

Linguistic and Social Aspects of Sibilant Palatalization in Homeland and Heritage Cantonese

Yanting Li, Xiao Dong, Ka-Fai Yip, Gareth Junjie Yang
UC Irvine, Indiana University, Yale University, Middlebury College

This paper investigates the linguistic and sociocultural factors that influence sibilant palatalization among Cantonese speakers from two different speech communities, namely Hong Kong (homeland) and Toronto (heritage). We analyzed naturalistic speech data of 36 speakers from the HLVC corpus, including homeland (Gen-0) speakers from Hong Kong, as well as first- (Gen-1) and second-generation (Gen-2) immigrants from Toronto. Our findings highlight that linguistic factors including vowel roundedness, vowel height, and sibilant type (fricative vs. affricate) significantly impact palatalization patterns. Generation emerged as an important sociocultural factor, with Gen-2 speakers producing a higher ratio of palatalization and widening its phonological context. Ethnic identity and language use are further found to influence palatalization patterns within the heritage community. Overall, there is evidence showing that the two speech communities are at different stages of the sound change, and that the contact with English might be contributing to such difference.

1. Introduction

One major question in variationist sociolinguistics is how sound change is conditioned by linguistic and socio-cultural factors. This paper contributes to this issue by a corpus-based study on an ongoing sound change process in two Cantonese speech communities. In particular, we investigate the variation of sibilant palatalization in Hong Kong (homeland) and Toronto (heritage) Cantonese, using data collected in a naturalistic setting in the Heritage Language Variation and Change (HLVC) corpus (Nagy 2011).

Present-day Cantonese is known to have only one set of phonemic sibilants /s,ts,tsʰ/ (e.g., Bauer & Benedict 1997, Zee 1999). However, the sibilants display variability between alveolars [s,ts,tsʰ] and post-alveolars/palato-alveolars [ʃ,tʃ,tʃʰ]/[ɕ,te,tɕʰ] depending on the phonological contexts. The allophonic variation is usually referred to as “palatalization” (Hashimoto 1972, Bauer & Benedict 1997, Cheung 2002, Lee & Zee 2010, Yeung & Havenhill 2023) or sometimes as “postalveolarization” (Chan 2007). Notably, the variability is suggested to reflect a sound change split that started from the late 20th century (Cheung 2002; see also Bauer & Benedict 1997 and Liu 2010). The time overlaps with the largest immigration wave from Hong Kong to Toronto in the late 1980s and early 1990s. Therefore, we have a case where the same sound change process was carried over from a homeland speech community to a heritage speech community. This case offers a window for us to observe whether the sound change may be developed differently among different speech communities, and if yes, what factors are responsible for the variation in change, specifically concerning the socio-cultural difference between Hong Kong and Toronto.

There are two reasons why this case study is particularly interesting, from both perspectives of Cantonese linguistics and variationist sociolinguistics. First, most well-studied Cantonese sound changes are *mergers* instead of *splits* such as consonant mergers (Zee 1999, Cheng, Babel & Yao 2022, among others) and tone mergers (Mok, Zuo & Wong 2013, Fung & Lee 2019, among others), with a rare exception on vowel splits by Tse

(2016b, 2019). Consonantal splits are relatively understudied, especially for heritage Cantonese. To the best of our knowledge, this study is the first systematic study on sibilant palatalization in heritage Cantonese. Second, as pointed out by Nagy and Meyerhoff (2008), the role of *language contact* is also largely understudied in variationist sociolinguistics. Since Hong Kong is a Cantonese-dominant community whereas Toronto is an English-dominant community,¹ it allows us to probe the question of how language contact affects and conditions sound change.

1.1 Sibilant palatalization in Cantonese

The synchronic variability of sibilant onsets in Cantonese is well-documented, but there is no consensus on what exactly the conditioning linguistic factors are. Two main phonological contexts have been identified: (i) consonant types (i.e., fricative /s/ vs. affricate /ts,tsʰ/) and (ii) following vowels (i.e., backness, height, and roundedness), the latter of which receives the most attention.

Vowel roundedness is said to play a crucial role. As observed as early as by Wong (1941), [s,ts,tsʰ] turn to [ʃ,tʃ,tʃʰ] when followed by the high front rounded vowel /y/. Kao (1971) adds that mid-front rounded /œ/ also triggers the variability. The vowel context is extended to all rounded vowels (i.e., /y,u,œ,ø,ɔ/) in the descriptions by Cheung (2002), Chan (2007), and Liu (2010). Other authors, however, claim that consonant types and vowel height and/or backness also play a role. Hashimoto (1972) suggests that apart from /y/, unrounded /i/ also induces palatalization, and that only affricates are palatalized. Bauer & Benedict (1997:28-30) note that fricatives are only palatalized before both /i/ and /y/, but affricates are palatalized before /i,y/ and other rounded vowels /œ,ø/. In the recent acoustic study by Yu (2016) that focuses on fricatives, both high vowels and rounded vowels are said to facilitate palatalization with considerable individual variations.² The acoustic and articulatory results in Yeung & Havenhill (2021) indicate that palatalization only occurs for affricates, but not for fricatives, before rounded vowels. The phonological contexts are summarized in Table 1.³

Table 1. The Phonological Contexts of Sibilant Palatalization in Cantonese

	Consonant types	Following vowels
Wong (1941)	Fricatives and affricates	High front rounded V
Kao (1971)	Fricatives and affricates	Front rounded Vs
Hashimoto (1972)	Affricates	High front Vs
Bauer & Benedict (1997)	Fricatives	High front Vs
	Affricates	High front <i>or</i> non-back rounded Vs
Cheung (2002)	Fricatives and affricates	Rounded Vs
Chan (2007)	Fricatives and affricates	Rounded Vs
Yu (2016)	Fricatives _(affricates not discussed)	High Vs <i>or</i> rounded Vs
Yeung & Havenhill (2021)	Affricates	Rounded Vs

On the other hand, palatalization also varies across different social groups, pointing to its sound change status. Cheung (2002) observes that the vowel context of palatalization is extended to all rounded vowels after 1995. He proposes the following diachronic change,

¹ In Hong Kong, over 90% of the population consider Cantonese as their usual spoken language tongue (Census and Statistics Department, 2021), but only around 4% of the population in Toronto consider Cantonese as their mother tongue (Statistics Canada, 2021).

² Yu (2016) also examines autistic traits, which he suggests to be responsible for the individual differences.

³ Lan (2017) also proposes that back vowels favor palatalization. However, 3 out of 5 items designed to include back vowels do not have back vowels as their main nucleus in Lan's paper.

where two sets of *phonemic* sibilants were merged in the mid-20th century (see also Zee 1999), and started to split into two sets of *allophonic* sibilants in the late-20th century.

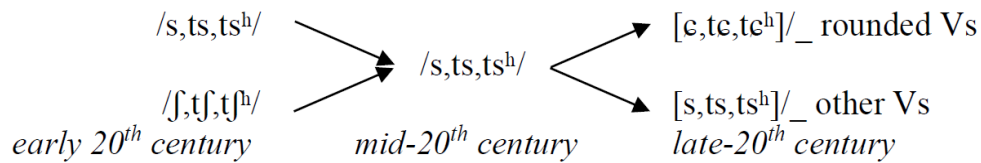


Figure 1. Sound change trajectory proposed by Cheung (2002:30).

Such impressionistic observations are further supported by the diachronic study of Liu (2010), who analyzes Cantonese songs from the 1970s to the 1990s, as well as by the age effects found in the synchronic studies. Chan (2007) finds out that younger speakers produce more post-alveolar affricates than older speakers in Guangzhou and Zhaoqing, though not in Hong Kong. Age effects for Hong Kong speakers are however confirmed in Lan (2017) and Yeung & Havenhill (2021). Female speakers are also found to have a higher degree of palatalization in Yu (2016) and Yeung & Havenhill (2021), which is consistent with the proposed sound change. The change has also been proposed to be due to contact with English (Liu 2010, Lan 2017; see also Havenhill, Liu & Li 2023 for Hong Kong English), but no systematic sociolinguistic study has yet been conducted to examine this claim.

1.2 The current paper

This paper investigates the linguistic and sociocultural factors of sibilant palatalization. We approach the topic from two novel angles: (i) comparing homeland and heritage Cantonese communities (as opposed to dialectal comparisons, e.g., Chan 2007), and (ii) using corpus data collected in a naturalistic setting (as opposed to data collected in a laboratory setting, e.g., Chan 2007, Yu 2016, Lan 2017, Yeung & Havenhill 2021). We have two main research questions:

- (i) What are the phonological contexts that favor sibilant palatalization?
- (ii) Does the change develop in different ways in Hong Kong (homeland) and Toronto (heritage) Cantonese? If yes, why? Do other social factors have an impact?

The first question addresses the discrepancies in the literature, and identifies the stage of sound change across communities by examining differences in phonological conditioning, as related to the second question. One might expect the context of palatalization to be further generalized to all vowels if the sound change reaches a later stage. As for the sociocultural factors, different from previous studies that focus on age and gender, we ask whether generation, ethnic identity, and language use also affect palatalization. This is only possible when heritage language communities are considered, and further allows us to examine the hypothesis that Cantonese sibilant palatalization is an English-contact-induced change.

2. Method

2.1 Data

As mentioned above, this study examines sociolinguistic interview data from the Heritage Language Variation and Change (HLVC) corpus (Nagy 2011), which records linguistic usage and change in ten non-official languages spoken in Toronto, including Cantonese.

Our dataset consists of 36 Cantonese speakers from three generations. Gen-0 consists of homeland speakers living in Hong Kong, where Cantonese is both their mother tongue and dominant language. Gen-1 includes individuals who were born in Hong Kong and moved to the Greater Toronto Area after age 18. For this group, Cantonese is their mother tongue, but most of them speak at least some English, with varying levels of proficiency and exposure to different varieties of English. Gen-2 speakers were born in the Greater Toronto Area whose parents are Gen-1, or moved there (from Hong Kong) before age 6. For this group, both English and Cantonese were acquired early, but English is their dominant language.

Each generation contains 12 speakers. Table 2 provides a list of the speaker samples, with each speaker identified by a unique speaker code. The code is structured as follows:

- The first letter, “C”, represents “Cantonese”.
- The second character indicates the generation: “X” for Gen-0, “1” for Gen-1, and “2” for Gen-2.
- The third letter represents the speaker’s gender: “F” for female and “M” for male.
- The following number indicates the speaker’s age.
- The final letter differentiates speakers with the same demographic characteristics.

For example, the code “C1F50B” refers to a Gen-1 female speaker who is 50 years old, and “B” indicates that there is another 50-year-old Gen-1 female speaker in the corpus labeled as C1F50A.

Gender distribution is balanced within each generation group. Age distribution between young speakers (<40 years old) and old speakers (≥ 40 years old) is balanced as much as possible. However, due to the dataset constraints and how Gen-1 is defined in the corpus, while age for the Gen-0 group is roughly balanced (young:old=5:7), Gen-1 only has old speakers (n=12) and Gen-2 has more young speakers (young:old=9:3).

Table 2. Speaker Sample

Generation	Females	Males	Total
Gen-0	CXF16A CXF19A CXF25A CXF43A CXF49A CXF77A	CXM17A CXM20A CXM46A CXM50A CXM52A CXM64A	12
Gen-1	C1F50A C1F50B C1F58A C1F78A C1F82A C1F83A	C1M52A C1M52B C1M59A C1M61A C1M62A C1M87A	12
Gen-2	C2F16A C2F16B C2F20A C2F21B C2F22A C2F41A	C2M17B C2M21D C2M21B C2M27A C2M44A C2M51A	12
Total	18	18	36

In addition, for all speakers, each interview in this corpus includes an Ethnic Orientation Questionnaire (EOQ), which gathers information about the speakers’ ethnic identity and language use. The questionnaire for Gen-0 is different from that for Gen-1 and

Gen-2, and therefore is not used in this study. Table 3 presents some sample questions included in the EOQ for heritage speakers. The speakers' response to each question was coded as 0, 1, or 2. For ethnic identity (EthnicID), a score of 0 indicates a stronger Canadian identity, 2 indicates a stronger Chinese identity, and 1 represents an intermediate response. For language use (LangUse) score, 0 indicates English dominance, 2 indicates Cantonese dominance, and 1 represents a balance between the two. To examine the possible effect of these two factors on sibilant palatalization, we used the average EthnicID score and average LangUse score of each speaker from Gen-1 and Gen-2.

Table 3. EOQ Question Sample for Heritage Speakers

	Sample questions
Ethnic Identity	1. Do you think of yourself as Chinese, Canadian, or Chinese-Canadian? 2. Are most of your friends Chinese? 3. Are people in your neighborhood Chinese? ...etc.
Language Use	1. Do you prefer to speak Cantonese or English? 2. Do you prefer to read and write in Chinese or English? 3. What language does your family speak when you get together? ...etc.

2.2 Annotation

The HLVC corpus provides time-stamped transcriptions linked to the corresponding .wav files of the interview recordings. Sentences and tokens were transcribed in *Jyutping* using ELAN. Sibilant tokens were then identified by searching through these transcriptions.

There are in total four annotators who are all phonetically trained. For each sibilant token, two annotators classified it as either palatalized (Yes) or not (No) auditorily and blindly to each other, and any disagreements were resolved by a third annotator. The first 25 minutes of each interview were annotated for each speaker. Tokens with background noises were excluded. Finally, 21,879 tokens from the 36 speakers were included in the analysis.

2.3 Data analysis

We conducted logistic regression models using R (R Core Team, 2023), taking palatalization percentage as the dependent variable and incorporating both linguistic and social factors as independent variables in our analysis. The three sibilants were categorized into two consonant types: fricative (/s/) and affricates (/ts/ and /ts^h/). Vowels were classified based on frontness, roundedness, and height. Cantonese has a total of nine vowels: /y, u, œ, ø, ɔ, i, ɛ, ɐ, a/. The vowels with specific features are listed below:

[+front]: /y, œ, i, ɛ/

[+high]: /y, u, i/

[+round]: /y, u, œ, ø, ɔ/

We also included social factors including generation, age, gender, ethnic identity, and language use in our analysis. For the analysis involving the ethnic identity and language use score, we only included the data collected from Gen-1 and Gen-2. Consequently, we did two rounds of data analysis. The first round involves data from all three generations and the factors considered were consonant type, vowel frontness, vowel roundedness, vowel height, generation, age, and gender. The second round only involves Gen-1 and Gen-2 speakers, with EthnicID score and LangUse score being added to the analysis. Three speakers in Gen-2 have

missing EthnicID and LangUse scores. Their data were consequently excluded from the second round of analysis.

We conducted a stepwise backward model selection approach for both rounds, starting with the most intricate model encompassing all independent factors and their interactions. Predictor variables were then removed one at a time until the model reached a specified lower threshold (palatalization percentage ~ 1). The optimal models selected from this procedure were used for the analysis.

3. Results

In this section, we present the results of our analysis. We will first focus on the linguistic factors that influence sibilant palatalization, and then move on to the sociocultural factors, as well as the combination of the two groups of factors.

One major linguistic factor at play is the following vowels, and more specifically, the roundedness, height, and frontness of the vowels. Our regression analysis shows that sibilants preceding rounded vowels (/y, u, œ, ɐ, ɔ/) are significantly more likely to be palatalized than those preceding unrounded vowels (/i, ɛ, ɐ, a/) ($p < 0.001$) as also shown in Figure 2a. We further looked at the percentage of each sibilant (Figure 2b) and confirmed that the effect of the vowel roundedness is consistent across all three sibilants.

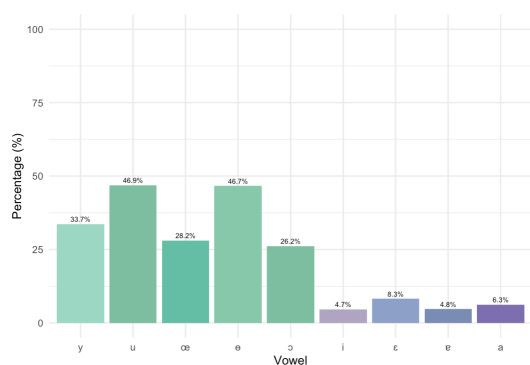


Figure 2a. Percentage of palatalization by following vowels.

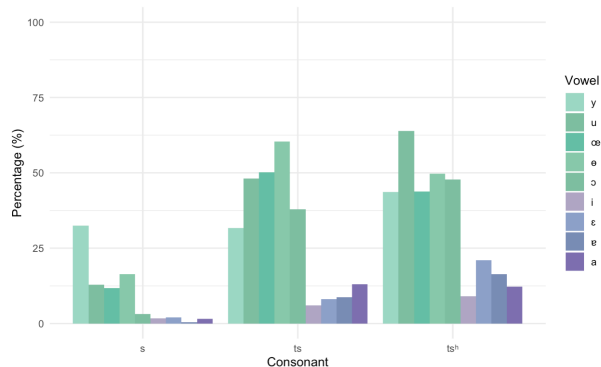


Figure 2b. Percentage of palatalization by following vowels by sibilants.

Vowel height is also found to have an effect: palatalization is more likely to happen when the sibilant is followed by a high vowel (/y, u, i/) than a non-high vowel ($p < 0.05$). However, vowel frontness is not statistically significant ($p=0.48$), and the percentage of palatalization is similar for sibilants preceding front (/y, œ, i, ɛ/) and non-front vowels.

In addition to vowels, the sibilants themselves also influence the likelihood of palatalization. Looking at Figure 3a, there is a clear difference between the fricative /s/ and the two affricates, /ts, tsʰ/. Only less than 5% of /s/ is palatalized, while the percentage for /ts, tsʰ/ is above 20%. Such a difference is significant statistically ($p < 0.001$).

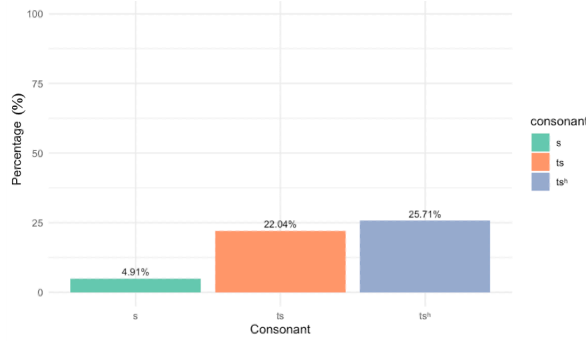


Figure 3a. Percentage of palatalization by sibilants.

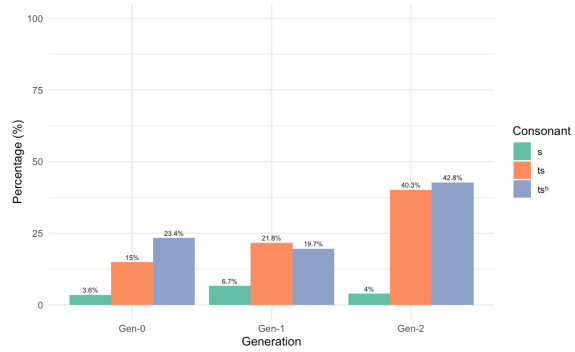


Figure 3b. Percentage of palatalization by sibilants by generation.

Further breaking down the statistics of each sibilant into different generation groups reveals more on the (non-)changes of the sibilants. As shown in Figure 3b, the ratio of palatalization of /s/ remains fairly constant across generations, whereas that of /ts, tsʰ/ shows a clear difference. For /ts/, the ratio is lowest in Gen-0, and higher in Gen-1, and the highest in Gen-2. For the aspirated /tsʰ/, while Gen-0 and Gen-1 have a similar ratio, Gen-2 has a much higher ratio.

To quickly sum up, by closely examining the linguistic factors influencing sibilant palatalization, we found out that vowel roundedness, vowel height, and sibilant type have significant effects. Next, we will report the analysis of the sociocultural factors. This includes generation, ethnic identity, language use, as well as gender and age.

The ratio of palatalization of Gen-1 is not significantly different from Gen-0. However, Gen-2's palatalization ratio is significantly higher than both Gen-1 and Gen-0 speakers. As indicated in Figure 4a, Gen-2's ratio (26.05%) is more than double compared to Gen-0 (11.82%). Across generations, we not only observed a change in the percentage of palatalization, but also a widening of the phonological contexts, as illustrated in Figure 4b. While Gen-0's palatalization occurs almost exclusively before rounded vowels, the ratio for *unrounded* vowels is slightly higher for Gen-1 and considerably higher for Gen-2.

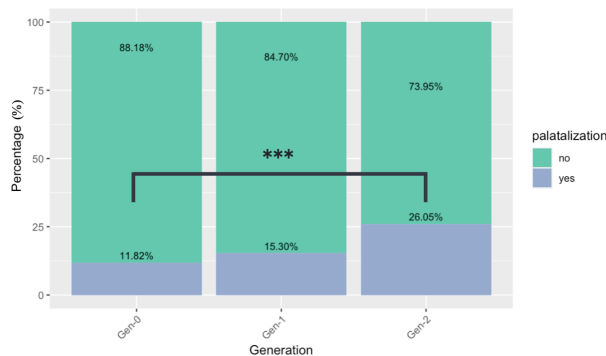


Figure 4a. Percentage of unpalatalized vs. palatalized sibilants by generation.

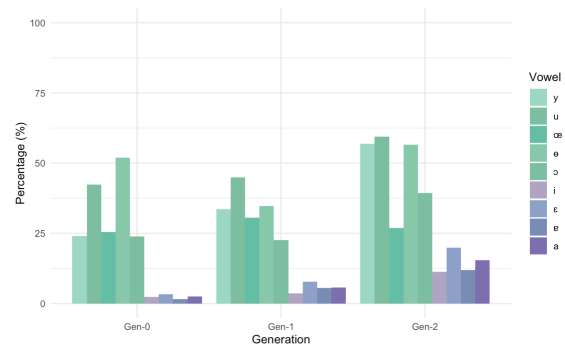


Figure 4b. Percentage of palatalization by following vowels by generation.

Gender and age have been found to play a role in sound changes, so we also included them in our analysis. However, neither is found to be significant, which could be due to the relatively smaller sample size (12 speakers per generation), and unbalanced sample for age. Nevertheless, some trends can be observed visually. In Figure 5a, female speakers all produce an equal or higher percentage of palatalized sibilants than male speakers across all

generations. In Figure 5b, the ratio of palatalization is lower for old speakers in Gen-0 yet higher in Gen-2 than the young speakers in the same generations.

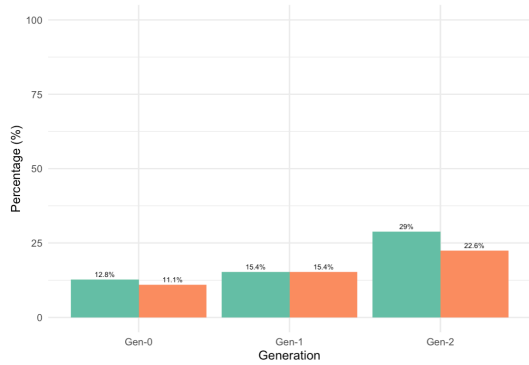


Figure 5a. Percentage of palatalization by gender by generation.

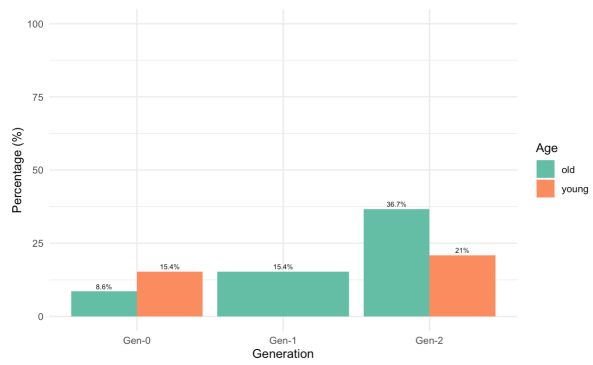


Figure 5b. Percentage of palatalization by age by generation.

For the analysis involving the EthnicID score and LangUse score, we only included the data collected from Gen-1 and Gen-2. The average scores of both groups are reported in Table 4. Meanwhile, the percentage of palatalization by the distribution of the two scores is visualized in Figure 6. Overall, Gen-1 speakers tend to receive higher scores on both measurements, and the distribution is also less scattered. In contrast, the distribution for Gen-2 speakers is more spread out, especially for the EthnicID score. The overall scores are also lower than Gen-1.

Table 4. Averaged EthnicID and LangUse Scores of Gen-1 and Gen-2 Speakers

Generation	Averaged Ethnic Identity Score (0-2, higher = stronger ethnic identity towards Chinese over Canadian)	Averaged Language Use Score (0-2, higher = more usage/preference of Cantonese over English)
Gen-1	1.50	1.53
Gen-2	0.97	0.80

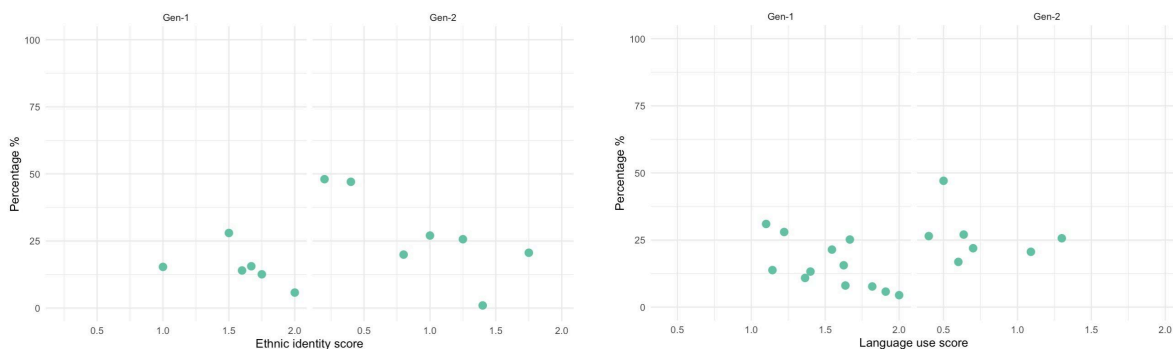


Figure 6. Percentage of palatalization by EthnicID scores (left) and LangUse scores (right) for different generation groups. The x-axis is the scores, and the y-axis indicates the average percentage of palatalization for speakers that received the same score.

The second round of data analysis shows that for both Gen-1 and Gen-2 speakers, EthnicID and LangUse scores are both significant: the higher the score, the lower the palatalization ratio. This is to say, when a person identifies more as a Chinese instead of a Canadian, or uses more Cantonese than English in life, her sibilants are less likely to be palatalized.

To quickly sum up, generation is a significant sociocultural factor that influences palatalization. Gen-2 speakers not only produce a higher percentage of palatalized sibilants, but also produce them before both rounded and unrounded vowels. For Gen-1 and Gen-2 speakers, ethnic identity and language use also make a significant difference. However, neither age nor gender is statistically significant.

4. Discussion

In the following, we discuss how the results answer the two research questions, namely, what are the phonological contexts for sibilant palatalization, and whether sibilant palatalization is developed differently in homeland and heritage communities as well as what the socio-cultural factors are.

Considering the first research question, first, our results indicate that vowel height, vowel roundedness and consonant types all have effects on palatalization. Different from what earlier authors observed (Cheung 2002, Chan 2007, Yeung & Havenhill 2021), we find out that rounded vowels are not the only phonological context for palatalization. High vowels also lead to more palatalization, supporting the findings in Yu (2016). One possible explanation is that the phonological context is indeed widened from only rounded vowels to both rounded vowels and high vowels (i.e., [+round] *or* [+high]), as a result of the sound change. This is similar to what Cheung (2002) proposes for the change in the late 20th century, namely that the vowels were generalized from high front rounded /y/ to all other rounded vowels. In other words, sibilant palatalization has developed to a later stage in the present day.

Second, we find out that the palatalization of fricative /s/ has rather different phonological contexts from affricates /ts, ts^h/: overall, /s/ (i) has a much lower ratio of palatalization, (ii) is predominantly palatalized before /y/ (as compared to other rounded vowels), and (iii) is not palatalized before unrounded vowels. Moreover, the ratio does not change across generations, unlike affricates which display a gradual difference (Gen-2 > Gen-1 > Gen-0). Several authors have also noted the special status of /s/, ranging from claiming that it does not undergo palatalization (Hashimoto 1972, Yeung & Havenhill 2021) or has a narrower vowel context than affricates (Bauer & Benedict 1997), to that its change was developed much slower than affricates diachronically (Liu 2010). Both Liu (2010) and Yeung and Havenhill (2021) propose that it is due to the articulation differences between fricatives and affricates. Concretely, Yeung and Havenhill suggest that the frication phase of affricates is shorter than fricatives, and thus affricates have more gestural overlap with the following vowels for co-articulation, hence the higher degree of palatalization. While it explains why /s/ has a lower ratio, it remains unclear how to account for the predominance of /y/ and the resistance to unrounded vowels. This raises the question of whether /s/ really undergoes the same phonological process as /ts, ts^h/ do. If the process were really the same, one might expect to see a much higher ratio for both /s/ and /ts, ts^h/ in Gen-2 (vs. Gen-1 and Gen-0), contrary to the results. We will return to this issue from the perspective of English contact below. For now, we conclude that the sound change for /s/ might be of a distinct nature from /ts, ts^h/ given the differential speed and phonological conditions.⁴

Third, Gen-2 speakers have a considerably higher ratio of palatalization for unrounded vowels, including non-high vowels (/ɛ, ɐ, a/, besides /i/). It indicates that the

⁴ We thank Dr. Holman Tse and Dr. Jonathan Havenhill for inspiring us to think in this direction.

phonological conditioning is broadened from rounded (and/or high) vowels to other unrounded vowels. We suggest that the sound change is already in a much later stage for Gen-2 speakers than Gen-1 and Gen-0. Therefore, we can conclude that sibilant palatalization is developed differently among communities (i.e., Hong Kong's Gen-0 vs. Toronto's Gen-2) in relation to our second research question, as discussed in more detail below.

The data collected from Hong Kong and Toronto show that palatalization is happening in both communities. However, differences are observed not only between the two communities, but also within the Toronto community, i.e., between Gen-1 and Gen-2 immigrants, suggesting that this further development of sound change is not simply geographic but also generational. Given that Gen-2 and Gen-1 grew up in different communities in their critical period, the explanation for the different paces of sound change should be considered with the languages that they acquire.

This leads to the idea of language contact with English, which is of a greater extent for Toronto Cantonese than Hong Kong Cantonese. For affricates, English only has postalveolars /dʒ/ and /tʃ/ both phonetically and phonemically, whereas Cantonese has two sets of allophonic variants [ts, tsʰ] and [tʃ, tʃʰ]. If a speaker uses more English and less Cantonese, the more familiar she might be with the English affricates, and that may influence her production of the Cantonese affricates, making them more English-like. This hypothesis has been raised by many other scholars including Yeung & Havenhill (2021), Chan (2007), and Liu (2010). In a study on the production of Cantonese vowels, Tse (2016b) used the same corpus and found the splits of /i:/, /ɔ:/ and /ɛ:/ in heritage speakers due to influence from English. For instance, the Cantonese /i:/ is pronounced as [ɪk/ɪŋ] when preceding velar consonants and as [i:] elsewhere due to the 'seek' vs. 'sick' contrast in English, and the distinction is becoming more obvious among Gen-2 speakers. It makes sense that such influence from English is found not only in Cantonese vowels, but sibilants as well. Lan (2017) examined the two Cantonese affricates produced by homeland speakers of different ages, and found that younger speakers tend to palatalize more. The author attributed the reason to contact with English, describing palatalization as a way to "assimilate to the Western way of speaking". Here, we do not have direct evidence proving whether such assimilation is a deliberate choice, or happens without the speaker even realizing it, although we do believe that language contact is at play. We further suggest that the influence is greater when both English and Cantonese are L1 (i.e., Gen-2 speakers), as opposed to English being L2 and Cantonese being L1 (i.e., Gen-1 speakers). On another note, language contact may also help explain the lack of change for the fricative, because the two languages share the same fricatives ([s] and [ʃ]), unlike the case for affricates.

Another piece of evidence that supports language contact is the role of LangUse scores. Zooming into the speakers in the heritage community, we noticed that the more a speaker (or her friends/family) uses/prefers English, the higher percentage of palatalized sibilants she produces. This is consistent with sociolinguistic studies of other languages. For instance, Nagy, Chociejski and Hoffman (2013) examined a combined dataset of Italian, Russian and Ukrainian and found 6 out of 8 questions under language use⁵ are significant for predicting the voice onset time (VOT). In another study looking at the same languages, the statistical significance of LangUse score offers direct support for the role of English contact in palatalization. We suggest that English "accelerates" the sound change in Toronto Cantonese, manifested as higher palatalization ratio and wider phonological contexts.

We also found a significant effect of ethnic identity on sibilant palatalization among heritage speakers. Since Labov's 1963 Martha's Vineyard study, the relationship between ethnicity and language variation has been increasingly studied. Hoffman and Walker (2010)

⁵ Language use is a combination of the Language and Language Choice subcategories in their work. The two subcategories have 12 questions in total, but only 8 have sufficient responses for testing their effects.

developed an ethnic orientation survey that included questions on various aspects of ethnic identity to explore its role in language variation within multicultural Toronto. Their findings suggest that even within the same ethnic group, individuals may have varying degrees of ethnic orientation, which in turn influences language use. Nagy, Chociej, and Hoffman (2013) further showed that 3 out of 5 questions related to ethnic identity were significant predictors of voice onset time (VOT). Speakers who orient more toward Canada exhibit more English-like VOT. Our results, therefore, further support the role of ethnic identity in language variation.

It is important to note that while their Ethnic Orientation (EO) score aggregates responses from the entire questionnaire, we chose to examine ethnic identity and language use separately to assess their individual impact. We found that these two scores are moderately correlated, as confirmed by a Pearson correlation test (coefficient = 0.41). This indicates that these variables are not entirely independent of each other, and the effect of the LangUse score may not directly reflect the extent of English contact influencing palatalization.

Gender and age have also been included in various previous studies, although they are not consistently shown to be significant. For our data, neither factor turned out to be significant. Despite that, the pattern for gender is consistent across all three generations: females palatalize as much as, if not more, than males. This is consistent with Yu (2016) and Yeung & Havenhill (2021) as well as a lot of sociolinguistic research showing that the female usually drives sound changes. On the other hand, findings on age in the literature are less consistent. Lan (2017) found that younger speakers tend to palatalize more. Yeung & Havenhill (2021) found a similar trend, but only for younger females instead of males. Chan (2007) found that younger speakers in Zhaoqing and Guangzhou generally palatalize more than older speakers. However, in Hong Kong, no difference was found between the two groups for affricates. Moreover, older speakers are found to palatalize more than younger ones, which is exactly the opposite from the other two cities as well as other works. Interestingly, old Gen-2 speakers in our dataset also have a much higher ratio of palatalization than young speakers. However, one major reason for such a result is that there are only 3 old speakers in Gen-2, and the possibility of having outliers is large. Another potential reason is that the young Gen-2 speakers who communicate with their grandparents in homeland can receive a good amount of input that contains less palatalization, while such communication opportunities are rarer or happened a long time ago for old Gen-2 speakers, leaving them even less familiar with Cantonese. Moreover, the young speakers are mostly in their 20s, and still stay relatively close to their parents (in fact, some of them still live in the same house as their parents do according to the interviews), whereas the older speakers are likely to live in their own place away from their parents. The lack of connection to Cantonese may result in a higher percentage of palatalization, which is consistent with the result for language scores.

5. Conclusion

In this study, we explored the linguistic and sociocultural factors that influence the sibilant palatalization of homeland (Hong Kong) and heritage (Toronto) Cantonese speakers. We annotated the naturalistic speech data of 36 speakers in total, including homeland speakers (Gen-0) from Hong Kong, as well as first- (Gen-1) and second-generation (Gen-2) immigrants from Toronto. We then analyzed the data together with the ethnic orientation information provided in the HLVC corpus.

Our analysis revealed that linguistic factors including the roundedness (rounded vs. unrounded) and height (high vs. non-high) of the following vowel, as well as the sibilant type (fricative vs. affricate) significantly affect the palatalization of the sibilant. As for the sociocultural factors, gender and age did not end up being significant for this dataset.

However, generation turned out to be a strong and consistent factor. A clear increasing trend has been observed in the percentage of palatalization from Gen-0 to Gen-1 and then to Gen-2 speakers. Meanwhile, Gen-2 speakers are found to palatalize significantly more than Gen-0, and allow palatalization to happen with a larger range of vowels. Within the heritage community in Toronto, a speaker's ethnic identity and language use significantly influence palatalization. These findings lead us to believe that the contact with English is likely to be facilitating palatalization, especially that of the two affricates.

The present study adds to the current literature on Cantonese linguistics by closely examining the ongoing sound change of sibilant palatalization, which as a consonant split, is a relatively understudied phenomenon in Cantonese. Meanwhile, by comparing speakers in Hong Kong and Toronto, this study enriches our knowledge about language variation in different communities, and how language contact plays a role in it. To better understand the acoustic features of palatalization, more precise measures of acoustic details are necessary. We are currently working on the analysis, and the preliminary results are reported in our poster presentation at LabPhon 19 (Li et al. 2024). With more future work including language contact into the investigation of language variation, we hope to better answer the question of how and why the sound system of one language can be influenced by, intertwined with or integrated into that of another.

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REFERENCES

- BAUER, ROBERT S., and P.K. BENEDICT. 1997. *Modern Cantonese Phonology*. Mouton De Gruyter.
- CENSUS AND STATISTICS DEPARTMENT. 2021. *2021 Population Census*. Hong Kong Special Administrative Region. Online: www.census2021.gov.hk/en/mrpsg_dashboard.html.
- CHAN, K. L. 2007. *The Sound Change of [ts, tsʰ, s] to [tʃ, tʃʰ, ʃ] in Hong Kong Cantonese*. Hong Kong: HKUST dissertation.
- CHENG, LAURETTA. S. P., MOLLY BABEL, and YAO YAO. 2022. Production and perception across three Hong Kong Cantonese consonant mergers: Community-and individual-level perspectives. *Laboratory Phonology* 13. Doi: <https://doi.org/10.16995/labphon.6461>.
- CHEUNG, HUNG-NIN SAMUEL. 2002. Cantonese of the 21st century: Formation of a new phonological system in the Hong Kong language. *Journal of Jiaman University* 24.25-40.
- ELAN (Version 6.7) [Computer software]. 2023. Nijmegen: Max Planck Institute for Psycholinguistics, *The Language Archive*. Online: <https://archive.mpi.nl/tla/elan>.
- FUNG, ROXANA. S. Y., and CHRIS K. C. LEE. 2019. Tone mergers in Hong Kong Cantonese: An asymmetry of production and perception. *The Journal of the Acoustical Society of America* 146.EL424-EL430.
- HASHIMOTO, OI-KAN YUE. 1972. *Studies in Yue Dialects 1: Phonology of Cantonese (Vol. 1)*. Cambridge University Press.

- HAVENHILL, JONATHAN., MING LIU, and TAK WANG LI. 2023. Articulation of Cantonese and English sibilants among bilingual speakers in Hong Kong. Presented at The 20th International Congress of Phonetic Sciences (ICPhS 2023), Prague.
- HOFFMAN, MICHOE. F., and JAMES A. WALKER. 2010. Ethnolects and the city: Ethnic orientation and linguistic variation in Toronto English. *Language variation and change* 22.37-67.
- ISAJIW, WSEVOLOD. W. 1985. Learning and use of ethnic language at home and school: Sociological Findings and Issues. In Lupul, 225-230.
- KAO, DIANA. 1971. *Structure of the Syllable in Cantonese*. The Hague: Mouton
- LABOV, WILLIAM. 1963. The social motivation for a sound change. *Word* 19.3: 273–309. DOI: doi.org/10.1080/00437956.1963.11659799
- LAN, YIZHOU. 2017. Foreign influence and sound change: A case study of Cantonese alveolar affricates. *Proceedings of the 31st Pacific Asia Conference on Language, Information and Computation*, Tokyo, 155-160.
- LEE, WAI-SUM, and ERIC ZEE. 2010. Articulatory characteristics of the coronal stop, affricate, and fricative in Cantonese. *Journal of Chinese Linguistics* 38.336-372.
- LI, YANTING, XIAO DONG, KA-FAI YIP and GARETH JUNJIE YANG. 2023. Variation of sibilant palatalization in homeland and heritage Cantonese. Presented at The 19th Conference on Laboratory Phonology (LabPhon 19), Hanyang University, Seoul, South Korea.
- LIU, QIAN. (2010). A Research on the Affricate and the Fricative Consonants of Hong Kong Cantonese - A Statistical Analysis of Cantonese Songs in the Past Thirty Years. *Journal of Jinan University (Philosophy and Social Sciences)* 32.123-129.
- MOK, PEGGY. P., DONGHUI ZUO, and PEGGY W. Y. WONG. 2013. Production and perception of a sound change in progress: Tone merging in Hong Kong Cantonese. *Language variation and change* 25.341-370.
- NAGY, NAOMI. 2011. A multilingual corpus to explore variation in language contact situations. *Rassegna Italiana di Linguistica Applicata* 43.65-84.
- NAGY, NAOMI, and MEYERHOFF, MIRIAM. 2008. Introduction: Social Lives in Language. *Social lives in language--sociolinguistics and multilingual speech communities: celebrating the work of Gillian Sankoff*, 1–17. Amsterdam; Philadelphia: John Benjamins.
- NAGY, NAOMI, and ALEXEI KOCHETOV. 2013. VOT across the generations: A cross-linguistic study of contact-induced change. *Multilingualism and language contact in urban areas: Acquisition-Development-Teaching-Communication*, 19-38.
- NAGY, N., JOANNA CHOCIEJ, and MICHOE F. HOFFMAN. 2014. Analyzing ethnic orientation in the quantitative sociolinguistic paradigm. *Language & Communication* 35.9-26.
- R CORE TEAM. 2023. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. Online: www.R-project.org.
- STATISTICS CANADA. 2021. Mother tongue by geography, 2021 Census. Online: <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/dv-vd/language-langue/index-en.html>.
- TSE, HOLMAN. 2016a. Variation and change in Toronto heritage Cantonese. *Asia-Pacific Language Variation* 2.124-156. DOI: doi.org/10.1075/aplv.2.2.02tse.
- TSE, HOLMAN. 2016b. Contact-induced splits in Toronto Heritage Cantonese mid-vowels. *Linguistica Atlantica* 35.133-155.
- TSE, HOLMAN. 2019. *Beyond the Monolingual Core and out into the Wild: A Variationist Study of Early Bilingualism and Sound Change in Toronto Heritage Cantonese*. Unpublished Doctoral Dissertation. University of Pittsburgh, Pittsburgh, PA.
- WONG, SHEK LING. 1941. *A Chinese Syllabary Pronounced According to the Dialect of Cantonese*. Canton: Lingnam University.

- YEUNG, PING HEI, and JONATHAN E. HAVENHILL. 2021. Acoustic ambiguity leads to articulatory re-analysis: Affricate palatalization in Hong Kong Cantonese. Presented at 33rd North American Conference on Chinese Linguistics (NACCL 33), virtual.
- YU, ALAN. C. L. 2016. Vowel-dependent variation in Cantonese /s/ from an individual-difference perspective. *The Journal of the Acoustical Society of America* 139.1672-1690.
- ZHANG, JIE. 2013. 实验音系学. (Experimental phonology). In Zhijie Wang and Dongdong Chen (eds.),《西方人文社科前沿述评》(Frontiers in Western humanities and social sciences research, Linguistics volume). People's University Press, Beijing, China. 89-115.
- ZEE, ERIC. 1999. Change and variation in the syllable-initial and syllable-final consonants in Hong Kong Cantonese. *Journal of Chinese linguistics* 27.120-167.