

# Vowel epenthesis in Sino-Japanese *kan-on*

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## Abstract

Japanese had historical language contacts with varieties of the Chinese language in different periods, resulting in the large-scale intake of loanwords. Sino-Japanese loanwords reveal aspects of the phonology of the languages in contact that are not necessarily obvious from the native language data. This study focuses on Sino-Japanese *kan-on*, the Late Middle Chinese loanwords in Early Middle Japanese. It assembles a corpus based on the 2136 kanji from the official Jōyō-Kanji list and performs a statistical analysis to look at the factors that influence the quality of the epenthetic vowels in Sino-Japanese *kan-on*.

Epenthetic vowels are inserted into Sino-Japanese through the adaptation of codas. Late Middle Chinese, the source language, has six coda consonants [p t k m n ŋ]. Apart from [ŋ], the other five are also phonemes in Early Middle Japanese, the borrowing language. However, the only coda that is allowed in word-final position in Japanese is the bound moraic nasal /N/. The Chinese obstruent codas [p t k] are kept in the adapted forms with the insertion of an epenthetic vowel to avoid illegal structures. The Chinese nasal codas /m n/ are adapted as the Japanese bound moraic nasal /N/. The Chinese velar nasal /ŋ/ is adapted as nasalised vowels in Japanese. This study expands the meaning of the term ‘epenthetic vowel’ to include the adapted vowel forms resulted from Chinese /ŋ/. The epenthetic vowels inserted through the adaptation of Chinese codas are shown in Table 1. When the Chinese coda is the labial or coronal obstruent /p t/, the epenthetic vowel /u/ is inserted. When the Chinese coda is the dorsal obstruent /k/, the epenthetic vowel is /u/ in 210/265 cases and /i/ in 50/265 cases; when the Chinese coda is the dorsal nasal /ŋ/, it is adapted as /ũ/ in 334/447 cases and /ĩ/ in 113/447 cases.

The adaptation patterns for dorsal vs. non-dorsal codas is explained by vowel harmony in the Sino-Japanese literature (e.g. Ito & Mester, 2015). It is believed that Japanese avoids coda consonants by inserting the default vowel /u/ when the coda in the source form is labial or coronal. When the coda is dorsal, however, the epenthetic vowel agrees with the backness of the preceding vowel in the adapted Japanese form. If the preceding vowel is the front vowel /e/, the epenthetic vowel is the front high vowel /i/. However, this backness harmony does not apply uniformly to all front vowels. When the preceding in Japanese is the other front vowel /i/, the epenthetic vowel alternates between /i/ and /u/.

This vowel harmony account is based on a generalisation of the adapted Sino-Japanese forms. The present study looks at both the source forms and adapted forms. A distribution analysis of the codas in the source forms in the corpus (Table 2) shows that codas of all places of articulation occur after the nucleus vowel or

vowel sequence, whereas only dorsal codas occur after a glide. A distribution analysis of the glides (Table 3) shows that the glide /j/ only occurs in VVG contexts whereas the glide /w/ occurs in all VG nuclei and one VVG context. In all the instances where the glide is /w/ in the source form, the epenthetic vowel is /u/ in the adapted forms. However, this is not the case for the glide /j/. When /j/ follows the diphthongs /ia ya/ in the source forms, the epenthetic vowel is /i/ in the adapted forms. But when /j/ follows /a:/, the epenthetic vowel

is /i/ in 10.3% of the instances and /u/ in 89.7% of the instances. The glide in the Chinese input seems to have an influence on the quality of the epenthetic vowel, but it must not be the only influencing factor. As the glides occur in two nucleus structures of different length, the data is coded for the number of segments

Table 1 The epenthetic vowels in Sino-Japanese *kan-on*

Place of Chinese coda	Chinese coda	Number of cases	Sino-Japanese adapted forms	Number of cases
Labial	[p]	56	[pu]	56
Coronal	[t]	140	[tu]	138
Dorsal	[k]	265	[ku]	210
			[ki]	50
	[ŋ]	447	[ũ]	334
			[ĩ]	113

Table 2 The distribution of Chinese labial, coronal and dorsal codas

Chinese source forms			
Contexts before coda		Coda place	
(C)(G)V <sub>1</sub> #	(C)(G)V <sub>1</sub> V <sub>2</sub> #	Labial, Coronal, Dorsal	
(C)(G)V <sub>1</sub> G #	(C)(G)V <sub>1</sub> V <sub>2</sub> G #	Dorsal	

Table 3 The distribution of Chinese glide /j/ and /w/

Chinese source forms					Sino-Japanese <i>kan-on</i> forms
Structure	Nucleus		Number of segments	Number of distinct segments	Epenthetic vowel (V2)
	V/VV	G			
VG	/u/	/w/	2	2	/u/ (10/10 cases)
VG	/ə/	/w/	2	2	/u/ (69/69 cases)
VG	/i/	/w/	2	2	/u/ (40/40 cases)
VG	/y/	/w/	2	2	/u/ (57/57 cases)
VVG	/a:/	/w/	3	2	/u/ (33/33 cases)
VVG	/a:/	/j/	3	2	/u/ (52/58 cases) & /i/ (6/58 cases)
VVG	/ia/	/j/	3	3	/i/ (142/143 cases)
VVG	/ya/	/i/	3	3	/i/ (15/15 cases)

in the nucleus. Another consideration regards the length of the vowel. Although Japanese is weight sensitive, the only vowels that are allowed to occur as the second element in the nucleus are the high vowels /i u/. It is unclear how Japanese listeners perceived the Chinese acoustic input /a:/ as it is not a legal nucleus vowel sequence in Japanese. The data is therefore also coded for the number of distinct segments in the nucleus.

A classification analysis is performed to investigate the factors that influence the quality of the epenthetic vowel. The data was coded in the statistics package SPSS. The analysis employs the Chi-square automatic interaction detection (CHAID) technique (Uffmann, 2006). The dependent variable is the quality of the Sino-Japanese epenthetic vowel. The predictor variables include the Chinese vowel(s) VV (includes both single short vowel V<sub>1</sub> and vowel sequences V<sub>1</sub>V<sub>2</sub>), the glide G before the coda, the place of articulation of the coda, the number of segments in the nucleus and the number of distinct segments in the nucleus. The classification tree is shown in Figure 1. The number of distinct segments in the Chinese nuclei is the best predictor variable. The root node is divided into two maximally distinct subgroups. When the number of distinct segments in the nucleus is 3, the epenthetic vowel is /i/ (99.4%). When the number of distinct segments in the nucleus is < 3, the epenthetic vowel is /u/ in 99.1% of the data. The data in this group is further split into two subsets. When there is no glide or the glide is /w/, the epenthetic vowel is /u/ (99.9%). When the glide is /j/, the epenthetic vowel is /u/ in 89.7% of the cases and /i/ in 10.3% of the cases.

The statistics show that the quality of the epenthetic vowel is the result of the interaction between two factors: the number of distinct elements in the nucleus of the source form and the final glide. When Japanese listeners perceive less than three segments in the input nucleus, the default epenthetic vowel /u/ is inserted. The quality of the glide does not have an influence on the choice of epenthetic vowel. When the glide is /j/, the epenthetic vowel is still /u/ almost 90% of the time. When Japanese speakers perceive three segments in the input nucleus, a vowel harmony process is triggered and the epenthetic vowel match with the input glide. The epenthetic /i/ shares place of articulation with the input glide /j/. Due to the distribution of the glide /w/ in the Chinese source forms, there is no data of the structure /V<sub>1</sub>V<sub>2</sub>w/. According to the observed pattern for the glide /j/, we expect that when the source form has /V<sub>1</sub>V<sub>2</sub>w/, the epenthetic vowel would be /u/ which shares place of articulation with the input glide/w/ (Further studies are in progress to test this assumption). The result of the current study contributes to the literature on epenthetic vowel by introducing the influence of the complexity of the input nucleus in epenthetic vowel harmony processes.

The finding also explains why when the preceding vowel in Sino-Japanese is /i/, the vowel harmony does not consistently apply to the epenthetic vowel, a problem we mentioned earlier for the vowel harmony theory based on Sino-Japanese adapted forms (e.g. Ito & Mester, 2015). An analysis of the Chinese source forms in the dataset shows that for all Sino-Japanese *kan-on* forms with V<sub>1</sub>=/i/, there are less than three segments in the input nucleus, so the default epenthetic vowel /u/ is inserted.

The place of articulation of the coda consonant does not interact significantly with the quality of the epenthetic vowel. Due to the distribution of Chinese codas, we do not have data where the labial and coronal codas also follow a glide like the dorsal codas. It is therefore unclear whether the place of articulation of the coda consonant also has bearings on the quality of the epenthetic vowel. Further experimental studies are planned to look into whether the adaptation strategy still applies when the coda is not a dorsal consonant.

## References

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Figure 1 Classification tree: the independent variables for Sino-Japanese epenthetic vowel

