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Perception and Production of English Stress by Brazilian Speakers

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Abstract

This study investigates the perception and production on the assignment of stress by 20 Brazilian speakers on English words stressed on the fourth syllable from the end. According to Brawerman (2006), which investigated only production, this pattern is difficult for Brazilian learners of English because it is an extremely rare stress pattern in their first language. The production test consisted of 40 words which were stressed on the fourth syllable from the end and 20 words which had other kinds of stress patterns and worked as distractors. The participants were recorded reading these words three times. They were also submitted to a computerized perception test designed with identification tasks which the participants listened to the words and had to click on a number corresponding to the number of the stressed syllable. Results show 85,4% of correct answers in the perception test, but 28,4% on the production test.

Adult speakers have been shown to struggle to produce certain sounds of a second language (L2), and very few people who start learning an L2 at an adult age are able to speak without any kind of accent (Flege et al., 1995). A second language accent is maintained especially because of the difficulty learners have to produce contrasts of an L2 which are not

distinctive in their first language (L1) in an appropriate way (Strange & Dittmann, 1984). According to Flege (1995), listeners hear foreign accents when they detect divergences from phonetic norms, and accent can be caused by a range of different reasons: inaccurate perception; inadequate phonetic input; lack of motivation or the interaction between L1 and L2 phonological systems.

L2 learners usually identify L2 sounds with L1 sounds even when both are acoustically different. This identification process between both languages in the perception level makes learners substitute L2 and L1 sounds at the moment of production. Studies demonstrate, however, that enough exposition to the target language may improve learners' perception of non-native contrasts, suggesting that adults' phonological perception may be adjusted with experience (Flege, 1995).

Flege et al. (1995) conducted a study to investigate whether non-native speakers are able to establish new categories for L2 sounds. The authors tested if 12 adult Japanese speakers who lived in the United States were able to produce /r/ and /l/ in an appropriate way in words like *read* and *lead*. Participants were divided in two groups according to how long they had been living in the USA: two years for the first group and 21 years for the second one. The study was innovative due to the fact that it tested such advanced speakers in the L2 and thus could verify if L2 sounds which are different from L1 sounds may be learned or if this difference between both languages makes adult learning impossible. As it was predicted, the sounds produced by the Japanese speakers living in the USA for two years were constantly misidentified by the listeners and were considered with a high accent level. Nevertheless, the sounds produced by more advanced Japanese speakers were correctly identified and were classified almost as native speakers' productions. These results go against the idea that L2 sound production mistakes come from the lack of ability to hear segments which do not exist in the speaker's L1 and suggest that advanced speakers are indeed able to establish new categories for L2 sounds.

This idea follows the Speech Learning Model, proposed by Flege (1995), which works with the notions of phonetic similarity and new category perception in the acquisition of segments. According to Flege (1995), L2 learners struggle to distinguish phonetic differences between L2 sounds or L1 and L2 sounds. A new category may be established for an L2 sound phonetically different from an L1 sound if the learner understands some of the phonetic differences between these sounds. Therefore, L2 sound production is correct when new phonetic categories are established.

Other important perception models (Best, 1995; Kuhl, 1991; Escudero, 2005; Best & Tyler, 2007) also analyze the perception of sounds and do not investigate what happens with suprasegments. Two studies, however, investigated word stress perception from two different perspectives. In the Stress Deafness Model (SDM), Dupoux et al. (2001) and Dupoux and Peperkamp (2002) presented a stress perception model based on the mental representation of stress in the lexicon. Altmann & Vogel (2002) created the Stress Typology Model (STM), which focuses on the stress perception from the phonological property differences of different metrical systems.

STRESS DEAFNESS MODEL

Cutler and Mehler (1993) claim that prosody is essential for L1 acquisition. When children learn their L1 language, they acquire the rhythm, making language acquisition easier and causing the adjustment of the perception-production mechanism. At an adult age, the adjustment of this perception and production mechanism is not so flexible and makes L2 processing harder. Mehler et al. (1988) suggest that children learn their L1 prosody before they learn segments. In languages such as Spanish, for example, in which stress is distinctive and differentiates minimal pairs¹, speakers have to process and represent stress in order to identify a lexical item. French speakers, on the other hand, do not need to process stress in this way given that their stress assignment is fixed.

Dupoux et al. (1997) conducted an experiment to test the ability of Francophone and Hispanophone native speakers to detect or ignore stress differences in English. In a stress discrimination test, the French participants had significantly more mistakes than the Spanish participants. In a second experiment, the participants had to ignore stress and perform the tasks based only on segmental information. In this test, Spanish speakers had more wrong answers. Thus, French speakers had difficulties to answer perception tests based on stress placement, while the Spanish had problems ignoring stress. A third experiment was carried out in order to compare the answers which were based on stress with the ones based on segments. It was shown that, for French speakers, the answers based on stress placement caused a larger number of mistakes than those based on segments. This study shows that L1 influence on the perception

¹ The same happens with Portuguese and English—languages which have distinctive stress (e.g., *sabia* x *sábia* x *sabiá* or 'record x re'cord).

of foreign languages is not related only to sound differences between languages. Suprasegmental information, such as stress, is also treated in different ways between speakers of varied languages. The authors suggest a model in which prosody representation is added to segmental information. The way this prosody representation is treated depends on the speaker's L1: elements which are distinctive are specified in details, while elements which are fixed or predictable are not represented.

The experiment of Dupoux et al. (1997) showed that French listeners are somewhat deaf to stress contrasts, especially in a more abstract processing level through tasks which require more memory processing and perceptual resources. Given these results, Dupoux and Peperkamp (2002) propose a perception model which works with segments and suprasegments and is characterized by the behavior of different languages regarding stress. The authors believe L2 processing is related to L1 and, thus, adult learners would struggle primarily with structures which are not familiar to their L1. Therefore, learners would show phonological deafness, i.e., problems with the discrimination of phonological contrasts which are not used in their L1. This difficulty would resist to L2 teaching and even be difficult to overcome with specific training.

Dupoux and Peperkamp (2002) claim that French listeners' difficulties to perceive stress are because they do not store stress in their mental representation of words given that in their L1 stress assignment is regular and not distinctive. On the other hand, speakers whose L1 has contrastive stress, such as Spanish, store stress in their lexicon. The authors also suggest that stress parameter, i.e., whether stress is contrastive or not, is established during L1 acquisition. If the speaker notices that stress is regular in his/her L1, he/she will not decode stress in his/her phonological representation and will lose the ability to use this information afterwards.

A possible limitation of this model is that it does not investigate what would happen with languages with unpredictable stress, such as Brazilian Portuguese. Moreover, as this model predicts general perception capacities, it does not make specific predictions about L2 acquisition and is not clear about the relationship between perception and production (Altmann, 2006).

STRESS TYPOLOGY MODEL

The STM, proposed by Vogel (2000) and modified by Altmann and Vogel (2002) (apud Altmann, 2006), is a different classification which includes stress perception and production in the L2 acquisition. Much like the

SDM, this model also employs the idea of stress parameters, classifies languages according to their stress regularities and focuses only on primary stress. However, this model consists of a binary branching hierarchy according to stress or other prosodic phenomena, such as tone. Furthermore, this model works with languages with unpredictable stress and non-stress languages.

Vogel (2000) (apud Altmann, 2006) classifies languages according to their stress typology. In stress languages, stress assignment may be predictable or not. Languages with unpredictable stress must have the stress lexically specified while languages with predictable stress must have parameter settings with information about which edge of the word is relevant for stress assignment and whether the language is sensible to syllable weight or not. Non-stress languages make use of pitch, tone or do not use this kind of information at the word level.

This model predicts different degrees of difficulty in the acquisition of primary stress in the L2. Negative settings would not influence the acquisition of stress. As previously predicted by the SDM, the best performance regarding L2 stress assignment would be by speakers who have non-stress L1 because there is no transference of positive parameters. They would be followed by speakers with unpredictable stress languages and the greatest difficulties would be displayed by speakers whose L1 has predictable stress since their language has several positive parameters which could impede the ability to acquire L2 stress.

In terms of production, Altmann's (2006) tests results converse to those of perception. That is, speakers whose L1 has predictable stress would produce better than speakers whose L1 lacks stress and those whose L1 has unpredictable stress. According to the author, good perception ability is not directly related to good production ability given that an L1 with positive stress parameter settings would hinder perception but would aid in production.

This study aims to investigate the relationship between stress perception and production by Brazilian learners of English. According to the STM and the SDM, Brazilian Portuguese speakers, whose L1 has unpredictable stress, would have fewer problems perceiving L2 stress than producing it.

METHODOLOGY

This section describes the methodology of the experiment, mentioning the participants, the words and the tests done.

Participants

This study had the participation of 20 undergraduate students of Language & Arts from a Brazilian federal university. All the participants were enrolled in the subject “Intermediate English” and had had about 400 hours of English instruction in their undergraduate studies.

The Target Words

The target words were all stressed on the fourth to last syllable, a pattern which is extremely rare in Brazilian Portuguese (BP)², in which words are stressed on one of the last three syllables. According with the results of Brawerman (2006), this pattern tends to be significantly more problematic to Brazilian students than the stress patterns which are common in their L1.

Production Test

The production test consisted of 40 words stressed on the fourth to last syllable and 20 distractors stressed on the third or second to last syllable. The 40 target words were made up of 30 words with four syllables and 10 words with five syllables (Table 1).

Table 1. Words Stressed on the Fourth to Last Syllable

fortunately	legislature	fascinating	capitalist	accuracy
virtually	architecture	calculator	militarist	modifier
subsequently	organizer	elevator	populism	satisfying
memorable	characterize	illustrator	feminism	decorative
noticeable	categorize	generative	citizenship	quantitative
reasonable	supervisor	speculative	difficulty	relatively
materialize	manipulative	investigator	considerable	inevitably
industrialize	communicative	sophisticated	particularly	administrator

In order to follow the same pattern as the target words, the 20 distractors consisted of 15 words with four syllables and five words with five syllables (Table 2).

² Brazilian Portuguese words can only be stressed in one of the three last syllables. Words stressed on the fourth to last syllable only exist when there is the addition of an epenthetic vowel like in *téc[i]nico* and *rit[i]mico*.

Table 2. Words Stressed on the Third or Second to Last Syllable (Distractors)

prejudicial	alternative	fascinating	immediate	intelligence
graduation	respectable	significant	democratic	receptionist
complexity	officially	historian	establishment	familiar
association	experimental	personality	vegetarian	dermatologist

Firstly, the participants read 40 sentences which had one word stressed on the fourth to last syllable. After that, they read the same target words in isolation and 20 distractors. The sentences and the words had been printed on cards which had previously been shuffled so as to randomize the order of the stimuli for each participant. After reading all the words, the cards were shuffled a second time and the participants would read the words again. Therefore, after each recording, the data of the production test of each participant were made up of 40 words stressed on the fourth to last syllable produced three times (once in a sentence and twice in isolation) and 20 words stressed on the third or second to last syllable produced twice in isolation.

Perception Test

The perception test was done with Microsoft Access 2003®. It consisted of 150 stimuli (50 words x 3 repetitions), divided into groups of 30 stimuli. The stimuli were the 40 words stressed on the fourth to last syllable used in the production test (Table 1) and 10 distractors with other stress patterns (Table 3). Each one was recorded by two American speakers—a man and a woman.

Table 3. Perception Test Distractors

prejudicial	complexity	respectable	significant	democratic
graduation	alternative	officially	immediate	familiar

Every word was repeated three times and randomized by the test program. Thus, each participant had a test in a different order and the words with four and five syllables were mixed. There was a slide with the word “break” after every 30 stimuli and the participants could choose to rest or continue the test.

The test featured identification tasks, in which the participants listened to the stimulus and had to click on the stressed syllable. In order to do that, there were four or five squares on the screen, according to the

number of syllables of each word, and the participants had to click on the square which corresponded to the stressed syllable, given that the word would never be written on the screen (Figure 1). If the stimulus were *elevator*, for example, there would be four squares on the screen and the participants, answering correctly, would click on the first square as it indicated the first syllable, which is the stressed syllable. They could listen to each stimulus as many times as necessary clicking on the button “*play again*”. After choosing the answer, an arrow would appear and the participants could click on it to automatically listen to the next stimulus.

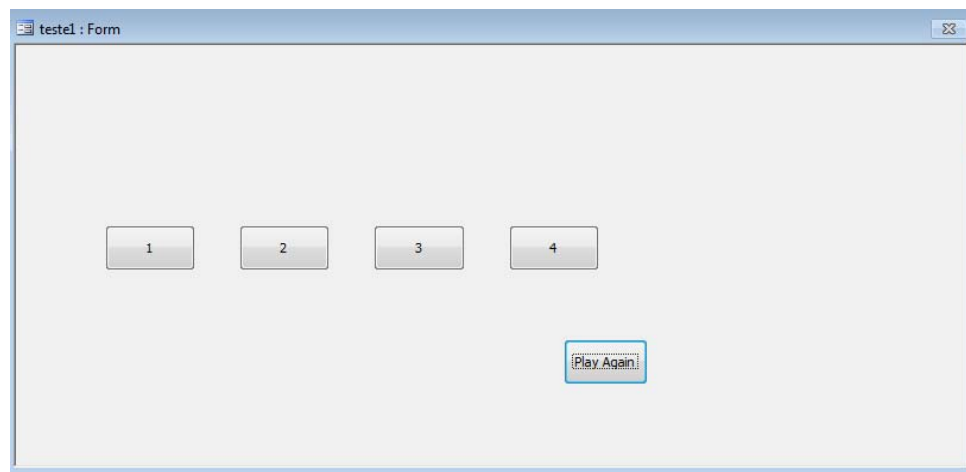


Figure 1. Example of the screen during the perception test.

RESULTS

The results presented in Table 4 show the percentage of the words produced correctly and incorrectly in the production test and their standard deviation (SD).

Table 4. Number of Correct / Incorrect Answers of the Target Words in the Production Test

Patterns	PRODUCTION TEST	
	Correct	Incorrect
%	28,4	71,6
SD	12,9	12,9

The incorrect pattern (71,6%) is the one which predominates in the production of the participants. The Wilcoxon Test, which was used to check statistical differences between both patterns, indicates that in the

production test the number of incorrect answers is significantly greater than the number of correct answers ($Z = -3,825, p < 0,001$), demonstrating that the participants tend to produce words stressed on the fourth to last syllable with an incorrect stress pattern.

Table 5 shows the data of the target words in the perception test. It can be seen that the correct stress pattern was the predominant one. The Wilcoxon Test demonstrates that the difference between the correct pattern (85,4%) and the incorrect one (14,6%) is significant ($Z = -3,884, p < 0,001$), which means that the participants tend to perceive stress correctly in words stressed on the fourth to last syllable.

Table 5. Number of Correct/Incorrect Answers of the Target Words in the Perception Test

Patterns	PERCEPTION TEST	
	Correct	Incorrect
%	85,4	14,6
SD	15,7	15,7

DISCUSSION AND FINAL CONSIDERATIONS

Concerning the acquisition of English stress by Brazilian Portuguese speakers, some hypotheses can be derived based on the STM. Considering Portuguese a language with unpredictable stress, this model predicts that the speakers would perceive stress easily but would struggle producing it. This prediction is confirmed in parts by the data of Brawerman (2006) and Brawerman-Albini (2011). Comparing the results which Brawerman-Albini (2011) obtained for the common stress patterns in Portuguese, both the data of the perception test (85% of correct answers) and the ones of the production test (80% of correct answers) show similar satisfactory responses, i.e., the participants of that study had a marked ability to perceive and produce stress, unlike what had been predicted by Altmann & Vogel's model (2002). Thus, the truly problematic task is the production of the words with an unfamiliar stress pattern—the ones stressed on the fourth to last syllable. However, the production of words stressed on the second and third to last syllable had a great number of correct answers, which does not confirm the prediction of the model that production would be difficult for speakers of languages with unpredictable stress. This difficulty was present to a significant degree only in the stress pattern which is rare in the participants' L1.

This research showed results similar to those presented in this section. It has not investigated common stress patterns in Portuguese, but it has demonstrated that the participants are able to perceive words stressed on the fourth to last syllable without major problems, even though it is a rare pattern in BP. The real difficulty concerned the production of these words and in this case it may be interpreted that L1 parameter settings do not allow this type of stress and this parameter was transferred to the L2. It can also be claimed that there is a lack of input with sufficient examples of this stress pattern since the strategy reported by the participants of Altmann (2006) was based on frequency.

Both the SDM and the STM predict that stress perception difficulties cannot be overcome after training or experience in the case of languages with predictable stress. However, there seems to be no prediction regarding production in languages with unpredictable stress. Thus, these models do not attempt to determine what would happen with production difficulties in this kind of languages after a perceptual training.

The authors indicate, however, that perception and production are independent from each other. The data presented in this study and previous research (Brawerman, 2006; Brawerman-Albini, 2011) do show that Brazilian speakers struggle when they have to produce words stressed on the fourth to last syllable, but this production difficulty is not reflected in perception. This was predicted by the STM as Portuguese is a language with unpredictable stress. Nevertheless, if Brazilian learners have a good perception of this stress pattern, why do they have this difficulty with production? It can be argued that this difficulty stems from some factors: (1) the unpredictability of English stress may make learners lose their confidence to study this topic; (2) the influence of BP makes learners avoid this stress pattern in English and use possible patterns in their L1; (3) the extremely low frequency of words stressed on the fourth to last syllable in BP and possibly in the L2 input received by students prevents them from having enough examples of this pattern to form a category which may be accessed in the production moment.

This importance of examples to form a category of words stressed on the fourth to last syllable which may be accessed for production is what motivated the research of Brawerman-Albini (2012) and Brawerman-Albini, Kluge and Silva (2013), which investigated the effects of a perceptual training in the acquisition of this stress pattern.

They obtained satisfactory results showing that a five-section-perceptual training was enough to allow participants to significantly improve their productions. In addition, the improvement was generalized

to words which had not been trained and was retained for two months after the end of the training. This result demonstrates practical consequences of teaching: the importance of repetition and of providing a correct input is strengthened and simple perception activities, which may be easily done in class, seem to have an important effect on an L2 stress acquisition.

Future research should lead to a better understanding of the relationship between perception and production with suprasegments and the use of perceptual activities in an L2 class environment.

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