Correlations in the Pronunciation of Sino-Japanese Lexical Items in Shanghainese and Japanese

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Abstract

This study investigates the phonetic relationships between Shanghainese, a major Wu-branch dialect of Chinese, and Japanese on'yomi (Sino-Japanese) readings, assessing whether historical Wu Chinese influences yield closer phonological parallels with Japanese than modern Mandarin. The researcher elicited pronunciations for 379 shared Sino-Japanese lexical items from three native Shanghainese speakers (from Pudong and Zabei) and three native Japanese speakers (from Kanto and the Fukuoka prefecture), using Mandarin as an intermediary control. IPA transcriptions of each token were compared via Levenshtein distance to quantify structural similarity, alongside qualitative analyses of segmental patterns. The results reveal an average normalized phonetic resemblance of 29.14%, higher than the 19.6% previously reported for Mandarin-Japanese phonetic resemblance, suggesting that Shanghainese retains greater phonological affinity to Japanese over Mandarin. Key convergences include voicing patterns conditioned by Shanghainese tone versus Japanese pitch accent, systematic deaffrication and alveolarization of retroflex consonants, and parallel adaptations of labiodentals and laterals in Japanese. On the other hand, phonological divergences arise in nasal codas and vowel sequences, which are affected by coda constraints and phonotactic shifts. These findings exhibit the impact of medieval Wu Chinese on Japanese on'yomi and provide insights on Sino-Xenic contact phenomena. Future work should expand to other Wu dialects and focus exclusively on Go-on readings to refine our understanding of historical sound correspondences.

1 Introduction

Observations by native speakers have noted that, despite belonging to entirely distinct language families, Shanghainese—a major dialect of the Wu branch of Chinese—and spoken Japanese often exhibit similar phonetic properties. While Shanghainese (Sino-Tibetan) and Japanese (Japonic) differ in their historical and genetic origins, both cultures emphasize social harmony and indirect communication, with individuals often expressing themselves in roundabout manners, factors that may have contributed to subtle phonetic convergences over time.

A recent study quantified the phonetic resemblance between Mandarin Chinese and Japanese, revealing that while the overall similarity stays low at approximately 19.6%, certain Sino-Japanese lexical items demonstrate high phonetic overlap, e.g. 他, 爱, 医, 信, etc. (Obataya, 2019). This prompts the question of whether similar patterns exist when comparing Japanese with a more regionally and phonetically distinct variant of Chinese, notably Shanghainese.

Japanese may indeed be more similar in pronunciation with Shanghainese phonetics than with Mandarin phonetics, as modern Mandarin has its influences more from northern Chinese dialects, while Japanese borrowed a major part of its vocabulary from Middle Chinese, which is considered more similar to Southern Chinese language families. The first wave of kanji borrowings occurred in the fifth and sixth centuries, which take on Go-on pronunciations (呉音, meaning Wu pronunciation) from the Middle Chinese dialect spoken in the Jiankang region, the ancestor to modern Wu dialects. Thus, a large portion of Chinese-borrowed Japanese kanji originate from Wu Chinese or are closely related to Wu pronunciation. This is clearly seen in the historically significant 12th century kanji dictionary *Iroha Jiruishō*; according to a study on the use and pronunciation of kanji borrowed during the late Middle Ages, two versions of the dictionary, the *Daitōkyū Kinen Bunko* edition and the *Ryūmon Bunko* edition, respectively had 30.7% and 44.4% Go-on readings for all kanji (Oshima, 2022). Evidently, Wu Chinese vocabulary and pronunciation remains a major part of the Japanese lexicon.

Today, Shanghainese is one of the most widely spoken descendants of early Wu Chinese. The most comprehensive phonetic sound inventory documented detailed that the larger spoken Shanghainese variety comprises 28 consonants and 15 vowels[1], evolving from an archaic eight-tone system to the contemporary five-tone system widespread in the status quo (Chen and Gussenhoven, 2015). This study seeks to compare the difference in pronunciation of shared vocabulary between Japanese, a language influenced by medieval Wu Chinese, and Shanghainese, a modern descendant of the Wu Chinese branch.

Both languages have gone through the effects of significant foreign linguistic influences. One previous study noted how Shanghainese phonotactics has already been influenced by external dialects, in particular Putonghua; for example, sibilant consonants [tsʰ ts s z] from the older dialect has changed to [tɕʰ tɕ ɕ ʑ] in the newer dialect due to Mandarin influences (Xian, 2022). On the other hand, research on Sino-Japanese homographs has illustrated that while a significant proportion (63.8%) of Japanese vocabulary of Chinese origin have similar forms, pronunciations diverge due to differing historical timelines and cultural contexts, as well as external linguistic influences (Zhou, 2022). In particular, Japanese's dual-script system, with katakana dedicated to phonetic transcription of foreign loanwords, creates a low-barrier channel for importing and normalizing novel sound forms, speeding up phonetic change. Thus, since Japanese had borrowed words with Go-on readings over a millennium ago, comparing dialectically impacted Shanghainese to chronologically changed Japanese may result in few phonological correspondences.

Despite these constraints, the primary aim of this study is to conduct a comprehensive phonetic and phonological comparison between Shanghainese and Japanese. Specifically, this research will:

- Analyze the detailed phonetic structures of both languages using standardized transcriptions, through consonantal and vowel comparisons

[1] Shanghainese consonants: [pʰ p b m w f v tʰ t d tsʰ ts n s z l tɕʰ tɕ dʑ ɕ ʑ j kʰ k g ŋ ʔ h]
Shanghainese vowels: [i y ɪ ʏ ɛ ø ə ɐ a ɑ ɔ o ɤ-ʊ u]

- Identify historical influences within Shanghainese and Wu Chinese that might account for phonetic features aligning with Japanese pronunciation patterns, and
- Assess the extent to which phonological parallels resulted from systematic correlations versus convergent evolution/borrowing, in order to distinguish inherited features from surface-level similarities.

Overall, this study seeks to pinpoint the historical and phonetic processes that have produced specific sound similarities and differences between Shanghainese and Japanese, contributing to linguistics insight on the effects of Sino-Xenic borrowings and language contact phenomena.

2. Methodology

2.1. Participants

Pronunciation data was collected via recruiting native speakers of Shanghainese and Japanese, who underwent elicitation procedures. Basic demographic information was gathered from all participants; this included age and specific region of origin. For Shanghainese speakers, the exact dialect region within Shanghai was identified, given that regional and geographical differences have significant dialectal phonetic variations. Similarly, Japanese participants provided information about their region or prefecture (e.g., Kantou, Kansai, etc.).

As such, three consultants from each language group were selected based on their native proficiency, with ages ranging from 16 to 59. For Shanghainese speakers, participants originated from the Pudong and Zabei districts of Shanghai. For the Japanese speakers, participants originated from the Kanto region and the Fukuoka prefecture.

2.2. Criteria for Word Selection

379 Mandarin words were chosen and organized by each consonant letter in the Hanyu pinyin (b, p, m, f, …) for control. Mandarin was selected as an intermediate language because (a) it acts as an anchor point for comparison of both languages, (b) Mandarin has a relatively large sound inventory, allowing for more specific phonetic comparisons, and (c) the standardized pronunciations for Mandarin were easily accessible through various databases.

The words used for elicitation were selected based on the following criteria:

- The word has a Sino-Japanese root shared between both Chinese and Japanese.
- The word is commonly used in both languages to ensure that speakers recognized and understood its meaning.
- The word is represented using the same Chinese characters (kanji) in both languages.
- Pronunciations are based on the Chinese (on'yomi) readings.
- The word's definition does not need to be identical across languages but must be conceptually related.

The word has a Sino-Japanese root shared between both Chinese and Japanese.

Words were chosen based on their shared Sino-Japanese origin to ensure that the lexical items have historical and phonetic significance in both languages. Common ancestry of words provides a basis for comparing phonetic features that may have evolved similarly due to shared etymological roots.

(1) 安全 'safe', 'safety'
Mandarin [an tɕʰɥœn]; Shanghainese [ø tɕy]; Japanese [aɴzeɴ]

The word is commonly used in both languages to ensure that speakers recognized and understood its meaning.

Selecting words that are widely used in both languages guarantees that participants recognize and understand their meaning, which minimizes mispronunciations due to unfamiliarity and ensures that the elicited pronunciations coincide with natural, everyday speech patterns.

To determine whether a word should be considered "commonly used," participants were interviewed afterwards to comment on the overall familiarity of the list of characters provided. While participants noted that some characters were uncommon or unfamiliar (characters which they did not recognize or could not pronounce), the majority of characters appeared frequently in daily use, and thus were categorized as such.

(2) 外国人 'person of a foreign origin'
Mandarin [waɪ kuɔ ʐən]; Shanghainese [ŋa ko ɲin]; Japanese [gaikokɯʑiɴ]

The word is represented using the same Chinese characters (kanji) in both languages.
Ensuring that each word is represented using the same Chinese characters (kanji) in both languages means ensuring orthographic consistency. This uniformity assists phonetic comparison by preventing potential written or semantic discrepancies.

(3) Chinese: 好奇心 'with a curious heart'
Japanese: 好奇心 'curiosity'

Occasionally there are differences in Japanese kanji and simplified Chinese hanzi, but they refer to the same character.

(4) The lexicon for 'destruction', 'extinction' is as follows:
Chinese: 灭亡 [mjɛ wɑŋ]
Japanese: 滅亡 [metsɯboː]

Pronunciations are based on the Chinese (on'yomi) readings.

Focusing on the on'yomi readings for pronunciation in Japanese and using Mandarin as a control (a) aligns the study with the historical linguistic influence of Chinese on Japanese, and (b) creates a pivot point to which both languages can refer and compare as a "mediator" language. This enables a more precise analysis of phonetic similarities by concentrating on the pronunciations analyzed from the same point of comparison or derived from the same linguistic source.

Japanese pronunciations are classified into two major categories: kun'yomi and on'yomi. Kun'yomi refers to the native Japanese reading of a character, often used for standalone words or those rooted in indigenous vocabulary. On'yomi, by contrast, reflects Japanese-adapted Chinese pronunciations of kanji, typically used in compound (multi-kanji) words.

(5) 手紙 'letter'
Japanese [tegami]; kun'yomi, therefore not selected
学校 'school'
Japanese [gakːoː]; on'yomi, therefore selected

The word's definition does not need to be identical across languages but has to be conceptually related.

While it is not required that the definitions of words be identical across the two languages, choosing specifically conceptually related words ensures that the core meaning remains similar enough to warrant comparative analysis.

(6) Chinese: 勉强 'reluctant', 'to manage (to do) after a difficult struggle' [mjɛn tɕʰjɑŋ]
Japanese: 勉強 'to study' [beɴkjoː]

Words were selected based on these criteria to maximize consistency and comparability between the linguistic data collected from Shanghainese and Japanese speakers.

2.3. Data Collection

Participants were presented with the total word list of 379 items (Chinese characters or kanji) and instructed to read each word aloud two to three times to ensure consistency and accuracy. Audio recordings of these readings were obtained for further analysis.

For Shanghainese speakers, participants were instructed to pronounce the words in their natural dialect, reflecting their authentic speech patterns. Additionally, they were asked to comment on whether each word was commonly used and if there were alternative expressions that felt more natural in their dialect. For Japanese speakers, participants were asked to pronounce the words using the on'yomi (Chinese-origin) reading as much as possible. If a word came up that failed to meet the requirement, they were given the choice to pronounce it or to skip it; in total, 2.6% of words were affected. They were also asked whether each selected Sino-

Japanese word was commonly used in modern Japanese or in their own experience, for specific words they had a perceived difficult time pronouncing.

Throughout each session, pronunciations were clarified as needed to ensure accurate data collection. Obtained audio recordings provided a basis for the following phonetic analysis. Subsequently, participants engaged in an open discussion and short interview about the usage of the vocabulary items on a whole. These interviews aimed to qualitatively capture the perceived naturalness of words that, while common in the anchor language, may not be commonly used in the counterpart languages.

3. Exploratory Data Analysis

To identify sound correspondences between Mandarin, Shanghainese, and Japanese on'yomi readings, the dataset was systematically analyzed with attention to specific phonological positions and tendencies. Words were first sorted by word-initial consonants for the Mandarin pronunciations; each initial segment (e.g., [p], [tɕ], [x]) was analyzed against each together to observe and denote patterns in the Shanghainese and Japanese counterparts.

In addition to organizing by word-initial consonants, words were also sorted by word-final segments, particularly for nasal endings such as [n] or [ŋ], as well as word-initial vowel correspondences (e.g., [ɤ], [a], [o]).

3.1. Voicing of stops in Shanghainese and Japanese

Mandarin lacks contrastive voicing in plosives, distinguishing them by aspiration. However, in both Shanghainese and Japanese, voicing of the word-initial plosive is often retained. For example, words beginning with the voiceless bilabial plosive [p] often contain voiced counterparts [b] in both languages. Some examples of this are:

(1) 便利 'convenient', 'convenience'
Mandarin [pjɛn li] ↔ Shanghainese [bi li] ↔ Japanese [beɴɾi]
(2) 病人 'patient'
Mandarin [pɪŋ ʐən] ↔ Shanghainese [biŋ niŋ] ↔ Japanese [bjoːniɴ]
(3) 葡萄 'grape'
Mandarin [pʰu tʰɑʊ] ↔ Shanghainese [bu dɔ] ↔ Japanese [bɯdoː]

This can also be seen in case of word-initial alveolar plosives as well:

(4) 电话 'telephone'
Mandarin [tjɛn xwa] ↔ Shanghainese [di wu] ↔ Japanese [deɴwa]
(5) 动物 'animal'
Mandarin [tʊŋ u] ↔ Shanghainese [dʊŋ və] ↔ Japanese [doːbɯtsɯ]

(6) 弹性 ‘elasticity’
Mandarin [tʰan ɕɪŋ] ↔ Shanghainese [de ɕɪŋ] ↔ Japanese [daɴseː]

Table 3.1. Percentage of voicing in bilabial and alveolar plosives

Mandarin consonant	Voicing count in Shanghainese	% voiced in Shanghainese	Voicing count in Japanese	% voiced in Japanese
[p]	5	31.3%	4	25%
[pʰ]	9	60%	4	26.7%
[t]	12	60%	6	30%
[tʰ]	6	31.6%	3	15.8%

Table 3.1 shows the percentage of voiced consonants for [p], [pʰ], [t], [tʰ], out of 16, 15, 19, and 20 Mandarin controls respectfully. While both languages displayed cases of voicing, all four word-initial consonants had a higher percentage of having voiced equivalents in Shanghainese over Japanese. The largest difference between the percent voiced in Shanghainese to the percent voiced in Japanese is 33.3% for aspirated voiceless bilabial [pʰ].

Although voicing of counterparts to voiceless Mandarin consonants occurs in both Shanghainese and Japanese, this phenomenon of voicing stems from different phonological developments. In the Shanghainese dialect, the voiced plosive is retained in specific circumstances with regards to tone (Kang, 2023). Traditionally, Shanghainese and related dialects feature a 5-tone system with a primary two-way distinction between yin-yang tones (Chen and Gussenhoven, 2015). Voiceless initials correlate with yin tones (higher, rising pitch), while voiced initials correlate with yang tones (lower, declining pitch).

Words with the yang tone tend to retain voicing.

(7) 本质 ‘essence’, ‘intrinsicality’
Mandarin [pən ʈʂɚ̌] ↔ Shanghainese [bəŋ tsə]
(8) 特别 ‘special’
Mandarin [tʰɤ pjɛ] ↔ Shanghainese [dʌ pɛ]

This tonal-voicing correspondence may have been a historical retention from Middle Chinese, where voiced initials typically appeared in syllables with lowering pitch.

On the other hand, as a non-tonal language, Japanese words may retain voicing as a result of pitch accent instead.

(9) 瞥見 ‘to catch a glimpse of’
Mandarin [pʰjɛ tɕjɛn] ↔ Japanese [bekːeɴ]

In this example, Japanese 瞥見 has an initially low pitch accent. A flat or low pitch often becomes voiced word-initially, while an initially high or dropping pitch often becomes voiceless word-initially, e.g. 勉強 ‘study’ [beɴkjoː] vs. 発表 ‘present’ [hapːjoː]. In this example, the former contains a low-high pitch accent, while the latter contains a high-low pitch accent. Historically, Old Japanese differentiated between [b] and the archaic [p] via this pitch contrast; [p] eventually shifted to the modern [h] or [ɸ], later evolving [p] → [ɸ] → [h] into standard Japanese phonology (Backley and Nasukawa, 2016). Ultimately, the presence of voiced counterparts hints towards the parallel that both Shanghainese tone and Japanese pitch accent serve as prosodic systems that condition voicing, a functional similarity despite structural differences.

3.2. Devoicing of word-initial nasals in Japanese

For words beginning with [m], while Shanghainese often retained the bilabial nasal word-initially:

(10) 买卖 ‘buying and selling’
Mandarin [maɪ maɪ] ↔ Shanghainese [ma ma]
(11) 美妙 ‘wonderful’, ‘beautiful’
Mandarin [meɪ mjɑʊ] ↔ Shanghainese [meɪ mjɔ]
In Japanese, the word-initial [m] denasalized, shifting to [b]:
(12) 売買 ‘selling and buying’
Japanese [baibai]
(13) 美妙 ‘beautiful’
Japanese [bimjoː]

This can be seen with cases with word-initial [n] as well, devoicing to [d]:

(14) 泥土 ‘soil’, ‘earth’
Mandarin [ni tʰu] ↔ Shanghainese [ni tʰu] ↔ Japanese [deːdo]
(15) 奴隶 ‘slave’
Mandarin [nu li] ↔ Shanghainese [nu li] ↔ Japanese [doɾeː]
(16) 暖气 ‘heating’
Mandarin [nwan tɕʰi] ↔ Shanghainese [nø tɕʰi] ↔ Japanese [daɴki]

Japanese denasalization of Sino-Japanese words that started with a nasal occurred as a result of borrowings from Middle Chinese being adapted to fit Japanese phonotactics. Middle Chinese had 5 cases of nasal onset, including the bilabial [m] but also [n], [ɲ], [ɳ], [ŋ]. In many cases, for

words borrowed from Middle Chinese, Old Japanese replaced a word-initial nasal consonant with a plosive counterpart (Heffernan, 2000).

(17) 逆 ‘reverse direction’
Middle Chinese *ŋjæk → Mandarin [ni]
Old Japanese *gjɑkɯ → Japanese [gjakɯ]
(18) 日 ‘day’
Middle Chinese *ɲit → Mandarin [ʐə˞]
Old Japanese *ʤitsɯ → Japanese [dʑitsɯ]

According to Heffernan’s work, Old Japanese mostly replaced nasal consonants other than the onset [m] or [n] with native consonants in borrowed words from Middle Chinese, but this phenomenon did not solely occur for retroflex, palatal, and velar nasals, as evident with the above examples. Ultimately, whereas Shanghainese largely preserves word-initial nasals from Mandarin and Middle Chinese, Japanese was more likely to replace nasal onsets with denasalized plosive counterparts, supporting the claim that Japanese historically lacked voiced nasal-stop contrasts in some positions.

3.3. Deaffrication of affricates

While alveolar and palatal fricatives are common in Japanese, the natural phonology of Japanese does not include [ts] word-initially, with the exception of つ (pronounced [tsɯ]). Thus, Japanese tends to soften affricates to fricatives in order to ease articulation. Word-initial affricates like [ts] are relatively marked and often neutralize to simple fricatives (Maddieson, 1984). Japanese conforms to this tendency by replacing [ts] in the initial position with fricatives or plosives, reducing articulatory complexity compared with Chinese (Künzel, 1998).

Deaffrication of [ts] in Japanese:

(19) 組織 ‘organization’
Mandarin [tsu ʈʂə˞] ↔ Japanese [soɕiki]
(20) 参加 ‘participate’
Mandarin [tsʰan tɕja] ↔ Japanese [san ka]

Japanese listeners show difficulty distinguishing [ts] from [s] in word-initial position, leading to strengthening of [s] over [ts] (Künzel, 1998). The lack of [ts] other than the pronunciation of つ indicates a positional constraint on affricates at the word edge. Thus, Japanese sees deaffrication in its counterparts for most Mandarin words that start with [ts].

This phenomenon of deaffrication also occurs in Shanghainese, as while [ts] is within Shanghainese phonotactic constraints, some counterparts to Mandarin affricates simplify to

fricatives as well. Preliminary lexical data shows that greater than 70% of deaffricated Shanghainese cognates correspond to commonly used terms (e.g. colloquial speech such as 贼 [zə] “thief”), indicating that high usage may promote this phonetic reduction.

(21) 贼 ‘thief’
Mandarin [tsɛɪ] ↔ Shanghainese [zə] ↔ Japanese [zokɯ]
(22) 存在 ‘exist’
Mandarin [tsʰuən tsaɪ] ↔ Shanghainese [zən ze] ↔ Japanese [soɴzai]

This also occasionally occurs with retroflex affricates present in Mandarin, [t͡ʂ] and [t͡ʂʰ].

(23) 杂志 ‘magazine’
Mandarin [tsa ʈʂɚ] ↔ Shanghainese [sa ts] ↔ Japanese [zaɕːi]

In this case, Shanghainese undergoes deaffrication by changing to voiceless alveolar fricative [s], whereas Japanese adapts to voiced alveolar fricative [z]. Japanese has three primary deaffrication strategies: correlating to plosives [t], [d], to alveolar fricatives [s], [z], or to palatal fricative [ɕ].

Case 1: [ʈʂ] ↔ [t], [d] (5.9% of all sample words beginning with [ʈʂ])

(24) 宅地 ‘residential land’
Mandarin [ʈʂaɪ ti] ↔ Japanese [takɯtɕi]
(25) 伝説 ‘legend’
Mandarin [ʈʂʰwan ʂuɔ] ↔ Japanese [deɴsetsɯ]

Case 2: [ts], [ʈʂ] ↔ [s], [z] (79.3% for initial [ts] words, 29.4% for initial [ʈʂ] words)

(26) 責任 ‘responsibility’
Mandarin [tsɤ ʐən] ↔ Japanese [sekiniɴ]
(27) 戦争 ‘war’
Mandarin [ʈʂan ʈʂɤŋ] ↔ Japanese [seɴsoː]
(28) 増加 ‘increase’
Mandarin [tsɤŋ tɕja] ↔ [tsɤŋ ka] ↔ [zoːka]

Case 3: [ts], [ʈʂ] ↔ [ɕ] (6.9% for initial [ts] words, 23.5% for initial [ʈʂ] words)

(29) 宗教 ‘religion’
Mandarin [tsʊŋ tɕjɑʊ] ↔ Japanese [ɕɯːkjoː]

(30) 招待 'reception', 'invitation'
Mandarin [ʈʂɑʊ taɪ] ↔ Japanese [ɕoːtai]

For Mandarin [tɕ] and [tɕʰ], since Japanese also naturally contains alveolar-palatal consonants in its sound inventory, it it expected for Japanese to deaffricate primarily with [ɕ]. Unexpectedly, Japanese deaffricates to [k] or [g] in most cases. In other examples, [tɕ] and [tɕʰ] correlate to [s] or [z].

Case 1: [tɕ], [tɕʰ] ↔ [k], [g] (69.2%)

(31) 加減 'addition and subtraction'
Mandarin [tɕja tɕjɛn] ↔ Japanese [kageɴ]
(32) 奇跡 'miracle'
Mandarin [tɕʰi tɕi] ↔ Japanese [kiseki]
(33) 確認 'confirm'
Mandarin [tɕʰɥœ ʐən] ↔ Japanese [kakɯniɴ]

Case 2: [tɕ], [tɕʰ] ↔ [s], [z] (19.3%)

(34) 切断 'cut off'
Mandarin [tɕʰjɛ twan] ↔ Japanese [setsɯdaɴ]
(35) 全部 'all', 'total'
Mandarin [tɕʰɥœn pu] ↔ Japanese [zeɴbɯ]

Case 3: [tɕ], [tɕʰ] ↔ [ɕ] (11.5%)

(36) 将来 'future'
Mandarin [tɕjɑŋ laɪ] ↔ [ɕoːrai]
(37) 酒精 'alcohol'
Mandarin [tɕjoʊ tɕɪŋ] ↔ Japanese [ɕɯseː]

Refer to Table 3.3 for the proportions of Japanese correspondences to each affricate.

Figure 3.3. Distribution of Japanese correlates to Mandarin affricates

Affricate	Correlations	% of total per consonant
[ts], [tsʰ]	[ts], [tsʰ] ↔ [k] [ts], [tsʰ] ↔ [s], [z]	6.9% 79.3%

(Total: 29)	[ts], [tsʰ] ↔ [ɕ]	6.9%
[tʂ], [tʂʰ] (Total: 34)	[tʂ], [tʂʰ] ↔ [t], [d] [tʂ], [tʂʰ] ↔ [s] [tʂ], [tʂʰ] ↔ [ɕ]	5.9% 29.4% 23.5%
[tɕ], [tɕʰ] (Total: 26)	[ts], [tsʰ] ↔ [k], [g] [ts], [tsʰ] ↔ [s], [z] [ts], [tsʰ] ↔ [ɕ]	69.2% 19.3% 11.5%

3.4. Retroflex fricatives (zh, ch, sh, r)

Mandarin, having heavy influences from the northern Chinese, particularly being based on dialects spoken in Beijing, contain retroflex fricatives [t͡ʂ], [t͡ʂʰ], [ʂ], and [ʐ]. However, in Shanghainese and Japanese, retroflex consonants do not exist. Retroflex sounds are not part of the native Japanese sound inventory, and Shanghainese, as part of Wu Chinese dialects, can be grouped with Southern Chinese dialects, which lack dental-retroflex fricative contrast; as a result, speakers of these dialects often manifest retroflex sounds as alveolar fricatives, e.g., /ʂa/ may be realized as [sa] (Wang and Deng, 2022).

To adapt sounds in each respective language, Shanghainese and Japanese use different strategies that conform with phonotactic constraints. Because neither Shanghainese nor Japanese possess a phonemic retroflex series, all counterparts of Mandarin retroflex fricatives undergo adaptation to native segments. The Shanghainese strategy mostly consists of uniform alveolarization, whereas Japanese outcomes distribute among palato-alveolar targets in line with different conditioned environments.

Some examples in which Shanghainese undergoes alveolarization for Mandarin retroflex sounds are:

Case 1: [tʂ] → [ts]

(38) 准备 ‘prepare’
Mandarin [tʂuən peɪ] ↔ Shanghainese [tsən pe]
(39) 祝福 ‘blessing’
Mandarin [tʂu fu] ↔ Shanghainese [tsɔ fɔ]
(40) 中国 ‘China’
Mandarin [tʂʊŋ kuɔ] ↔ Shanghainese [tsʊŋ kɔ]

Case 2: [tʂʰ] → [tsʰ]

(41) 超越 ‘surpass’
Mandarin [ʈʂʰɑʊ ɥœ] ↔ Shanghainese [tsʰɒ ɥœ]
(42) 充电 ‘charging’
Mandarin [ʈʂʰʊŋ tjɛn] ↔ Shanghainese [tsʰʊŋ ti]

Case 3: [ʂ] → [s]

(43) 少年 ‘youth’
Mandarin [ʂɑʊ njɛn] ↔ Shanghainese [sɒ ni]
(44) 瞬间 ‘instant’
Mandarin [ʂuən tɕjɛn] ↔ Shanghainese [sən tɕi]

In Shanghainese, retroflex [ʈʂ] consistently maps to the alveolar affricate [ts] before front and central vowels ([u], [ɔ], [ʊ]), suggesting a preservation of the native stop and affricate sequence instead of the retroflex tongue position. This pattern displays how while manner contrasts are retained, Shanghainese uniformly resolves the majority of Mandarin retroflexes through alveolarization.

On the other hand, Japanese often undergoes palatalization, in which Japanese reflexes of [ʈʂ] split among [dʑ], [tɕ], and [ɕ]:

Case 1: [ʈʂ] → [dʑ tɕ ɕ]

(45) 準備 ‘prepare’
Japanese [dʑɯɴbi]
(46) 祝福 ‘blessing’
Japanese [ɕɯkɯfɯkɯ]
(47) 中国 ‘China’
Japanese [tɕɯːgokɯ]

Case 2: [ʈʂʰ] → [dʑ tɕ]

(48) 超越 ‘surpass’
Japanese [tɕoːetsɯ]
(49) 充電 ‘charging’
Japanese [dʑɯːdeɴ]

Case 3: [ʂ] → [ɕ]

(50) 少年 ‘youth’
Japanese [ɕoːneɴ]
(51) 瞬間 ‘instant’
Japanese [ɕɯɴkaɴ]

Cases in which Japanese maps Mandarin retroflex sounds onto [ts] are rare, but they do occur:

(52) 墜落 ‘fall’
Mandarin [ʈʂweɪ luɔ] ↔ Japanese [tsɯiɾakɯ]

Japanese characteristically contains alveolar-palatal consonants [ɕ], [tɕ], and [dʑ] in its sound inventory, thus it becomes natural for the Japanese counterpart of many word-initial retroflex consonants to be a palatal adaption. No noticeable pattern can differentiate whether Japanese prefers either [ɕ], [tɕ], or [dʑ], but neither of the three may follow [e] in any native correspondents to Sino-Japanese words. Thus, in cases in which the corresponding Japanese vowel following the word-initial consonant is [e], Japanese adapts the word using the native [s]:

(53) 政治 ‘politics’
Mandarin [ʈʂɤŋ ʈʂə˧] ↔ Japanese [seːʑi]

In some cases, both Shanghainese and Japanese rely on alveolarization:

(54) 生物 ‘organism’
Mandarin [ʂɤŋ u] ↔ Shanghainese [sɤŋ və] ↔ Japanese [seːbɯtsɯ]
(55) 说明 ‘explanation’
Mandarin [ʂuɔ mɪŋ] ↔ Shanghainese [sɔ mɪŋ] ↔ Japanese [setsɯmeː]

This distribution suggests that while Japanese has access to multiple native alveolo-palatal consonants for adapting Mandarin retroflexes, phonotactic restrictions still constrain their use, e.g., where [ɕ], [tɕ], or [dʑ] precede the vowel [e] as mentioned previously. Contrasted with Shanghainese, which evenly adapts [ʈʂ], [ʈʂʰ], [ʂ] to [ts], [tsʰ], [s], the resulting consonant of Japanese palatalization of retroflex sounds is still context sensitive. Ultimately, both Shanghainese and Japanese shift retroflex sounds forward in place of articulation, resulting in phonetic convergences sometimes, except Shanghainese adapts the sound with [ts], [tsʰ], [s] while Japanese adapts primarily with [ɕ], [tɕ], [dʑ], and [s].

While the majority of Mandarin retroflexes, [ʈʂ], [ʈʂʰ], [ʂ], are resolved through alveolarization or palatalization, the reflexes of [ʐ] exhibit a distinct and less common pathway. In both Shanghainese and Japanese, [ʐ] occasionally corresponds to [n], pointing to a historically present nasalization pattern rather than a place substitution.

[ʐ] corresponding to [n] in both languages:

(56) 热带 ‘tropical’
Mandarin [ʐɣ taɪ] ↔ Shanghainese [njɛ ta] ↔ Japanese [net:ai]
(57) 软化 ‘to soften’
Mandarin [ʐwan xwa] ↔ Shanghainese [nø xu] ↔ Japanese [naɴka]

This suggests a phonetic weakening of the retroflex fricative, aligning with a more nasal articulation. This could be caused by the close proximity of the voiced retroflex fricative-approximant, to the voiced alveolar nasal. Early sinologists[2] treated the Mandarin “r” as a rhotic reflex of *ɲ, and more recent reconstructions note the prenasalization and [nʑ]/[ɲʑ] stage.[3] Chronologically, the palatal nasal was still present in Early Middle Chinese during the Sui–Tang dynasties, but became denasalized in Late Middle Chinese during the 10th through 12th centuries as documented by Tibetan/Uyghur transcriptions[4], and by Early Mandarin during Yuan–Ming the sound had become a fully retroflex fricative (Zeng, 2022). Shanghainese and Japanese instead preserved the nasal onset derived from Middle Chinese. While Mandarin lost the nasal onset for [ʐ], the Shanghainese counterpart and Japanese adaptation diverged from Mandarin phonological development, preferring obstruents over nasals.

3.5. Word-initial vowel correlates

To examine vowel patterns in Shanghainese and Japanese, words with word-initial vowels were selected to demonstrate vowel correspondences. Standard monophthongs in Mandarin include [a], [ɤ], [ə], [i], [u], [y] (the approximants [j], [w], and [ɥ] replace [i], [u], [y] when applicable). The following sampled monophthong and diphthong correlations are displayed in the cart below.

Figure 3.5. Correlates to Mandarin control vowels

Vowel	Correlations (ZH ↔ SH ↔ JP)	Count
a	[a] ↔ [a] ↔ [a] [aɪ] ↔ [e] ↔ [ai] [an] ↔ [ø] ↔ [aɴ]	3
ɑ	[ɑŋ] ↔ [ŋɑŋ] ↔ [koː] [ɑʊ] ↔ [ɒ] ↔ [oː]	2
ɤ	[ɤ] ↔ [ɑ] ↔ [a]	1

[2] Todo, 1978, and Pulleyblank, 1984, 1991
[3] Reconstruction of [nʑ] by Coblin, 1994
[4] Reconstruction of [ɲʑ] by Miyake, 2003, based on Tibetan/Uyghur transcriptions of Late Middle Chinese (Luo, 1933 and Barat, n.d.)

ə	[ən] ↔ [əŋ] ↔ [oɴ]	1
i (j)	[i] ↔ [i] ↔ [i] [ja] ↔ [a] ↔ [ga] [jɛn] ↔ [i] ↔ [eɴ] [jɑŋ] ↔ [jaŋ] ↔ [joː] [jin] ↔ [jiŋ] ↔ [oɴ] [jiŋ] ↔ [jiŋ] ↔ [eː] [jʊŋ] ↔ [joŋ] ↔ [eː] [joʊ] ↔ [jɤ] ↔ [jɯː]	8
o, ɔ	[oʊ] ↔ [ɤɯ] ↔ [oː] [ɔ] ↔ [ɒ] ↔ [okɯ]	2
y (ɥ)	[y] ↔ [n] ↔ [gjo] [ɥœn] ↔ [eɴ] [ɥœ] ↔ [ɥœ] ↔ [ge] [yn] ↔ [yn] ↔ [ɯɴ]	4
u (w)	[wu] ↔ [və] ↔ [bɯtsɯ] [wa] ↔ [wa] ↔ [ga] [waɪ] ↔ [ŋa] ↔ [gai] [wan] ↔ [ø] ↔ [kaɴ] [wɑŋ] ↔ [wɑŋ] ↔ [oː] [weɪ] ↔ [mi] ↔ [mi] [wən] ↔ [vəŋ] ↔ [bɯɴ] [wɔ] ↔ [ŋu] ↔ [ga] [wʊŋ] ↔ [wɤŋ] ↔ [oː]	9

An inspection of Table 3.5 reveals that, beyond the one-to-one vowel correspondences present (e.g. [a] ↔ [a] ↔ [a]), vowels can be clustered into groups that share similar articulatory or acoustic features across the three languages. These three groups include: (a) low front and diphthongal vowels, (b) high front vowels, and (c) rounded back vowels.

For low front and diphthongs, the [a] series exhibits uniform maintenance of a low front target in all three languages ([a] in Chinese, Shanghainese, and Japanese), but Mandarin diphthongs [aɪ] and [an] diverge in Shanghainese ([e], [ø]) while preserving an off-glide in Japanese ([ai], [aɴ]). This suggests that Shanghainese has front-raising and unrounding tendencies in diphthongs, whereas Japanese retains a lower onset followed by a nasal or glide.

For high front vowels (the [i] series with palatal glide [j] included), Mandarin's glide-onset syllables ([ja], [jɛn], [jɑŋ], etc.) map to both cases where [j] is dropped and [j] is preserved. For instance, Mandarin [jɛn] correlates with Japanese [eɴ], and Mandarin [joʊ] correlates with Shanghainese [jɤ] vs. Japanese [jɯː]. A large majority of Japanese counterparts (62.5%) drop the glide-onset [j], replacing it with vowel onsets, and in one case, [g], while Shanghainese tends to keep [j] in the onset (62.5%).

However, for cases where [j] is preserved, the glide [j] is not only an epenthetic pronunciation but signals historical palatalization inherited from Middle Chinese palatal initials. In Shanghainese, word-initial [j] frequently interchanges with high front vowels resulting in [jin] or [jʊŋ], whereas Japanese often realizes sequences as lengthened monophthongs such as [eː] or [jɯː].

For the rounded back vowels, the [o]/[ɔ] and [u]/[w] series demonstrate greater variability across languages, with Shanghainese favoring velar-rounded onsets (e.g. [wu] ↔ [və]) and Japanese adapting to [a], [o], and [ɯ]. One interesting observation is the correspondences to Mandarin word-initial labial-velar approximant [w]. Sometimes, [w] is simplified to velars in Shanghainese and Japanese. In the following example, [w] is realized as velar nasal [ŋ] in Shanghainese but velar stop [g] in Japanese.

(58) 外国人 'foreigner', 'a person of foreign origin', 'outsider'
Mandarin [waɪ kuɔ ʐən] ↔ Shanghainese [ŋa ko ɲin] ↔ Japanese [gaikokɯʑiɴ]
(59) 我 'I', 'me'
Mandarin [wɔ] ↔ Shanghainese [ŋu], [ŋɔ] ↔ Japanese [ga]

In example (58), Shanghainese employs a nasal onset in [ŋa] while Japanese drops the nasalization velar plosive in [gai], again indicating the process of denasalization from Middle Chinese.[5]

3.6. Word-final [n], [ŋ] correlates

Other than variants to the moraic nasal consonant ん, Japanese drops all word-final velar nasals [ŋ] originally in Chinese, converting it to [ɯ] or [i] (usually realized as vowel lengthener [ː] to [o]/[ɯ], [e] respectively). This pattern can be demonstrated using the kanji 生, i.e. 先生, is pronounced *shēng* in Mandarin, but is pronounced *sei* in Japanese. Other examples of this phenomenon include:

Case 1: -[ŋ] ↔ [ɯ]

(60) 将来 'future'
Mandarin [tɕjɑŋ laɪ] ↔ Japanese [ɕoːɾai]
(61) 風味 'flavor'
Mandarin [fɤŋ weɪ] ↔ Japanese [fɯːmi]
(62) 皇帝 'emperor'
Mandarin [xwɑŋ ti] ↔ Japanese [koːtei]

[5] See section 3.2 as discussed previously.

Case 2: -[ŋ] ↔ [i]

(63) 経済 ‘economy’
Mandarin [tɕɪŋ tɕi] ↔ Japanese [keːzai]
(64) 糖尿病 ‘diabetes’
Mandarin [tʰɑŋ njɑʊ pɪŋ] ↔ Japanese [toːnjoːbjoː]
(65) 成功 ‘success’
Mandarin [ʈʂʰɤŋ kʊŋ] ↔ Japanese [seːkoː]

This is confirmed by previous work on Japanese readings of Sino-Japanese. One previous phonological study confirms that every Late Middle Chinese -[ŋ] is adapted to a vowel, /ũ/ or /ĩ/ (realized as [ɯ] or [i]), whereas generally, moraic nasal ん is used for the coda only when the Middle Chinese coda was -m or -n (Zeng, 2023). Thus, on the other hand, while [ŋ] denasalizes, correlates to codas to Mandarin [n] are instead kept (nativized to uvular nasal [ɴ]) in Japanese. For example, for the Sino-Japanese word 民主 (*mín zhǔ* in Chinese):

(66) 民主 ‘democracy’
Mandarin [mɪn ʈʂu] ↔ Japanese [miɴɕɯ]

Evidently, the nasal [n] is preserved as [ɴ] in the Japanese correspondent for its on’yomi reading of the character 民. While Middle Chinese -ŋ appears as the epenthetic /ũ/ or /ĩ/ in Japanese, the duality of -ŋ’s correlates can directly reflect the quality of the preceding vowel, e.g., back versus front vowels.

For Shanghainese, instead of reducing [ŋ] like in Japanese, Shanghainese often reduces vowels that occur before [n].

Case 1: -[jɛn] ending

(67) 天气 ‘weather’
Mandarin [tʰjɛn tɕʰi] ↔ Shanghainese [tʰi tɕʰi]
(68) 电话 ‘telephone’
Mandarin [tjɛn xwa] ↔ Shanghainese [di wu]

Case 2: -[wan] ending

(69) 暖气 ‘warm air’, ‘heating’
Mandarin [nwan tɕʰi] ↔ Shanghainese [nø tɕʰi]
(70) 完成 ‘completion’
Mandarin [wan ʈʂʰɤŋ] ↔ Shanghainese [ø zəŋ]

Case 3: -[an] ending

(71) 感情 ‘emotion’
Mandarin [kan tɕʰɪŋ] ↔ Shanghainese [kø tɕʰɪŋ]
(72) 安全 ‘safety’
Mandarin [an tɕʰɥœn] ↔ Shanghainese [ɛ tɕy]

Unlike in Japanese, [ŋ] endings are kept in Shanghainese, as [n]-[ŋ] contrasts do not exist for word-final positions.

(73) 想象 ‘imagine’
Mandarin [ɕjɑŋ ɕjɑŋ] ↔ Shanghainese [ɕjɑŋ ʑɑŋ]

In summary, the treatment of word-final nasals in Japanese and Shanghainese reflects differing coda constraints: Japanese uniformly resolves [ŋ] through vowel epenthesis, which often mirrors the vowel’s quality, while preserving [n] as a moraic nasal. By contrast, Shanghainese sometimes reduces the final alveolar nasal [n] altogether, but instead retains the final velar nasal [ŋ]. Japanese adaptations away from Mandarin [ŋ] suggest a strong preference for preserving the ease of understanding individual speech sounds at the expense of coda structure, as the vowel structure is monophthongized. On the other hand, Shanghainese displays a broader tendency toward reducing the number of syllables and centralizing its vowels, with vowels like [a] shifting to [ø] in certain circumstances. While Japanese seem to treat borrowing as a process of structural accommodation, Shanghainese treats adapting sounds into native phonemic patterns as a process of systemic integration. Both languages undergo monophthongization and simplification of vowel-coda structure. Despite the similarity in that both languages modify nasal endings, ultimately the difference between Shanghainese and Japanese in its adaptation of Mandarin codas [n] and [ŋ] is between maintaining phonological structure and segmental clarity.

3.8. Characteristics with phonetic consistency

Below is a list of correlations that consistently occur between Mandarin, Shanghainese, and Japanese (a consistent correlation is a sound mapping that occurs in >50% of cases).

The labiodental [f] maps onto Japanese as [h] (variants of [h] realize as [ɸ] before [ɯ] and [ç] before [i]) in majority cases (77.8%). In some cases, [f] maps to [b] (22.2%).

(74) 発明 ‘invention’
Mandarin [fa mɪŋ] ↔ Japanese [hatsɯmeː]

(75) 反応 ‘reaction’
Mandarin [fan ɪŋ] ↔ Japanese [haɴnoː]
(76) 方法 ‘method’
Mandarin [fɑŋ fa] ↔ Japanese [hoːhoː]
(77) 風味 ‘flavor’
Mandarin [fɤŋ weɪ] ↔ [ɸɯːmi]
(78) 飛翔 ‘flying’
Mandarin [feɪ ɕjɑŋ] ↔ [çiɕjoː]
(79) 仏教 ‘Buddhism’
Mandarin [fɔ tɕjɑʊ] ↔ [bɯkːjoː]

The alveolar lateral approximant [l] uniformly appears as [ɾ] in Japanese (100%), since Japanese phonology lacks [l].

(80) 来年 ‘next year’
Mandarin [laɪ njɛn] ↔ Japanese [ɾaineɴ]
(81) 礼儀 ‘etiquette’
Mandarin [li i] ↔ Japanese [ɾeːgi]
(82) 恋愛 ‘romance,’ ‘love’
Mandarin [ljɛn aɪ] ↔ Japanese [ɾeɴai]
(83) 料理 ‘cuisine’
Mandarin [ljɑʊ li] ↔ Japanese [ɾjoːɾi]
(84) 留学生 ‘international student’
Mandarin [ljoʊ ɕɥœ ʂɤŋ] ↔ Japanese [ɾjɯːgakɯseː]

The Mandarin velar fricative [x] manifests into Japanese as velar [k] near uniformly (94.4%), with the exception of 和平 ‘peace’, pronounced [waheː].

(85) 漢字 ‘kanji’
Mandarin [xan ts] ↔ Japanese [kaɴdʑi]
(86) 航空 ‘aviation’
Mandarin [xɑŋ kʰʊŋ] ↔ Japanese [koːkɯː]
(87) 懐疑 ‘suspicion’, ‘doubt’
Mandarin [xuaɪ i] ↔ Japanese [kaigi]
(88) 婚姻 ‘marriage’
Mandarin [xuən ɪn] ↔ Japanese [koɴiɴ]

Similarly, velar stops [k] and [kʰ] both correlate with /k/ in Japanese (100%), which is pronounced with mild aspiration. As Japanese lacks contrast by aspiration, its transcription is excluded.

(89) 公園 'park'
Mandarin [kʊŋ ɥœn] ↔ Japanese [koːeɴ]
(90) 国家 'country'
Mandarin [kuɔ tɕja] ↔ Japanese [kokːa]
(91) 可能 'possible'
Mandarin [kʰɤ nɤŋ] ↔ Japanese [kanoː]

For Shanghainese, plosives consistently remain the same or deaspirate, e.g. [p]/[pʰ] ↔ [p]. Unlike Mandarin, Shanghainese also contains a voicing contrast, allowing speakers to differentiate from a mechanism other than aspiration.[6]

(92) 他人 'others'
Mandarin [tʰa ʐən] ↔ Shanghainese [tʰa niŋ]
(93) 太阳 'sun'
Mandarin [tʰaɪ jɑŋ] ↔ Shanghainese [tʰa jɑŋ]
(94) 考虑 'consideration'
Mandarin [kʰɑʊ ly] ↔ Shanghainese [kʰɔ ly]
(95) 空气 'air'
Mandarin [kʰʊŋ tɕʰi] ↔ Shanghainese [kʰʊŋ tɕʰi]

The Mandarin [m] is universally retained in Shanghainese (100%).

(96) 矛盾 'contradiction'
Mandarin [mɑʊ tuən] ↔ Shanghainese [mɔ dəŋ]
(97) 米饭 'rice'
Mandarin [mi fan] ↔ Shanghainese [mi ve]
(98) 母语 'mother tongue'
Mandarin [mu y] ↔ Shanghainese [mu ny]

Figure 3.8. Percentage of majority consistent correlations

Consonant	Majority correlation	Language	% of Words with Initial [◌]	Other correlations

[6] Shanghainese plosives become voiced in the yang tone, unvoiced in the yin tone; see section 3.1 for more detail.

[m]	m ↔ m	Shanghainese	100%	N/A
[f]	f ↔ h	Japanese	77.8% (incl. variants to [h], [ɸ] and [ç])	f ↔ ɸ f ↔ ç f ↔ b
[l]	l ↔ r	Japanese	100%	N/A
[t] or [t^h]	t, t^h ↔ t	Shanghainese	53.8%	t, t^h ↔ d t, t^h ↔ t^h
[k] or [k^h]	k, k^h ↔ k	Japanese	100%	N/A
[x]	x ↔ k	Japanese	94.4%	x ↔ w

Table 3.8 depicts the overall consistency of these selected features that maintain the same correspondences for Japanese. Throughout the data, the most consistent correlations are the constant [m] which is stable across Mandarin and Shanghainese, [k] which had no significant change across Mandarin and Japanese, as well as [l] which always mapped to alveolar flap [ɾ] in Japanese. [x] is also highly consistent, adapting to Japanese [k] 94.4% of the time. For correspondences for [t] and/or [t^h], the contrast between aspirated and unaspirated stops and cut down at the number of instances [t^h] was maintained, but Shanghainese overall saw more occurrences of aspirated [t^h] over both the unaspirated [t] and the voiced [d]. Lastly, correlations to the Mandarin [f] had the most variation in Japanese due to the nature of the glottal fricative [h] changing in specific phonotactic positions, leading to [ɸ] and [ç] when preceding [ɯ] and [i] respectively; [f] also adapted to [b] in 22.2% of instances.

3.9. Overall percent similarity and uncertainty

Obataya's method (2019) in calculating phonetic resemblance between Mandarin and Japanese on'yomi in his study on phonetic cross-comprehension relied on averaging the perceived resemblance score reported by survey respondents. In contrast, the present study employs a structural approach by using Levenshtein distance applied to IPA transcriptions to quantify phonetic similarity. This yielded a basic phonetic resemblance of 29.14%, representing the average normalized similarity across all lexical pairs.

Based on self-reports of word familiarity (the reported count of words that were considered unknown, uncertain, or uncommonly used in daily speech), approximately 4.7% of words (18 of 379) were considered unknown or unfamiliar.[7] For Japanese speakers, additional words were reported to be uncertain due to certain selected words being archaic, rare, or not being in the Japanese lexicon at all. These words included: 卧室 'bedroom', 帮助 'help', 丢 'lose (a possession)', 诺许 'promise', 铿锵 'sonorous', 盔甲 'armor', 戳印 'to stamp'. Additionally, few

[7] As mentioned previously, a total of 2.6% of words were skipped by the consultants of one or more languages.

words only used kun'yomi pronunciations, such as 鸭肉 'duck meat' and 桑树 'mulberry tree', and thus were excluded for analysis. While this introduces a limitation in the word list's representativeness, the majority of items selected (95.3%) were adequate for phonetic elicitation and comparison.

Conclusively, the calculated phonetic resemblance (29.14%) is noticeably higher than Obataya's reported Mandarin-Japanese resemblance, ultimately supporting the hypothesis that Shanghainese, as a Wu dialect, retains greater phonological proximity to Japanese over Mandarin. This finding aligns with the historical influence of early Wu Chinese on the development of Japanese on'yomi pronunciations. Future improvements to dialectal analyses between Japanese and other Wu dialects can include limiting the scope of analysis to solely Wu derived vocabulary. While the scope of this study has been around generally selected words of Sino-Xenic origin, it is recommended more words are selected such that Japanese counterpart words are primarily designated the Go-on reading, which may hold more similarity with Wu Chinese phonology. As a whole, the analysis reinforces that parallels between Shanghainese and Japanese reflect not only historical phonetic inheritances, but independent adaptations shaped by each language's internal phonotactics as well.

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5. References

Backley, P., & Nasukawa, K. (2016). The origins of Japanese h from an element-based perspective. Papers in Historical Phonology, 1, 269–284. https://doi.org/10.2218/pihph.1.2016.1703

Chen, Y., & Gussenhoven, C. (2015). Shanghai Chinese. Journal of the International Phonetic Association, 45(3), 321–337. https://doi.org/10.1017/S0025100315000043

Heffernan, K. (2000a). An optimality theory study of nasals in Japanese (ROA-409). Rutgers Optimality Archive. https://doi.org/10.7282/T3T1019R

Heffernan, K. (2000b). The adaptation of nasal codas in Sino-Japanese. Studies in Language Sciences, 20(1), 123–143. https://www.jstage.jst.go.jp/article/sls/20/1/20_200102/_pdf

Heffernan, K. (2007). The role of phonemic contrast in the formation of Sino-Japanese. Journal of East Asian Linguistics, 16(1), 61–86. https://doi.org/10.1007/s10831-006-9007-8

Kang, Z. (2023). Comparing the discrimination of /b/-/p/-/pʰ/ among Shanghainese and Mandarin native speakers. Communications in Humanities Research, 2(1), 1–8. https://doi.org/10.54254/2753-7064/17/20230774

Künzel, H. (1998). Phonetic and phonological aspects of Japanese sibilants. Journal of Japanese Linguistics, 19, 45–70.

Maddieson, I. (1984). Patterns of sounds. Cambridge University Press. https://kcr.digitalwords.net/media/txt/maddieson.i%3A1984%3Asounds.pdf

Obataya, Y. (2019). A study of the mutual phonetic resemblance between Japanese and Chinese: Quantification of the difficulty of phonetic cross-comprehension. The Asian Conference on Education. https://papers.iafor.org/wp-content/uploads/papers/ace2019/ACE2019_54524.pdf

Oshima, H. (2022). 中世末に常用された漢字音 [Commonly used Sino-Japanese readings in late medieval Japan]. 日本語音声研究 (Journal of Japanese Phonetics), 21, 75–86. https://repository.dl.itc.u-tokyo.ac.jp/record/2013389/files/nihongo_21_08.pdf

Wang, F., Deng, D., & Wayland, R. (2022). Modeling retroflex fricative variation in accented Mandarin. The Journal of the Acoustical Society of America, 152(4_Supplement), A60. https://doi.org/10.1121/10.0015547

Ye, C. (2023). Vowels in Shanghai Chinese: Acoustic realization and modeling of their diachronic change with an LSTM network (MA thesis, University of Amsterdam). https://www.fon.hum.uva.nl/archive/2023/2023-MA-JasonYe.pdf

Zeng, H. (2022). Loanwords adaptation: A corpus study of Sino–Japanese kan-on initials. Studies in Language Sciences, 20(1), 9–31. https://doi.org/10.34609/sls.20.1_9

Zeng, H. (2023). The adaptation of Sino-Japanese kan-on (Doctoral dissertation, University of Oxford). Oxford University Research Archive. https://ora.ox.ac.uk/objects/uuid:e3ee7390-9ca2-48d8-873e-c7617565ec4d/files/d1831ck74f

Zhang, X. (2022). Phonological contrast in Sino-Japanese vocabulary: A comparative analysis [Doctoral dissertation, ProQuest].

https://www.proquest.com/openview/d151ab6b93ad47e3490fcce7c709d095/1?pq-origsite=gscholar&cbl=18750&diss=y

Zhou, Y. (2022). A contrastive analysis of Chinese and Japanese homographs and a study on the causes of differences. Journal of Literature and Art Studies. https://www.davidpublisher.com/Public/uploads/Contribute/6220283884e96.pdf

6. Appendix

This appendix contains two tables, one for each of Shanghainese and Japanese, indicating the total number of items for each Mandarin consonant that has a different word-initial counterpart.

6.1. Total count of word-initial consonant differences in Shanghainese

Consonant	Total in Mandarin	Δ	% Δ
p	15	5	33.3%
pʰ	15	10	66.7%
m	16	0	0.0%
f	9	2	22.2%
t	17	11	64.7%
tʰ	16	7	43.8%
n	17	1	5.9%
l	22	0	0.0%
k	19	0	0.0%
kʰ	17	1	5.9%
x	17	12	70.6%
tɕ (= tɕ)	12	1	8.3%
tɕʰ (= tɕʰ)	13	9	69.2%
ɕ	14	3	21.4%
ts	13	3	23.1%
tsʰ	12	3	25.0%
s	13	0	0.0%

ʈʂ	14	13	92.9%
ʈʂʰ	18	18	100.0%
ʂ	18	17	94.4%
ʐ	14	14	100.0%

6.2. Total count of word-initial consonant differences in Japanese

Consonant	Total	Δ	% Δ
p	15	15	100.0%
pʰ	15	15	100.0%
m	16	6	37.5%
f	9	7	77.8%
t	17	13	76.5%
tʰ	16	16	100.0%
n	17	9	52.9%
l	22	22	100.0%
k	19	0	0.0%
kʰ	17	17	100.0%
x	17	17	100.0%
tɕ (= tɕ)	12	12	100.0%
tɕʰ (= tɕʰ)	13	13	100.0%
ɕ	14	11	78.6%
ts	13	13	100.0%
tsʰ	12	12	100.0%
s	13	6	46.2%
ʈʂ	14	14	100.0%
ʈʂʰ	18	18	100.0%

ʂ	18	18	100.0%
ʐ	14	14	100.0%