CONTEXTUAL ASPECTS AS A FACTOR IN VARIATION IN THE PHONETIC REALISATION OF THE MORA NASAL IN OSAKA JAPANESE

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Abstract
In this paper an account is given for the occurrence of a complete oral closure during the production of the mora nasal in intervocalic position in Osaka Japanese. This kind of realisation is dependent on the vocalic context and is favoured where the vowel following the mora nasal is an open one.
Nous nous proposons de donner ici une explication concernant la réalisation d'une fermeture orale complète lors de la production, en position inter-vocalique, de la mora nasale du parler japonais d'Osaka. Une telle réalisation varie avec le contexte vocalique; elle apparaît plus souvent lorsque la voyelle qui suit la mora nasale est une voyelle ouverte.

Introduction
The pronunciation of the mora nasal in Japanese is described in various ways. Such variation can be found depending on the specific context, but also varies between different researchers' analyses. The mora nasal is the syllable final nasal in Japanese (e.g. "n" in Honda). Amongst other elements, it came into the Japanese language with early loan-words from Chinese and extended the originally simpler phonotactics, which consisted of (C)V-syllables only. For the Standard dialect of Japanese it is more or less agreed that the mora nasal in preconsonantal position should be assimilated to the place of articulation to that of the following consonant (Vance 1986, Nakano 1969). In the case of the following syllable beginning with a vowel, the mora nasal is expected to be realised as a nasal vowel. Vance (1986) and Arisaka (1940) agree in that there can never be a complete oral closure.

As has been shown elsewhere (Tronnier, 1996), a consonantal realisation of the mora nasal before a vowel, i.e. articulated with a complete oral closure, can be observed for the Osaka variety of the Japanese language. The mora nasal in Osaka Japanese differs in phonological role from its role in standard Japanese in that it can carry pitch accent (see e.g. Nagano-Madsen, 1992). However, the consonantal pronunciation of the mora nasal was not the only observed way of realisation in Tronnier (1996). Some speakers do not have the consonantal variant in their repertoire. They belong to a younger group of age (between 15 and 20). The speakers showing the occurrence of the consonantal variant and being mainly between 40 and 45 years old also have the vocalic variant in their repertoire. The choice between the consonantal or the vocalic version is not found to be dependent on the speech tempo.

Observations suggest that the type of adjacent vowels in a VNV-sequence (N stands for the mora nasal) influences on the realisation type of the imbedded mora nasal as being either vocalic or consonantal. In addition, the combination of the two adjacent vowels seems to play a major role in the choice of variant.

The Japanese language contains the five vowels /a, i, u, e, o/, where /u/ is an unrounded vowel. Within Jones' cardinal vowel system, arranged according to an articulatory analysis, i.e. tongue position (Abercrombie 1967), they are found to be placed as shown in Figure 1 (Nihon Onsei Gakkai 1976). Such placement again refers to the standard variety of Japanese. However, with regard to vowel quality, the Osaka dialect - in contrast to more northern Japanese dialects - is not known to differ considerably from standard Japanese.

![Figure 1. The placement of the five Japanese vowels within the cardinal vowel system according to tongue position (adopted from Vance, 1986).](image-url)
ceeding the mora nasal and following the mora nasal. In addition, the combination of the adjacent vowels, i.e. their relationship according to a) their degree of openness and b) distance in terms of lying next to each other or how many steps apart within the Japanese vowel system as is shown in Figure 1 will be investigated.

The Experiment
The material for this investigation consists of read speech. It contains a list of 65 sentences of the type "A yori wa, B hoo ga ii" and 65 sentences of the type "B yori wa, A hoo ga ii", so that two realisations of the target word A could be obtained. A is a compound word, enclosing a mora nasal (N) at a morpheme boundary in intervocalic position (VNV). The rest of the phrase was designed not to contain any kind of phonological nasal, including the meaningful word B, which stands in semantic relation with A. The text was presented in Japanese script, where the words A and B were often presented in Kanji plus Furigana. However, for some more familiar cases, Kanji only was presented. Due to the requirement that the target word A should contain a mora nasal in intervocalic context, and all 5x5 possible contexts should be presented, it was not easy to find well-known words, that could be understood by all the subjects when presented in Kanji only. However, it was not possible to find suitable words in all 25 vowel contexts. Therefore, the combinations /uNu/, /oNu/, /aN/ are missing in the material. In addition, an unbalanced number of tokens of the different vowel combinations occurred in the presented list of sentences. The subjects were asked to read the sentences without interruption.

The group of subjects consists of five native speakers of the Kansai variety of Japanese. They all have the consonantal variant of the mora nasal in their repertoire and they have all lived in the city of Osaka all their lives and their parents are natives of the Osaka or the Kansai area as well.

The recordings were made mostly in the subjects' homes. A portable two-channel DAT-recorder was used for this purpose.

The recorded data were analysed in the ESPS/Waves+ environment. With the help of spectrograms, the waveform and the possibility of auditory output of fractions of the speech signal, traditional interactive labelling was undertaken.

For the statistical analysis, the STATISTICA-package was used. The number of consonantal realisations of the mora nasal in the target word A for each combination of the adjacent vowels in each sentence position was calculated in percent (%). Due to mispronunciation, hesitations and speech errors, a few realisations (<10) of the target words had to be excluded from further analysis.

For the different aspects, one and two-factor ANOVAs with repeated measures for the different sentence positions was applied.

Results
The consonantal realisation of the mora nasal was only obtained in an average of 31% of all utterances.

First of all, no significant difference was observable in the type of realisation of the mora nasal between the two repetitions of the same target words in different sentence positions (p>0.05). In addition, no significantly deviating behaviour of any of the five subjects could be observed (p>0.05).

The vowel preceding the mora nasal does not seem to play an important role in determining the realisation type of the mora nasal (p>0.05).

However, the type of vowel following the mora nasal seems to be of great importance (p<0.001). As can be seen in Figure 2, the number of realisations of the consonantal version of the mora nasal co-occurs with the degrees of openness of the five Japanese vowels in post-nasal position: the more open the post-nasal vowel, the higher the number of consonantal realisation of the mora nasal.

The strong influence of the most open vowel /a/ on the realisation of a consonantal version of the mora nasal (x=65%, sd=43.21) is highly significant in comparison to the vowels /i/ (x=1.44%, sd=5.31) and /u/ (x=13.64%, sd=35.13) (p<0.001) and significant in comparison to the vowels /e/ (x=31.54%, sd=37.91) and /o/ (x=36.96%, sd=48.19) (p<0.05). However, the vowel /o/ does not differ significantly from the vowels /e/ and /a/. Even /e/ and /u/ do not differ significantly from each other in respect to their influence on the realisation type of the preceding mora nasal. The same is the case for the two closed vowels /i/ and /u/.

The degree of openness of the post-nasal

[1] This means "in comparison to A, B is better".
The vowel seems to be proportionally influential in the number of consonantal realisations of the mora nasal.

Figure 2. The five Japanese vowels in post-nasal position show a different degree of influence (in %) on the number of the consonantal realisation of the preceding mora nasal.

One further observation is, that where the post-nasal vowel being more open than the pre-nasal vowel, a significant preference for the consonantal variant of the mora nasal is observed ($p<0.005$). The three directional factors are distributed in the combinations such as 1) pre-nasal more open vowel and post-nasal more closed vowel, 2) pre-nasal and post-nasal vowel with the same degree of openness and 3) pre-nasal more closed vowel and post-nasal more open vowel. The relative degree of openness of the vowels according to Figure 1 serves as a basis for this classification, so that all five vowels have a different degree of openness. In more detail, a significant difference can be found between the combinations 1) and 2) ($p<0.05$), in that where the two vowels adjacent to the mora nasal have the same degree of openness, the occurrence of the consonantal version is much more frequent ($\bar{x}=39.66\%$, $sd=44.31$) than where the pre-nasal vowel is more open than the post-nasal vowel ($\bar{x}=13.15\%$, $sd=32.08$). An even higher significance can be detected between the combinations 1) and 3) ($p<0.001$). Here again, the case of the pre-nasal vowel being more open than the post-nasal vowel (i.e. 1)) favours the occurrence of the consonantal version of the mora nasal to a lesser extent. In comparison, in the reverse combination 3), where the pre-nasal vowel is more closed and the post-nasal vowel is more open, the consonantal variant is favoured more often ($\bar{x}=45.09\%$, $sd=44.95$). There is no significant difference between combination 3) and combination 2) ($p>0.5$), where both vowels adjacent to the mora nasal have the same degree of openness. For each of the three combinations a significantly varied number of consonantal realisations of the mora nasal can be observed in combination with the type of the various post-nasal vowels, that is for 1) open-close direction $p<0.05$, 2) same degree of openness for both adjacent vowels $p<0.001$ and 3) close-open direction $p<0.05$. If we compare the cases, where the preceding and the following vowels have the same degree of openness, a similar distribution as for the case of the post-nasal vowels can be observed (Figure 3). The highest rate of consonantally realised occurrences is found in the case of pre- and post-nasal /a/ ($\bar{x}=100\%$, $sd=0$). Hardly any consonantal realisations appear where the pre- and post-nasal vowel is /i/ ($\bar{x}=2.5\%$, $sd=7.07$). In-between with significant differences from the combination with the vowel /a/ ($p<0.001$) and in tendency but not significantly higher occurrence of the consonantal variety than /i/ ($p=0.3$) and with an inter-mediate number of consonantal realisations /e/ ($\bar{x}=21.45\%$, $sd=18.37$) in pre- and post-nasal position can be observed. Here again, the openness of the post-nasal vowel rather than the combination of the two adjacent vowels seems to be relevant and additionally contributes to the significant difference between 1) and 2) and the similarity in the number of consonantal realisations for 2) and 3). Thus, the factor of degree of openness of the post-nasal vowel already incorporates the factor of combination of vowels adjacent to the mora nasal according to their degree of openness.

Figure 3. If both adjacent vowels have the same degree of openness (i.e. aNa, eNe, iNi), the open vowel /a/ triggers a consonantal realisation of the mora nasal much more frequently (in %).
The effect of distance between the vowels within the five Japanese vowels accommodated in the cardinal vowel system as presented in Figure 1 seems to play a marginal role (p<0.05). If the two vowels adjacent to the mora nasal are not neighbours in the Japanese vowel system, but if they have the same quality or lie further apart than one step only, a slight tendency for the preference for the consonantal realisation of the mora nasal is seen. However, when analysing the individual vowel combinations in more detail, again, the strong influence of the degree of openness of the post-nasal vowel rather than the effect of distance on the choice of the consonantal variant becomes evident.

Discussion

In the preceding sections a detailed analysis of the influence of adjacent vowels on the type of realisation of the mora nasal in Osaka Japanese as either consonantal or vocal has been described. It has been shown that the degree of openness of the following vowel is most important in the choice of the type of mora nasal, that is: towards a more open degree of the post-nasal vowel a higher probability of occurrence of the consonantal variant is found. Other effects favouring the consonantal version over the vocalic one, such as combinations of the pre-nasal and the post-nasal vowels with respect to varying degree of openness and absence of adjacency in the vowel system are also based on the degree of openness of the post-nasal vowel.

Bell-Berti et al. (1979) showed in an experiment on coarticulatory effects of vowel quality on the function of the velum that, for English, the velum was elevated much faster for a high vowel than for a low vowel when following a nasal consonant. The question arises, whether a retroactive effect can be assumed here, that is: the production of a nasal - be it a nasal vowel or a nasal consonant underlyingly - allows the velum to be elevated much more slowly in the case of a following low/open vowel, leaving enough time for the other articulators to perform a complete oral closure. This has yet to be examined in more detail for the mora nasal in Osaka Japanese.

One further explanation could be the effect - also described by Bell-Berti et al. (1979) for English - that the open vowel /a/ evokes a relatively lowered velar position in comparison to the vowel /i/ in general, not only in the case of an adjacent nasal. This might have led to the perceived need of some speakers of the Osaka variety of Japanese to dissociate and mark the transition between two vowels for some cases, where the mora nasal is imbedded. Such dissociation with the help of a complete oral closure would occur in the case of a preceding closed/high vowel and a following open/low vowel, because the natural velar opening towards the open vowel would confuse the percept to whether a mora nasal occurs in this place or whether not. Furthermore, it would be reasonable to assume this kind of dissociation in the case of both adjacent vowels of an open quality. Both assumptions are supported from the data presented here.

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References


