THE PHONOLOGICAL SYSTEM OF CANTONESE.

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THIS STUDY OF THE CANTONESE PHONOLOGICAL SYSTEM IS A CASE STUDY OF THE PHONOLOGICAL COMPONENT OF A GENERATIVE GRAMMAR. ATTEMPTS ARE MADE IN CHAPTER III TO SOLVE SOME OLD PROBLEMS CONNECTED WITH THE ANALYSIS OF CANTONESE WITHIN THIS NEW THEORETICAL FRAMEWORK. MOST OF THE PROBLEMS ARE PSEUDO-PROBLEMS, IN THE SENSE THAT THEY POSE DIFFICULTIES ONLY FOR "DISTINCTIVE SEGMENT ANALYSIS" (THE AUTHOR'S TERM FOR PHONEMIC ANALYSIS), BUT NOT FOR THIS DISTINCTIVE-FEATURE ANALYSIS. THE PHONOLOGICAL SYSTEM OF CANTONESE IS PRESENTED IN CHAPTER II, IN WHICH THE SOUNDS ARE GIVEN DISTINCTIVE FEATURE REPRESENTATIONS, AND IN CHAPTER IV, IN WHICH SYLLABLE STRUCTURE IS STUDIED. SEQUENTIAL CONSTRAINTS AMONG SOUNDS ARE USED AS A CUE TO SIMPLIFY LEXICAL OR SYSTEMATIC PHONEMIC REPRESENTATIONS OF CANTONESE WORDS. ADDITIONAL INFORMATION CONCERNING THIS DOCUMENT MAY BE OBTAINED BY WRITING TO WILLIAM S-Y. WANG, DEPARTMENT OF LINGUISTICS, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA 94720. (AUTHOR/AMM)
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The Phonological System of Cantonese*

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*Figure Ia is a modification of Map 18 (Major languages) in Chi-yun Cheng's National atlas of China: dialect boundaries not relevant to the present study have been eliminated. Figures Ib and Ic are my enlargements of the shaded area in Figure Ia.
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Abstract

This study of the Cantonese phonological system is, in fact, a case study of the phonological component of a generative grammar. Attempts are made in Chapter III to solve some old problems connected with the analysis of Cantonese within this new theoretical framework. It turns out that most problems are pseudo-problems, in the sense that they pose difficulties only for 'distinctive segment analysis' (my term for phonemic analysis), but not for our distinctive-feature analysis. The phonological system of Cantonese is presented in Chapters II and IV. In Chapter II, Cantonese sounds are given distinctive-feature representations. In Chapter IV, syllable structure is studied. Sequential constraints among sounds are used as a cue to simplify lexical or systematic phonemic representations of Cantonese words.
Chapter I. Introduction

1.1 The Cantonese dialect. The term 'Cantonese', in its broader sense, refers to a group of similar dialects spoken in southern China, in the southern half of the Guǎngxi (Kwangsi) province and the western half of the Guǎngdong (Kwangtung) province, and often referred to as the Yüe dialects. Settlements of speakers of this group are found in Southeast Asia, in the Hawaiian Islands, and in North, Central, and South America. Cantonese claims a large number of overseas Chinese speakers.

The dialect group called Cantonese is characterized by:

1. the preservation of the final consonants -m, -n, -ŋ, the yang final series, and -p, -t, -k, the ru final series; the latter is so called because its members co-occur with the ru (or entering) tones;
2. the presence of nine or more tonal contrasts for isolated syllables at the systematic phonetic level; and
3. the distinction between long and short vowels interplaying with the distinction among several tones.

Within this dialect group we can again distinguish five subgroups according to dialectal differences and areas of distribution. Of these five subgroups, the Yüe hǎi subgroup is the most important because it includes the lingua franca of the area, the so-called standard Cantonese, among its members. Standard Cantonese is the dialect of Canton City and its closest variety, spoken in Kowloon and Hongkong. The term 'Cantonese', in its narrower sense, refers to standard Cantonese; it is in this sense that Cantonese will be used throughout this paper.

1.2 Theoretical background of analysis. The present study of the Cantonese phonological system is meant to be a case study of the phonological
component of a generative grammar. A generative grammar is a system of sound-meaning correlations, in the form of a set of rules which assign structural descriptions to the sentences of a particular language and thereby express a fundamental aspect of the speaker's competence. This system may be represented graphically as follows:

Figure II. A model of sound-meaning correlations.

It is taken for granted that the reader is familiar with Chomsky's *Aspects of the theory of syntax*, so that we can go directly into the phonological component which is our primary concern. The phonological component of a generative grammar corresponds to the lower part of the graph where the phonetic representation of an utterance is shown to be connected with syntax on the one hand and the lexicon on the other. Roughly speaking,
three things are involved in the phonological component which yield the
ultimate phonetic representation of an utterance: (1) the structural de-
scription or phrase marker in the form of labeled bracketing; (2) the sys-
tematic phonemic representation of each lexical entry introduced by the
lexical rule; and (3) the phonological rules.

Both the lexical entries and the phonological rules are expressed
through the use of distinctive features. The function of distinctive fea-
tures is to analyze each sound into its essential features, which are
responsible for sameness or difference and for the interactions among
sounds. It is the task of a universal grammarian to provide us with a
repertory of distinctive features with which we can describe any language
in the world.

Phonological rules may be either syntactically or phonologically moti-
vated. Hence it is rather meaningless to speak of a sharp demarcation
between the syntactic and the phonological component of a generative grammar,
as may be suggested by the graph in Figure II. The structure of a sentence
and the grammatical categorization of each of its lexical entries have defi-
nite conditioning effects on its pronunciation. The interaction of sounds
or, more precisely, the interaction of features also contributes to the
pronunciation. In the Indo-European languages, as well as in other language
families, we have numerous examples of sandhi, i.e. phonologically motivated
sound changes.

The interaction of features may sometimes be attributed to the inherent
redundancy built into the universal system by the very definitions of the
phonological distinctive features. This kind of redundancy is generally
understood and need not be expressed outside the universal grammar. Hence,
we may say that this type of feature interaction is a natural consequence
of the overlapping of domains of phonological features. Another type of feature interaction which is accidental and differs from language to language generally results from the morpheme structures peculiar to each language. The task of phonological rules is to make explicit the latter type of feature interaction, which includes sequential constraint among features and interaction between segmental and prosodic features.

As opposed to segmental features, prosodic features indicate phonological properties that range over the entire syllable or morpheme. Hence they are also called suprasegmental features. Prosodic features interact with segmental features at various places in the syllable or morpheme. In the case of pitch or tonal features, there is a pretty good physical correlation, in the sense that tonal features range over the entire voiced portion of the syllable. However, this is not true of all prosodic features. For example, a diacritic feature like [± Romance] or [± colloquial] does not have any physical correlation. It is introduced solely to simplify the system by capturing some regularities governing the behavior of a class of morphemes.
Chapter II. The sounds of standard Cantonese

2.1 Major class features of Cantonese segmental sounds. Since an identical set of sounds may alternate differently in different phonological systems, empirical considerations are of primary importance in the presentation of major classes or the basic configuration of the system. One key to major classification lies in the classification of the nasal consonants. [n] alternates with [l] in Cantonese and some Húnán dialects, but with [d] in Swahili; while in Taiwanese, a Min dialect, [l] alternates with [d]. In Figure III we present the major classes of the three different systems:

In each system three features are involved. They are [± consonantal], [± nasal], and [± sonorant] or [± vocalic]. It is the consideration of [n] and its natural class that leads us to the above selections. For Cantonese, however, [± vocalic]—in Swahili, [± sonorant]—may be substituted for the feature [± nasal]. In doing this we are using the three major class
features, i.e. \([±\) consonantal\], \([±\) sonorant\], and \([±\) vocalic\], proposed by Chomsky and Halle which, unfortunately, fail to adequately account for the configuration of Taiwanese. Since we need the feature \([±\) vocalic\] to further separate the vowels from the glides in our study of Cantonese, we shall favor the use of \([±\) vocalic\] at the expense of \([±\) nasal\]. Thus the major classes of Cantonese form the following configuration:

![Figure IV. Major classes of Cantonese sounds.](image)

2.2 The segmental system of Cantonese. To assign a unique representation to each segmental sound of Cantonese, we use the following features suggested by Chomsky and Halle in *The sound pattern of English*:

A. Major class features

- **consonantal**: obstruction of air in the vocal tract
- **sonorant**: free passage of air through either the vocal tract or the nasal tract
- **vocalic**: free passage of air through the vocal tract only, produced with a periodic excitation accompanied by open oral cavity
B. Cavity features

grave-acute: grave sounds are articulated with a primary narrowing located at the periphery of the oral cavity; i.e. at the lips or in the velar or pharyngeal region.

diffuse-nondiffuse: diffuse sounds are produced with a narrowing which equals or exceeds that of a constriction and is located in the front part of the vocal tract.

compact-noncompact: this feature is restricted to vowels. Compact vowels are produced with a forward and downward flanged oral cavity which contains no constriction or narrowing of high degree.

flat-nonflat: flat sounds are produced with a secondary narrowing at the periphery of the oral cavity often referred to as rounding.

C. Manner of articulation features

continuant-discontinuous: continuant sounds are characterized by the absence of abrupt transition between sound and silence.

tense: tense sounds are produced with greater deformation of the vocal tract away from its rest position and emit a higher amount of energy in conjunction with a longer duration in time. In stop consonants, tenseness is manifested by a greater strength of the explosion.

D. Source feature

strident: complex impediment, rough-edged supplementary obstruction creating edge effects at the point of articulation.

The above-mentioned features give us a Cantonese phonological system consisting of eleven obstruents or true consonants, three nasal consonants, one liquid, eight vowels, two glides, and the glottal stop (here presented
in Figure V). Obstruents and vowels and their variants will be treated in detail in Chapter III.

2.3 Redundancy rules. With these rules we have filled in certain holes in the matrix given in Figure Va. (Features generated by this set of redundancy rules are shown in Figure Vb.)

(1) [-son] → [-voc]
(2) [+voc] → [+son]
(3) 
   \[
   \begin{cases}
   [+son] \\
   [+voc]
   \end{cases}
   \rightarrow [+cont]
   \]

(4) 
   \[
   \begin{bmatrix} 
   -cons \\
   -voc \\
   -son 
   \end{bmatrix}
   \rightarrow \begin{bmatrix} 
   +\text{grave} \\
   -\text{flat} 
   \end{bmatrix}
   \]

(5) 
   \[
   \begin{bmatrix} 
   \text{odiff} \\
   \text{-cont} \\
   \text{-tense} 
   \end{bmatrix}
   \rightarrow \begin{bmatrix} 
   -cons \\
   -voc 
   \end{bmatrix}
   \]

(6) 
   \[
   \begin{bmatrix} 
   \text{acomp} \\
   \text{atense} 
   \end{bmatrix}
   \rightarrow \begin{bmatrix} 
   +\text{voc} \\
   +\text{grave} \\
   -\text{flat} 
   \end{bmatrix}
   \]

(7) 
   \[
   \begin{bmatrix} 
   \text{acons} \\
   \text{-tense} 
   \end{bmatrix}
   \rightarrow \begin{bmatrix} 
   +\text{cont} 
   \end{bmatrix}
   \]
Figure Va. The segmental system of Cantonese.
2.4 The tonal system of Cantonese. To assign a unique representation to each Cantonese tone, we use the tone features suggested by William S-Y. Wang (1967:97-9), with the following set of redundancy conventions:

(1) [-contour] → [rising]  
    [falling]  
    [convex]

(2) { [+high] } → [-mid]  
    { [-central] }

(3) [+central] → [-contour]
We find from the Cantonese data that 1 55 alternates with 5 13; 1 35 with 1 21, 1 22, 1 33, 1 23; and 1 4 with 1 2 and 1 3. With the present set of tone features, and the consideration of natural classes, we are in a difficult position to classify the Cantonese tones, since the latter two alternations each involves several tones and the change of at least two features. Thus, tones belonging to the same natural class may be far apart in the configuration shown in Figure VI.

2.5 Redundancy rules.

(1) [+high] → [-central]  
- mid

(2) [+mid] → [+central]

(3) [-central] → [-mid]

(4) [-short] → [+contour]

(5) [+rising] → [+contour]

Due to the interaction of pitch, duration, and final consonants, it is not generally necessary to mark the feature [± short] on the systematic phonemic level. This feature is introduced here only to facilitate further descriptions.
Figure VIa. The tonal system of Cantonese.
Figure VIb. The tonal system of Cantonese: features generated by redundancy rules.
Chapter III. Problems in the treatment of Cantonese phonology

3.1 Some deviations from standard Cantonese. Even though one has to idealize away from idiolectic and idiosyncratic elements in the speech of various members of the speech community when making linguistic descriptions, there are nonetheless three variant features of Cantonese pronunciation that are worth mentioning (see Li 1937):

1. the absence of a distinction between initial 1 and n
2. the confusion of the zero initial and initial η
3. the use of the apical vowel

3.1.1 The absence of a distinction between initial 1 and n. Historically speaking, Cantonese initial n results from the merger of two Ancient Chinese initials, ni⁴⁷ and niⁿʰ, while Cantonese initial 1 comes from the Ancient Chinese initial lai.¹ The distinction between n and 1 is evidenced by Hakka, Min, and Wu dialects of Chinese, as well as by Mandarin. One would expect that in Cantonese also this distinction would be kept for the two sets of words with different origins. This is not the case, however, in the speech of some Cantonese speakers, especially those from the vicinity of Nán-hǎi.² The two sets of words are pronounced either with the same initial, 1 or n, or with 1 and n in free variation with each other.

3.1.2 The confusion of the zero initial and initial η. The rime dictionaries indicate that words belonging to the Yiⁿ group share an initial distinct from that of the Yi⁰ group in Ancient Chinese. Though there has been merging through the years, this distinction is still evidenced by some Hakka, Min, and Wu dialects. In Cantonese, however, the situation is rather chaotic. The two initials neither merge nor remain
distinct. The two sets of words are pronounced in all the possible ways:
(a) some speakers keep the distinction; (b) some pronounce both sets with
initial ꞌ; (c) some drop initial ꞌ from the system and pronounce both sets
with the zero initial; and (d) some may even pronounce words of the Ying
group with initial ꞌ and words of the Yi group with the zero initial, just
the reverse of what is considered standard.

3.1.3 The use of the apical vowel. In Cantonese, the sounds which
are transcribed /ts, t's, s/ in Figure V are ordinarily pronounced as
alveopalatal continuants: [ʈʂ, ʈʂʰ, ʂ]. However, some educated and older
Cantonese speakers tend instead to use the dental counterparts of these
sounds when they precede the apical vowel /ɻ/; /ɻ/ in turn becomes [ɻ],
thus yielding the sounds [ʈʂɻ, ʈʂɻʰ, ʂɻ]. This pronunciation was once
prestigious, but is now little used by the younger generation. The lin-
gering effect of this phenomenon is reflected in the replacement of the
palatal series by the dental series in the speech of some speakers. Since
the two series never oppose each other within the same system, we shall
for ease of transcription choose as norm the symbols for the dentals and
expect no confusion to arise from our preference.

3.2 Initials. Here the terms initial, medial, final, and tone are
used as in the traditional classification of Chinese sounds in rime dic-
tionaries. However, in accordance with our segmental analysis, a final
should be represented as two segments, consisting of the main vowel op-
tionally followed by a glide, a nasal, or a stop consonant. Since our
primary concern here is the treatment of Cantonese sounds, we shall leave
the discussion of syllable structure in terms of segmental and tonal
characterization until Chapter IV.

3.2.1 The zero initial. In Ancient Chinese, the zero initial belongs
to the Yu group. In Cantonese, what we call the zero initial results from
the merging of the Yú group (with initial *∅ or *w), the Ying group (with initial *ʔ), the Yunq group (with initial *j), and the Weir group (with initial *ŋ). Here we choose to keep distinct the zero initial and initial ʻ for Cantonese, though a further step of merging has already taken place for Mandarin. The zero initial of Cantonese is realized phonetically as a semivowel (j, w) or as the glottal stop. Though in the speech of some speakers the glottal stop is sometimes lost, we shall still mark it in our transcription. On the systematic phonemic level, however, it is not necessary to represent the initial semivowels since they can be predicted from the following medial or main vowel. In view of this, the zero initial is justified on the systematic phonemic level. This underlying 'zero' may be the explanation for the gradual disappearance of initial ʻ, ?, j, and w in Cantonese, a process almost completed by Mandarin.

Starting with a zero initial in the systematic phonemic representation, the following instructions generate the respective initials. If a syllable starts with medial -u-, i.e. if a syllable lacks an initial segment marked [+cons], and if -u- is not followed by the vowel /i/, initial w replaces the medial -u-. A medial -i- not preceded by an initial bearing the [+cons] feature and not followed by the vowel /u/ is replaced by initial j. If /u/ is the main vowel of a syllable not preceded by a [+cons] initial, initial w is introduced. If /i/, or /w/, is the main vowel and is not preceded by a [+cons] initial, initial j is introduced. When u combines with i in the forms ui and iw, the first element is treated as the main vowel rather than as a medial. The initial semivowels w and j are introduced accordingly.

Finals consisting of other main vowels, when not preceded by any of the [+cons] initials, take as their initials the glottal stop or ʻ: those
with yin tones take the glottal stop; those with yáng tones take мя. The zero initial, in this sense, no longer exists on the systematic phonetic level, though the recognition of its existence on the systematic phonemic level may have greatly simplified our system.

We can summarize the above operations in the following ordered rules:

(1) \( \emptyset \rightarrow \begin{cases} \text{-cons} \\ \text{-voc} \\ \text{+son} \\ \text{grave} \end{cases} / \# \begin{cases} \text{cons} \\ \text{voc} \end{cases} \)

(2) \( \begin{cases} \text{-cons} \\ \text{+voc} \\ \text{+diff} \\ \text{grave} \end{cases} \rightarrow \emptyset / \# \begin{cases} \text{-cons} \\ \text{voc} \\ \text{+son} \end{cases} \)

(3) \( \emptyset \rightarrow \begin{cases} \text{+cons} \\ \text{+son} \\ \text{grave} \\ \text{-diff} \\ \text{-voc} \end{cases} / \# \begin{cases} \text{-cons} \\ \text{voc} \end{cases} \) with yáng tones

(4) \( \emptyset \rightarrow \begin{cases} \text{-cons} \\ \text{-voc} \end{cases} \) with yin tones

The zero initial which functions like an initial consonant is, in fact, non-consonantal in three of its four possible realizations. Hence, it should be distinguished from the stop consonants and the nasal consonants. Here we introduce a diacritic feature \([\pm \text{consonantal}']\) which should be regarded as an equivalent of \([\pm \text{consonantal}]\) with respect to its function in
sequential constraints, but in feature specification of lexical entries this feature has the following implications:

(a) \([u \text{ cons}'] \rightarrow [-\text{cons}']\)

(b) \([+\text{cons}'] \rightarrow [-\text{voc}] \quad \# \quad [+\text{voc}] \quad (+[-\text{cons}])\)

(c) \([+\text{cons}'] \rightarrow [+\text{grave}] \quad \# \quad [+\text{voc}] \quad \text{with yáng tones}\)

(d) \([+\text{cons}'] \rightarrow [-\text{voc}] \quad \text{elsewhere}\)

(b), (c), and (d) are in fact modifications of rules (1), (3), and (4). In referring to rules (1)-(4) of this section, we mean the modified version of these rules. From now on, an initial consonantal segment must be marked either \([+\text{cons}]\) or \([+\text{cons}']\). A nonconsonantal segment must be \([-\text{cons}]\) and \([+\text{voc}]\).

3.2.2 The initials n, l, n, and ? (ø). In section 3.1 we have already touched upon the absence of a distinction between initial n and l and between n and ?(ø) in the speech of some Cantonese speakers. Linguists who take into consideration the historical origin of such initials often insist upon keeping them distinct. They simply explain away the
chaotic situation mentioned above as the coexistence of standard and deviant pronunciations. A linguist's job, however, is to record the actual situation and explain whatever changes he finds, instead of assuming no change at all and explaining any change as deviant. As the case of the zero initial may indicate, alternation and variation of sounds may well be symptoms of a sound change in progress.

So far, the arbitrariness of linguists and lexicographers has rarely been questioned. This may be because words with initial n are few in number. The list given in footnote 2 almost exhausts the inventory except for a few homophones of the words already given. A literate person can easily memorize the list. This may also explain the fact that nonnative speakers of Cantonese can do better in a test of l and n distinctions than some native Cantonese speakers.

To assume a distinction between initial ŋ and ?(ð) is arbitrary: not only has empirical evidence been ignored; the historical argument is also unsound. In view of the development of Ancient Chinese into Mandarin, it is not unlikely that, in Cantonese also, initial *ŋ can be dropped by some members of the Yi group, depending on its environment. Comparing qié-yùn initials with corresponding ones in modern Cantonese pronunciation, we can find many instances where initial *ŋ and *ʔ(ð) merge with the zero initial. For example (Wáng 1957:127):

\[
\begin{align*}
*ŋiu^u & \rightarrow u \\
*liu^v & \rightarrow u \\
*yan^w & \rightarrow on \\
*yan^x & \rightarrow on \\
*yan^y & \rightarrow ou \\
*yan^z & \rightarrow ou
\end{align*}
\]

This is to say, the merging of the Yi and Ying groups actually takes place for Cantonese as well as for Mandarin. There is absolutely no reason why the qié-yùn classification should be strictly followed in the classification of sounds in modern
Chinese dialects. This type of classificational problem is, however, not of central interest in our framework.

3.2.3 Labialized stops vs. the medial -u-. This problem centers around the status of two labialized velars: $k^w$ and $k'^w$. This is by no means a problem unique to Cantonese. Parallels are found in the analysis of Mandarin and Amoy. We find it unnecessary to set up additional labialized velars in our system. The reasons are:

1. $kuX$ is not distinct from $k^wuX$, nor is $k'ux$ distinct from $k'^wuX$ where $X$ may be null or any permissible final,
2. the kaikou $hu^ac$ medial quality can be represented by the medial -u- or the main vowel /u/ without being attributed to the initial stop, while
3. the secondary rounding feature of the initial $k$ or $k'$ can be predicted by the following segment, and
4. secondary rounding is just not a common feature for Chinese initials, so it is best to consider it a result of assimilation to the following rounded vowel.

If we were classifying the Cantonese sounds in terms of initials and finals, we might have to worry about the fifteen extra kaikou hu finals (-ua, -uai, -uai, -uai, -uo, -uan, -uaj, -uaj, -uaj, -uot, -uot, -uok, -uok, and -uik) to be added to the final inventory as a result of excluding two initials, $k^w$ and $k'^w$. But within the present theoretical framework, simplicity is not measured by the number of distinctive segments, but by the overall patterning in terms of distinctive features.

3.3 Medials. There are only two medials in Cantonese: -u- and -i-. Medial -u- occurs only after initial $k$, $k'$, or $\emptyset$. The semivowel $w$ is introduced in the place of $\emptyset$ when followed by -u-. Medial -i- always
occurs with $\emptyset$ which is realized as the semivowel j. Eventually both medials are dropped. This operation can be represented by the following two ordered rules:

(1) $\emptyset \rightarrow$ 
\[
\begin{array}{c}
\text{[\text{-cons}]} \\
\text{-voc} \\
\text{+son} \\
\text{agrave}
\end{array}
\bigg/ \bigg/ \#
\begin{array}{c}
\text{[\text{-cons}]} \\
\text{+voc} \\
\text{agrave} \\
\text{diff} \\
\text{grave}
\end{array}
\]

(2) 
\[
\begin{array}{c}
\text{[\text{-cons}]} \\
\text{+voc} \\
\text{+diff} \\
\text{agrave}
\end{array}
\rightarrow \emptyset \bigg/ \bigg/ \#
\begin{array}{c}
\text{[\text{-cons}]} \\
\text{-voc} \\
\text{+son} \\
\text{agrave}
\end{array}
\]

When -u- is preceded by a velar stop, the following operation takes place:

(5) \[
\begin{array}{c}
\text{[\text{+flat}]} \\
\text{-cont}
\end{array}
\rightarrow \bigg/ \bigg/ \#
\begin{array}{c}
\text{[\text{+cons}]} \\
\text{-son} \\
\text{-grave} \\
\text{diff}
\end{array}
\]

(6) 
\[
\begin{array}{c}
\text{[\text{-cons}]} \\
\text{+voc} \\
\text{+grave} \\
\text{+flat} \\
\text{+diff}
\end{array}
\rightarrow \emptyset \bigg/ \bigg/ \#
\begin{array}{c}
\text{[\text{+cons}]} \\
\text{-son} \\
\text{+grave} \\
\text{-diff} \\
\text{-cont} \\
\text{+flat}
\end{array}
\]
In other words, k or k' takes on the secondary rounding feature and the conditioning factor, i.e. medial -u-, eventually drops.

If we understand a medial as a segment between the initial consonant and the main vowel, then we have no medials on the systematic phonetic level. They disappear in the process of realization, while the zero initial and the velar stops gain in their characterization.

3.4 Finals. Cantonese has a very rich final system. It has preserved the complete series of nasal finals: -m, -n, and -ŋ (the so-called yáng shêng yûn ad or yáng finals) and the complete series of stop finals: -p, -t, and -k (the so-called rù shêng yûn ae or rù finals). Words with vocalic finals (the so-called yin shêng yûn af or the yin finals) may end with almost any vowel or a vowel combined with -i or -u.

3.4.1 The yin finals. The class of yin finals consists of the main vowel optionally followed by another vocalic segment. This final vocalic segment may be -i, -u, or -ü in Cantonese. Since the occurrence of -ü can always be predicted from the preceding vowel, we shall represent both -u and -ü as /u/. We have a parallel in the Suzhou dialect of Wu, where [y] is always preceded by [ø]. The two final vocalic segments -i and -u correspond to Ancient Chinese *-i and *-u, as well as to the -i and -u in Mandarin, Hakka, Min, and Wu dialects, and may be looked upon as offglides. Here two supplementary rules are necessary:

\[
\begin{align*}
\text{[+voc]} & \quad \text{[+voc]} \\
\text{[-voc]} & \quad \text{[-voc]} \\
\text{[+flat]} & \quad \text{[+flat]} \\
\text{[-diff]} & \quad \text{[-diff]} \\
\end{align*}
\]
3.4.2 The rù finals, the rù tones, and syllable length. A rù final consists of a vowel followed by a stop consonant, -p, -t, or -k. The rù tones are 1 5, 1 3, 1 2, and 1 4. 1 4 is a colloquial variant of 1 3 and 1 2 and therefore not to be represented on the systematic phonemic level. It is generally believed that since rù tones correspond to rù finals, they are also shorter, because the final stop consonant abruptly checks the airstream. This is true only for certain vowels. The following is an inventory of rù finals which are as long as the yin and yáng finals:

```
    p   t   k
  a   -ap  -at  -ak
  e   -ek
  ö   -ök
  o   -  t  -ök
  i   -ip  -it
  ü   -üt
  u   -ut
```

Figure VII. Long rù finals.

Perfect correspondence of rù final, rù tone, and shorter duration is true only for the following rù finals:
One possible explanation for the mismatch of stop finals with duration is that the main vowel overrides the stop ending in the determination of syllable length. We shall examine this notion in the next section.

3.4.3 Vowels and syllable length. It is claimed that there is a distinction between long and short vowels in Cantonese. Looking at the features in Figure V and the data in 3.4.2, we find a perfect correlation between the segmental feature \([\pm \text{ tense}]\) and the prosodic feature \([\pm \text{ short}]\):

(a) \([\pm \text{ tense}] \rightarrow \pm \text{ short}]\)

Therefore we have

\[ i, u, u, e, a, o, o \] \([\pm \text{ tense}]\) and \([-\text{ short}]\)

\[ I, U, e, o, o \] \([-\text{ tense}]\) and \([+\text{ short}]\)

Moreover, we find the following pairs: \(i \sim I, u \sim U, e \sim o,\) and \(a \sim o.\)

Members of each pair differ only in the characterization of the feature \([\pm \text{ tense}]\). Again from the data in 3.4.2, we find that \(I\) is predictable from \(i\) and \(U\) is predictable from \(u\) by the following laxing rule:

(b) \([+\text{ tense}] \rightarrow [-\text{ tense}]\)

\[
\begin{array}{c|c|c}
[+\text{ cons}] & [+\text{ cons}] \\
\hline
[+\text{ voc}] & [-\text{ son}] \\
[+\text{ grave}] & [+\text{ grave}] \\
[+\text{ flat}] & [-\text{ diff}] \\
[+\text{ diff}] & [-\text{ cont}] \\
\end{array}
\]
While / and u occur only before -rj and -k, they may be considered to result from their respective [- tense] counterparts by the following tensing rule:

(c) [-tense] $\rightarrow$ [+tense]

Since the feature [± tense] is a major conditioning factor in determining syllable length, rules (b) and (c) should be ordered before rule (a).

The difference in vowel length for words with yin and yang finals is not as obvious as with rù finals, since the voiced portion of the syllable is considerably lengthened and it is very difficult to separate the voiced portion of the main vowel from the voiced portion of its following [+vocalic] segment.

3.5 Reading (wén) vs. colloquial (bái) pronunciation. The following is a sample of words for which there is a distinction between reading and colloquial pronunciations:

<table>
<thead>
<tr>
<th>Reading</th>
<th>Colloquial</th>
<th>Reading</th>
<th>Colloquial</th>
<th>Reading</th>
<th>Colloquial</th>
</tr>
</thead>
<tbody>
<tr>
<td>tIrj</td>
<td>22</td>
<td>t'Irj</td>
<td>22</td>
<td>kIrj</td>
<td>53</td>
</tr>
<tr>
<td>tsIrj</td>
<td>22</td>
<td>t'sIrj</td>
<td>22</td>
<td>lIrj</td>
<td>21</td>
</tr>
<tr>
<td>mIrj</td>
<td>22</td>
<td>m'sIrj</td>
<td>22</td>
<td>t'Irj</td>
<td>53</td>
</tr>
<tr>
<td>hIrj</td>
<td>53</td>
<td>h'sIrj</td>
<td>53</td>
<td>t'sIrj</td>
<td>35</td>
</tr>
<tr>
<td>t'sIrj</td>
<td>53</td>
<td>t's'Irj</td>
<td>53</td>
<td>lIrj</td>
<td>33</td>
</tr>
</tbody>
</table>

List A
<table>
<thead>
<tr>
<th>Reading</th>
<th>Colloquial</th>
<th>Reading</th>
<th>Colloquial</th>
</tr>
</thead>
<tbody>
<tr>
<td>pun</td>
<td>p'un</td>
<td>kau</td>
<td>k'au</td>
</tr>
<tr>
<td>tsa</td>
<td>t'sa</td>
<td>tiu</td>
<td>t'iu</td>
</tr>
<tr>
<td>tün</td>
<td>t'un</td>
<td>t'sin</td>
<td>tsin</td>
</tr>
<tr>
<td>tam</td>
<td>t'am</td>
<td>p'æŋ</td>
<td>p'æŋ</td>
</tr>
<tr>
<td>kən</td>
<td>k'ən</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**List B**

<table>
<thead>
<tr>
<th>Reading</th>
<th>Colloq</th>
<th>Reading</th>
<th>Colloq</th>
</tr>
</thead>
<tbody>
<tr>
<td>sai</td>
<td>33, 35</td>
<td>saŋ</td>
<td>53, 55</td>
</tr>
<tr>
<td>keŋ</td>
<td>33, 35</td>
<td>pui</td>
<td>53, 55</td>
</tr>
<tr>
<td>sæ</td>
<td>33, 35</td>
<td>tink</td>
<td>35, 55</td>
</tr>
<tr>
<td>jin</td>
<td>33, 35</td>
<td>kei</td>
<td>35, 55</td>
</tr>
</tbody>
</table>

**List C**

<table>
<thead>
<tr>
<th>Reading</th>
<th>Colloq</th>
<th>Reading</th>
<th>Colloq</th>
</tr>
</thead>
<tbody>
<tr>
<td>lə</td>
<td>21, 35</td>
<td>mou</td>
<td>23, 35</td>
</tr>
<tr>
<td>t'ing</td>
<td>21, 35</td>
<td>lei</td>
<td>23, 35</td>
</tr>
<tr>
<td>mun</td>
<td>21, 35</td>
<td>nai</td>
<td>23, 55</td>
</tr>
<tr>
<td>t'saŋ</td>
<td>21, 35</td>
<td>lay</td>
<td>23, 55</td>
</tr>
<tr>
<td>p'un</td>
<td>21, 35</td>
<td>mei</td>
<td>23, 55</td>
</tr>
<tr>
<td>meŋ</td>
<td>21, 35</td>
<td>tæu</td>
<td>22, 35</td>
</tr>
<tr>
<td>p'æŋ</td>
<td>21, 35</td>
<td>min</td>
<td>22, 35</td>
</tr>
<tr>
<td>sæ</td>
<td>21, 35</td>
<td>hæŋ</td>
<td>22, 35</td>
</tr>
<tr>
<td>man</td>
<td>21, 55</td>
<td>lün</td>
<td>22, 35</td>
</tr>
<tr>
<td>mei</td>
<td>21, 55</td>
<td>t'seŋ</td>
<td>22, 35</td>
</tr>
<tr>
<td>luy</td>
<td>21, 55</td>
<td>mui</td>
<td>22, 35</td>
</tr>
</tbody>
</table>

**List D**
In the reading pronunciation of each of the words in List A, /i/ is the main vowel, which is realized as [I] by rule (c) of 3.4.3; in colloquial expressions the main vowel is /e/, which is realized as [ɛ] before and k. The tones are the same for both forms. For most of the words in List B, \([-\text{rising}] \rightarrow [+\text{rising}] \left[ \underline{\text{high}} \right] \), while a change in aspiration takes place. Unaspirated expressions become aspirated in their colloquial forms. For the last two entries in the list, however, aspiration is dropped. This change is accompanied by a change in tone. For words in List C and List D, the difference in reading and colloquial pronunciations lies only in tone. These changes, though fairly regular, cannot be predicted by looking at the environments in terms of segmental or tonal features. In other words, they are to be marked on the systematic phonemic level by a feature which is neither segmental nor tonal. Therefore the feature \([\pm \text{ colloquial}]\) is introduced to bring about the necessary change.

A look at List D tells us that it is not a biunique mapping of tones between the reading and colloquial pronunciations. To solve this problem, let us assume that the following process takes place:

\[
\begin{align*}
\{-23\} & \rightarrow 35 \\
\{1 \ 21\} & \rightarrow 55 \\
\{-13\} & \rightarrow 35
\end{align*}
\]

Another diacritic feature, \([\pm \text{ colloquial}]\), is introduced to indicate the alternative process.

The following is a set of rules which accounts for all the reading and colloquial forms in the above lists except for the last two entries in List B.
Though the last two entries in List B, t'sin - tsin and p'ay - p'ay, may suggest a fairly reasonable phonological change, the change itself is not predictable. Moreover, the data are too limited to warrant any generalizations. Therefore, the reading form and the colloquial form would simply be entered as separate morphemes in our lexicon.

It seems that [-high] tones have a tendency to become [+ high] in their corresponding colloquial forms. Whereas

\[
\begin{align*}
\begin{cases}
\downarrow 21 \\
\downarrow 23 \\
\downarrow 22 \\
\downarrow 33
\end{cases}
\rightarrow & 35 \\
\end{align*}
\]

we have
for words with short rù finals. Examples are given in List E:

<table>
<thead>
<tr>
<th>Reading</th>
<th>Colloq</th>
</tr>
</thead>
<tbody>
<tr>
<td>hēp</td>
<td>˨ 2</td>
</tr>
<tr>
<td>kēp</td>
<td>˧ 3</td>
</tr>
<tr>
<td>lōt</td>
<td>˨ 2</td>
</tr>
<tr>
<td>tsōt</td>
<td>˨ 2</td>
</tr>
<tr>
<td>jūk</td>
<td>˨ 2</td>
</tr>
<tr>
<td>lūk</td>
<td>˨ 2</td>
</tr>
</tbody>
</table>

List E

The change of tone can be expressed by a simple rule:

\[
(f) \quad [-\text{high}] \rightarrow [+\text{high}] \quad \begin{cases} 
+\text{colloq} \\
+\text{central} \\
+\text{short} 
\end{cases}
\]

The colloquial forms of other rù finals which, by the nature of the main vowel, are [- short] can be generated by applying rules (a)-(d).

3.6 The alternation between the yin píng tones, ˥ 55 and ˧ 53. Of the three tonal alternations mentioned in 2.4, the first concerns a pair of yin píng tones. In an article which appeared in Zong Guo Yù Wén 1964, Fú-bang Zong held that, as a result of phonemic split, the two yin píng tones had separate phonemic status. However, a study of minimal pairs indicates that, in spite of semantic differences in contrastive environments, most of the cases are phonologically or morphologically conditioned. Bear in mind that, within the present theoretical framework, we are not so much concerned with the phonemic status of ˥ 55 and ˧ 53 as we are with the predictability of one tone from the other.
3.6.1 Phonological conditioning: tone sandhi. When preceding tone \( \overline{55}, \overline{5}, \) or \( \overline{53}, \overline{53} \) becomes \( \overline{55}. \) So it is \( \overline{55} \) that we always find in the following environment:

\[
\begin{align*}
\{ \overline{55} \} & \quad \# \quad \{ \overline{53} \}
\end{align*}
\]

where \( \# \) stands for syllable boundary.

Our guess is that the comparatively lower ending pitch of \( \overline{53} \) is assimilated to the relatively higher starting point of the pitch of the following syllable. For example:

\[
\begin{align*}
kou \quad \overline{53} + fu & \quad \overline{55} \quad \rightarrow \quad kou fu \quad \overline{55} \quad \overline{55} \\
tsU\overline{5} & \quad \overline{53} + se & \quad \overline{53} \quad \rightarrow \quad tsU fu se \quad \overline{55} \quad \overline{53} \\
t's\overline{5} & \quad \overline{53} + ts\overline{5} & \quad \overline{53} \quad \rightarrow \quad t's fu ts\overline{5} \quad \overline{55} \quad \overline{53} \\
ts1 & \quad \overline{53} + tsUk & \quad \overline{5} \quad \rightarrow \quad ts1 fu tsUk \quad \overline{55} \quad \overline{5} \\
lok & \quad \overline{22} + yI & \quad \overline{53} + pan & \quad \overline{53} + fan & \quad \overline{53} \quad \rightarrow \quad lok yI pan fan \\
\end{align*}
\]

This tone sandhi can be expressed by the following rule:

\[
(+\text{contour} \rightarrow [-\text{contour}] / [+\text{high}] \# \# [-\text{rising}] [-\text{central}] \]

3.6.2 Morphological conditioning. According to Fú-bang Zong, nearly seventy-five per cent of the Cantonese words with yin píng tones that he examined had only one tone value each. This was either \( \overline{55} \) or \( \overline{53}, \) never both tones for the same character. This finding led Zong to believe that \( \overline{55} \) and \( \overline{53} \) could not be variants of the same tone. We are also told that, except for the tone sandhi mentioned above, each tone remained constant and stable in various phonological environments. Zong
nevertheless, made a very interesting observation. He found that a word with a yin píng tone almost always takes on the tone value \(\downarrow 55\) when it is used as a nominal, whether in isolation or in connection with another word. As nonnominals, a yin píng word is most likely of tone \(\downarrow 53\). This observation may allow us to mark the two yin píng tones alike on the systematic phonemic level and then to impose a morphological conditioning on the systematic phonemic representations to bring out the respective shapes.

Before we do that, let us examine the remaining twenty-five per cent of the data. Here each word has two possible tones, \(\downarrow 55\) and \(\downarrow 53\). However, these two yin píng tones are not in free variation with each other. Their occurrences are somehow predictable. Here are some further observations which may confirm our earlier guess of morphological conditioning.

1. \(\downarrow 55\) cooccurs with nominals (N) when \(\downarrow 53\) cooccurs with verbs (V), adjectives (A), and measure words (MW).

2. In nominal phrases (NP) consisting of a head (H) and a modifier (Mod) (i.e. NP + Mod + H), \(\downarrow 55\) goes with the head when \(\downarrow 53\) goes with the modifier, even though the modifier may be a nominal in its isolated form.

Let us generalize and express the alternation between \(\downarrow 53\) and \(\downarrow 55\) as a morphologically conditioned process:

\[
\begin{align*}
\text{[+high]} & \quad \rightarrow \quad \text{[-contour]} \\
\text{[-rising]} & \quad \rightarrow \quad \text{[-short]} \\
\end{align*}
\]

\[
\begin{align*}
X \ # & \quad \text{[+count]} \ # \\
\text{N(H)} & \quad \text{NP} \\
X \text{ may be null}
\end{align*}
\]
<table>
<thead>
<tr>
<th>in...</th>
<th>meaning...</th>
<th>used as a...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pou</strong></td>
<td>fan pou</td>
<td>rice-cooker</td>
</tr>
<tr>
<td></td>
<td>pou fan</td>
<td>to cook rice</td>
</tr>
<tr>
<td><strong>so</strong></td>
<td>isolation</td>
<td>a comb</td>
</tr>
<tr>
<td></td>
<td>isolation</td>
<td>to comb</td>
</tr>
<tr>
<td><strong>hün</strong></td>
<td>jün hün</td>
<td>a circle</td>
</tr>
<tr>
<td></td>
<td>hün wak</td>
<td>to mark</td>
</tr>
<tr>
<td><strong>t'an</strong></td>
<td>t'sai t'an</td>
<td>a vegetable stall</td>
</tr>
<tr>
<td></td>
<td>fan t'an</td>
<td>to share, to split</td>
</tr>
<tr>
<td><strong>taj</strong></td>
<td>taj hai</td>
<td>spikes</td>
</tr>
<tr>
<td></td>
<td>taj hai</td>
<td>to nail a shoe</td>
</tr>
<tr>
<td><strong>tsai</strong></td>
<td>jøk tsai</td>
<td>medicine, drug</td>
</tr>
<tr>
<td></td>
<td>jøt tsai jøk</td>
<td>a dose of medicine</td>
</tr>
<tr>
<td><strong>t'san</strong></td>
<td>tsou t'san</td>
<td>breakfast</td>
</tr>
<tr>
<td></td>
<td>sam t'san (fan)</td>
<td>three meals</td>
</tr>
<tr>
<td><strong>køi</strong></td>
<td>kûj køi</td>
<td>rooster</td>
</tr>
<tr>
<td></td>
<td>køi tan</td>
<td>egg</td>
</tr>
<tr>
<td><strong>kûj</strong></td>
<td>kei kûj</td>
<td>technician</td>
</tr>
<tr>
<td></td>
<td>kûj t'søj</td>
<td>factory</td>
</tr>
<tr>
<td><strong>køn</strong></td>
<td>hai køn</td>
<td>navy</td>
</tr>
<tr>
<td></td>
<td>køn hau</td>
<td>military academy</td>
</tr>
</tbody>
</table>

List Fan
This difference in the assignment of Cantonese yin ping tones reflects a
difference in syntactic categories, a phenomenon which has a parallel in
the placement of English primary stress. For example, in English we have
'convert, a nominal, and con'vert, a verb. The primary stress is placed
on the first syllable in the nominal but on the second syllable for the
verb form. Exceptions to the rules given above would simply have the fea-
ture [+ contour] marked on the systematic phonemic level. Otherwise, the
yin ping tone would be characterized on the systematic phonemic level by
only two features, [-high] and [-rising], since [-short] and [+ contour]
can be generated by the rules.

Another interesting phenomenon in Cantonese is that words with yin
ping tones always have the form 55 when they are used as the last syl-
lable of a feminine proper noun. When they are used in a masculine proper
noun, however, there is no regularity. Here are some examples of proper
nouns and their Cantonese pronunciations:
Here we have the rule:

\[
[+\text{contour}] \rightarrow [-\text{contour}] / \begin{array}{c}
X \# \begin{array}{c}
[+\text{high}] \\
\rule{1cm}{0.5pt}
\end{array} \\
\end{array} \end{array} \quad \text{(fem, proper)}
\]

\(X\) is not null

3.6.3 **Semantic conditioning.** For certain nominals, \(\downarrow 55\) and \(\Uparrow 53\) are sometimes used to differentiate between two different meanings. In such cases, the \(\downarrow 55\) pronunciation often represents a later development of semantic content which reflects a cultural change initiated by or introduced into the speech community. For example:
<table>
<thead>
<tr>
<th>in...</th>
<th>meaning...</th>
</tr>
</thead>
<tbody>
<tr>
<td>fsh</td>
<td>55 jek fs Asians and a prescription</td>
</tr>
<tr>
<td></td>
<td>53 tsh fsh the eastern side or direction</td>
</tr>
<tr>
<td>tsoy</td>
<td>55 t'ou tsoy seal; insignia</td>
</tr>
<tr>
<td></td>
<td>53 man tsoy an essay; a literary composition</td>
</tr>
<tr>
<td>ko</td>
<td>55 t'sa ko a teahouse</td>
</tr>
<tr>
<td></td>
<td>53 san ko a new residence</td>
</tr>
<tr>
<td>ka</td>
<td>55 fa hak ka a chemist</td>
</tr>
<tr>
<td></td>
<td>53 ka t'In family</td>
</tr>
<tr>
<td>jin</td>
<td>55 jin tse cigarette</td>
</tr>
<tr>
<td></td>
<td>53 jin fo fireworks</td>
</tr>
<tr>
<td>tsU</td>
<td>55 t'sh t'ai t'Ug a posthumous title given to an emperor</td>
</tr>
<tr>
<td></td>
<td>53 tso t'Ug ancestors</td>
</tr>
</tbody>
</table>

List H

Since there is no other formal characterization to differentiate the two sets of meanings, we would simply consider the two pronunciations as homophones and mark them as separate lexical entries. A certain loss of generality is to be expected in this treatment, but in doing it any other way there would be a danger of overgeneralization.

The following is a list of words with yin ping tones which, in combination with another word in larger constructions, can be pronounced either as 55 or as 53. There is absolutely nothing in the environment or in the semantic context to indicate why 55 is preferred in one combination, 53 in another. We shall mark them as they are in the lexicon since generalization is impossible.
<table>
<thead>
<tr>
<th>t'se</th>
<th>in...</th>
<th>meaning...</th>
</tr>
</thead>
<tbody>
<tr>
<td>tan t'se</td>
<td>135</td>
<td>153</td>
</tr>
<tr>
<td>hei t'se</td>
<td>133</td>
<td>153</td>
</tr>
<tr>
<td>fo t'ss</td>
<td>135</td>
<td>153</td>
</tr>
<tr>
<td>ma t'se</td>
<td>123</td>
<td>155</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>k'wa</th>
<th>in...</th>
<th>meaning...</th>
</tr>
</thead>
<tbody>
<tr>
<td>wog k'wa</td>
<td>131</td>
<td>155</td>
</tr>
<tr>
<td>sai k'wa</td>
<td>135</td>
<td>153</td>
</tr>
<tr>
<td>ha mst k'wa</td>
<td>153</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pau</th>
<th>in...</th>
<th>meaning...</th>
</tr>
</thead>
<tbody>
<tr>
<td>su pau</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>ma pau</td>
<td>121</td>
<td>153</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>tan</th>
<th>in...</th>
<th>meaning...</th>
</tr>
</thead>
<tbody>
<tr>
<td>tan k'qi</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>tan yan</td>
<td>153</td>
<td>123</td>
</tr>
<tr>
<td>tan jen p'ot ma</td>
<td>135</td>
<td>121</td>
</tr>
</tbody>
</table>

List 1aq
Chapter IV. Syllable structure

4.1 The canonical form of Cantonese syllables. Since most Chinese morphemes are monosyllabic, the discussion of morpheme structure is largely the discussion of syllable structure. A Cantonese syllable has the following canonical form:

\[ C_1(V_1)V_2 \left( \begin{array}{c} V_3 \\ C_2 \end{array} \right) \text{ or } C(V)V \left( \begin{array}{c} V \\ C \end{array} \right) \]

\( C_1 \) stands for any initial consonant including the zero initial, which would be marked [+ cons]; \( C_2 \) stands for any of the six consonant endings: -p, -t, -k and -m, -n, -ŋ. \( V_2 \) is the main vowel. \( V_1 \) may be considered an onglide, \( V_3 \) an offglide. \( V_1 \) is what is traditionally called a medial; \( V_3 \), together with \( V_2 \), forms what is traditionally called the yin final. The canonical forms of Cantonese monosyllables are thus:

\[
\begin{array}{ccc}
\text{I} & \text{II} & \text{III} \\
1 & C_1V_2 & C_1V_2V_3 & C_1V_2C_2 \\
2 & C_1V_1V_2 & C_1V_1V_2V_3 & C_1V_1V_2C_2 \\
\end{array}
\]

If we further break down \( C_2 \) into two classes: \( N \), the nasal endings, and \( T \), the stop consonants, the canonical forms of Cantonese monosyllables will be:

\[
\begin{array}{cccc}
\text{I} & \text{II} & \text{III} & \text{IV} \\
1 & C_1V_2 & C_1V_2V_3 & C_1V_2N & C_1V_2T \\
2 & C_1V_1V_2 & C_1V_1V_2V_3 & C_1V_1V_2N & C_1V_1V_2T \\
\end{array}
\]

Examples are:

I | II | III | IV
---|---|---|---
ma 'horse' | mai 'to buy' | man 'slow' | mat 'to wipe'
ku-[kʷa] 'melon' | kuai-[kʷai] 'strange' | kuan-[kʷan] 'to close' | kuat-[kʷat] 'to scrape'
The reason for making \( C_1 \) an obligatory segment is that, on the systematic phonetic level, a syllable always begins with a consonant. That is to say, the zero initial is realized in its various forms. Instead of generating a segment from nothing, we shall assume the existence of a segment in the underlying form. Applying the phonological rules of 3.3, we eventually get rid of the medial in the systematic phonetic representation. Hence, the longest syllable on the systematic phonemic level consists of four segments, while the longest syllable on the systematic phonetic level consists of only three segments. The canonical forms we are considering here are what we would expect to find in the lexicon, i.e. the systematic phonemic representations.

4.2 Some general facts about Cantonese syllable structure. The canonical forms of Cantonese give us the following information about Cantonese syllable structure:

(1) Every syllable contains at least two segments, i.e. the initial and the main vowel.

(2) The longest vowel chain is a triphthong, \( V_1 V_2 V_3 \).

(3) There is no consonant cluster.

(4) The longest syllable contains four segments.

(5) Any consonant may occur as the initial, but only p, t, k, m, n, and \( \eta \) may occur in the final position of a syllable.

(6) \( V_1 \) and \( V_3 \) can only be /i/ and /u/.

(7) The first segment after the syllable boundary must be consonantal.

(8) The second segment after the syllable boundary must be nonconsonantal. (A corollary of (3).)

(9) If the segment immediately preceding a syllable boundary is consonantal, then the segment before it must be nonconsonantal. (A corollary of (3).)
(10) A segment preceded and followed by a nonconsonantal segment must be nonconsonantal.

(11) If the segment immediately preceding a syllable boundary is consonantal, it must be one of the following (cf. (5)):

\[
\begin{array}{ccc}
\text{p} & \text{t} & \text{k} \\
+\text{cons} & +\text{cons} & +\text{cons} \\
+\text{son} & -\text{son} & -\text{son} \\
-\text{grave} & -\text{grave} & +\text{grave} \\
+\text{diff} & +\text{diff} & -\text{diff} \\
\end{array}
\]

4.3 The distributional pattern of Cantonese sounds. The canonical forms have shown us the permissible Cantonese monosyllable; now we have to find out what the actual syllables are and account for them. We find that Cantonese sounds have the distributional pattern recorded in Figures IX-XI. It is often said that Cantonese has 20 initials and 53 finals; the figures in themselves, however, are insignificant. We are interested in finding out how the features interact when placed in neighboring segments. Let us examine the finals to see how \(V_2\) interacts with the last segment of the syllable.
To add to the list of finals, there are two syllabic finals, m and n, which occur in isolation. We have not included them in our discussion of canonical forms. We may add the following syllable structure rule:

\[
(1) \quad [+\text{seg}] \quad \rightarrow \quad +\text{cons} \quad +\text{son} \quad +\text{voc} \quad \# \quad \#
\]
ip and n can be specified as:

\[ \hat{m} \text{ [+diff]} \quad \hat{n} \text{ [-diff]} \]

Of the \(2 \times 51 = 102\) possible combinations of medials with finals, only 28 actually occur. They are:

<table>
<thead>
<tr>
<th>Medial -i-</th>
<th>Yin Final</th>
<th>Yáng Final</th>
<th>Rù Final</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>iün, iœi, iœu, iœ, iœi, (iœ), (iœ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iœm, iœn, iœŋ, iœŋ, iœŋ, iœn</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iœp, iœt, iœk, iœk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medial -u-</th>
<th>Yin Final</th>
<th>Yáng Final</th>
<th>Rù Final</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ua, uœi, uœi, uœ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>uœn, uœn, uœŋ, uœŋ, uœŋ, uœŋ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>uœk, uœt, uœt, uœk, uœk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure X. Medial-final combinations on the systematic phonemic level.

According to rules (1) and (2) of 3.2.1, -i- becomes j and -u- becomes w when preceded by the zero initial. When preceded by a velar stop, -u- first contributes to the secondary lip rounding of the velar stop and then drops, according to rules (5) and (6) of 3.3. Medial -i- never occurs with any initial other than the zero initial. Medial -u- occurs only with a velar stop initial or the zero initial. As a result, we have initials j, w, k\(^w\) and k\(^lw\) introduced into the system, while -i- and -u- systematically disappear. The distributional pattern would appear like this on the level of systematic phonetic representations:
Figure XI. Medial-final combinations at the systematic phonetic level.

Adding the initials to the finals, we have a total distributional pattern as shown in Figure XII. Figure XI is incorporated in the pattern, with j, w, k\(^w\), and k\(^lw\) considered initials. Hence the total distributional pattern is given in terms of systematic phonetic representations. Words in parentheses are colloquial expressions without written forms or without corresponding expressions in other major dialects of China.

4.4 Sequential constraints. A knowledge of the interactions of features within the syllable would be of great help to us in simplifying our lexical representation. This knowledge can be obtained by studying the distribution patterns given in Figures IX, X, and XI. Here are some of our observations expressible as syllable-structure rules.
Figure XII.
The total distributitional pattern

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
<th>j</th>
<th>k</th>
<th>l</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>b</td>
<td>(+)</td>
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<tr>
<td>h</td>
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</tr>
<tr>
<td>i</td>
<td>(+)</td>
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<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>j</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
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<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>k</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
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<td>(+)</td>
<td>(+)</td>
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<tr>
<td>l</td>
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<td>(+)</td>
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<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
</tbody>
</table>
Figure XII. The total distributional pattern (cont.)
<table>
<thead>
<tr>
<th></th>
<th>u</th>
<th>ui</th>
<th>un</th>
<th>ut</th>
<th>U₂</th>
<th>Uk</th>
<th>ün</th>
<th>üt</th>
<th>ð</th>
<th>ɣ</th>
</tr>
</thead>
<tbody>
<tr>
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<td>+</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p'</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t'</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>+</td>
<td>+</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>l</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure XII.**

The total distributional pattern (cont.)
A. Sequential constraints of VC sequences.

1. A consonant segment immediately preceding the syllable boundary is always nonvocalic, discontinuous, and nonstrident (i.e. m, n, ñ, p, t, or k):

2. If the segment preceding the syllable boundary is consonantal, grave, and nondiffuse (i.e. ñ and k), the segment before it must be a, ə, I, U, ë, or ə, never ü, u, i, e, or o.

3. If the segment preceding the syllable boundary is consonantal, grave, and diffuse (i.e. m and p), the segment before it must be a, ə, or i.

4. If the segment preceding the syllable boundary is consonantal and nongrave (i.e. n and t), the segment before it must be a, ñ, i, u, ü, ə, or ə. Except for ə and ə, all the possible vowels are tense.

5. The two grave and nonflat vowels (i.e. a and ə) can occur before any of the six consonant endings.

6. Of the nongrave vowels, I, ɛ, and ë go only with -ñ and -k; ü and ö go only with -n and -t. Of the grave vowels, U always goes with -ñ and -k and ü with -n and -t.

7. ñ never occurs with -m and -p; i never occurs with -ñ and -k; e and o never occur before a consonant.

8. The previous observations may suggest that we could further specify the consonantal endings, using the vowel as a conditioning factor. This is, however, not only implausible but, in fact, circular in
view of our previous analysis. Our earlier treatment of vowel length in 3.4.3 has motivated us to use consonant endings as the conditioning factor to predict the specification of the vowel as [± tense] and eventually that of the syllable as [± short]. To avoid circularity, we have to give a more complete specification of the consonantal endings; we cannot use the vowel features as conditioning factors. The loss of economy can be compensated for by a simpler vowel specification and the gain in generality with respect to syllable-length prediction. Hence, vis-à-vis the whole system, we may have even gained in economy.

(9) Using the consonantal endings as our conditioning factor, we have the following syllable-structure rules to account for observations (2)-(7):
Feature specification of the VC sequences.

Here and in other feature specifications in this section, we shall further abbreviate the symbols representing the distinctive features as follows:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>cons</td>
<td>consonantal</td>
</tr>
<tr>
<td>S</td>
<td>son</td>
<td>sonorant</td>
</tr>
<tr>
<td>V</td>
<td>voc</td>
<td>vocalic</td>
</tr>
<tr>
<td>G</td>
<td>grave</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>diff</td>
<td>diffuse</td>
</tr>
<tr>
<td>F</td>
<td>flat</td>
<td></td>
</tr>
<tr>
<td>Cp</td>
<td>comp</td>
<td>compact</td>
</tr>
<tr>
<td>Str</td>
<td>strid</td>
<td>strident</td>
</tr>
<tr>
<td>Ct</td>
<td>cont</td>
<td>continuant</td>
</tr>
<tr>
<td>T</td>
<td>tense</td>
<td></td>
</tr>
</tbody>
</table>

am [ +G | +C] ap [ +G | +C]
     -F +S  [-F -S]
     +Cp +D  [+Cp +D]

am [ +G | +C] ap [ +G | +C]
     -F +S  [-F -S]
     -Cp +D  [-Cp +D]
<table>
<thead>
<tr>
<th></th>
<th>im</th>
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Note: The table contains symbols and operations, possibly related to a mathematical or logical system, but the specific context is not clear from the image alone.
| \( \alpha \) | \( \beta \) | \( \gamma \) | \( \delta \) | \( \epsilon \) | \( \zeta \) | \( \eta \) | \( \theta \) | \( \iota \) | \( \kappa \) | \( \lambda \) | \( \mu \) | \( \nu \) | \( \xi \) | \( \omicron \) | \( \pi \) | \( \rho \) | \( \sigma \) | \( \tau \) | \( \upsilon \) | \( \phi \) | \( \chi \) | \( \psi \) | \( \omega \) |
B. Sequential constraints of diphthongs: VV/C.

(1) The segment following a consonant is always nonconsonantal and vocalic, as is a segment preceding a consonant.

\[
\begin{array}{c}
\text{Ug} \\
\text{Uk}
\end{array}
\rightarrow
\begin{cases}
[\text{seg}] \\
[+cons] \\
[+voc]
\end{cases}
\]

(2) Any nonconsonantal segment in a noninitial position of the syllable is vocalic.

\[
\begin{array}{c}
\text{[-cons]} \\
\text{[+voc]} \\
\text{[+cons]}
\end{array}
\rightarrow
\begin{cases}
\text{X} \ [\text{---}] \\
\text{Y}
\end{cases}
\]

where X and/or Y may be null; the total number of segments contained in X and Y may not exceed 2.

(3) The second segment of a diphthong must be i, u, a, o, or e. These are all tense vowels.

\[
\begin{array}{c}
\text{[ ]} \\
\text{[+seg]}
\end{array}
\rightarrow
\begin{cases}
\text{[+tense]} \\
\text{[+cons]} \\
\text{[+seg]} \\
\text{[+cons]}
\end{cases}
\]

(4) If the second segment of a diphthong is a or o, the first segment must be i or u. If the second segment is e, the first segment must be i. In other words, if the second segment of a diphthong is nondiffuse, the first segment must be diffuse.
(5) If the second segment of a diphthong is u, and if the first segment is nondiffuse, it must be ə, ɔ, ø, or a. If the first segment is diffuse, it must be i.

(6) If the second segment of a diphthong is i, and if the first segment is nondiffuse, it must be e, ɛ, ø, or a. If the first segment is diffuse, it must be u.

(7) From (5) and (6) we have

(8a) If i is preceded by a nongrave, flat, and nondiffuse vowel, it becomes rounded, i.e. ü, by assimilation:
(8b) \[\begin{align*}
&-\text{grave} \\
&+\text{flat} \quad \longrightarrow & -\text{tense} \\
&+\text{diff} \\
\end{align*}\] 

(9) If the first segment of a diphthong is \( [+\text{grave}] \) (i.e. o or ɔ), and if the second segment is diffuse, then the characterization of the feature \([\pm \text{tense}]\) depends on the characterization of the feature \([\pm \text{grave}]\) and \([\pm \text{flat}]\) of the second segment:

\[\begin{align*}
&+\text{grave} \\
&+\text{flat} \quad \longrightarrow & -\text{atense} \\
&+\text{flat} & \quad \longrightarrow & +\text{cons} \\
&+\text{diff} \\
\end{align*}\]

(10) If the first segment of a diphthong is diffuse, it must be tense. If it is nondiffuse, it must be nontense. Therefore,

\[\begin{align*}
&[\text{diff}] \quad \longrightarrow & +\text{atense} \\
&[+\text{cons}] \\
\end{align*}\]

(11) If the first segment of a diphthong is compact, it must be tense.

\[\begin{align*}
&+\text{comp} \\
&+\text{tense} \\
\end{align*}\]

(12) If the first segment of a diphthong is nondiffuse, the following segment must be diffuse:

\[\begin{align*}
&[---] \\
&[+\text{diff}] \\
\end{align*}\]
Feature specification of diphthongs: VV/C

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C. Sequential constraints of triphthongs: VVV.

(1) A triphthong is a combination of a medial and a yin final with two segments. The combinations of a medial and a yin final with one segment have already been treated in section B as diphthongs, together with yin finals consisting of two segments.

(2) Any nonconsonantal segment in a noninitial position of the syllable is vocalic.

(3) The first and the third of the nonconsonantal segments may be either i or u.

\[
[-\text{cons}] \longrightarrow [+\text{diff}] / [+\text{cons}] \quad \left\{ \begin{array}{c}
[-\text{cons}] \\
[-\text{cons}] [-\text{cons}] [-\text{cons}] \\
[-\text{cons}] [-\text{cons}] [-\text{cons}] \\
\end{array} \right. \\
\#
\]

(4) If the first nonconsonantal segment of a triphthong is u, then the third must be i. If the third nonconsonantal segment of a triphthong is u, then the first must be i. In other words, we do not have a triphthong of the form *uVu in Cantonese.
(5) If the final segment of a triphthong is grave and flat (i.e. u), then the segment preceding it is [+grave], [-flat], nondiffuse and noncompact (i.e. ʊ or ø):

(6) If the final segment of a triphthong is nongrave and nonflat (i.e. i), then the segment preceding it is always grave, nonflat, and nondiffuse (i.e. ə or ø):

(7) Here again u becomes ũ when preceded by ʊ.

Feature specification of triphthongs: VVV/C #.

D. Sequential constraints of CVX sequences.

This can be subdivided into five cases:

1. where X = Ø; in this case we have a syllable #CV#. 

2. where X = V; " " " " " " " " CVV#.

3. where X = VV; " " " " " " " " CVVV#.

4. where X = C; " " " " " " " " CVC#.

5. where X = VC; " " " " " " " " CVVC#.

In all these cases, the segment following the consonantal segment is nonconsonantal and vocalic. Now let us examine these cases one by one.

1. #CV#

(1) The segment following a consonantal segment and immediately preceding a syllable boundary is always nonconsonantal and tense.

[+seg] [-+tense] / [+cons] [---] #

(2) All tense vowels can occur in the position C#. These tense vowels are æ, ε, η, i, u, and ü.

(3) Of the seven tense vowels that can occur in C#, æ and ε have the widest distribution. æ occurs after a consonant, while ε occurs with all of the initial consonants but k'.

(4) We know from the discussion in 3.2.1 that if both æ and ε occur with the same subsequent sequence, only one of the two can be generated from the zero initial. In this case, the other would have to be fully specified.
(5) E has a fairly wide distribution. It occurs after all except five of the initial consonants: t', p', f, l, h, and y.

(6) i and u occur only after strident consonants (i.e. ts, t's, and s) and the zero initial, which will eventually become the semi-vowel j according to rule (1) of 3.2.1. In colloquial expressions i also occurs after t and n, as in [ni ti] 'these'. The reading form of [ni] is [nei].

(7) u has a limited distribution. It occurs only after grave, [c:diffuse], [c:cont] consonants (i.e. f, k, and k') and the zero initial, which according to rule (1) of 3.2.1 eventually becomes w.

(8) œ has the most limited distribution in C#. It occurs in only three forms: [t'œ] (colloquial: [lœ]) 'to spit', [kœ] 'a saw', and [hœ] 'boat'.

(9) Not much can be said about vowels with a wide distribution. But for those with a more limited distribution in the environment C#, we can make the following generalizations:

(a) [ +cons ] —— [ +strid ] / [ ----- ] [ -grave ] #

(b) [ +cons ] --- [ diff ] / [ ----- ] [ +grave ] #

(c) This is not so much a generalization as a statement of fact:
### Feature specification of #CV#. (Comprehensive List of Examples)

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<th>Feature</th>
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<th>p'a</th>
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*Note: [+colloq] indicates colloquial usage.*
2. \#CVV#

(1) In \#CVV\#, if the second segment is i or u, the first segment may be the zero initial, which would be realized as j or w by rule (1) of 3.2.1.
(2) ai and ei have the widest distribution. ai occurs with all initials and ei occurs with all but initial n.

(3) iu, ou, au, and öu never occur after f.

(4) au occurs after all other initials except t and t'.

(5) ou occurs after all other initials except k'.

(6) öu occurs after any initials but p and p'.

(7) iu, öu, and ei never occur after y and z.

(8) ei occurs after all other initials except t', ts, and t's.

(9) öu occurs after all other initials except p, p', m, and f.

(10) öi occurs after all initials except p, p', m, and f.

(11) Other than the zero initial, ui only occurs after k, k', p, p', m, and f, whereas uü occurs only after k, and uü only after k or k'.

(12) Here are some generalizations:

(a) [+cons] → 

(b) [+seg] → [+cons]
Feature specification of #CVV#. (Comprehensive List of Examples)

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4. #cvc#

(1) Both -un and -ut occur with initials p, p', m, f, and the zero initial. Furthermore, -un occurs with k, and -ut occurs with k'.

(2) Both -ôn and -êt occur with initials ts, t's, s, and 1. Furthermore, -ôn occurs with initial t and the zero initial.

(3) Both -ôn and -êt occur with k and h. -ôn also occurs with the zero initial which, according to rule (3) of 3.2.1, will be realized as ȝ. However, some pronunciations favor ȝ rather than ȝ. We shall have to specify ȝ in the lexicon.
(4) Both -ün and -üt occur with t, t', l, ts, t's, s, h, and the
zero initial. -ün also occurs with n.

(5) -än, -ät, -än, -ät, -in and -it have very wide distributions.
-än, -än, and -ät occur with all consonants (including the zero
initial) except k'. Neither -in nor -it occur with γ. -it does
not occur with n. -ät occurs with all but four initial con-
sonants: k, k', γ, and h.
Some generalizations:

(a) \([+\text{grave}] \times [+\text{diff}] \) / \[+\text{cons}\] [+\text{grave}] [+\text{cons}] / [-\text{son}] -\text{flat} -\text{son} / [+\text{comp}] -\text{grave}

(b) \([+\text{grave}]\) / \[-\text{diff}\] \times [-\text{tense}] / \[+\text{cons}\] [+\text{grave}] / [-\text{son}] +\text{flat} / [+\text{comp}] -\text{grave}

(c) \([+\text{son}] \rightarrow \{[-\text{grave}]\} \) / \[+\text{cons}\] -\text{grave} / [-\text{son}] -\text{flat} / [+\text{comp}] -\text{grave} / [+\text{diff}] -\text{grave}

(d) \([+\text{son}] \rightarrow \{[-\text{grave}]\} \) / \[+\text{cons}\] -\text{grave} / [-\text{son}] -\text{flat} / [+\text{comp}] -\text{grave} / [+\text{diff}] -\text{grave}

(6) \(-\text{am}, -\text{ap}, -\text{am}, -\text{ap}, -\text{im}, \text{ and } -\text{ip}\) never occur with initial \(p, p', m, \text{ or } f\). This distributional pattern shows signs of dis-similation.

\[ [+\text{cons}] \rightarrow \{[-\text{grave}]\} \) / \[+\text{cons}\] +\text{grave} / [+\text{comp}] +\text{grave} / [+\text{diff}] +\text{flat}

(7) \(-\text{am} \text{ and } -\text{ap}\) do not occur with \(k'\). \(-\text{ip}\) does not occur with \(k' \text{ and } \gamma\). \(-\text{im}\) does not occur with \(-\gamma\).
(8) -\text{\`}z\text{\`} and -\text{\`}k occur with all consonants (including the zero initial). -\text{\`}k also occurs with \text{\`}.

(9) -\text{\`}k does not occur with n and k'. -\text{\`}y and -\text{\`}k occur with all other consonants except y.

(a) \[ [+\text{cons}] \rightarrow \begin{cases} [+\text{son}] \\ [+\text{grave}] \end{cases} \quad / \quad \begin{cases} [+\text{cons}] \\ [+\text{grave}] \end{cases} \]

(b) \[ [+\text{grave}] \rightarrow [\text{-tense}] \quad / \quad [\text{-flat}] \\
\quad [\text{-diff}] \]

(c) \[ [+\text{son}] \rightarrow [\text{+cons}] \\
\quad [\text{+diff}] \quad / \quad [\text{+cons}] \\
\quad [\text{+flat}] \\
\quad [\text{+diff}] \]
(10) Both -œŋ and -œk occur with t, l, ts, t's, s, k, k' and j. -œŋ also occurs with n and h.

(a) \[+\text{seg}] \rightarrow \begin{align*}
&\{-\text{cons} \} \\
&\quad \begin{cases}
\text{-voc} \\
\text{+son} \\
\text{-grave}
\end{cases} \\
&\quad \begin{cases}
\text{-strid} \\
\text{+tense}
\end{cases}
\end{align*} \\
\begin{align*}
&\{ \text{-grave} \} \\
&\{ \text{+cons} \}
\end{align*}

(b) \ [+\text{cons}] \rightarrow \begin{align*}
&\begin{cases}
\text{-grave} \\
\text{-strid} \\
\text{-tense}
\end{cases} \\
&\text{+gravity} \\
&\text{-diff}
\end{align*} \\
\begin{align*}
&\{ \text{-grave} \} \\
&\{ \text{+cons} \}
\end{align*}

(c) \ [+\text{cons}] \rightarrow \begin{align*}
&\begin{cases}
\text{-gravity} \\
\text{-voc} \\
\text{+son}
\end{cases}
\end{align*} \\
\begin{align*}
&\{ \text{-grave} \} \\
&\text{+cons} \\
&\text{+son} \\
&\text{+flat} \\
&\text{+graves} \\
&\text{-diff}
\end{align*}

(d) \ [+\text{cons}] \rightarrow \begin{align*}
&\begin{cases}
\text{+gravity} \\
\text{-diff}
\end{cases}
\end{align*} \\
\begin{align*}
&\{ \text{-grave} \} \\
&\text{+cons} \\
&\text{+son} \\
&\text{+flat} \\
&\text{+graves} \\
&\text{-diff}
\end{align*}

(11) Both -œj and -œk occur with p', m, l, ts, t's, k, h, j, w, and the zero initial. -œk also occurs with p, f, and ? -œj also occurs with s.

(a) \ [+\text{tense}] \rightarrow \begin{align*}
&\begin{cases}
\text{+gravity} \\
\text{-son} \\
\text{+tens}
\end{cases} \\
\text{+son} \\
\text{+comp}
\end{align*} \\
\begin{align*}
&\{ \text{+gravity} \} \\
&\text{+cons} \\
&\text{+son} \\
&\text{+flat} \\
&\text{-diff}
\end{align*}

(b) \ [+\text{son}] \rightarrow \begin{align*}
&\begin{cases}
\text{-grave} \\
\text{+voc}
\end{cases} \\
\text{+cons}
\end{align*} \\
\begin{align*}
&\{ \text{+gravity} \} \\
&\text{+cons} \\
&\text{+son} \\
&\text{+flat} \\
&\text{+graves} \\
&\text{-diff}
\end{align*}
In view of the fact that -\& and -ak do not occur with -k' either, (c) is modified to:

(c') \[
\begin{array}{c}
\begin{array}{c}
+\text{grade} \\
-\text{diff} \\
-\text{cont}
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{son} \\
-\text{flat}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{grade} \\
+\text{comp}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{diff}
\end{array}
\end{array}
\]
\]

(12) Both -\& and -ak occur with p, p', m, t, n, l, ts, s, and \&.
-\& also occurs with t', t's, k, h, θ, and w.

(a) \[
\begin{array}{c}
\begin{array}{c}
+\text{grade} \\
+\text{diff}
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{son} \\
-\text{flat}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{grade} \\
+\text{comp}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{diff}
\end{array}
\end{array}
\]
\]

(b) \[
\begin{array}{c}
\begin{array}{c}
-\text{grade} \\
-\text{strid}
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{son} \\
-\text{flat}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{grade} \\
+\text{comp}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{diff}
\end{array}
\end{array}
\]
\]

(c) \[
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
+\text{strid}
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
+\text{grade} \\
+\text{comp}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
+\text{strid}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
+\text{cons} \\
-\text{diff}
\end{array}
\end{array}
\]
\]
(13) Both -ιγ and -ικ occur with p, p', m, t, t', n, l, ts, t's, s, k, w, and the zero initial. -ιγ also occurs with f, k', and h.

(a) 

(b) 

(c) 

(14) Almost all occurrences of -εγ and -εκ are in colloquial forms derived from corresponding -ιγ and -ικ words. In such cases, the characterization of the colloquial form is identical with that of the reading form, except for an additional diacritic feature [+ colloquial] or [+ colloquial'].

(15) Not all reading forms have corresponding colloquial forms. Hence, the distribution of -εγ and -εκ is somewhat more limited than that of -ιγ and -ικ.

(16) Though all words with -εγ finals are colloquial expressions, not all words with -εκ finals are colloquial forms. In
Cantonese, sIk 'to eat' and sEk 'stone' contrast with each other. While -Ik does not occur with k' and h, -ek does.

(17) Here are some facts about the distribution of the -ek which occurs in noncolloquial forms:

(a) [+strid] → [+cont] / [+cons] [−grave] [−son] [−flat] [−diff] [+cons] [−son] [−flat] [−diff]

(b) +grave [−diff] → [+cont] / [+cons] [−grave] [−son] [−flat] [−diff] [+cons] [−son] [−flat] [−diff]

Feature specification of #CVC#. (Comprehensive List of Examples)

| p'aj | +C  | +G  | +C  |
|      | −S  | −F  | −D  |
|      | +G  | +S  | +G  |
|      | +D  | +Cp | +D  |

| slk | +C  | −G  | +C  |
|     | −S  | −F  | −S  |
|     | +Str| −F  | +G  |
|     | +Ct | −D  | −D  |

| man | +C  | +G  | +C  |
|     | +S  | +S  | +S  |
|     | +G  | −F  | +G  |
|     | +D  | +Cp | −D  |

| slk | +C  | −G  | +C  |
|     | −S  | −F  | −S  |
|     | +Str| −F  | +G  |
|     | +Ct | −D  | −D  |

| hap | +C  | +G  | +C  |
|     | −S  | −F  | −S  |
|     | +G  | +S  | +G  |
|     | −D  | +Cp | −D  |

| koek | +C  | −G  | +C  |
|      | −S  | −F  | −S  |
|      | +G  | +F  | +G  |
|      | −D  | +Ct | −D  |

| hān | +C  | −G  | +C  |
|     | −S  | −F  | −S  |
|     | +G  | +F  | +G  |
|     | −D  | +Ct | −D  |

<p>|jit | +C  | −G  | +C  |
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<td>+G</td>
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<td></td>
<td>+D</td>
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<td>+D</td>
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</tbody>
</table>
5. \#CVVC#

(1) In \#CVVC# the segment immediately following the initial segment must be nonconsonantal, vocalic, a grave, a flat, and diffuse (i.e. i or u).

\[ +\text{seg} \rightarrow \begin{bmatrix} -\text{cons} \\ +\text{voc} \\ -\text{grave} \\ +\text{flat} \\ +\text{diff} \end{bmatrix} / [+\text{seg}] [-\text{cons}] [+\text{seg}] \]

(2) If the segment immediately following a consonantal segment is grave and flat, the initial consonantal segment must be k, k', or the zero initial.

\[ [+\text{cons}] \rightarrow \begin{bmatrix} -\text{son} \\ +\text{grave} \\ -\text{diff} \\ -\text{cont} \end{bmatrix} / \begin{bmatrix} +\text{grave} \\ +\text{flat} \end{bmatrix} [-\text{cons}] [+\text{seg}] \]

(3) If the segment immediately following a consonantal segment is nongrave and nonflat, the initial segment must be the zero initial.

\[ [+\text{seg}] \rightarrow [+\text{cons}'] / \begin{bmatrix} +\text{grave} \\ -\text{flat} \end{bmatrix} [-\text{cons}] [+\text{seg}] \]

(4) -uI\# and -uIk occur after k, but not k'. -u\#k, -u\#t, -u\#t, and -u\#an do not occur after k', either.
(5) In the sequence VVC, -i- does not occur with -an, -at, -əŋ, -ək, -ək, -ət, -ən, -ən, -ət, -ək, -un, and -ut. Hence,

(a) \([+\text{grave}] \rightarrow [-\text{flat}] / [+\text{seg}]\)

(b) \([+\text{grave}] \rightarrow [-\text{flat}] / [a\text{comp}] / [+\text{seg}]\)

(c) \([+\text{grave}] \rightarrow [+\text{diff}] / [+\text{seg}]\)

(d) \([+\text{cons}] \rightarrow [+\text{son}] / [+\text{seg}]\)
(6) In the sequence VVC, -u- does not occur with -âm, -âp, -âm, 
-ap, -im, -ip, -Sn, -öt, -ön, -öt, -in, -it, -ök, -çğ, -çk, 
-öçğ, -öçk, -Uŋ, -Uk, ün, or -üt. Hence we have

(a) [-cons] → [+grave] / [+seg] [+flat] [+] [cons] [+flat] [-grave]

(b) [+grave] → [-diff] / [+seg] [+grave] [+] [cons]

(c) [-cons] → [+cons] / [+seg] [+flat] [+] [cons] [+flat] [+grave]

(d) [+grave] → [+son] / [+seg] [+flat] [-flat] [-comp] [+grave]

Feature specification of #CVVC#.

<table>
<thead>
<tr>
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<th>[+C'][]</th>
<th>[+]</th>
<th>[+]</th>
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<td>G</td>
<td>C</td>
</tr>
<tr>
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<td>[+C']</td>
<td>-F</td>
<td>+S</td>
</tr>
<tr>
<td></td>
<td>(+D)</td>
<td>-Cp</td>
<td>-G</td>
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<td>G</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>[+C']</td>
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<td>+G</td>
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<tr>
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<td>(+D)</td>
<td>-Cp</td>
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<table>
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<tr>
<th>jön</th>
<th>[+C'][]</th>
<th>[+]</th>
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<tbody>
<tr>
<td></td>
<td>-G</td>
<td>-G</td>
<td>+C</td>
</tr>
<tr>
<td></td>
<td>[+C']</td>
<td>-F</td>
<td>+S</td>
</tr>
<tr>
<td></td>
<td>(+D)</td>
<td>-D</td>
<td>-G</td>
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</tbody>
</table>
| jøeh | \[
\begin{bmatrix}
-G & -G & +C \\
-F & +F & +G \\
(+D) & -D & -D
\end{bmatrix}
\] |
| --- | --- |
| wat | \[
\begin{bmatrix}
+G & +G & +C \\
+F & -F & -S \\
(+D) & +Cp & -G
\end{bmatrix}
\] |
| k'øat | \[
\begin{bmatrix}
+G & +G & +C \\
+F & -F & -S \\
(-D) & (+D) & +Cp & -G
\end{bmatrix}
\] |
| wok | \[
\begin{bmatrix}
+G & +G & +C \\
+F & +F & +G \\
(+D) & -D & -D
\end{bmatrix}
\] |
| k'øøk | \[
\begin{bmatrix}
+G & +G & +C \\
+F & +G & +S \\
(+D) & -D & -D
\end{bmatrix}
\] |
References


Chomsky, Noam, and Morris Halle. The sound pattern of English. (To be published by Harper and Row.)


Wang, Li. 1937. Hán yǔ shǐ gāo. (Outline of Chinese historical phonetics.) Shanghai.


Footnotes

1 This study was supported by National Science Foundation Grant GS1430.

2 The five subgroups are: (1) Yüe hǎi. Its area of distribution includes the basin of Xijiang and the delta of Zhujiang (Pearl River). (2) Sī yì. Spoken in the towns of Táishan, Xinhūi, Kàiping, Enpíng, and their vicinity. (3) Gāo-Léi. Spoken in Gaozhou, Léizhou, and their vicinity. (4) Qin-Lián. Spoken in Qinzhōu, Liánzhōu (Hepu), and their vicinity. (5) Gùi nán. Spoken in the southern part of the Guangxi province. This area includes Wúzhōu, Róngxiān, Yùlín, and Bóbái.

3 A set of distinctive features was also listed in Jakobson, Fant, and Halle (1952), Jakobson and Halle (1956), and Halle (1959). I believe, however, that the set coming out in Chomsky and Halle will be an improved version and the most sophisticated of all with respect to current phonological theory.

4 For example, Li Wáng (1937:125) and Lien-hsen Lin (1964:135). But this is probably the best these linguists can do within their theoretical framework of distinctive segments rather than distinctive features.

5 [y] and [\phi] are the IPA transcription. For Cantonese, we have chosen the symbol [\psi] for IPA [\phi] and the symbol [\ddot{u}] for IPA [y]. The sounds symbolized by o range over IPA e, æ, and û.
a Guangxi (Kwangsi) 廣西
b Guangdong (Kwangtung) 廣東
c Yue 粵
d Yang 陽
e Ru 入
f Yuehai 粵海
g Niu 泥
h Nian 娘
i Lai 来
j Hakka 客家
k Min 關
l Wu 吳
m Nanhai 南海
n Ying 影
o Yi 疑
p Yu 餘
q Yun 雲
r Wei 微
s Words beginning with n: 桥, 泥, 尼, 南, 内, 年, 努, 难, 纳, 撒, 宁, 女, 你, 纽, 拐, 娘, 棱, 棋, 那, 拿, 膜, 匡, 脂, 潦.

Words beginning with l: 进, 罗, 梨, 蓝, 盘, 利, 李, 連, 罗, 役, 蘭, 立, 懶, 柳, 楼, 涌, 潑, 潤, 砂, 历, 磚.

t Que-yun 齐韵
u Qiu 愚, a member of the Yi group
v Qiu 进, a member of the Ying group
inan 岸, a member of the Yi group
xiàn 按, a member of the Ying group
yìan � createTime, a member of the Yi group
zián 早, a member of the Ying group
ac 關口呼
diyáng sheng yún 陽聲韵
ea rù sheng yún 入聲韵
af yin sheng yùn 陰聲韵
ag Suzhou 蘇州

Words of List A:

Words of List B:

Words of List C:

Words of List D:

Words of List E:

Words of List F:
The title of the article is 關於廣州話陰平調的分化問題.

The examples are: kou fuŋ 高峰, tsuŋ sem 世心, t'isŋ tsan 青磚,
tsi tshuk 知足, and lek yŋ pon fan 落英綻紛。

Words in List F are: pou 煲, so 林, hun 圍, t'au 巷, tig 個, tsoŋ 師,
t'san 餐, kei 裏, kūŋ 大, k'ūn 協; fan pou 炊煲, pou fan 紹飯, so 林, jin hun 頓僑,
hun wak 圍劃, t'oei t'ian 茶攤, fan t'au 分攤, tig hai 伙鞋, jek tsoŋ 藥劑,
jet tsai jek 藥劑, tsou t'ian早餐, sam t'ian (fan) 三餐飯, kūŋ kei 公雞,
kei tan 貓蛋, kei kūŋ 技工, kūŋ tsoŋ 工廠, hoi k'ūn 海軍, k'ūn hau 軍校。

Words in List G are: lei hau k'ūn 李香君, hūŋ sēn kiu 洪宣嬋,
uŋ siu t'siŋ 鴻小青, luk tso 線球, mui lan fong 梅蘭芳, tsay fai 張飛,
kīŋ 京, t'sēd sai t'seng 徐世昌, au wāng sau 欧陽修, kūn hau hūŋ 關漢卿。

Words in List H are: jek fong 藥方, tuŋ fong 傳方, t'au tsong 圖章, mui
tsay 文章, tiss kē 茶居, son kōu 新居, fa hak ka 化學家, kī tūŋ 家庭,
jin tai 煙仔, jin for 煙火, tuŋ tshai tsung 唐太宗, tsou tsing 祖宗。

Words in List I are: tan tis 童軍, hei tis 汽車, fo tis 汽車,
ma tis 馬車, woy kwa 黃瓜, sei kwa 西瓜, hā mat kwa 哈蜜瓜, sa pau 書包,
ma pau 麻包, tan kūsi 袖軲, tan jen 眼, tan jen pēt ma 單人匹馬。
The Chinese characters for words in Footnote 2 are:


S.-Y. Wang 王士元
F. K. Li 李方桂
Li Wang 王力
Han Yu Shi Gao 漢語史稿
Lien-Hsien Lin 林連仙
香港中國人的語言現象概說
The Chung Chi Journal 崇基學報