

Article

## The Teaching and Learning of Third Tone Sandhi: L2- and Heritage-Learners of Mandarin Chinese in Canadian University Classes

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### Abstract

In this paper, we probe the question of whether heritage learners (HLs) have a phonological (rather than just the documented phonetic) advantage in language classes. Polinsky (2015) argues adult HLs, while divergent in morphosyntax, have certain “phonological” advantages. Chang, Yao, Haynes and Rhodes (2011) argue that HLs are more nativelike than second language (L2) learners in producing certain phonetic details. We explore the teaching and learning of Chinese T3 tone sandhi (i.e., a phonological feature that learners must acquire). Given that T3 has been argued to be the most problematic tone in both L2 perception and production among all lexical tones (Zhang, 2014, 2016), we probe how “good” their sandhi pronunciation is. Our data show that the Mandarin HLs do not have a phonological advantage over (i.e., are not significantly different from) non-heritage L2 learners. Furthermore, we show that Cantonese HLs are significantly less comprehensible than non-heritage L2 learners. Little time is devoted to pronunciation in language teaching (Huensch, 2019). This is true in many Chinese classes in Canadian universities. Common textbooks (e.g., *Integrated Chinese*) emphasize vocabulary and grammar. Chinese instructors in Canadian universities face the challenge of having a mixed student population: heritage language learners (HLs) and non-heritage L2 learners. This can lead to high levels of anxiety in the HLs in the classroom (Prada & Guerrero-Rodriguez, 2020). Teachers need to be aware of this HL anxiety and cannot assume that HLs will be “experts” in their class.

### Keywords

Heritage learners, Chinese, tone sandhi, comprehensibility, L2 learning

## 1. Introduction

The disciplines of second language (L2) pronunciation (Levis, 2005, 2020; Thomson & Derwing, 2015) and L2 phonology (Archibald, 2021; Cabrelli, Luque & Finestrat-Martínez, 2019) often address distinct questions. Shea (2021) reminds us there is a common ground:

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L2 phonology can be conceptualized as the frame in which L2 pronunciation develops or, where theory, data, and methods meet. In other words, pronunciation does not happen without phonology. (p. 1)

In this paper, we address questions of both the teaching and learning of one particular aspect of Standard Chinese (hereafter Mandarin) phonology: T<sub>3</sub> tone sandhi (T<sub>3</sub>S). The primary group of learners we will be looking at are heritage learners of Mandarin in Canadian universities. We will compare their performance to L2 learners.

## 2. Literature Review

### 2.1 Heritage Mandarin learners in Canadian universities

Li (2005) conducted a survey in Canada and had 695 respondents indicate that they were HLs of Chinese in Canadian universities; this is not a small population. Even if we just look at the results of the 2016 Canadian Census ([Statistics Canada 2017](#)) we note the following:

Table 1

*Languages Spoken at Home in Canada and Metro Vancouver*

	Top Two non-official languages spoken at home in Canada	Top two non-official languages spoken at home in Metro Vancouver
Mandarin	641,100	180,170
Cantonese	594,705	193,030

The number of Chinese speakers in Canada, our major urban centres and our universities is not insignificant. Yet, Li and Duff (2008) note (pg. 15) that “only 7 out of 19 Canadian universities or colleges . . . . Indicate that they offer Chinese HL courses on an annual basis.” Li and Duff (2018) reiterate that the Canadian postsecondary system has been slow to accommodate the needs of heritage Chinese learners. Xiang (2016) provides a summary of similar issues in the American educational context. We hope to address this issue in the domain of pronunciation/phonology. Let us first consider the domain of pronunciation in the second language curriculum.

Evidence has shown that pronunciation instruction can be effective ([Lee, Jang, & Plonsky, 2015](#)), and that learners want to improve their pronunciation ([Huensch & Thomson, 2017](#)). There is a growing interest in how research findings are being used in language classrooms but Huensch (2019) notes that much of this research on teacher belief has focused on English instruction, though Huensch expands it to the teaching of French, German and Spanish. In many American institutions, a course in L2 phonetics is often part of the undergraduate major in French or Spanish or German. For a broad overview of the literature on ease and difficulty in the teaching of L2 pronunciation, see O’Brien (2021).

And yet studies show that teachers do not teach pronunciation regularly because they lack training ([Derwing & Munro, 2015](#)) or lack confidence ([Baker, 2011](#)). When pronunciation is taught, the focus tends to be on segmental phenomena ([Foote, Trofimovich, Collins & Urzúa, 2016](#)). This is often because the textbooks, if they mention pronunciation at all, tend to focus on segments ([Derwing et al., 2012](#)).

All this is consistent with what we have seen in Mandarin classes in Canadian universities. Common textbooks (e.g., *Integrated Chinese, volumes 1, 2, 3*) emphasize vocabulary and grammar at the expense of pronunciation. For each lesson, the textbook structure includes a “Lesson opener” where learning objectives are outlined. A “Text” section includes narratives and dialogues. A “Vocabulary” section provides definitions for target vocabulary in the text. A “Grammar” section corresponds to numbered references in the text. There is “language practice” for students to practice producing the target grammatical points introduced in the lesson, and “cultural literacy” that introduces aspects of

Chinese culture. Finally, there is a “lesson wrap-up” to encourage reviewing learned structures, as well as some “supplementary modules” where attention is given to deepen learners’ understanding of Chinese characters or Chinese pragmatics. Notably, there is no specific section designed in the series of textbooks for speaking other than the small section called “Basics” at the beginning of Volume 1. The Basics section covers the articulation of the consonants and vowels of Mandarin.

On the prosodic level, it covers the introduction to syllables, tones, characters, and tone sandhi. Relevant to our purposes, T<sub>3</sub>S is briefly introduced as “If two third-tone syllables are spoken in succession, the first third tone becomes second tone (a tone change that linguists call tone sandhi)” followed by three examples and six practice items. There are audio files associated with the relevant sections.

One may argue language instructors’ beliefs and pedagogical practices need to be recognized in addition to textbook or teaching materials coverage as a factor which influences student behaviour. Deng (2022) surveyed ten Chinese instructors to gain information on their beliefs and pedagogical practices in Chinese language teaching. She found that most instructors (eight out of ten) reported challenges in teaching tones to students including tone production, tone perception, tone sandhi. Seven out of ten believed the acquisition of tone sandhi would influence learners’ comprehensibility. In regard to tone sandhi teaching, the instructors’ tended to employ a traditional rule-based Grammar-Translation method (see Richards & Rodgers, 2001 for more details) as they “explain the rules”, or “tell the rule of tone sandhi” followed by “more exercises” or “use a list of vocab with tone sandhi to practice.”

## 2.2 Heritage students

Around the world, there are many cases of children who speak a minority language at home until the time when they go to school and get exposed to the societal majority language for much of the day. For example, a child may speak Russian at home until they go to elementary school when they become immersed in English if they live in Toronto. A child may speak Turkish at home until they go to school and become immersed in German if they live in Berlin. This increased exposure to the majority language can cause a shift in their language dominance where the chronological L2 (which is the societally-dominant language) becomes the psycholinguistically dominant language (see Birdsong, 2014 for more on language dominance). Let us look at the definition of HL from Rothman (2009):

A language qualifies as a *heritage language* if it is a language spoken at home or otherwise available to young children, and crucially this language is not a dominant language of the larger society. (p. 156)

Many researchers have probed the nature of HL grammars (Montrul, 2016). A variety of languages have been studied (Spanish, Russian, Korean, etc.). He (2015) provides an overview of the research on heritage learners of Chinese.

There are also socio-political and educational factors that can affect HLs (Cummins & Swain, 1986). Cummins was mainly concerned with documenting the inequities in mainstream educational systems that resulted in discrimination against minority-language students (HLs). He showed the many values of maintaining the heritage language of the children (and thus not encouraging subtractive bilingualism).

Research has shown that HL grammars can be different from monolingual grammars. In the domain of morphosyntax, it has been argued that the following kinds of linguistic properties are vulnerable in heritage grammars (Benmanoun, Montrul & Polinsky, 2013):

- gender agreement (Russian, Spanish, Swedish)
- case marking (Russian, Korean)
- aspect (Hungarian, Spanish)
- mood (Hungarian, Russian, Spanish)

Of course, Mandarin lacks gender agreement and overt case marking but does have aspectual (*le*, *guo*, *zhe*, *zai*) and modal particles (*ne*, *ba*, *ma*). There is some evidence (Ming & Tao, 2008; Jia & Bayley, 2008) that these are vulnerable in HLs. It would be likely that outer aspect (situational) would be more vulnerable than inner aspect (lexical) but this remains to be seen. Core syntax, on the other hand, has been argued to be more robust (Lohndal, Rothman, Kupisch & Westergaard, 2016), and this would be predicted to hold for Mandarin as well. Jin and Henriks (2005) report that for children *zai* and *zhe* emerge later than *le*.

Early research (Montrul, 2005) referred to these grammars as being “incomplete” however it has been argued more recently that *different* does not mean *deficient* (Kupisch & Rothman, 2016). And yet, terms such as *Spanglish* to describe certain varieties (where Spanish and English are mixed) or *Chinglish* are still common (and not complementary) implying that the HL production is somehow “lacking”. Polinsky (2015) looks at this population of HL speakers when they go back to school to “re-learn” the language they spoke in their childhood. She refers to these learners as L3HLs. For some individuals this may be a case of adding literacy skills to their primarily conversational repertoire (Montrul & Bowles, 2010) but for others it may include the learning of fundamental grammatical properties. It is in this sense that Polinsky can fit the HL learners into the third language acquisition (L3A) literature. If someone learned Mandarin at birth, switched to English for elementary and high school and then took Mandarin class at university, they are like a sequential trilingual but two of the languages happen to be the same (in our case Mandarin). The broad research question she seeks to address is: how does HL L3A compare with second language acquisition (L2A)?

To return to the Canadian context and to T<sub>3</sub>S, we can frame the following research question: how will L2 and heritage learners fare in their production of Mandarin tone 3 sandhi? Will the heritage speakers have an advantage over the L2 learners? Will the Mandarin and Cantonese heritage learners behave in the same way? These findings will have the potential of informing practice in Canadian university classrooms.

### 2.3 L3A of Chinese

When we look at L3A, one empirical question that arises is the role and effect of the L1 and L2 on the L3 grammar. Researchers try to predict when the L1 will transfer and when the L2 will transfer (Rothman, 2015; Westergaard, Mitrofanova, Mykhaylyk & Rodina, 2017). Researchers also try to determine whether L3A is facilitated by such transfer.

However, we must acknowledge though that linguistic status (e.g., L1, L2 or L3) are not the only potentially relevant factors in accounting for acquisition profiles. If the HL speakers are not exposed to academic language in their L1 (but only get it in their L2 at school), they may lack exposure to formal registers, passives, or a variety of other properties that might affect their L3A. With this background let us look at the acquisitional advantages proposed by Polinsky (2015).

### 2.4 HL L3A versus L2A

Polinsky (2015) describes the interesting situation of, in her terms “when L1 becomes an L3.” In other words, she describes the scenario of heritage language (HL) learners. She investigates the following domains: lexicon; morphosyntax; phonetics and phonology. In terms of the lexicon, she argues that L3HL speakers have an advantage over L2ers when it comes to what Cummins (1979) would have called Basic Interpersonal Communicative Skills (BICS). BICS are the communication skills that characterize the everyday language use of language learners. The type of language used in casual conversation, or on the playground would be classified as BICS. By way of contrast, Cummins refers to Cognitive Academic Language Proficiency (CALP). CALP would be exemplified by the kind of language we would use to write an academic essay. Therefore, students who have not received formal education in their HL might well lack HL CALP skills.

Having acquired the HL as an L1 in a naturalistic setting, HLs are often conversationally fluent (Potkowski, 2007). Yet they do not seem to have advantages in morphosyntactic structures when compared to L2ers (Ming & Tao, 2008). We see examples of transfer of English (the dominant language) into Mandarin (Aist, Campana, Allen, Swift & Tanenhaus, 2012).

Polinsky (2015) does suggest that L3HL learners have an advantage of L2ers in the domain of “phonetics and phonology.” The primary phenomenon she reports on, however, is Voice Onset Time (VOT). VOT is the durational lag between the release of a stop (e.g. [p] or [b]) and the vibration of the vocal folds in the following vowel. A language like English has a [p] with a *long-lag* VOT in the syllable [pa] but a *short-lag* VOT in the syllable [ba]. A language like Mandarin also has a *long-lag/short-lag* contrast (Yang, Chen & Xiao, 2020). Therefore, both English and Mandarin values should facilitate targetlike L3 VOT. However, the VOT accuracy is also documented (Au, Knightly, Jun & Oh, 2002) in cases where the L3HL (say Spanish) has a different VOT contrast than the L2 (say English). Spanish produces a [p] with a *short-lag* VOT and [b] with *pre-voicing* (the vocal folds start vibrating before the consonant is released to produce the vowel). So, it does not seem to be linguistic typology or proximity which explains the targetlike production of the L3HL speakers. Rather it is most likely Age of Acquisition (AoA) of the L1/L3 which predicts this pattern; the learners with early AoA do well on certain phonetic factors. Chang et al. (2009) demonstrate that Mandarin HLs have accurate productions of the post-alveolar contrast /ʃ/ç/. With respect to tone, Kan and Schmid (2019) report that Cantonese HLs living in the United States aged five to eleven are significantly less accurate than age-matched monolingual controls on tone discrimination.

Polinsky (2015) also reports on global accent studies that she conducted which demonstrate that native listeners assess some HLs as having non-native accents. As the work of Munro and Derwing (1995) has shown, the constructs of accentedness and intelligibility are independent. Speakers with very heavy foreign accents can be highly intelligible. Consistent with this, Munro, Flege and Mackay (1996) demonstrated that age effects affect accentedness scores much more than they affect intelligibility scores. It is this sort of work which has led to many pronunciation classes focusing more on the intelligibility of the learners rather than their nativelikeness (Levis, 2020).

In fact, many studies of HLs do not compare their phonetic performance to monolingual native speakers. Instead, they compare the HLs to a bilingual control group. Kupisch and Rothman (2016) look at HLs of Italian in Germany (who were exposed to both Italian and German from birth). They compare them to subjects living in Italy with German as an HL (who were exposed to both Italian and German from birth); in this way AoA is controlled. We mention this to underscore that HLs are different research subjects than monolinguals and have different grammars than monolinguals. This point is also emphasized in Bayram, Kupisch and Rothman (2019) who demonstrate that HL grammars are coherent grammars governed by the properties of Universal Grammar.

It is worth noting though, that such age effects are found primarily in the domain of phonetics as opposed to phonology. Phonology is concerned with the mental representations of linguistic structures, not “just” the motoric implementation of phonetic segments (see Archibald, 2021 for further discussion). Studies have also shown that HLs have quite accurate phoneme discrimination ability (Au, Knightly, Jun & Romo, 2008; Oh et al., 2003; Chang, Yao, Haynes & Rhodes, 2009). Pronunciation is about understanding as well as talking.

Clearly, the linguistic environment is an important element to consider in language acquisition and heritage language acquisition is no different. Flege (2018) argues that familiar age-of-acquisition effects are essentially input effects given that younger learners receive more input than older learners over the course of their acquisition period. Kupisch and Rothman (2016) argue that HLs may differ from non-HLs in terms of the amount of input they receive and in terms of the formal schooling they receive. They showed that the French heritage learners in Germany (who received formal education in French) behaved quite differently in their heritage languages from Italian heritage learners in Germany (who received their formal education in German); both groups had targetlike German.

All this being said, we still don't have any evidence as to whether the L3HL learners have a *phonological* advantage. This is the question we probe in this paper. In order to do so, let us address the phonology of tone in Mandarin.

## 2.5 Basic tones

Following Duanmu (2007), we adopt the position that Mandarin has four tones on non-final full syllables. There are two level tones and two contour tones:

- Tone 1: High
- Tone 2: Low High
- Tone 3: Low
- Tone 4: High Low

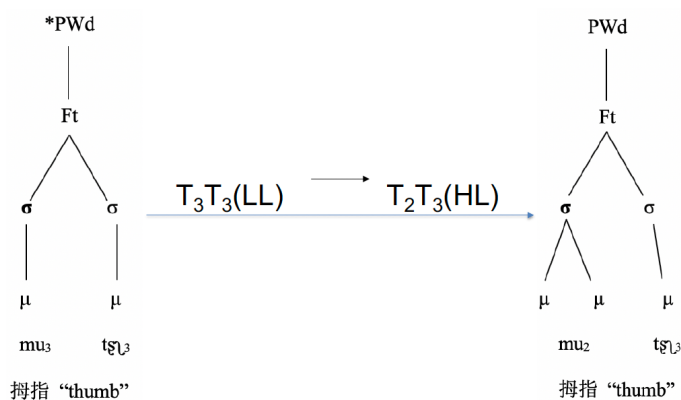
At times, however, tones may change in a certain context. These processes are known as tone sandhi (TS). One of the best studied TS is known as tone 3 sandhi ( $T_3S$ ).

## 2.6 Tone Sandhi

When there are two adjacent  $T_3$ s, the first becomes  $T_2$ . Thus, Low Low  $\rightarrow$  Low High Low. In this sense,  $T_3$  sandhi is an entirely phonological phenomenon.  $T_3$  sandhi, as a phonological process, is argued to be motivated by Chinese prosodic structure, more particularly, the underlying trochaic foot structure (Qu, 2013) where a heavy syllable is followed by a light one. She argues that Chinese syllable weight is determined by the tone it bears: a  $T_3$  syllable is considered light, while  $T_1/T_2/T_4$  syllables are considered heavy. When forming the trochaic foot, a  $T_3T_3$  (light-light) structure changes to  $T_2T_3$  (heavy-light), as shown in Figure 1.

Figure 1

$T_3$  Sandhi Process (Deng, 2022, p. 37)



Other Chinese tone sandhi processes, such as *yi-bu-qi-ba* sandhi, are excluded from the discussion of this paper, as these tone sandhi processes are morpheme-restricted meaning that the tone sandhi processes only apply to these four morphemes: *yi* (one), *bu* (not), *qi* (seven), and *ba* (eight); thus, unlike  $T_3$  sandhi, these sandhi processes are not predictable based on tone sequence alone across any morphemes compared.

So, this TS process is what learners of Mandarin (either HL or L2) need to acquire. Students need to learn to both produce and understand  $T_3S$  items. Our working hypothesis is that, since TS are not phonologically contrastive, that if students produce “thumb” with a surface  $T_3T_3$  sequence (rather than

a T<sub>2</sub>T<sub>3</sub> sequence) that it will not be misunderstood by listeners but will sound accented or take longer to process.

## 2.7 Cantonese tonal phonology

We have separated the Cantonese and Mandarin heritage learners into two groups because of their different underlying phonological properties. Chen (2000) notes that “Cantonese typifies a tone-rich but sandhi-poor system: it has one of the largest tonal inventories....but aside from contour tones arising out of syllable elision....and morphologically-conditioned tone change, the underlying tones remain virtually unchanged in connected speech.” (p. 84) Indeed, Pulleyblank (1986) would not refer to Cantonese as a tone sandhi language. This is relevant for our purposes in that the Cantonese HLs do not have L1 tone sandhi that they can transfer to the learning of Mandarin.

We have also classified Cantonese as a language without metrical feet. Yip (1992) argues that Cantonese shows some evidence for foot structure in familiar name formation (e.g., yip<sup>22</sup> become a<sup>33</sup> yip<sup>25</sup>). Our position is that this is not part of the *core* phonology of Cantonese (it may only be relevant in morphological contexts), and we, therefore, classify Cantonese as a language without phonological feet. Remember that foot structure is the domain of T<sub>3</sub>S. Therefore, learners without foot structure in their L1 may be at a disadvantage when learning foot-based processes (such as T<sub>3</sub>S) in Mandarin. We will return to this claim when we discuss our results.

Chen, He, Wayland, Yang, Li and Yuen (2019) looked at the acoustics of the T<sub>3</sub>S production in L2ers (L1 Cantonese and L1 English). The Cantonese production and the English production were significantly different from the Mandarin production. Such baseline research supports the claim that Cantonese learners do *not* have an advantage when it comes to learning Mandarin T<sub>3</sub>S.

We turn now to a discussion of the experimental data that will inform our discussion here.

## 3. The Research Design and Results

In this paper, we draw on the work of Deng (2022) who had native speakers of Chinese listen to the speech of learners producing sandhi and non-sandhi words and rate their comprehensibility. She then used these comprehensibility scores to compare groups of learners (e.g., non-heritage learners and HLs), and to compare scores on sandhi words and non-sandhi words.

### 3.1 Participants

Participants were recruited from post-secondary institutions from a number of countries including Canada, the U.S.A., China, South Korea and Japan. Initially there were ninety-one adult learners of Chinese. Each participant received 10 Canadian dollars (or the equivalent amount in local currency of the participant) to compensate them for their time to participate in the study. All participants gave their consent prior to participating in the study. The learners were categorized as either non-heritage learners who do not have a heritage background and are currently learning Chinese as their additional language (non-HLs) or heritage language learners (HLs). HLs are further divided into Mandarin HLs (MHL) and Cantonese HLs (CHL) depending on their heritage language being Mandarin or Cantonese. Altogether, there were nineteen CHLs, nine MHLs, sixty-three non-heritage learners.

To comply with socio-distancing recommendation during the pandemic of Covid-19, data collection was conducted remotely via the online survey platforms *Jotform* ([www.jotform.com](http://www.jotform.com)), and *Wenjuanxing* ([www.wjx.cn](http://www.wjx.cn)). The choice of the platform is determined by the participant’s geographical location and internet access. Jotform was not accessible in mainland China, thus, participants located in mainland China during the data collection period accessed the surveys via Wenjuanxing.

All participants filled out a survey regarding their basic demographic information (e.g., age, gender, education level), language background and Chinese learning experience. Chinese learners were

asked to read two Chinese wordlists written in *pinyin* with tone marks. The first list was a screening wordlist consisting of twelve monosyllabic words (three with each tone) to determine whether learners had acceptable knowledge and pronunciation of the four Mandarin tones. The second list was the experimental wordlist of forty disyllabic Chinese words<sup>1</sup>. This list contained twenty T<sub>3</sub>-sandhi words and twenty non-sandhi words (meaning non-T<sub>3</sub>-T<sub>3</sub> sequences, e.g., T<sub>4</sub>-T<sub>3</sub>). Learners were asked to read the words at their normal speech rate and volume.

### 3.2 Raters

The twenty native speaker raters were all from Northern mainland China, and they were all undergraduate students attending a teachers' university in China. They were asked to rate both word lists. In the screening task of monosyllabic words, the judges rated each word's tonal production as either *acceptable* or *unacceptable*. For T<sub>1</sub>, T<sub>2</sub> and T<sub>4</sub> the screening threshold was set at 80%. With three words in each tone class and twenty raters for each word this means that participants who received a score of 144/180 forms correct would be deemed to pass the screening test. For T<sub>3</sub> we set the screening threshold at 66%. There were three T<sub>3</sub> words and with twenty raters this means that participants with a score of 40/60 forms correct would be deemed to pass the screening test (essentially those who got two out of three correct). A lower threshold for T<sub>3</sub> accuracy was set given that it is evidenced in the literature that T<sub>3</sub> is indeed more difficult (i.e., higher error rates and late acquisition) for learners of Chinese to acquire among all four lexical tones (e.g., Ioup & Tansomboon, 1987; Zhang, 2017). Sixty-seven of the original ninety-one learners (hereafter, referred to as *eligible learners*) passed the screening. Within this eligible population there are twelve Cantonese Heritage Learners, seven Mandarin Heritage Learners, forty-eight non-heritage learners. These are the participants we report on in this paper.

### 3.3 The comprehensibility of tone Sandhi

Our 67 eligible learners' disyllabic words were rated by the twenty judges for *comprehensibility* as well as *accentedness* on a scale of 1-9, following Derwing and Munro (1997, 2009). The raters listened to sound files (without written input) and were asked to make their assessment. Munro and Derwing (1995) showed that constructs like accentedness, intelligibility, and comprehensibility were independent. *Accentedness* is a rating of how different the non-native speech sounds from native speech. *Intelligibility* is a measure of whether the listener can recover the intended message of the speaker (regardless of the accentedness); heavily accented speech can be fully intelligible. *Comprehensibility* references the amount of effort that the listeners employ to recover the message. Essentially, the listener rates whether it was easy or difficulty to understand the speech. The comprehensibility rating scale we used is 1 to 9, with 1 being *extremely easy to understand* and 9 being *extremely difficult to understand*. The accentedness rating scale is 1 to 9, with 1 being *no accent* and 9 being *extremely strong accent*. Inter-rater reliability was very high (98.6% for accentedness ratings and 97.1% for comprehensibility ratings, calculated using the Intraclass Correlation Coefficient test in SPSS). This demonstrates that all the judges were performing the rating task in a similar fashion thus demonstrating the validity of the ratings.

## 4. Results

In this paper, we focus on the comprehensibility ratings of the T<sub>3</sub> production of different groups of learners (i.e., non-HLs, CHL and MHL). We are, therefore, not probing whether the participants have acquired a targetlike phonological rule which changes a T<sub>3</sub> into a T<sub>2</sub>. Rather, we are probing the comprehensibility of their production to native Mandarin listeners.

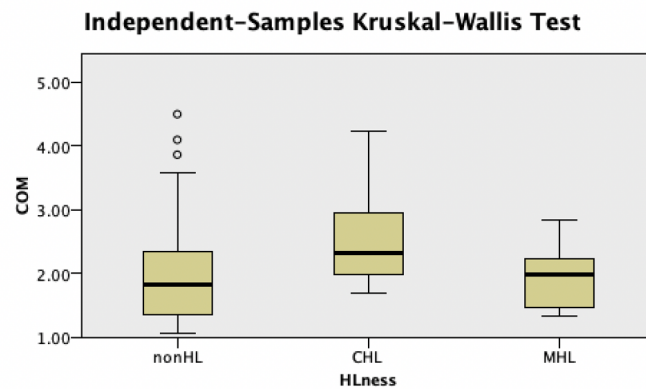
The scores we focus on are the comprehensibility scores of the non-HLs and HLs (broken down into Mandarin HL and Cantonese HL). Nonparametric Kruskal-Wallis Test results, shown in Figure 2, indicated that there was a significant difference ( $p= 0.002$ ) among non-HLs ( $M= 1.93$ ), Mandarin HLs



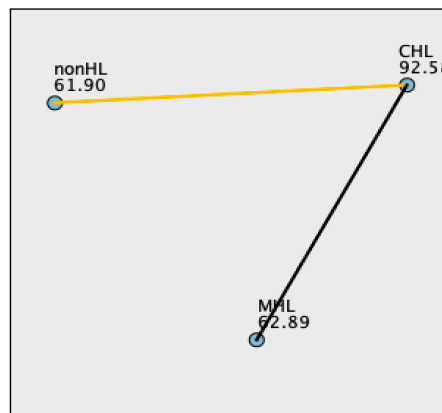
( $M= 2.00$ ) and Cantonese HLs ( $M= 2.55$ ) in terms of comprehensibility of all disyllabic experimental words (i.e., both sandhi words and non-sandhi words). The post-hoc pairwise comparisons further revealed that only Cantonese HLs were significantly less comprehensible than non-HLs ( $p= 0.002$ ) with the mean rank of Cantonese HLs 92.58 being higher than that of non-HLs being 61.90 (which means Cantonese HLs received higher comprehensibility rating scores than non-HLs, thus, less comprehensible), and the Mandarin HLs were not significantly different than Cantonese HLs ( $p= 0.069$ ) or non-HLs ( $p= 1.000$ ).

Figure 2

*Comprehensibility Comparisons among the Three Learner Groups on all Disyllabic Experimental Words*



Pairwise Comparisons of HLness



Each node shows the sample average rank of HLness .

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
nonHL-MHL	-.992	11.107	-.089	.929	1.000
nonHL-CHL	-30.682	8.861	-3.463	.001	.002
MHL-CHL	29.690	13.057	2.274	.023	.069

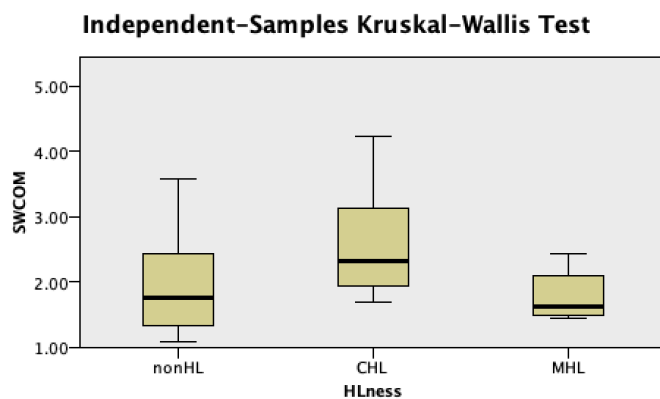
Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05. Significance values have been adjusted by the Bonferroni correction for multiple tests.

When further looking into specific word type, we found that these three learner groups perform similarly for non-sandhi words (on which sandhi rules do not apply, such as  $T_1T_3$  sequences) with a significance level of 0.062. However, as shown in Figure 3, they perform differently on sandhi words (i.e.,  $T_3T_3$

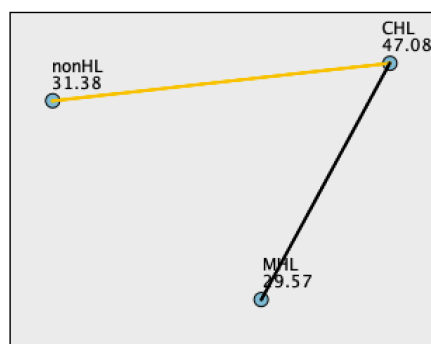
sequence) for the  $p$  value is at 0.036 among three groups. The post-hoc pairwise comparisons further revealed that the difference was owing to non-HL group and CHL group ( $p= 0.037$ ;  $M= 1.98$  vs. 2.57 respectively) having significantly different comprehensibility scores as well. As for comparison between MHL and CHL, it was not significant ( $p= 0.176$ ).

Figure 3

*Comprehensibility Comparisons among the Three Learner Groups on Sandhi Words*



**Pairwise Comparisons of HLness**



Each node shows the sample average rank of HLness.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
MHL-nonHL	1.804	7.883	.229	.819	1.000
MHL-CHL	17.512	9.266	1.890	.059	.176
nonHL-CHL	-15.708	6.288	-2.498	.012	.037

Taken together, these results indicate:

1. On non-sandhi words (which are simply stored in the lexicon, not computed as allomorphs), all three groups behave the same. This suggests that all learners are equally capable of storing lexical tones.
2. On sandhi words (which are generated by a process involving foot structure), the CHL group performs worse than the non-HL group, presumably because Cantonese lacks tone sandhi and foot structure. The MHL group is not performing significantly differently from the CHL group or the non-HL group. This suggests that *neither* of these two HL groups has acquired the phonological process which is triggered by trochaic foot structure.

## 5. Discussion

What these data reveal is that the Cantonese and the Mandarin heritage learners do not have an advantage over L2 learners when it comes to the phonological domain. The heritage learners may have conversational fluency (what Cummins calls Basic Interpersonal Communication Skills) but they have not acquired certain aspects of complex phonology, morphology or syntax. This leads us to the question of whether the MHLs have lost their L1 T<sub>3</sub>S (i.e., it has been attrited) or whether they never acquired it in the first place. To answer that question, we need to look at when children acquire T<sub>3</sub>S. Rattanasone, Tang, Yuen, Gao and K. Demuth (2018) suggest that the L1 acquisition of T<sub>3</sub> sandhi is a “protracted process probably fully attained after the age of 5.”, so our HLs may not have acquired it in their L1. Wang, Schwartz and Jenkins (2005) investigated heritage learners in the United States and found that the 3-year-olds’ monosyllabic productions in stressed syllables were not adultlike, and “dipping tone [T<sub>3</sub>] was significantly more difficult for the children.” Their perception of the four tones in monosyllables was accurate but “the perception of the dipping tone [T<sub>3</sub>] was more difficult...posing the greatest challenge.” (p. 1076). Hao (2012) also notes that T2 and T3 in citation form are difficult for Mandarin adults as well.

It may well have been the case, then, that the HLs would have acquired the elements that would be stored (phonemes and lexical tones) but would have *not* fully acquired the contextual rules of tone sandhi. This is reminiscent of O’Neil’s (1998) discussion of how the acquisition of context-sensitive rules can be different from context-invariant phenomena.

## 6. Implications for Pronunciation Teaching

We surveyed ten instructors of Chinese to probe their classroom activities. Eight out of ten were in Canadian post-secondary institutions, one was in Japan, and the other one was in the U.S.A. All instructors of Chinese are from the post-secondary institutions where the learner participants were recruited. The following are some of the comments provided by the participating teachers which indicate (a) their beliefs about the importance of T<sub>3</sub>S, and (b) the nature of T<sub>3</sub>S coverage/activities in their classrooms. Couper (2021) reminds us of the import of taking teacher beliefs into account when looking at what happens in the language classroom in the domain of pronunciation.

What did we learn about the teaching of T<sub>3</sub>S in Canadian university classrooms? Table 2 shows some responses from the teachers.

Table 2

*T<sub>3</sub>S Teaching in Canadian University Classrooms*

Question	Answers
Do you teach tone sandhi?	<ul style="list-style-type: none"> <li>• Yes, because the phenomenon is prevalent in the Chinese language.</li> <li>• Yes. It is an important part of the Chinese language features, so I introduce this feature in level 1.</li> <li>• Yes, some students like to learn about these patterns,</li> <li>• Yes. The students need to know the rules so they can pronounce the words properly especially when they learn the vocab from reading the vocab list in the textbook.</li> <li>• Yes, it is a part of the Chinese phonetics for beginners.</li> <li>• Yes, it is part of the first year Chinese curriculum when teaching pronunciation and Pinyin. Many students can distinguish tone sandhi and ask questions about it as soon as we start to combine a third tone with other tones in their tone drills.</li> </ul>

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How do you teach it?	<ul style="list-style-type: none"> <li>• Explicit instruction with examples and consciousness raising activities when it is time for all kinds of tones appear in front of 三声, I will introduce the big picture of sandhi.</li> <li>• Explain to them what it is. Give them examples and dictation exercises. First, I will explain the rules, and then use a list of vocab with tone sandhi to practice, such as Zǒngtǒng (president), Xiǎojiě (miss) etc.</li> <li>• When a student asks a question related to tone sandhi, it is a good point to start a mini lesson. If not, I will ask the students to listen to two syllables with tone sandhi and the two syllables read separately.</li> </ul>
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So, the textbooks don't emphasize tone sandhi but the instructors cover it. In spite of this, we note that the MHL comprehensibility is just like the non-HL group (and thus presumably not achieving the desired learning outcomes).

In addition to teacher beliefs and instructional practice, we want to raise one other aspect of the classroom environment which we feel needs to be taken into account: language anxiety.

### 6.1 Language anxiety

It is well-established that foreign language anxiety can affect the L2 learning experience (Horwitz, Horwitz, & Cope, 1986; MacIntyre & Gardner, 1989). There is a growing body of literature which shows that HLs can exhibit high levels of anxiety when placed in L2 classes (Tallon, 2009, 2011; Sevinç & Dewaele, 2018; Prada, Guerrero Rodríguez & Pacual y Cabo, 2020). The skill that triggers the most anxiety is speaking (Swain & Burnaby, 1976). Research in Europe (Sevinç, 2017; Sevinç & Dewaele, 2018) has shown that third-generation HLs show the most HL anxiety (compared to 1<sup>st</sup> and 2<sup>nd</sup> generation). Our subjects were primarily second generation but nevertheless anxiety is likely present. Tseng (2021) shows how late-generation speakers adopt “deficit sociolinguistic identities” which can curtail their language use. Clearly, we want to mitigate this in our classrooms.

González Darriba, Kinsella, Marull and Campbell (2021) report on the advantages of having HL sections of university courses for Spanish speakers in the U.S. This is certainly something that could be considered in Canadian universities and colleges where numbers warrant.

### 6.2 HLs in L2 classrooms

Felix (2009) provides some telling quotations as to how HLs can feel in an L2 classroom. She draws on Spanish HLs in the United States but the picture is likely the same in Mandarin classes in Canada. Given our results on the Mandarin and Cantonese HL performance with respect to the phonological phenomenon of tone sandhi, it certainly seems plausible that this could add to a feeling of anxiety when HLs are speaking in class. Felix (2009) reports that at times the students felt like they were being treated as teachers, which only fuelled their anxiety. The quotations in Table 3 certainly reveal some anxiety.

Table 3

#### *Language Anxiety in HLs in the L2 Classroom*

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- And what I found is that [the instructor] was using me to help the other kids. A lot. Like she would put me in a group of like I think there were 30 in the class, divide up the groups and put me with like the worst Spanish speakers to help them.
- When I took the class I did feel slightly embarrassed because I'm Hispanic. I felt I never should have had to be in a classroom learning what should have come naturally.

- I remember the first evening when they were taking roll, when they were basically asking why would you want to speak Spanish and some girl commented out loud without me answering, “Oh easy A, right?” And I was all like, uh, I didn’t say anything. But I went home thinking that it was like it’s not an easy A, just because she thinks I know Spanish. So it’s not the fact that I want an easy A. I want to read it and write it. Like I said, some stuff that we’re learning in class is like all new to me. So I’m getting a benefit out of it and it enhances my skills so it’s not anything about an easy A.
- I hate it when I tell my Anglo friends that I’m a Spanish major because they don’t take me seriously. They usually say “Don’t you already know Spanish?” It’s really annoying trying to explain.

Deng (2022) had no interview data but in a survey sixteen of twenty learners reported that they found speaking to be one of their greatest challenges in learning Chinese. We take this to be a likely indication of anxiety.

We can’t expect MHLs to have an expert-level of language skills especially when it comes to what Cummins would have called Cognitive Academic Language Proficiency. We certainly can’t expect CHLs to have a linguistic advantage either. Especially since Cantonese lacks tone sandhi and, as we have seen, the CHLs are performing worse than the non-HLs, we can’t expect them to be “experts” in the class either.

## 7. Summary

Teachers and researchers sometimes make the assumption that heritage learners will have an advantage over second language learners when it comes to the formal study of their heritage language. The literature has shown us that the morphology and syntax of heritage learners can be vulnerable to non-targetlike endstates while the phonetic aspects of their speech such as fluency and segmental accuracy may be targetlike. In this paper, we probed the question of whether Chinese heritage learners would have an advantage in their production of tone 3 sandhi compared to non-heritage learners. Our data took the form of listener ratings of the comprehensibility of their sandhi and non-sandhi words.

Mandarin HLs do not have phonological advantages over non-heritage learners as they do not differ significantly from non-heritage learners in terms of comprehensibility. For sandhi words, Cantonese HLs were significantly less comprehensible than non-heritage learners, but not significantly different from Mandarin HLs. There was not a significant difference between Mandarin HLs and non-heritage learners.

These data show that these Mandarin heritage learners certainly do not have a phonological advantage in terms of their comprehensibility as measured by T<sub>3</sub> sandhi processes. In this respect, heritage phonological competence appears to be vulnerable in the same way as the morphological and syntactic components are reported to be in other studies.

When combined with the literature on heritage language anxiety that we have referred to, we feel that Canadian university programs need to revisit some of their assumptions about the heritage learners who might be in the classrooms. Teachers need to recognize that beyond certain phonetic skills, heritage learners may face considerable challenges in the L2 classroom.

Gordon (2021) reminds us that “explicit pronunciation instruction enhances production of intelligible, comprehensible, and fluent second language speech” (p. 94) Teachers need to find ways to incorporate explicit task-based pronunciation activities into their university classes (Mora & Levkina, 2017). Where numbers warrant, schools should consider separate HL sections. Where they do not warrant, teachers should not have unreasonable expectations of the HL students (both Mandarin and Cantonese). Program activities should be structured to attempt to reduce the anxiety of the HL students in the classes.

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## Notes

1. Deng (2022) modified Zhang and Lai (2010)'s experimental wordlist using the "Chinese Text Computing" corpus (<https://lingua.mtsu.edu/chinese-computing/statistics/bigram/form.php>) by Da (2004), an updated version of the 1998 version of the corpus used by Zhang & Lai (2010).

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# 三声变调的教与学： 加拿大大学汉语课堂中的二语和继承语学习者的研究

邓婕

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## 摘要

本论文探讨了继承语学习者 (HLs) 在语言课堂上是否具有音系学优势 (而不仅仅是记录在案的语音优势) 的问题。Polinsky (2015) 认为, 成年继承语学习者虽在词素句法上表现不一, 但在“音系学”上有一定的优势。Chang、Yao、Haynes 和 Rhodes (2011) 认为, 继承语学习者在产生某些语音细节方面, 比第二语言 (L2) 学习者更地道。本文探讨汉语三声变调 (学习者必须习得的音系特征之一) 的教与学。考虑到三声被认为是汉语音调中二语感知和产出最容易出问题的音调 (Zhang, 2014, 2016), 我们探究学习者的三声变调发音有多“好”。我们的数据显示, 官话继承语学习者, 相较于非继承语的二语学习者, 没有音系优势 (即没有显著差异)。此外, 我们还发现, 在语言可理解度方面, 粤语继承语学习者明显低于非继承语学习者的二语学习者。在语言教学中, 花在发音上的时间很少 (Huensch, 2019)。加拿大大学的许多中文课就是如此。常见汉语教材 (如综合汉语) 强调词汇和语法。加拿大大学的中文教师面临着学生语言背景混合的挑战: 继承语学习者 (HLs) 和二语学习者。这可能导致课堂上继承语学习者的高度焦虑 (Prada & Guerrero-Rodriguez, 2020)。教师需要意识到这种焦虑, 不可想当然地认为继承语学习者是中文班上的“专家”。

## 关键词

继承语学习者, 汉语, 变调, 可理解度, 二语学习

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John Archibald, 加拿大皇家学会会士, 维多利亚大学语言学教授, 研究领域为第二或第三语言的音系学习得。他曾任卡尔加里大学语言研究中心主任, 维多利亚大学人文学院院长。他出版了八本书, 五十多篇期刊文章和书籍章节。