TYPOLOGY OF THE SYLLABLE-INITIAL CONSONANTS
IN THE CHINESE DIALECTS

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ABSTRACT

This paper presents the typological facts about the syllable-initial consonants in the 70 Chinese dialects of the 11 dialect groups, *Mandarin*, *Jin*, *Wu*, *Xiang*, *Hui*, *Gan*, *Min*, *Yue*, *Kejia*, *Pinghua*, and *Tuhua*. There are 52 consonant types, including 13 plosives, 16 fricatives, 11 affricates, 6 nasals, and 6 approximants. The most frequent consonants, found in 60 or more dialects are [p](67), [t](70), [k](70), [pʰ](69), [tʰ](69), [kʰ](69), [f](60), [s](68), [ts](70), [tsʰ](69), [m](70), [ŋ](60), [j](70), and [l](69). The number of consonants in an inventory varies from 16 to 32. Smaller inventories (18 to 24) are favoured, and 20 is most common. The average proportion of the obstruents to sonorants across the 70 consonant inventories is 70.3% to 29.7%, which is nearly the same as what Lindblom and Maddieson [1] predicts for languages. The 'modal consonant inventory' of the Chinese dialects is smaller in size than that of the UPSID languages (Maddieson [2]).

Keywords: Phonetic typology, syllable-initial consonants, phonetic consonant inventory, Chinese dialects.

1. INTRODUCTION

The present study is a typological analysis of the occurrence frequencies and occurrence patterns of the syllable-initial consonants in a sample of 70 Chinese dialects. Despite the general perception of linguistic homogeneity across the Chinese dialects, many are significantly different from one another and are mutually unintelligible due largely to the differences in sound system. This is in particular true of the dialects spoken in the geographical regions south of the river *Yangtze* (now *Changjiang*) due to isolation as a result of geographical barriers over an extended period of time. Norman [3] calls attention to the fact that "*There are literally scores of mutually non-intelligible varieties of Chinese.*" (p.187) and "*To the historical linguist Chinese is rather more like a language family than a single language made up of a number of regional forms. The Chinese dialectal complex is in many ways analogous to the Romance language family in Europe.*" (p.187) Based on the content of phonetic

inventories of the syllable-initial consonants of the 70 Chinese dialects of the 11 dialect groups, this paper presents (*i*) the consonant inventories and their contents, sizes and frequencies of occurrence, (*ii*) the consonants of the classes of plosives, fricatives, affricates, nasals, and approximants and their frequencies of occurrence, and (*iii*) the occurrence patterns of the initial consonants of the classes of plosives, fricatives, affricates, nasals, and approximants. The findings in this study are discussed in relation to (*i*) the 'modal consonant inventory' (Maddieson [2]), and (*ii*) the constancy of the 'obstruent-sonorant proportion' (Lindblom and Maddieson [1]).

2. PROCEDURE

The types of sources for building the phonetic inventories of the syllable-initial consonants of the 70 Chinese dialects in this study consist of journal articles published mostly in *Fangyan* (*Dialect*), an official journal of the Institute of Linguistics at the Chinese Academy of Social Sciences, book chapters, and monographs. The classification of the dialect groups and their sub-groups is based on the *Language Atlas of China* (Wurm and Li [5]) and Xiong and Zhang [6]. The typological facts about the initial consonants to be presented are based on the consonant inventories of a representative sample of 70 geographically and genetically balanced dialects of the 11 Chinese dialect groups, including (*i*) the northern *Mandarin* (8) and *Jin* (6), (*ii*) the central *Hui* (5), *Gan* (8), *Xiang* (5), and *Wu* (8), and (*iii*) the southern *Min* (9), *Yue* (8), *Kejia* (Hakka) (9), *Pinghua* (2), and *Tuhua* (2). The numeral in parentheses denotes the number of sub-dialect groups, from each of which a single dialect is selected for the study. The northern dialect groups, *Mandarin* and *Jin*, are spoken over wide geographical regions, including all the areas north of the river *Yangtze* and the vast areas in southwestern China. The central dialect groups, *Hui*, *Gan*, *Xiang*, and *Wu*, are spoken in the eastern and central provinces south of *Yangtze*. The southern dialect groups, *Min*, *Yue*, *Kejia*, *Pinghua*, and *Tuhua* are spoken in the southern coastal provinces. The *Tuhua* and *Pinghua* groups are spoken over much smaller geographical areas, with the former being restricted to the

southern-most area of *Hunan* province and northern tip of *Guangdong* province and the latter being confined to the eastern part of the southern coastal province of *Guangxi*. This explains why the number of the dialects from these two dialect groups is small.

3. RESULTS

3.1. Consonant inventories

Fig. 1 shows the 17 phonetic consonant inventories of different sizes ranging from 16 to 32 in the 70 Chinese dialects. The distribution of the consonant inventories across the dialects tends to be skewed, where the smaller sizes are favoured. The 20-CI (CI = consonant inventory) has a higher frequency of occurrence, found in 12 dialects of 8 dialect groups. Each of the CIs from 18 to 24, excluding 22, occurs in at least 5 dialects. The 17-CI, 22-CI, 25-CI, 26-CI, 29-CI and 30-CI are less common, found in 3 or 4 dialects. The 16-CI, 27-CI, 28-CI, 31-CI and 32-CI are found in 1 or 2 dialects.

Figure 1: Bar graph showing the frequencies of occurrence of the 17 initial consonant inventories of different sizes (16-32) in the 70 Chinese dialects of the 11 dialect groups, where C = consonant.
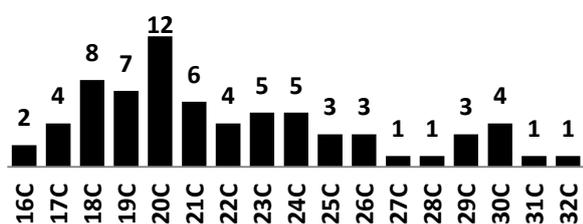
3.2. Consonant types

In this study, a total of 52 syllable-initial consonant types are identified in the 70 Chinese dialects of the 11 dialect groups. All the consonants are made with a pulmonic airstream mechanism. Implosives, ejectives, clicks, trills, taps/flaps, consonant clusters and uvular, pharyngeal and epiglottal articulations are non-occurring. The 52 consonant types consist of 13 plosives, 16 fricatives, 11 affricates, 6 nasals, and 6 approximants, and they are at the respective 4, 9, 4, 6 and 5 places of articulation. Of the 52 consonants, the most frequent ones occurring in 60 to 70 dialects are [p][t][k][pʰ][tʰ][kʰ][f][s][ts][tsʰ][m][ŋ][j][l]. The next most frequent ones are [ɕ][h][tɕ][tɕʰ][n][ɲ][w] (in 38-56 dialects). The rest are less frequent or rare, e.g., [b][d][g][z][ʂ][x][tʂ][tʂʰ][ʋ] (in 14-33 dialects), [v][ɬ][ʑ][ɦ][dz][dʐ][ɻ][ɭ] (in 7-12 dialects), and [c][cʰ][ʔb][ʔd][ɸ][θ][ʐ][ç][ɣ][dʑ][pf][pfʰ][ŋ][ɳ] (in 1-3 dialects), where [ʔb][ʔd] are preglottalized plosives found in a single *Min* dialect. Amongst the dialects, the occurrences of [w] and [ʋ] are mutually exclusive.

The presence of [w] implies the absence of [ʋ] and the reverse is also true, except for a single *Gan* dialect, in which [w] and [ʋ] occur as allophones.

The total number of occurrence of the consonants in the 70 dialects is 1,544. The breakdown is 1,086 (70.3%) obstruents (467 plosives (30.2%), 326 fricatives (21.1%), 293 affricates (19%)) and 458 (29.7%) sonorants (231 nasals (15%), 227 approximants (14.7%)). The number of the voiceless obstruents is 967 (418 plosives, 278 fricatives, 271 affricates), and the number of voiced obstruents is 119 (49 plosives, 48 fricatives, 22 affricates). The voiceless plosives are more frequent than the voiced ones, as a result of the diachronic devoicing of the Middle Chinese (600 AD-1200 AD) voiced obstruents across the Chinese dialect groups starting in circa 1000 AD (Pulleyblank [4]). The consonant categories in order of decreasing number of occurrence are plosive > fricative > affricate > nasal > approximant.

3.2.1. Plosives

The initial plosives occur in all the 70 Chinese dialects. The total number of occurrence of the plosives is 467. The 13 types of the plosives at 4 places of articulation are the voiceless [p](67, i.e., in 67 dialects), [t](70), [k](70), [pʰ](69), [tʰ](69), [kʰ](69), [c](2), [cʰ](2), the voiced [b](19), [d](14), [g](14), and the preglottalized [ʔb](1), [ʔd](1). The numbers of occurrences of the voiceless and voiced plosives are 418 and 49, respectively. There are more types of the voiceless plosives than the voiced ones. The voiced plosives are mainly found in the *Xiang* and *Wu* groups, sporadically in the *Min* and *Yue* groups, but not in the *Mandarin*, *Jin*, *Hui*, *Gan*, *Tuhua*, and *Pinghua* groups. A single *Min* dialect lacks [p pʰ tʰ kʰ], and 2 *Yue* dialects are without [p].

The 8 occurrence patterns of the initial plosives in the 70 dialects are [p pʰ t tʰ k kʰ] (49, i.e., in 49 dialects), [p pʰ t tʰ k kʰ b d g] (11), [p pʰ t tʰ c cʰ k kʰ] (2), [p pʰ t tʰ k kʰ b] (2), [pʰ t tʰ k kʰ b d] (2), [p pʰ t tʰ k kʰ b g] (2), [p pʰ t tʰ k kʰ b d] (1), and [t k b g ʔb ʔd] (1). The most common pattern [p pʰ t tʰ k kʰ] is found in 49 dialects of the 11 dialect groups, except for the *Wu* group. All the 8 *Wu* dialects share the pattern [p pʰ t tʰ k kʰ b d g]. There are occurrence patterns of only the voiceless plosives or both the voiceless and voiced plosives, but not those of only the voiced plosives.

3.2.2. Fricatives

The initial fricatives occur in all the 70 Chinese dialects. The total number of occurrence of the fricatives is 326. The 16 types of fricatives at 9 places of articulation are the voiceless [s](68, i.e., in

68 dialects), [f](60), [ɕ](48), [h](38), [x](33), [ʂ](17), [ɬ](9), [ɸ](2), [ç](2), [θ](1) and the voiced [z](15), [v](12), [ʐ](8), [ɦ](8), [ɣ](3), [ʑ](2). The numbers of occurrences of the voiceless and voiced fricatives are 278 and 48, respectively. Similar to the plosives, the voiceless fricatives have more types and a higher frequency of occurrence than the voiced ones. Two *Min* dialects lack [s]. In both cases, the voiceless lateral fricative [ɬ] occurs instead. Of the 10 dialects that lack [f], 8 are *Min* dialects, in which [f] ➙ [h], and the other two are a *Gan* dialect, in which [f] ➙ [ɸ], and a *Jin* dialect, in which [f] ➙ [x]. The voiceless alveolopalatal fricative [ɕ] occurs in all the dialects of the *Mandarin*, *Jin*, *Hui*, *Xiang*, *Gan*, and *Wu* groups and a few dialects of the *Min* and *Kejia* groups, but not in the *Yue*, *Tuhua*, and *Pinghua* groups. The glottal fricative [h] is found in many dialects of the *Wu*, *Yue*, *Min*, and *Kejia* groups, whereas the velar fricative [x] occurs mainly in the *Mandarin*, *Jin*, *Hui*, and *Xiang* groups. The occurrences of [x] and [h] in a dialect are mutually exclusive. The presence of [h] implies the absence of [x], and the reverse is also true. The exception is a *Min* dialect, in which both [x] and [h] occur as distinctive sounds. The frequency of occurrence of the apical postalveolar/retroflex [ʂ] is higher in the *Mandarin* group (in 6 of the 8 *Mandarin* dialects) than the *Jin*, *Gan*, *Hui*, *Xiang*, and *Kejia* groups. The *Yue*, *Min*, *Tuhua*, *Pinghua*, and *Wu* groups lack [ʂ].

There are 30 different occurrence patterns of the fricatives of the sizes from 2 to 10. The more frequent patterns are [f s ʂ ɕ x] (12, i.e., in 12 dialects) and [f s ɕ x] (10), and the less frequent ones are [f s h] (7), [f s ɬ h] (5), [f s ɕ h] (4), and [f v s z ɕ ʑ h ɦ] (4). The smallest patterns are [s h] (2) and [ɬ h] (2), both occurring in the *Min* group. The largest pattern [f v s z ʂ ʐ ɕ ʑ x ɣ] is found in a single *Xiang* dialect. The other patterns [f s x], [s ɕ x], [s ɕ h], [ɸ s ɕ h], [f s ɬ x], [f θ s h], [f s ç h], [s z ɕ h], [s ɕ h ɦ], [ɸ s z x h], [f s ɕ x ɣ], [f v s ɕ x], [f s z ɕ x], [f s z ɬ h], [f s ʂ ɕ h], [f s ʂ ɕ ç x], [f v s z ɕ ʑ h], [f v s z ɕ h ɦ], [f v s z ɕ x ɣ], [f v s z ʂ ʐ ɕ h], and [f v s z ɕ x ɦ] are infrequent, found in 1 or 2 dialects. Similar to the plosives, there are occurrence patterns of only the voiceless fricatives or both the voiceless and voiced fricatives, but not those of only the voiced fricatives.

3.2.3. Affricates

The initial affricates occur in all the 70 dialects. The total number of occurrence of the affricates is 293. The 11 types of affricates at 4 places of articulation are the voiceless [ts](70, i.e., in 70 dialects), [tsʰ](69), [tɕ](48), [tɕʰ](48), [tʂ](17), [tʂʰ](17), [pf](1), [pfʰ](1) and the voiced [dz](9), [dʐ](11), [dʑ](2). The numbers of the occurrences of the voiceless and voiced

affricates are 271 and 22, respectively. Similar to the plosives and fricatives, the voiceless affricates have more types and a higher frequency of occurrence than the voiced ones. The alveolar [ts] is most common, found in all the 70 dialects. A single *Min* dialect lacks [tsʰ], which has merged with [s]. The alveolopalatal affricates [tɕ tɕʰ] are found in all the *Mandarin*, *Jin*, *Hui*, *Xiang*, *Gan*, and *Wu* dialects and some *Min* and *Kejia* dialects, but not in the dialects of the *Yue*, *Tuhua*, and *Pinghua* groups. The voiceless apical postalveolar/retroflex affricates [tʂ tʂʰ] and fricative [ʂ] occur in the *Mandarin*, *Jin*, *Hui*, *Xiang*, *Gan*, and *Kejia* groups, but not in the *Wu*, *Min*, *Yue*, *Tuhua*, and *Pinghua* groups. The voiced affricates [dz dʑ dʐ] are only found in the southern dialect groups of *Xiang*, *Wu*, and *Min*. The labio-dental [pf pfʰ] occur in a single *Mandarin* dialect.

There are 8 occurrence patterns of the affricates of the sizes from 1 to 9. The more frequent patterns are [ts tsʰ tɕ tɕʰ] (22, i.e., in 22 dialects) and [ts tsʰ] (21), and [ts tsʰ tʂ tʂʰ tɕ tɕʰ] (14). The less frequent ones are [ts tsʰ dz tɕ tɕʰ dʑ] (7), [ts tsʰ tɕ tɕʰ dʑ] (2), [ts tsʰ dz tʂ tʂʰ dʐ tɕ tɕʰ dʑ] (2), [pf pfʰ ts tsʰ tʂ tʂʰ tɕ tɕʰ] (1), and [ts] (1). The largest [ts tsʰ dz tʂ tʂʰ dʐ tɕ tɕʰ dʑ] is found in 2 *Xiang* dialects, and the smallest [ts] in a single *Min* dialect. The patterns that also contain the voiced affricates [dz dʑ dʐ] or [dz dʑ] are found only in the *Wu*, *Xiang*, and *Min* groups. Again, there are no occurrence patterns of only the voiced affricates, but patterns of only the voiceless affricates or both the voiceless and voiced affricates.

3.2.4. Nasals

The initial nasals occur in all the 70 dialects. The total number of occurrence of the nasals is 231. The 6 types of initial nasals at 6 places of articulation are [m](70, i.e., in 70 dialects), [ŋ](60), [n](56), [ȵ](41), [ɲ](2), and [ɳ](2). The bilabial [m] occurs in all the 70 dialects. The velar [ŋ] is less frequent due to its lower occurrence frequency in the northern dialect groups, *Mandarin* and *Jin*. The alveolar [n] is less frequent than [m] and [ŋ] as a result of many instances of change [n] ➙ [l] in the central dialect groups, *Hui*, *Xiang*, and *Gan*. The alveolopalatal [ȵ] mainly occurs in the *Wu*, *Gan*, and *Kejia* groups. The palatal [ɲ] and apical postalveolar/retroflex [ɳ] are rare, with [ɲ] occurring in a *Gan* and a *Kejia* dialect and [ɳ] in 2 *Gan* dialects. The nasals have more places (6) of articulation than the plosives (4), affricates (4) and approximants (5), but less than the fricatives (9).

The 11 occurrence patterns are [m n ȵ ŋ] (27, i.e., in 27 dialects), [m n ŋ] (19), [m ȵ ŋ] (8), [m n] (4), [m n ȵ] (4), [m] (2), [m ŋ] (2), [m ɲ ŋ] (1), [m n ɲ ŋ] (1), [m ɳ ȵ ŋ] (1), and [m n ɳ ȵ ŋ] (1). The largest

pattern [m n ɳ ȵ ŋ] occurs in a single *Gan* dialect and the smallest [m] in a *Mandarin* and a *Xiang* dialect.

3.2.5. Approximants

The initial approximants occur in all the 70 dialects. The total number of the occurrence of the approximants is 227. The six types of approximants are [j](70, i.e., in 70 dialects), [l](69), [w](46), [ʋ](25), [ɻ](10), and [ɹ](7). The initial [j] and [l] occur in all the 70 dialects except a single *Hui* dialect, in which [l] has merged with [n]. As mentioned earlier, amongst the dialects, occurrences of [w] and [ʋ] are mutually exclusive, except for a *Gan* dialect. The *r*-sounds [ɻ] and [ɹ] occur nearly exclusively in the northern *Mandarin* and *Jin* groups.

The 10 occurrence patterns of the approximants in the 70 dialects are [l w j] (37, i.e., in 37 dialects), [l ʋ j] (16), [l ɻ w j] (4), [l ɻ ʋ j] (4), [l ɹ w j] (3), [l ɹ ʋ j] (2), [l ʋ w j] (1), [l ɹ ɻ w j] (1), [l ɹ ɻ ʋ j] (1), and [ʋ j] (1). The pattern [ʋ j] without the *r*-sounds and [l] is found in a single *Hui* dialect.

3.2.6. Series of phonation types of the obstruents

In the 70 Chinese dialects, (*i*) the bilabial, alveolar and velar plosives have 3 series of phonation types (voiceless aspirated, voiceless unaspirated, voiced), the palatal plosives have 2 (voiceless aspirated, voiceless unaspirated), and the preglottalized plosives have 1 (voiced). (*ii*) The coronal affricates have 3 series (voiceless aspirated, voiceless unaspirated, voiced), and the labiodental affricates have 2 (voiceless aspirated, voiceless unaspirated). (*iii*) The labiodental, coronal, velar and glottal fricatives have 2 (voiceless, voiced), and the dental and palatal fricatives have 1 (voiceless). Except for a single *Min* dialect, all the 70 dialects have at least 2 plosive series (voiceless aspirated, voiceless unaspirated) and 2 affricate series (voiceless aspirated, voiceless unaspirated).

4. DISCUSSION

Owing to space limit, two points are discussed. First, 'modal consonant inventory' (Maddieson [2]) and second, 'obstruent-sonorant proportion' in consonant inventory (Lindblom and Maddieson [1]).

4.1. Modal consonant inventory

The modal consonant inventory (MCI) proposed in Maddieson [2] contains the most frequently occurring 21 consonants of the UPSID (UCLA Phonological Segment Inventory Database) languages, comprising /p b t d k g ʔ f s ʃ tʃ tʃʰ m n ɲ ŋ w j l r/ plus one other. In the present study, the most

frequent consonants that occur in 60 (86%) or more dialects are [p t k pʰ tʰ kʰ f s ts tsʰ m ŋ j l]. These 14 types in the Chinese dialects are phonemically represented as /p t k pʰ tʰ kʰ f s ts tsʰ m ŋ j l/, also 14 in number. The Chinese MCI of 14 consonant phonemes is smaller in size than the UPSID MCI. While the Chinese MCI lacks /b d g ʔ ʃ tʃ tʃʰ n ɲ w r/, the UPSID MCI lacks /pʰ tʰ kʰ ts tsʰ/. Those shared by the both are /p t k f s m ŋ j l/, which accounts for 64% of the Chinese MCI.

4.2. Obstruent-sonorant proportion

In Lindblom and Maddieson [1], it is stated that "*... languages tend to have 70% obstruents and 30% sonorants. This is so independent of the size of the particular inventory.*" (p.66) The obstruent-sonorant proportions (∝) of the initial consonants in the 70 CI range from '61.1% ∝ 38.9%' to '87.1% ∝ 12.9%' and the average obstruent-sonorant proportion across the 70 CIs is '70.3% ∝ 29.7%' (standard deviation = '4.03% ∝ 0.85%'). The average proportion agrees with Lindblom and Maddieson [1] that "*languages tend to have 70% obstruents and 30% sonorants*". But the obstruent-sonorant proportion in the 70 Chinese dialects is not "*independent of the size of the particular inventory*". Fig. 2 shows a moderately strong linear positive correlation ($r = 0.78$) between the obstruent sizes (61.1% to 87.1%) and the 70 CI sizes (16-32), where the obstruent size increases as the CI size increases.

Figure 2: Linear correlation relationship ($r = 0.78$) between the 70 obstruent sizes in percentage (61.1% to 87.1%) and the sizes of the 70 CI (16 to 32); less than 70 points displayed due to overlap.
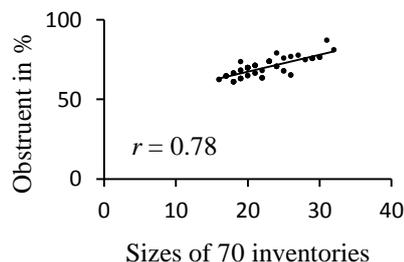
5. CONCLUDING REMARK

The typological information about the inventories and occurrence patterns of the initial consonants in the 70 Chinese dialects of the 11 dialect groups is believed to be useful for determining the varying degrees of phonological affinity between the dialects and between the dialect groups in Chinese and for explaining the divergent evolution of the initial consonant system of Middle Chinese.

6. REFERENCES

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