Sound Change and Emergence of Patterns of the Syllable-final Consonants in the Chinese Dialects

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Introduction. The syllable-final consonants that occur in the present-day Chinese dialects include the unreleased voiceless stops [-p -t -k], glottal stop [-ʔ], and nasals [-m -n -ŋ]. They are the reflexes of the historical syllable-final stops, -**p* -**t* -**k*, and nasals, -**m* -**n* -**ŋ*, that occurred in Middle Chinese and Old Chinese ([1,2,3]). In some dialects, -**p* -**t* -**k* -**m* -**n* -**ŋ* are preserved. In other dialects, some of them are retained, resulting in the varied patterns of the syllable-final stops and nasals in different dialects. The purpose of this study is twofold, (i) to identify the changes of the historical -**p* -**t* -**k* -**m* -**n* -**ŋ* in the present-day Chinese dialects through examining the content of the defective patterns, which do not contain all the descendants of -**p* -**t* -**k* -**m* -**n* -**ŋ*, and (ii) to explain the sound changes in the syllable-final consonants that have led to the formation of the defective patterns. The study is based on the occurrence data on the syllable-final stops and nasals in a representative sample of genetically and areally balanced dialects of the 70 subgroups of the 11 Chinese dialect groups, including *Mandarin* (8), *Jin* (6), *Hui* (5), *Gan* (8), *Xiang* (5), *Wu* (8), *Min* (9), *Yue* (8), *Kejia* (9), *Pinghua* (2), and *Tuhua* (2). The numeral in parentheses denotes the number of the subgroups of each of the 11 dialect groups.

Patterns. A total of 15 patterns of the syllable-final stops and nasals in the 70 sample dialects are identified and they may be grouped into five types. Type 1 consists of six patterns, [-p -t -k -m -n -ŋ] (15, i.e., occurring in 15 dialects), [-p -t -k -ʔ -m -n -ŋ] (1), [-p -k -m -ŋ] (2), [-p -ʔ -m -n -ŋ] (1), [-t -k -n -ŋ] (2) and [-t -ʔ -n -ŋ] (2). These patterns contain the syllable-final oral/glottal stops and nasals. Type 2 consists of three patterns, [-ʔ -ŋ] (9), [-ʔ -n -ŋ] (6) and [-ʔ -m -n] (1), that contain a glottal stop and one or two nasals. Type 3 consists of a single pattern, [-ʔ] (3), that contains only a glottal stop. Type 4 consists of four patterns, [-n -ŋ] (14), [-ŋ] (9), [-n] (3) and [-m -ŋ] (1), that contain one or two nasals. Type 5 consists of a single pattern that contains no or zero syllable-final consonant 'Ø'.

Sound change in syllable-final stops. The historical -**p* -**t* -**k* are preserved in the dialects, in which the Type 1 patterns, [-p -t -k -m -n -ŋ] and [-p -t -k -ʔ -m -n -ŋ], occur. The pattern, [-p -t -k -ʔ -m -n -ŋ], occurs in a single *Min* dialect, *Xiamen*. The extra [-ʔ] in the pattern results from the bifurcation of -**p* -**t* -**k* into (i) [-p][-t][-k] when following the back vowels and (ii) [-ʔ] when following the front vowels. The changes in the syllable-final stops in the other Type 1 patterns, [-p -k -m -ŋ], [-p -ʔ -m -n -ŋ], [-t -k -n -ŋ] and [-t -ʔ -n -ŋ], include (i) the merging of -**p* into [-k] and [-t], -**t* into [-p], -**t* into [-k], and -**k* into [-t]; and (ii) cases of debucaalization, [-ʔ] < -**p*, [-ʔ] < -**t* and [-ʔ] < -**k*. The changes are bi-directional in terms of place of articulation. Also, the change from -**p* to [-k] does not require -**p* to first change to [-t]; and the change from -**p* or -**t* to [-ʔ] does not require -**p* or -**t* to first change to [-k]; the change in -**p* -**t* -**k* is triggered by the change in the preceding vowel; and the direction of change is conditioned by the vowel type. In Type 2 and Type 3 patterns, [-ʔ -ŋ], [-ʔ -n -ŋ], [-ʔ -m -n] and [-ʔ], each of -**p* -**t* -**k* has turned into [-ʔ].

Sound change in syllable-final nasals. The historical -**m* -**n* -**ŋ* have remained intact in the Type 1 patterns, [-p -t -k -m -n -ŋ], [-p -t -k -ʔ -m -n -ŋ] and [-p -ʔ -m -n -ŋ]. The pattern, [-p -t -k -ʔ -m -n -ŋ], occurs only in *Xiamen*. In the dialect, -**m* -**n* -**ŋ* have remained intact in some rimes, and in other rimes, they are dropped with concomitant change of the preceding vowel into a nasal vowel ([Ṽ] < 'Ø' < -**m* -**n* -**ŋ*). Such changes have not taken place in the syllable-final nasals in the other two patterns, [-p -t -k -m -n -ŋ] and [-p -ʔ -m -n -ŋ]. The occurrence of nasal vowels in *Xiamen* suggests that [-m][-n][-ŋ] are unstable. Despite the similarity on the surface level between [-p -t -k -ʔ -m -n -ŋ] and [-p -t -k -m -n -ŋ] in number and type of the syllable-final nasals, the phonological behaviour of [-m][-n][-ŋ] in the two patterns differs. This is also true between [-p -t -k -ʔ -m -n -ŋ] and [-p -ʔ -m -n -ŋ]. The other Type 1 patterns, [-p -k -m -ŋ], [-t -k -n -ŋ], [-t -ʔ -n -ŋ], Type 2 patterns, [-ʔ -ŋ], [-ʔ -n -ŋ], [-ʔ -m -n], and Type 4 patterns, [-n -ŋ], [-ŋ], [-n], [-m -ŋ], contain one or two syllable-final nasals. The changes in the syllable-final nasals in these patterns are (i) elision of one or two of -**m* -**n* -**ŋ*, (ii) change in place of articulation, including [-n] < -**m*, [-ŋ] < -**m*, [-m] < -**n*, [-ŋ] < -**n*, [-n] < -**ŋ*, but not [-m] < -**ŋ*, (iii) bifurcation, including [-m, -n] < -**m*, [-m, -ŋ] < -**m*, [-n, -ŋ] < -**m*; [-n, -m] < -**n*, [-n, -ŋ] < -**n*, [-m, -ŋ] < -**n*; and [-ŋ, -n] < -**ŋ*, but not [-ŋ, -m] < -**ŋ* and [-m, -n] < -**ŋ*, and (iv) emergence of nasal vowels ([Ṽ] < 'Ø' < -**m* -**n* -**ŋ*).

Theoretical consideration and explanation. **(I)** Chen [4] proposes a theory of diachronic change of -**p* -**t* -**k* and -**m* -**n* -**ŋ* in the Chinese dialects and postulates successive stages of the developmental changes

of the historical syllable-final stops and nasals. The stages of change in the syllable-final stops are Stage 1: -**p* -**t* -**k* → Stage 2: [-t, -k] ([-t] < -**p*; -**t* -**k* unchanged) → Stage 3: [-k] ([-k] < -**t*; -**k* unchanged) → Stage 4: [-ʔ] ([-ʔ] < [-k]) → Stage 5: 'Ø' ('Ø' < [-ʔ], i.e., [-ʔ] dropped). The stages of change in the syllable-final nasals are Stage 1: -**m* -**n* -**ŋ* → Stage 2: [-n, -ŋ] ([-n] < -**m*; -**n* -**ŋ* unchanged) → Stage 3: [-ŋ] ([-ŋ] < -**n*; -**ŋ* unchanged) → Stage 4: [Ṽ] (< 'Ø' < [-ŋ], i.e., [-ŋ] dropped and occurrence of the nasal vowel) → Stage 5: V (< [Ṽ], i.e., vowel de-nasalization). Chen's postulation indicates (i) the diachronic changes are unidirectional in respect to the place of articulation, that is, from front to back, [-p] > [-t] > [-k] > [-ʔ] > 'Ø' and [-m] > [-n] > [-ŋ] > [Ṽ] > [V], and (ii) the successive stages are unalterable and unskippable. However, the present study shows that the diachronic changes in -**p* -**t* -**k* and -**m* -**n* -**ŋ* are (a) bi-directional, such as [-p] < -**t*, [-t] < -**p*; [-t] < -**k*, [-k] < -**t*; and [-m] < -**n*, [-n] < -**m*; [-n] < -**ŋ*, [-ŋ] < -**n*, (b) the successive stages are alterable and skippable, and (c) the changes in most cases are conditioned by the pre-consonantal vowel type. There is no a priori phonetic or phonological justification that -**p* or -**t* must first turn into [-k] before changing to [-ʔ]. Articulatorily for -**p*, -**t* or -**k* to turn into [-ʔ], the release of the oral closure suffices. As reported in Iwata, et al. [5,6], the laryngoscopic data reveal that the production of the syllable-final applosives in the Chinese dialects, Fukienese and Cantonese, is glottalized, characterized by a laryngeal constriction with a closed glottis as observed in the production of the glottal stop. The glottalization prevents the vocal folds from vibrating at the vowel offset and creates the phonatory condition for effectively producing the unreleased final stops. There are parallels between the syllable-final stops and nasals. (a) It is unnecessary for -**m* and -**n* to turn into [-ŋ] before the occurrence of [Ṽ], as the changes, [Ṽ] < 'Ø' < -**m* and [Ṽ] < 'Ø' < -**n*, occur in many dialects, (b) the diachronic changes in the historical syllable-final nasals are bi-directional, such as [-m] < -**n*, [-n] < -**m*; [-n] < -**ŋ*, [-ŋ] < -**n*, and (c) the successive stages are alterable and skippable. The diachronic data in the present study thus call into question on the validity of Chen's theory. **(II)** In this study, the syllable-final consonants in descending frequency of occurrence are [-ŋ] (61) > [-n] (56) > [-ʔ] (23) > [-m] (20), [-t] (20), [-k] (20) > [-p] (18). A larger number of occurrence**s** of [-m][-n][-ŋ] than that of [-p][-t][-k] at the same place of articulation may be because the nasal murmur and nasality on the V-to-N transition are more perceptible than the unreleased stops, contributing to nasal identification and nasal place distinction ([7,8]). As for a larger number of occurrence**s** of [-ŋ] than that of [-m -n], it may be because in the dialects [-ŋ] occurs more frequently after the vowels [a ɑ ɔ], which have a higher intensity level ([9,10]), contributing to a more perceptible V-to-N transition. **(III)** The occurrence of [-ʔ] following the loss of [-p][-t][-k] serves the function of preventing the disappearance of checked syllables and checked tones, thus maintaining the contrast between CV, CVN and CVS syllables (N = nasal; S = stop). The same can be said about the function of the nasal vowels that occur following the loss of [-m][-n][-ŋ].

Conclusion. The change in the syllable-final consonants is a link in the chain of sound change. It is triggered by the change in the preceding vowel, and it in turn brings about the changes in syllable type and tone type and the appearance of nasal vowels, which contribute to the shaping of the sound systems in the Chinese dialects.

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