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Aspects of the Acquisition of Swedish Quantity by Native Speakers of English, Spanish and Estonian

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ABSTRACT

The main purpose of the experiments reported here has been to test a hypothesis about the influence of L1 phonology on the acquisition of contrastive L2 phonetic categories. This hypothesis holds that an L2 contrastive category will be difficult to acquire if it is based on a phonetic feature not exploited in the L1. Twenty native speakers each of American English, Latin American Spanish and Estonian as well as a control group of 20 native speakers of Swedish were given a production and perception test to assess their mastery of the Swedish long-short vowel contrast. Our results support our hypothesis indicating that the success of learning the Swedish long-short vowel contrast seems to be related to the roll of the duration feature in the L1.

1. Introduction

A primary issue in both past and current studies of second language (L2) speech acquisition is how and to what extent the first language (L1) influences the learning of L2. The experiments reported here are designed to test a "feature hypothesis" relevant to the learning of L2 phonology. This hypothesis was first mentioned in Flege's Speech Learning Model (SLM), one of the current models of L2 speech acquisition (Flege, 1995). The hypothesis could be stated as follows: L2 features not used to signal phonological contrast in L1 will be difficult to perceive for the L2 learner and this difficulty will be reflected in the learner's production of the contrast based on this feature.

Our aim was to test the feature hypothesis by investigating the acquisition of the Swedish quantity contrast by native speakers of English, Spanish and Estonian. These three languages exhibit three different degrees of prominence for the role of duration in the signaling of phonological contrast. Duration is most prominent in Estonian, less prominent in English and least prominent in Spanish.

According to the feature hypothesis, learning quantity in Swedish for the high and low vowels, where the contrast is based on spectral cues, should not be difficult for most L2 learners since all languages use spectral features in their differentiation of phonetic vowel categories. The contrast should, however, for the mid vowels, be easier for those whose L1 phonology exploits durational cues (Hadding-Koch and Abramson, 1964).

2. Method

2.1. Subjects

A total of 80 adult subjects participated, first in a production experiment, and then in a perception experiment. 20 of these subjects were native speakers of Swedish. There were also 20 native speakers each of South American Spanish, North American English and Estonian. To be included in one of these L2 learner groups subjects had to have arrived in Sweden after their 18th birthday and lived in Sweden for at least ten years.

2.2 Production experiment

The subjects produced 40 frequent two syllable Swedish words, all with lexical accent II. Half of the words had a phonologically long vowel, and the remaining half had short vowels. There were ten words each in four groups representing high vowels (/ɤ:/, /ɤ/), rounded mid (/ø:/ /ø/), and unrounded mid (/ɛ:/ /ɛ/), and low vowels (/a:/. The recorded productions were digitized and the temporal measurements were made using Cool Edit.

2.3 Perception experiment

The purpose of the perception experiment was to find out whether the subjects could determine if the 40 common Swedish words they had produced in the production experiment contained a phonologically short or long vowel.

2.3.1 Stimuli.

A phonetician, who is a native speaker of Swedish recorded productions of the 40 test words. He also produced a set of 40 non-words formed by changing these vowels in the test words from short to long or from long to short.

2.3.2 Procedure.

The 80 naturally produced stimuli were randomly presented a single time immediately following a definition. Each real word and the non-word paired to it by changing the phonological length of the vowel were presented following the same definition. The real word and its corresponding non-word were always located on separate halves of the test. The subjects were asked to click a “correct” or “incorrect” button as a response.

A total of four percent scores was computed for each subject, one for each of the four vowel contrast groups. Each score was based on 20 judgements, 10 for the real words, 10 for the non-words (where the correct response was “incorrect” because the word does not exist in Swedish).

3. Results

3.1 Production

Figure 1 shows how large a difference the subjects produced between the pairs of phonologically long and short Swedish vowels. There was little difference between the native speakers of Estonian and native Swedish production, whereas the native English speakers produced the two quantity classes with less durational difference than the Swedes. The Spanish speaking subjects produced even less difference than the English speakers. The mean duration values obtained for the 80 subjects were submitted to a three way ANOVA in which Group (4 levels) served as a between- subjects factor and Vowel

Contrast (4 levels) and Phonological length (2 levels) as within subject variables ANOVA yielded a significant three-way interaction, $F(9, 228)=2.99, p=0.002$.

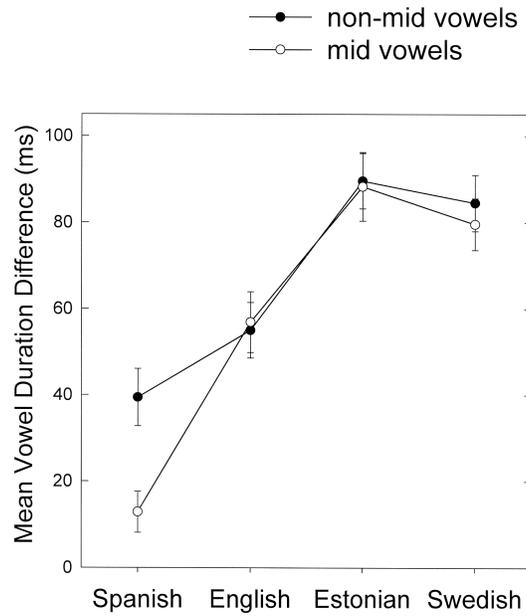


Figure 1. The mean temporal difference between phonologically long vs short mid and non-mid vowels spoken by subjects in four groups, in ms.

3.2 Perception

Figure 2 shows the percentage of correctly recognized vowels. Like the Swedes, the Estonian

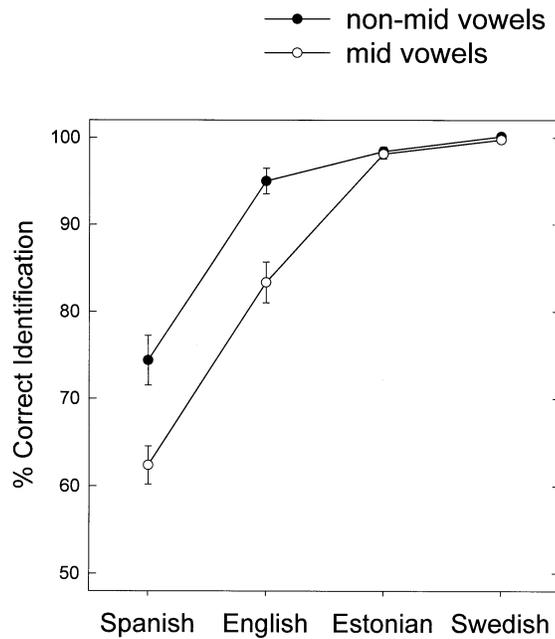


Figure 2. The per cent correct scores obtained for two pairs of Swedish mid vowels and two pairs

of Swedish non-mid vowels by the subjects in four groups. subjects obtained near-perfect scores. Scores for the native English subjects were lower on average (mid: 83%, non-mid: 95%), and those of the native Spanish subjects lower still (mid: 62%, non-mid: 74%). The difference between mid and non-mid contrasts for the native English and Spanish subjects, but not for the Estonian subjects, resulted in a significant interaction in an ANOVA examining the non-native subjects' scores, $F(2,57)=13.8$, $p<0.01$. For mid vowels, the Estonians' scores were significantly higher than the native Spanish

subjects' scores ($p<0.01$ by Tukey's test). For non-mid contrasts, the difference between the native

Estonian and English subjects did not reach a significant level, with both groups obtaining higher scores than the native Spanish subjects ($p<0.01$).

4. Discussion

The broadest interpretation of our results would be that the feature hypothesis is supported. The native Estonian speaking subjects were most successful, the native Spanish speakers appear to be least successful and the native English speakers somewhere in between. The feature hypothesis predicts that the mid vowel quantity contrast based primarily on duration would be more difficult for the L2 learners whose phonology did not exploit this phonetic feature. This prediction seems to hold for the perception of these vowel categories in both native Spanish and English speakers. The Estonians, however, displayed high proficiency in both perception and production of the mid vowels. Miller and Grosjean (1997) in their study of French dialects, postulate, on the basis of their experimental results, that the "overall prominence of a given acoustic property" in the L1, in this case duration, has important consequences for learning L2 phonology. While the notion of overall prominence could be considered vague, this interpretation could be applied to the results of the present study and used as support for the feature hypothesis.

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