CAN A MORAIC NASAL OCCUR WORD-INITIALLY IN JAPANESE?

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ABSTRACT

In this study two experiments were conducted to examine whether a moraic nasal could occur word-initially in Japanese, manipulating duration of an onset nasal. In Experiment I, the duration of word-initial nasals, /n/ and /m/, in two CVCC nonwords were prolonged up to 300% in steps of one-tenth of the original duration. 10 Japanese college students were presented with the stimuli and asked to write them in Roman letters. The results showed that both nasals, irrespective of place of articulation, were recognized as N+n and N+m respectively when the word-initial nasal exceeded 1.8 times longer than the original duration. In Experiment II, the word initial CV syllable in two non-words, /KaNnaka/ and /KaNmaka/, was spliced off, leaving a long word-initial nasal and the nasal duration (both N+n and N+m) was decreased up to 10% in steps of one-tenth of the original duration. 10 Japanese college students were presented with them to dictate in Roman letters. The results showed that both nasals were recognized as N+n and N+m respectively as long as a certain duration was maintained. The results of the two experiments suggest that a word-initial nasal, just like a word-medial one, can be recognized as moraic as long as it achieves a certain duration in Japanese.

1. INTRODUCTION

Although a moraic nasal in Japanese may be defined just by its durational properties [1], phonological studies also suggest that syllable position (namely, in a coda) plays an important role in determining moraic status [2]. These two definitions have been investigated independently in the literature, so that we do not know how these two are interrelated each other.

We have attempted to examine the relationship between them, by manipulating the duration of a nasal in two syllable positions, an onset and a coda [3]. There were two results: First, moraic status was assigned irrespective of duration as long as a nasal occupied a coda. Second, when the nasal in a syllable onset in "tenoto" was prolonged 1.5 times longer than the original duration, the word began to be recognized as "tEnoto"; i.e., the prolonged nasal was split into two syllable positions, one in a coda of the first syllable and the other in an onset of the second syllable. These results suggest two properties of moraic status. First, moraic status is determined by a durational property, as many production studies have reported [4, 5, 6]. Second, moraic status is also determined as long as a nasal occupies a coda position. We ask: what will happen if a word-initial nasal is sufficiently prolonged? Japanese phonology predicts that no moraic nasal occurs in this position because a coda does not exist word-initially. The present study attempts to examine further the relationship between moraic status and syllable position in Japanese.

In the two experiments described below, we use a dictation task which aims to capture listeners' knowledge on the durational properties in a word-initial position with respect to moraic status. In Experiment I the word-initial nasals, /n/ and /m/, in two CVCC utterances are prolonged up to 300% in steps of one-tenth of the original duration. Japanese listeners dictate these items in Roman letters to see if they recognize them as a moraic nasal. In Experiment II, the word initial CV in two nonwords, /KaNnaka/ and /KaNmaka/, is spliced off, leaving a long word-initial nasal and its duration was decreased up to 10% of the original duration. Japanese listeners dictate the non-word in Roman letters to see if they recognize them as a moraic nasal.

2. EXPERIMENT I

2.1. Method

2.1.1. Subjects

The subjects were 10 Japanese college students at Dokkyo University. The subjects were rewarded with course credit for participating in the study.

2.1.2. Materials

Two CVCC non-words, /nata/ and /mapa/, each of which contains a lamino-dental nasal and a bilabial nasal as an onset word-initially were designed. These words were recorded at a normal tempo by a male native speaker of Tokyo Japanese. No pitch accent was assigned in recording. Two fragmental CV segments, /nata/ and /mapa/ were also recorded, extending the nasals up to 300 msec by the same speaker with no pitch accent. 20 stimuli were made by Kay Sona-Graph 5500 in such a way that a nasal was spliced off from the fragmental CV segments in steps of one-tenth of the original duration in /nata/ and /mapa/ and the original nasal in the CVCC non-words was replaced by the nasal taken from the fragments. The stimuli were recorded twice with two second interval at the random order.
2.1.3. Procedure

The subjects were instructed to write each stimulus word in Roman letters as soon as they heard it twice on a test sheet. They were told to use a capital N if they heard a moraic nasal. The stimuli were presented individually through a binaural headphone in a quiet room.

2.2. Results

The results of the identification functions for the nasal consonants, /n/ and /m/, that were increased in duration are illustrated in Figure 1 and 2 respectively. The vertical axis indicates the percentage of identification of a moraic and a non-moraic nasal. The horizontal axis indicates the rates of increased nasal duration (rate 1.0 = the original onset nasal duration in /nata/ and /maka/).

As can be seen from Figure 1, when the rate reached 1.4, a moraic nasal began to be recognized. When it exceeded 2.4, it was always recognized. Although the rates were different, the same result was observed in Figure 2.

2.3 Discussion

The results have shown that the increased word initial nasal in /nata/ can be recognized as a moraic or non-moraic nasal depending upon its duration. The result was exactly the same as the one word medially in our previous study [3]. The more interesting result is /maka/. In spite of the fact that the acoustic signal in the word initial nasal is bilabial, when it has sufficient duration, it is also recognized as a moraic nasal. The same result was observed in our previous study [7]. These results suggest that a word initial nasal can be recognized as a moraic nasal if it has a sufficient duration.

3. EXPERIMENT 2

3.1. Method

3.1.1. Subjects

The subjects were 10 Japanese college students at Dokkyo University who did not participate in the experiment. The subjects were rewarded with course credit for participating the study.

3.1.2. Materials

Two non-words, each of which contains a moraic nasal preceding a lamino-dental and a bilabial nasal word-medially were designed. These words were /kaNaka/ and /kaMaka/. They were recorded at a normal tempo by a male native speaker of Tokyo Japanese. No pitch accent was assigned in recording. 10 stimuli for each non-word were made with Kay Sono-Graph 5500, splicing off the initial CV syllable and the duration of a nasal in /Naka/ and /Maka/ was decreased in steps of one-tenth of the nasal duration which was uttered in /naka/ and /maka/ independently.

3.1.3. Procedure

The same as the one in Experiment 1.

3.2. Results

The results of the identification functions for the nasal consonants /n/ and /m/ that were decreased in duration are illustrated in Figure 3 and 4 respectively. As can be seen in Figure 3, when the rate was 1.0, namely the original nasal duration (N+n), a moraic nasal was recognized. However, when the rate reached 0.6, a moraic status began to disappear. The same result was also observed in Figure 4.
limited number of consonants which occur in a coda or syllables consisting of CV or V. Since our concern in this study is nasals, we will not deal with other consonants and vowels here.

Before examining the results in details, let us first look at an example in (1), in which two nasals occur within the same syllable, one in an onset and the other in a coda.

\[
(1) \quad \sigma \quad \sigma \\
\mu \mu \mu \\
n h \quad p a
\]

Moraic status is assigned to the second nasal in the first syllable because it occupies the coda position, while it is not to the first nasal because it occupies the onset position. This mora assignment is purely phonological. This condition is obviously valid even in speech perception because a nasal in /teno/ was recognized as a mora nasal irrespective of its duration [3]. Although it is generally believed that the duration of a nasal in a coda position in speech production is significantly longer than that in an onset position [4, 5, 6], it is not the case in speech perception.

There is an arresting phenomenon, however, which cannot be elucidated in terms of a syllable position alone. For example, when a word-medial nasal in /tenoto/ was prolonged, it was recognized as N+n by Japanese listeners [3]. This is interesting because the increment of the onset nasal duration has caused a resyllabification, which is illustrated in (2).

\[
(2) \quad \sigma \quad \sigma \quad \sigma \quad \sigma \quad \sigma \\
\mu \mu \mu \mu \mu \\
t e \quad no \quad to \quad te \quad n o \quad to
\]

As can be seen in (2), the prolonged onset duration in the second syllable was split into two nasals, one as the onset and the other as the coda in the first syllable. How could this happen? It is very obvious that the resyllabification was triggered by the increment of the nasal duration in the second syllable, so that duration is deeply involved with the moraic status assignment. But why did the increment of the nasal duration trigger the resyllabification? Let us look at (2) again. Notice that the resyllabification occurred in the first syllable. Although a basic syllable structure in Japanese is a CV, a CVC syllable is also admitted in Japanese. Let us assume that any CV syllable is allowed to possess a coda position as long as the onset of the following syllable are /n, p, t, k, s/. This structural change can be illustrated in (3).

\[
(3) \quad \sigma \quad \sigma \quad \sigma \\
 CV \quad C x V \quad C V \quad C x V
\]

where Cx is /n, p, t, k, s/
In (3) the basic syllable structure in the first syllable is CV. If Cx, the onset of the second syllable is one of the given consonants, the first syllable is ready to undergo resyllabification. Notice that the coda in the new syllable structure is null under the normal utterance because it does not achieve enough duration to trigger resyllabification.

Now, let us consider a case when the onset nasal in the second was prolonged. When the onset nasal is overflowed, it can be transferred to the coda in the preceding syllable because this position is empty. Since it can occupy the coda position, moraic status is assigned to it. Notice that the amount of the overflowed duration is not crucial because the duration at the coda does not play an important role, as we saw in /tento/. Because of the presence of an empty syllabic coda with the overflowed nasal, moraic status may have been assigned to it in a word-medial position.

Then, how can we account for the results in the present study? Recall that the experimental materials in this study differ from the ones in the earlier study in that the nasals are placed word-initially, that is to say, there is no syllable preceding the nasals. In spite of the fact that a syllabic consonant is not allowed in Japanese, the results in this study showed that a moraic nasal occurred. What these results may suggest is that there should be some alternative explanations for assigning moraic status.

Following the above explanation, we assume that there exists another syllable for this moraic nasal which occurs word-initially. We propose two types of syllable structures which are invisible word-initially. The first type is a VC syllable where the nucleus is empty which is illustrated in (4).

![Diagram](image)

In (4) when the word-initial nasal is prolonged, the overflowed nasal can fill the coda, so that this position assigns moraic status. The second type is a V syllable in which a prolonged nasal fills the vowel position to become a syllabic nasal which is not allowed in Japanese phonology. This is illustrated in (5). Although a syllabic nasal is not reported in Japanese phonology, theoretically this could be possible.

![Diagram](image)

Thus far, we have discussed moraic status with the lamino-dental nasal. In the present experiment, we have also examined a bilabial nasal. The interesting point in /mapa/ is that unlike /nata/ the word-initial segment was a bilabial nasal. When this segment was prolonged, the same result was also reported in other works [7, 8]. Then, how can we account for it? When the nasal in /mapa/ was prolonged, it was simply recognized as it was when the rate was close to 1.0. When it exceeded a certain rate, it began to be recognized as a moraic nasal. Unlike the lamino-dental nasal, if the duration is the only factor which determines moraic status, there is a contradiction because the prolonged nasal is a bilabial. Japanese listener could recognize it as it is or as /mu/ with an ephenhesis. This result may be explained only if we admit that there is a coda position word-initially.

5. CONCLUSION

In this paper we have examined whether a moraic nasal can occur word-initially in Japanese. We have conducted two experiments, manipulating (increasing and decreasing) the word-initial nasal duration. We have confirmed that a moraic nasal can occur word-initially as well as word-medially. Based upon the these results we have proposed a mechanism of moraic status assignment in terms of syllable and duration.

ACKNOWLEDGMENTS

This research was supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports and Culture (grant #06610475). We are grateful to Anne Cutler for valuable comments.

REFERENCES