INTELLIGIBILITY OF ACCENTED SPEECH: THE PERCEPTION OF WORD-FINAL NASALS BY DUTCH AND BRAZILIANS

Denise C. Kluge[1], Mara S. Reis[1], Denize Nobre-Oliveira[2] and Andréia S. Rauber[3]

[1]Federal University of Santa Catarina, Brazil,
[2]Federal Center of Technological Education of Santa Catarina, Brazil, [3]University of Minho, Portugal

ABSTRACT

In both English and Dutch, the nasal consonants /m/ and /n/ in word-final position have different phonological representations and are phonetically distinctive. In contrast, in Brazilian Portuguese /m/ and /n/ undergo similar phonological processes which result in the deletion of the nasals and regressive vowel nasalization. The present small-scale study aims at investigating whether speakers of English as a foreign language with two dissimilar phonological representations and phonetic realizations of nasals in word-final position differ when recognizing English words produced either accurately or in an accented way. The data collection took place at Universidade Federal de Santa Catarina and University of Amsterdam, with 10 speakers of each language. The results indicate that Dutch speakers tend to recognize the nasal productions more consistently than the Brazilians, a fact that is interpreted as due to the similar phonological and phonetic patterns of the target sounds that Dutch and English share.

1. INTRODUCTION

The nasalization of a vowel that precedes a nasal consonant is considered a widespread coarticulatory process present in the majority of the world's languages [1]. However, the degree of nasalization is different among languages, varying from subtle, as in English [2] and Dutch [3], to strong as in Portuguese [4].

Furthermore, languages may also have different patterns of phonological representations of the same phonemes in different word positions. The object of the present study is the investigation of the English bilabial and the alveolar nasal consonants /m/ and /n/ in monosyllabic word-final position. These consonants vary in the type of phonological representation between the two groups involved in the study, Brazilian Portuguese (BP) speakers, and Dutch speakers. For the Dutch, /m/ and /n/ are phonetically distinctive in word-final position, while in Portuguese they are phonetic realizations of the archiphoneme /N/.

The presence of nasalized vowels or consonants is spread over 99% of the languages [1], and this process of coarticulatory nasalization is extremely common. However, the nasals /m/ and /n/ in English word-final position are fully pronounced [5], with different places of articulation [6]. In fact, /m/ and /n/ in word-final position are phonetically distinctive in English, which leads to the existence of minimal-pairs such as *gym-gin*. What differs among languages is the degree of nasalization—while vowel nasalization is subtle in English ([2, 7, 8]) and in Dutch [3], BP is characterized by its typical vowel nasalization [4]. It is important to note that although vowel nasalization can occur in English, there are no nasal vowels in its inventory [2].

Therefore, due to the representation of the nasals in their native language (L1) in the context of a monosyllabic word, whereas Dutch speakers, as well as English speakers, maintain distinctive realizations between the nasals, Brazilians nasalize the preceding vowel and delete the nasal consonant. In other words, while Dutch and English have similar patterns of representation and realization of the nasals in word-final position, Portuguese differs in both aspects. Previous studies ([9, 10]) show that BP learners of English as a foreign language (EFL) tend to transfer the L1 pattern to both their second language (L2) perception and production.

As regards perception and production studies, it is commonly believed that adults are language-specific perceivers and that speech perception occurs through the filter of the L1 system, at least in initial stages of L2 learning ([11, 12, 13, 14, 15, 16]). Furthermore, current models of L2 phonological perception or of L2 phonological learning ([17, 18, 19]) have highlighted the role that accurate speech perception plays on accurate L2 speech production. A study conducted by Kluge et al. [10] found that, as proposed by Flege and colleagues, there is a tendency for a positive correlation between perception and production of English word-final nasals by Brazilian EFL learners, that is, the sounds which are better perceived are the ones which are better produced. Drawing on this perspective, it can be assumed that Brazilian and Dutch speakers/listeners would perceive the English target nasals according to their specific L1 norms. Table 1 summarizes the main differences among the languages involved in the study as far as the nasals /m/ and /n/ in word-final position are concerned.

Phonological system	realization	phonetic status	vowel nasalization
Brazilian Portuguese	deleted	not distinctive	yes – strong
Dutch	full	distinctive	maybe – subtle
English	full	distinctive	yes – subtle

Table 1. Realization of /m/ and /n/ in word-final position in BP, Dutch, and English.

Therefore, the English interlanguage of BP and Dutch speakers is expected to perform differently if they transfer their L1 phonological representations of /m/ and /n/ in word-final position into their L2: while Dutch would tend to perceive the English nasals in a more target language fashion, since the two systems have similar representations of the target nasals, Brazilians would not consistently distinguish the differences in the English production of nasals, as already shown by Kluge et al. [10].

The influence that a foreign accent exerts on speech intelligibility is a debatable aspect implicated in successful cross-language communication [20]. As Reis [21] points out, intelligibility, as far as English is concerned, is a current issue

in this period of "globalization and the importance of English as the contemporary lingua franca" (p. 138).

The intelligibility of foreign-accented speech has been evaluated through a variety of procedures. In fact, Bent, Bradlow and Smith [22] state that intelligibility depends on testing methods, and that results from different procedures could not be compared. Thus, the type of testing material (i.e., word, sentence, passages), the way of eliciting speech (e.g., reading tasks vs. extemporaneous speech), the listening condition (e.g., in quiet or with noise), and the tasks of the judges (e.g., subjective rating, transcription, comprehension questions, summary of the utterance) interfere in what may be analyzed as intelligible or not. Nonetheless, Weil [23] is assertive about foreign-accented speech studies: "accented speech is less intelligible than non-accented speech" (p. 7).

As regards the procedures of intelligibility tests, studies have applied a variety of them, such as mispronunciation detection [24], sentence verification [25], phonetic and word discrimination ([20, 26]), and transcription accuracy ([25, 27, 28]). Ingram and Nguyen [29] argue that the use of judgment based on rating scales is the most common type of intelligibility and accentedness assessment ([30, 31, 32, 33]). In this kind of test, the listeners are required to evaluate how difficult it is to understand an utterance, or how strong the accent is. The present study provides the listeners with a word intelligibility test with two types of tasks: (i) word recognition, and (ii) judgment on a rating scale of how English-like the pronunciation of a word sounds. Two types of realization of word-final nasals were presented in the test: accurately produced with full distinctive realization of each nasal consonant, and BP-accented speech produced with vowel nasalization/nasal consonant deletion. The tasks and the entire method used in the study will be described in the next section.

2. METHOD AND PROCEDURES

Two instruments were used for data collection: a questionnaire for assessing the participants' background, and a word recognition test. The data gathering took place at the Universidade Federal de Santa Catarina (UFSC), and at the University of Amsterdam (UvA).

2.1. Research question and hypotheses

In order to examine the intelligibility of English monosyllabic words with the nasal consonants in word-final position produced with the typical BP vowel nasalization/nasal deletion accent, the following research question (RQ) and hypotheses (H) are proposed:

RQ 1: How do groups with different L1 patterns of phonological representation of the nasal consonants in word-final position recognize L2 English words produced both accurately and in an accented way?

H1a: Dutch listeners will recognize accurately produced English words more often than will BP listeners;

H1b: Dutch listeners will recognize accented English words more often than will BP listeners.

2.2. Participants

Two groups of EFL speakers participated in the study: 10 Brazilian EFL learners (9 females and 1 male, ages ranging from 18 to 30 years) and 10 Dutch participants (all females, ages ranging from 18 to 26 years).

The questionnaire that assessed the BP participants' profile showed that they had been learning English for an average of 8 years. They used to speak the L2 in an average of 9% of their daily routines (at home/school, with family/friends, at work); however, they listened to the L2 in an average of 26% of the time (at school, on the internet, watching TV etc.).

The Dutch listeners had never been to a Portuguese-speaking country, thus we might assume that they were not used to the typical vowel nasalization that Portuguese speakers transfer when producing English nasals in word-final position. These participants had been studying English for an average of 9.4 years, used the L2 in about 8% of their daily routines, and listened to the L2 an average of 22% of the time.

Although the level of L2 proficiency was not assessed, and we assume a considerable difference between the quantity and quality of authentic input that these two groups receive, the present study upholds Flege's and other scholars' viewpoint that the amount of first language use is one of the determinant factors that interferes in L2 perception ([34, 35, 36, 37]). Therefore, given that the two groups (i) demonstrate similar length of L2 experience in formal settings, (ii) use their L1s more often than the L2, and (iii) use the L2 with similar frequency rates, they could be considered functional monolinguals or naïve non-native listeners [16]. According to Best and Tyler [16], functional monolinguals are those who learn the L2 in formal learning settings, and do not use the L2 in an everyday basis.

2.3. Materials

2.3.1. Stimuli

Six monosyllabic minimal-pair words were used in the perception test, all of them ending with the nasals /m/ or /n/ in word-final position: *cam/can, Tim/tin,* and *gem/gen*. The words were recorded by two female speakers, one American and one Brazilian. Both speakers had phonetic training and were proficient in their L2, i.e., the American in BP, and the Brazilian in American English. The speakers were recorded individually in a silent room, with a Sony MZ-NHF800 Minidisk and a monodirectional Sony microphone (ECM-MS907). Each word was recorded in two different conditions: with and without vowel nasalization/nasal deletion. That is, the word *Tim*, for example, was recorded either as /tɪm/ or as /tĩ/ by the two talkers. It is important to note that the vowel quality was maintained in both productions, according to the American vowel inventory.

Thus, each of the six words had two different conditions (with or without vowel nasalization/nasal deletion) and was produced by the two speakers, so that the six words resulted in twelve realizations. In the test, each realization was repeated four times, two produced by each of the speakers. As a consequence, the entire test consisted of 48 productions (12 realizations x 4 repetitions = 48 samples). The stimuli were digitized and normalized for peak intensity with Sound Forge 7.0, and the 48 words were organized and randomized in Praat [38]. Three extra trials were inserted both in the beginning and in the end of the test, totaling 54 trials. However, these 6 extra trials were not analyzed.

2.3.2. Intelligibility test

The intelligibility test consisted of a word recognition task. The words were presented in isolation, and each of the 48 words was repeated twice in each trial. In the word recognition task, the participants heard the word and had 4 seconds to mark, within a three-alternative forced choice answer, the word they heard. For example, when the participants heard the production of *Tim* or *tin*, they had to choose between *Tim, tin* or *neither of the alternatives*.

The results of this task guided the data analysis as regards the interference of vowel nasalization and nasal consonant deletion on word intelligibility. It was expected that, due to the pattern of phonological representation of the nasals in word-final position of each language—with or without phonetic distinction—, the BP-accented English speech would be consistently perceived as accented by the Dutch, and inconsistently perceived as accented by the BP participants. The analysis of the responses in the word recognition task was considered correct only when the participants chose the appropriate corresponding label for the intended production. For example, if the word produced was /tɪm/, the corresponding label was *Tim*. If the word produced was /tĩ/, which is either a mispronunciation of *Tim* or *tin*, the listeners were expected to choose the label *neither of the alternatives*.

2.3.3. Statistical analysis

The statistical analysis was based on the correct responses of the two groups for the 48 items in the test. Due to the limited number of participants, 10 in each group, the raw data were converted into percentages. Statistical significance (alpha level) was set at .05, and due to the non-consistency between the results of skewness and kurtosis, the entire data were considered not normally distributed. Thus, the following non-parametric tests were used (1) Mann-Whitney for between groups comparison of means; (2) Friedman for within group comparison of means, and (3) Wilcoxon as the post hoc test to verify the relation between the variables that had achieved significance in the Friedman test.

3. RESULTS AND DISCUSSION

The Dutch listeners were hypothesized to recognize more words, either produced accurately or in an accented way, than were BP listeners. Table 2 shows that accurate productions were recognized in an average of 77.9% by the Brazilians, and 97.5% by the Dutch, while the nasalized words were recognized 40.8% by the Brazilians, and 76.7% by the Dutch. A Mann-Whitney U Test confirms that not only had the Dutch significantly recognized more accurate words than the Brazilians (Z= -3.449, p= .001), they also outperformed the Brazilians in the recognition of the nasalized words (Z= -2.612, p= .009). Thus, the overall results demonstrate that Dutch listeners significantly recognized more words, either accurate or accented, than did the Brazilians (Z= -3.080, p= .002), a result which corroborates the hypotheses of the study.

	Accurate N: 240		Nasalized N: 240		Total N: 480	
	Score	mean	score	mean	score	Mean
BP	187	77.9 (14)	95	40.8 (27.7)	282	58.7 (17.9)
Dutch	234	97.5 (4.5)	184	76.7 (17.9)	418	87.1 (8.6)

Table 2. Recognition of accurate words.
N= Total number of occurrences. Score = total number of recognized words. Standard deviation in parentheses.

When analyzing word recognition by type of realization within the same group, a Friedman test confirms that there is a significant difference between the recognition of the accurate and accented words: for the Dutch (X^2 (1, N=10) = 7.000, p=.008), and for the Brazilians (X^2 (1, N=10) = 9.000, p=.003). That is, the statistical test confirmed that nasalized words disfavored word recognition by the two groups.

Therefore, since accurate pronunciation led to more word recognition by the two groups, the suggestion given by some authors ([39, 40]) that foreign-accented speech is more intelligible for L2 speakers is not corroborated by the results of the present study. Alternatively, the results of the word recognition task seem to support Ingram and Nguyen's [29] statement that accented-speech does not necessarily favor intelligibility by non-native listeners, as indicated by some studies ([41, 42, 43]).

4. CONCLUSION

The present small-scale study aimed at investigating whether EFL speakers with two different phonological representations of nasals in word-final position differed in a word intelligibility test of tokens produced accurately and with BP-accented word-final nasals. The hypothesis was that, due to different patterns of phonological representations, Dutch listeners would recognize either accurate or nasalized words more consistently than the Brazilians. The results showed that, in general, not only do the Brazilian participants recognize fewer words, they also vary more in word recognition than the Dutch participants.

It is important to bear in mind that the results of the word intelligibility test do not implicate that BP-accented production of word-final nasals *impede* overall speech intelligibility. However, whereas some studies have shown discrepancy between word comprehensibility and overall intelligibility ([25, 27, 35]), Weil [23] asserts that accented-speech surely is less intelligible than more native-like speech. Our findings lead to the conclusion that awareness of the difficulty in producing the target nasals may help L2 speakers to avoid vowel nasalization, thus enhancing intelligibility.

To conclude, it is important to state that this small-scale study had some limitations: (i) although other Portuguese varieties (e.g., European Portuguese) present vowel nasalization, due to availability of participants only BP speakers were tested; (ii) since in Dutch and English /m/ and /n/ are phonetically distinctive in word-final position, it would have been convenient to have another control group formed by native speakers of another Latin language; (iii) only front vowels preceded the target nasals, future research should investigate whether similar results would be obtained with back vowels; (iv) still regarding the stimuli, the place of articulation of the first consonant of the monosyllabic words should also be controlled.

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