,k > zero II	6

Level I P-Rules Continued

9	10	12	No.
--	ŋ > n/i,e,ɤ ___	--	7
ou > ɤu/___#,k	--	--	8
TÇ >TS/___ɨ,ə$\left\{\begin{matrix}\text{i}\\ \text{ŋ}\end{matrix}\right\}$ .1: TÇ > TS/__ʉ,e$\left\{\begin{matrix}\text{i}\\ \text{ŋ}\end{matrix}\right\}$ .2: TÇ > TS/__o#,e$\left\{\begin{matrix}\text{i}\\ \text{ŋ}\end{matrix}\right\}$ .3: TÇ > TS/__ʉ,o#	--	TÇ > TS/___ ɨ,u,uɤ y,ɤi, iŋ,ɤŋ	9
.1.2: ie > i/___~,t .3: ie > i/$^{\text{Cless}}_{\text{T}}$ ___~,t	--	--	10
o > ∅/___~,t	õ > ɤ /C___	--	11
n,K > TÇ/___ i- y,y-	K > TÇ/___ i,i- y,y-	K > C/___ i,i- y,y-	12
TS > TÇ/___i-,y-	(TS > TÇ/__y#)	TS > TÇ/___ i,i- y,y-	13
--	--	--	14
.1: ʉ > ɨ	--	--	15
--	--	--	16- 21
.1: i > y/__oŋ	i > y/___oŋ,k	"	22
yɤ̇ > y/___~,t	--	--	23
ŋu > ŋ	--	--	24

1	2	3	4	5	No.
-- Vi > V	--	--	--	--	1-3
Ṽ > V	"	"	Ṽ > V	"	4
.2: ɑŋ,aŋ > Ṽ	"	"	--	ɑŋ > Ṽ	5
-t,k > ʔ	"	"	"	"	6
.1: ŋ > n/i,ɤ ___	"	--	ŋ > n/i,ɤ ___	"	7
ou > ɤ u	"	"	"	--	8
TŞ > TS	TŞ > TS/___ɑ{ŋ,k} ___o{(#,~), (ŋ,k)}	TŞ > TS/___o#	--	--	9
.1: ie > I	--	--	--	--	10
õ > ø	--	õ > ɤ	"	õ > ø	11
n,K > TÇ/___i,i- y,y-	"	"	"	"	12
.1: ts,> TÇ/___iau tsh	--	--	--	TS > TÇ/___i,i-	13
au > a	ɑu > ʌ	ɑu > ɔ	--	ɑu > ɔ	14
--	--	--	--	u > ɨ	15

Level I P-Rules Continued

1	2	3	4	5	No.
	"	"	"	"	16
e > ɤ/C__t,k					
.1: ie > i/$^{\text{Cless}}_{\text{K}}$ __t,k .1.2: ie > iɤ/K___t,k	ie > iɤ/K__t,k	ie > iɤ/__t,k	"	"	17
--	a > ɑ/i__t	a > ə/___t	"	--	18
y > i/TS___# .2: y > i/l___#	y > i/l,TS__#	y > i/n___#	--	y > i/___#	19
.1: øy > ø$_{\text{Y}}$ .2: øy > Y	eu > ei	ei > e	eu > ei	--	20
--	o > u/$^{\text{Cless}}_{\text{m}}$__#	o > u/$^{\text{Plessm}}_{\text{Klessŋ}}$_#	--	--	21
--	--	--	--	--	22-24

Level I P-Rules Continued

6	7	8	11	13	No.
--	--	--	--	--	1-3
Vi > V, Ṽ > V	"	"	Vi > V	Vi > V, Ṽ > V	4
ɑŋ, aŋ > Ṽ	"	"	--	aŋ,ɔŋ > Ṽ	5
-t,k > ʔ	"	"	"	"	6
--	--	--	--	ŋ > n/$\begin{smallmatrix}\text{P ɤ,uɤ}\\\text{i,e,æ}\end{smallmatrix}$—	7
ɤu > ɤ /___#	"	"	"	"	8
--	--	--	--	--	9
--	--	ie > i	--	--	10
õ > ø	õ > ɤ	õ > ø	o > ø/____~,t	õ > ø	11
n,K > TÇ/$\begin{smallmatrix}\text{i,i-}\\\text{\_\_y,y-}\end{smallmatrix}$	"	"	n,K > TÇ/_i,i-	n,K > TÇ/$\begin{smallmatrix}\text{i,i-}\\\text{\_\_y-}\end{smallmatrix}$	12
--	--	--	TS > TÇ/__i,i-	TS > TÇ/$\begin{smallmatrix}\text{i,i-}\\\text{\_\_y,y-}\end{smallmatrix}$	13
ɑu > ɔ	"	"	"	"	14
ʉ > ɨ	"	--	--	--	15

6	7	8	11	13	No.
e > ɣ /C__t,k	"	"	--	--	16
ie > iɣ /___t,k	--	(ie > iɣ /__t,k)	--	--	17
a > ɑ /___t	"	--	--	--	18
y > i/l___#	--	--	--	--	19
--	iøy > y	--	--	--	20
--	--	--	--	--	21
--	--	--	--	i > y/___o ŋ,k	22
--	--	--	--	y ɣ > y/___t,k	23
--	--	--	--	ŋu > ŋ̩	24

1.1	1.2	2	3	4	5	6	7	No.
ɤ > ə /_ n	ɤ > ə/_ ŋ,ʔ	"	"	"	"	"	"	1
ɤu > əu	"	ɤu > ɤɯ	"	"	"	--	--	2
e > E/__#	"	e > E/__$\genfrac{}{}{0pt}{}{i}{\#}$	e > E/__#	--	--	--	--	3
a > æ/__#	"	a > ɛ/__#	"	a > ɛ/__# > æ/__i	a > ɛ/__# > E/__i	a > ɛ/__#	"	4
ɨ > ɿ ʉ > ʮ	"	ɨ > ɿ ʉ > ʮ	"	ɨ > ɿ ʉ > ʮ	ɨ > ɿ	"	"	5
i > I/__ʔ	ie > iI/__$\genfrac{}{}{0pt}{}{ʔ}{\#}$	"	--	ie > iI/_#	--	--	ie > iI$^{>\vee}$ /__ʔ	6
--	--	--	--	Vi > VI	"	--	--	7
--	--	--	--	--	--	--	--	8

8	11	13	9.1	9.2	9.3	10	12	No.
ɤ > ə /__ ŋ,ʔ	ɤ > ə /_ŋ	ɤ > ə /_$^{n}_{ʔ}$	ʌ > ɜ /_#	ʌ > ə /_#	"	ɤ > ə /__	"	1
--	--	--	ɤu > əu	--	--	--	--	2
--	e > E/__#	--	e > E/__#	--	--	--	--	3
a > ɛ /_$^{\#}_{ʔ}$	--	--	--	--	--	--	--	4
ɨ > ʅ	"	"	"	"	ɨ > ʅ ʉ > ʯ	ɨ > ʅ	"	5
ie > iI/_ʔ	--	--	--	--	--	ie > iɛ /_#	--	6
--	--	--	--	--	--	--	--	7
--	--	$\begin{matrix}\text{nas}\\ \text{lat}\end{matrix} > \begin{matrix}\text{ʔX/II\_}\\ \text{ɦX/else}\end{matrix}$	--	$\begin{matrix}\text{nas}\\ \text{lat}\end{matrix} >$ ɦ̸	"	--	--	8

1	2	3	4	5	6	7	No.
Level III:							
23 > 312	23 > 22	23 > 312	23 > 13	23 > 312	--	--	1
45 > 435	"	"	--	--	--	--	2
42 > 442	"	--	42 > 442	--	--	--	3
31 > 231	"	"	"	"	"	--	4
Level II:							
231 > 23	"	"	"	"	"	--	1
435 > 423	--	435 > 423	--	--	--	--	2
--	534 > 34	--	--	534 > 34	"	"	3
213 > 31	--	--	--	--	--	--	4
Level I:							
442 > 44	"	--	442 > 44	--	--	--	1
23 > 13	"	23 > 22	23 > 213	23 > 13	"	"	2
--	--	--	213 > 13	--	213 > 13	"	3
312 > 31	--	312 > 31	--	312 > 31	--	--	4
423 > 42	--	--	--	45 > 23	45 > 34	"	5
45ʔ > 5ʔ	"	"	"	"	"	"	6
.2: 23ʔ > 2ʔ	"	"	"	"	"	"	7

8	11	13	9	10	12	No.
Level III:						
23 > 22	--	23 > 312	--	23 > 312	--	1
45 > 44	--	45 > 435	--	45 > 435	--	2
--	--	42 > 442	"	"	"	3
--	--	--	--	31 > 231	31 > 331	4
Level II:						
--	--	--	--	231 > 23	331 > 22	1
--	--	435 > 423	--	--	--	2
534 > 34	"	"	534 > 53	"	"	3
--	--	--	--	213 > 31	"	4
Level I:						
--	--	442 > 44	"	"	"	1
--	--	--	--	23 > 213	--	2
213 > 13	213 > 22	213 > 13	213 > 22	--	--	3
--	--	312 > 31	--	--	--	4
-- --	-- 34 > 44	423 > 42 34 > 55	-- 23 > 24	-- --	-- --	5
45ʔ > 5ʔ	--	45ʔ > 5ʔ	.1: 45ʔ > 23 .2.3: 45ʔ > 323	45ʔ > 5ʔ	45ʔ > 45	6
23ʔ > 2ʔ	--	23ʔ > 2ʔ	.1: 23ʔ > 12 .2.3: 23ʔ > 212	23ʔ > 212ʔ	23ʔ > 23	7

Additional P- and D-Rules

1.SZ.1 III: a > e/___n

II: a > e/u__i   eu > øy   aŋ > oŋ /m__
ɑ > ɤ /ŋ__k   ɑ > o/u__k   ɤ > ə /n,z__t
dz > z   dʑ > ʑ

I: ɦ > zero/__i,i-,y,y-   (uo > o/__k)

D: ɑ > ᴘ /___   534 > 513   31 > 331
42 > 41   13 > 24   5ʔ > 4ʔ

1.SZ.2 III: a > e/___n

II: a > e/u__i   eu > øy   aŋ > oŋ /m__
ɑ > ɤ /u__k   dz > z   dʑ > ʑ

I: (ɤ > o/P___t)

D: 534 > 412   42 > 52

2.WX IV: ɤn > ɤŋ/T___   (ɤn > { ɤŋ ,oŋ} /TS__)

II: ɑ > ɤ /u__k   dz > z   (dʑ > ʑ)
(TS___k)

D: 34 > 35   23 > 14   44 > 55
435 > 324   (yəʔ > yaʔ /ɦ_)   22 > 33

3.CS IV: TÇ > TS/__ɨ2   (yei > y/ʔ___)

III: o > ɔ /m___k

II: uɤ > uo/__t,k   ɑ > o/u___k   (dz > z)
(TÇ___k)

I: uo > ɔ /___k   (ɤ > o/P___t)

D: 22 > 33   42 > 53   534 > 324

4.CZS IV: aŋ > eŋ /TS___

III: e > a/u___i   ŋ > ɦ/___ {y,yɤn,iok}

II: ɤ > ɑ/z___t   ɑ > ɤ, ɔ /u__k   aŋ > oŋ /m__
(ɑ > ɤ /TS_k)   > ɤ /ŋ ___k

I: y > u/___ɤŋ, ɤt   b > a/Nas,Lat II___

D: 44 > 55   13 > 24   534 > 423
au > ɐɯ

5.HM IV: (aŋ > eŋ /TS___)

II: uɤ > o/h,ɦ___k   ɑ > ɤ /ŋ,u__k   (dz > z)

I: yŋ > iŋ   o > uo/__#   e > ie/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{TS,u,ʔ}}$ __~
ɦ > h/___$\begin{bmatrix}\text{V}\\ \text{-Diff.}\end{bmatrix}$ ɑ > ɤ /___k

D: 13 > 14   42 > 53

6.SHS III: uɤ > o/___k

II: ɑ > ɤ /u___k   (ɤ > ɑ/z,n__t)   dz > z
(ɑ > ɤ /TS,Klessŋ __k)   dʐ > ʐ

I: ỹø > Y

D: (13 > 14)   42 > 53

7.JD II: ɑ > ɤ /u___k   eu > øy   dz > z
> ɔ /TÇ__k   dʐ > ʐ

I: yŋ > iŋ   o > uo/___#   e > ie/ $\left\{\begin{matrix}\text{C\_\_\_\textasciitilde}\\ \text{P\_\_\_\#}\end{matrix}\right\}$

D: 42 > 53   2ʔ > 3ʔ

8.SJ IV: (ɦyei > vi)

III: uɤ > o/___k   o > ɔ /m___k

II: uɑ > o/___k   dz > z   dʐ > ʐ

I: ɤ > e/y___k   ɦ > zero/___yVk   h,ɦ > f,v/__u#
ɦu > v/___at

D: e > I/y___ʔ   34 > 35   2ʔ > 3ʔ   42 > 53

9.WZ.1 IV: y > i/K___ɤk   ŋ > ɦ/___ɤn

III: iɛ > i   ɤn > on/ŋ___
(Klessŋ,ʔ __)

II: y > u/ɦ,ʔ ___

I: uɤt > ot   u > zero/$\genfrac{}{}{0pt}{}{\text{Cless}}{\text{ʔ}}$ ___ $\genfrac{}{}{0pt}{}{\text{Vless}}{\text{ɛ, ɔ}}$

D: 45 > 54   53 > 42   22 > 11   h > x   øy > ɵy

9.WZ.2 IV: eu > ɤu/T___
I: i,y,u > zero/Clessʔ___Vless ɛ, ɔ
D: 45 > $\underline{45}$ 323 > $\underline{323}$ 53 > 42
23 > $\underline{23}$ 212 > $\underline{212}$ ŭ > ɿ/___

9.WZ.3 III: øy > y/TS___ ik > ɨ/TS___ ɔ̃ > ʌ̃/TÇi__
I: a > ɛ /C__k,# ɦ > zˉ/___u ia > iɛ /T__~,t
i,y,u > zero/Cless ʔ ___ Vless ɛ, ɔ iɛ > yʌ /__Non Nas.
D: 45 > $\underline{45}$ 323 > $\underline{323}$ 53 > 42
23 > $\underline{34}$ 212 > $\underline{212}$ ŭ > ɿ /___

10.JH V: ɤ > ɑ /u___t
IV: (yei > y/TS___)
II: ɑ > ɤ /u,C___k (ɤ > ɑ/K___t)
> o /i___k > ɑ/n___t
(ik > iat/T___) (y ɤ > y/TÇ___t)
ie > yɤ/TÇ___~,t
I: o > u/C___ŋ b > a/m,n,l II___ ɦ > zero
ŋ > zero/___Non-pal.
D: 53 > 52 435 > 434 44 > 33 31 > 241
5ʔ > 3ʔ h > x

11.SX IV: eŋ > en ɤŋ > ɤn/y___
III: uɤ > uo/___k (ɔk > ot/i___) o > ɤ /K___n
II: (ɦ > v/___u) (z > dz) (dz > z)
I: a > æ /___~,t (uo > o/K___k) (ok > iok/K__)
ɤ > e/___k ok > uok/ʔ__
D: (æ > jæ/K___~, ʔ) ɦ > jɦ/___i#
(e > je/K___~,#) > ɥɦ/___y#
o > U/___ŋ ɑ > ɒ /___ŋ ɔ > ɒ /___#
a > A/u___ 45ʔ > $\underline{45}$ʔ 31 > 231 45 > 335
23 > 113 22 > 11 42 > 51 44 > 33
23ʔ > $\underline{12}$ʔ

12.YK

V: ɤ > e/T___ŋ

IV: ʌk > ʌi/C___   iɔ > uʌ/TÇ___k
ɨ2 > i/ç,ʑ___
 > ɨ/elsewhere

III: io > u/TÇ___k   ɔ > ɑ/C___k

II: ɑk > ɑu   e > ɤ/___
p > m/___iŋ, ɑŋ, ã, ɤŋ, --
t > n/___iŋ, --, ã, ɤŋ, oŋ

I: (y > ɯ /K___#)   aŋ, ak > ai/C___

D: ɦ > ɥ /___y,y-   a > A/i___#;___u,ŋ
 > j /___$ia^{\#}_{k}$ > ʿɑ /u___#
 > ɤ /___ɯ   > ɐ̌ /else___#
h > x   ai > ɐe   ɤ > e˞/i,y___
45 > 35   53 > 52   23 > 13   31 > {241,24}

13.WL

III: ɤu > iɤu/K___

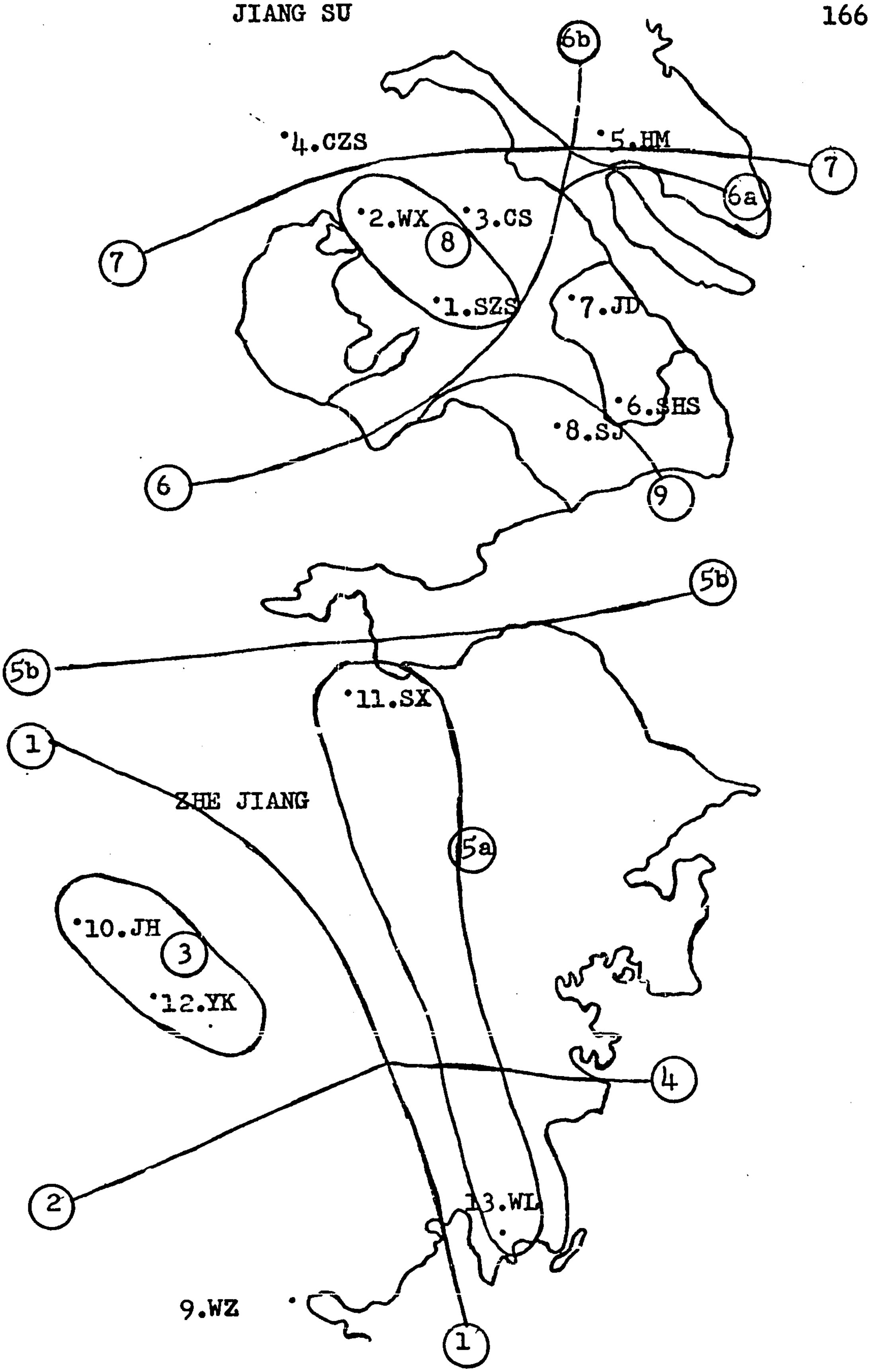
II: ɦ > ʔ /___õ   ɑ > ɔ /___ŋ

I: a > ia/Kstops___~   ŋ > ɲ/___$\tilde{a}_{t}$
e > ie/Kstops___#,~   a > ɛ /T,TSi___#;___ʔ
o > uo/Kless ŋ___#   œ > ø/___ŋ
K___k
ɦ > ʔ /___y#,iu,o#   a > ɛ /F,v___~
a > iɤ /Kstops___t   o > u/___ŋ
b > a/nas,lat II___   ɑ > ɤ /___t

D: 2ʔ > 1ʔ   44 > 33

3.42 Dialectal Relationships

On the following map I have put the isoglosses that correspond to rule difference and similarity among the Wu Dialects. The isoglosses were chosen on the basis of clustering of characteristics, i.e., I have not drawn in an isogloss for every rule difference. I have also not drawn in the isogloss separating two dialects when just they are surrounded by one isogloss.


JIANG SU
6b
•4.CZS
•5.HM
7
6a
•2.WX
•3.CS
8
7
•1.SZS
•7.JD
•6.SHS
•8.SJ
6
9
5b
5b
•11.SX
1
ZHE JIANG
5a
•10.JH
3
•12.YK
4
2
13.WL
9.WZ
1

The major Wu isogloss is 1. It is supported by the following rules:

V: 4
IV: 1-6,8,9,11b,14,17
III: 1-5,10,14,15,19,T3
II: 2,4,5,8,9,11,T3
I: 1-2,4-6,8,9,12-14,22,T1,6,7
D: 1,4

This constitutes the clustering of the largest number and greatest depth of ordering of rules of any isogloss. It generally parallels the border of a mountainous area in central ZheJiang that isolates 9.WZ, 10.JH and 12.YK from the dialects to the north. 10.JH and 12.YK lie in a long narrow river valley that runs through these mountains to the plain to the north. This valley and the influence of the many Min dialects around 9.WZ have apparently kept 10.JH and 12.YK more like the rest of Wu than 9.WZ, which shows many changes not shared by other Wu dialects. These geographical facts receive their linguistic interpretation in isogloss 2 which depicts the rules where both 9.WZ and 10.JH-12.YK differ from Northern Wu and from each other:

V: 4
IV: 1-8, 14
III: 1-5,10,15
II: 2,4,5,8,9,11
I: 1-2,6,8,9,12,13,22,T3,6,7
D: 1

and isogloss 3, which represents those rules that 10.JH and 12.YK share only with each other:

V: 6
III: 9, (12)
II: 3,7,T4
I: 11, (7)

Apparently, 9.WZ has had some influence on 13.WL, the neighboring dialect also in the narrow coastal plain of southern ZheJiang. This influence is represented by isogloss 4 which is supported by the following rules:

V: 4
IV:10,12
III: 8,T3
I: 22,23,24
D: 8

9.WZ has similarly influenced 12.YK (V:1,II:1) and 10.JH (V:5), but not sufficiently to suggest another isogloss.

Isogloss 5b, which represents properties shared by all of the dialects south of it:

V: 1
II: 7,12,14
I: 13,16,17
D: 4

is considerably weaker than isogloss 1, so that it and isogloss 5a, supported by the rules:

IV: 8
III: (11,15)
I: 19,T5

distinguish 11.SX and 13.WL as a distinct subgroup of the Northern Wu dialects.

Isogloss 6, the major isogloss in the north, represents the similarities of 1.SZ, 2.WX, 3.CS and sometimes 4.CZS, as opposed to the dialects to the east and south. The first three dialects can share their rules with 5.HM:

Iso. 6a III: 10,18,T1,4
II: 6,T1
D: 2

or not:

Iso. 6b III: 17,T2,3
II: 10,T2
I: 8,9,15,T1
D: 3,5,6

Note that isogloss 6 is supported by more rules than either isogloss 7 or isoglosses 5a-5b.

Isogloss 7, which isolates 4.CZS and 5.HM from the dialects south of it, is supported by the following rules:

IV: 9
II: 12,13
I: 4
D: 3,4,7

It probably represents an influence from Mandarin on the border Wu dialects. It is supported by 4.CZS's idiosyncratic rules:

IV: 12
III: 12,19,T1
II: 6,9,11,13
I: 5,14,19,T3

and it and 6a-b are supported by 5.HM's idiosyncratic rules:

III: 14
II: 5,9,14
I: 8,13,18,19

Within the group 1.SZ, 2.WX and 3.CS, there are many bonds, but 1.SZ and 2.WX share these rules:

IV: 12
III: 12,T3
II: 5,9
I: 17,19,T1,2

and 3.CS is set off by several idiosyncratic rules:

IV: 9
III: 7,17,18
I: 9,19,20,T2

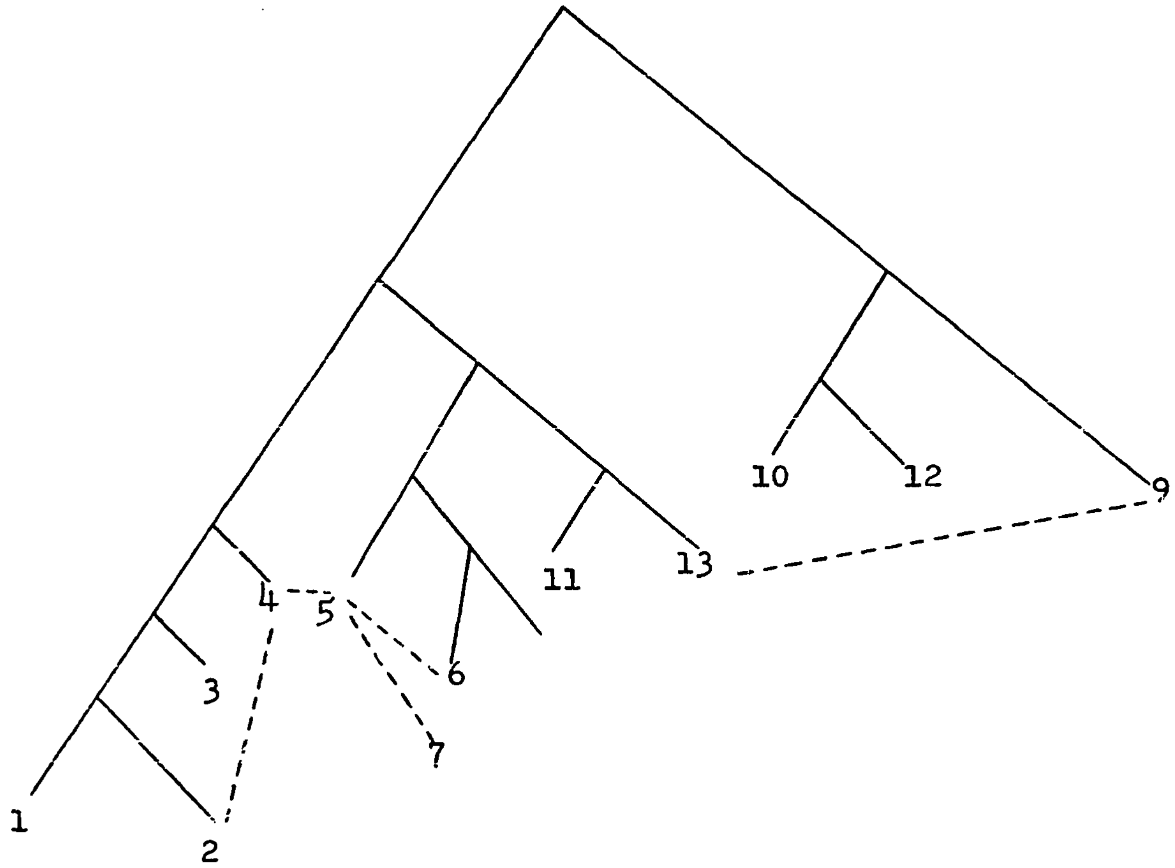
so that 1.SZ and 2.WX appear to be more closely related than either is to 3.CS. Notice, however, that there are several bonds between 2.WX and 4.CZS and between 1.SZ and 3.CS, as follows:

2.WX,4.CZS	1.SZ,3.CS
	IV: 8
III: 7,20	III: T1
II: 11,13,14	II: 11,T2
I: 20	I: T4

The links between 2.WX and 4.CZS cross an already well motivated isogloss--this must be due to influence of 4.CZS on 2.WX; and there are only five rules linking 1.SZ and 3.CS. Thus these links both seem less important than the links between 1.SZ and 2.WX.

Of the remaining three dialects, there is little evidence for any subgrouping. 5.HM (and 4.CZS on occasion) influence sometimes just 6.SHS (III: 7,T4; II: 13,T1; I:19), sometimes just 7.JD (III: 12; I: 15), and sometimes both (III: 13,16; I: T2)--this is represented in isogloss 9. Since this represents either the Mandarin pressure from the north, or innovations in some of the dialects 1.SZ-7.JD that do not happen to reach one of these three dialects; and since there are also links between just the pairs 6.SHS and 8.SJ (II:6) and 7.JD and 8.SJ (III: 7; I: T7), isogloss 9 cannot substantiate too strong a 6.SHS-7.JD subgroup.

On the basis of these isoglosses, their relative strength and their interpretations presented above, the Wu systematic historical relationships can be diagrammed as follows:



3.5 Conclusion

I posited in 3.1 and 3.2 a model for making rigorous and precise comparisons of dialects possible. I attempted in 3.3 and 3.4 to show how this model works in the case of the Wu dialects. Even though both the model and the analysis of the data could undoubtedly be improved, it can be concluded that the model presented will allow us to perform theoretically sound and linguistically interesting research in dialectology.

1. 'Linguistic Diversity in South Asia,' IJAL Publication 13.

2. Chao, Y. R., 'Contrastive Aspects of the Wu Dialects,' Language, 43.1, 1967; p. 94.

3. 'Is Structural Dialectology Possible?' Word 10.3, 1954; pp. 388-400.

4. 'The Short Vowel System of Northern Switzerland,' Word 16.2, 1960; pp. 155-182. 'Dialect Geography and the Concept of Phonological Space,' Word 18.1, 1962; pp. 23-32.

5. 'On Discreteness and Continuity in Structural Dialectology,' Word 13.1, 1957; pp. 44-59.

6. 'Some General Properties of Phonological Rules,' Language 43.1, 1967; p. 126.

7. See 1.31 for a discussion of Wang's concept. The notion of rule equivalence presented in 1.42 is also relevant to this section.

8. Hence, economy and plausibility do not conflict. It would be interesting to see if chains occur which are not economical, i.e., if change sometimes does not take the shortest plausible route.

9. Aspects of Phonological Theory, Harper and Row, New York, 1968; p. 67.

10. Wm. G. Moulton has pointed out to me how readily such diagrams can be converted into iconic symbols to be used on dialect maps.

11. In addition, this example supports the need for a single feature over which a D-rule arrow can range to show diphthongization and monophthongization as gradual shifts.

12. The phonetic symbols used in the rules are to be understood as designating distinctive feature matrices.

13. 'Phonological Differences in Three Hindi Dialects,' Language 34.2, 1958; pp. 212-224.

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17. Moulton, W. G., 'Types of Phonemic Change,' *To Honor Roman Jakobson*; Mouton and Co.; The Hague; 1967.

18. Postal, P. M., *Aspects of Phonological Theory*; Harper and Row; New York; 1968.

19. Stankiewicz, E., 'On Discreteness and Continuity in Structural Dialectology,' *Word*, 13; 1957.

20. Wang, W. S-Y, 'Phonological Features of Tone,' *International Journal of American Linguistics*, Vol. 33; 1967.

21. Wang, W. S-Y, 'Competing Changes as a Cause of Residue,' *Project on Linguistic Analysis Reports*, Second Series, No. 2; Phonology Laboratory, Department of Linguistics, University of California; Berkeley; October, 1967; and *Language* 45; 1969.

22. Weinreich, U., 'Is Structural Dialectology Possible?' *Word*, 10; 1954.

Abbreviations used in the following Chinese sources:

FYPC *方言与普通话集刊*，文字改革出版社

Peking; 1958.

ZGYW *中國语文*；文字改革出版社

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