The perception of the glottal fricative /h/ in onset position by Brazilian learners of English as a foreign language

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Abstract
In this study, we departed from the assumption that Brazilian Portuguese (BP) speakers of English have the tendency to mispronounce the English retroflex /ɹ/ as the glottal fricative /h/. With the use of a Picture Elicitation L1 Production Task, a Background Questionnaire and an L2 Transcription Perception Task, the following was investigated: (1) Participants’ L1 rhotic production variations in onset position, and possible Cross Linguistic Influence of these productions in their perception of the English glottal fricative /h/; and (2) Participants’ experience with the TL and its correlation with their perception of the English glottal fricative /h/. 13 learners participated in the pilot study and 15 in the experiment. All of them were BP learners of English in different learning levels, with ages ranging from 26 to 42 years old. The data obtained revealed that all of them produced L1 rhotics as glottal fricatives, and more than 70% of them transcribed the words beginning with <h> using <r>. Moreover, results showed that there is a positive correlation between experience with the L2 and correct perception of TL glottal fricative as a rhotic in onset position.

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Resumo

Neste estudo, partimos do pressuposto de que os falantes de português brasileiro (PB) aprendizes de inglês como língua estrangeira têm a tendência de pronunciar o retroflexo /ɹ/ em inglês como a fricativa glotal /h/. Com o uso de um Teste de Produção com imagens em PB, um Questionário e um Teste de Percepção com transcrição em inglês, investigaram-se: (1) Variações das produções róticas em PB na posição inicial e uma possível influência dessas produções na percepção da fricativa glotal /h/; e (2) A correlação da experiência dos participantes com a língua inglesa na percepção da fricativa glotal /h/. A pesquisa contou com a participação de 13 aprendizes no piloto e com 15 no experimento, em diferentes níveis de aprendizagem e com idades entre 26 e 42 anos. Os dados obtidos do experimento revelaram que todos eles produziram róticos em PB como fricativas glotais, e que mais de 70 % deles transcreveram as palavras que começam com <h> usando <r>. Além disso, os resultados mostraram que existe uma correlação positiva entre a experiência com a L2 e a correta percepção da fricativa glotal em posição inicial.

Palavras-chave: percepção fonológica em L2; fricativas glotais; róticos.

Introduction

Brazilian learners of English as a Foreign Language (EFL) present some specific pronunciation difficulties, especially at the beginning of their learning process. One of the most distinctive drawbacks is the mispronunciation of the English retroflex /ɹ/, tending to be pronounced as the glottal fricative /h/, especially in onset position. This might be due to the tendency to transfer the rhotic sounds from their mother tongue (L1) to English. The Brazilian pronunciation of rhotics is varied, and position dependent: the realizations of r-sounds (represented by the orthographic <r>) can be as glottal fricatives [h, h], velar fricatives [X, χ], a trill [ɾ], a retroflex [ɾ], and a flap [ɾ]. In onset position, the most common pronunciation is of glottal fricatives [h, h], but a trill [ɾ], as well as a flap [ɾ] can also be found in some dialects. Therefore, according to Osborne

[W]hereas in English the phonemes /h/ and /ɹ/ are represented by the two graphemes <h> and <r>, respectively, in Brazilian Portuguese the two sounds are conventionally represented with the same grapheme <r>, when in onset position [...]

Some studies have focused on the production of rhotic sounds


by Brazilian speakers when speaking English. However, to the best of our knowledge, very few studies investigated these learners’ perception of the glottal fricative /h/. Our assumption is that Brazilian learners of English are likely to perceive the glottal fricative as a rhotic, due to the interference of L1, following the tenets of literature on how information retrieved from long-term memory (LTM) might influence online processing, on the notion of category assimilation in the Speech Learning Model (SLM), and the effect of orthography on speech perception. On the other hand, we suspect that knowledge and experience with the target language (TL) will facilitate learners’ differentiation between /h/ and retroflex [ɹ].

Based on the aforementioned, the research questions (RQ) that guide our study are:

RQ1 How often do BP learners of English whose L1 rhotic production in onset position is a fricative perceive the TL glottal fricative /h/ in onset position as [ɹ]?

RQ2 Is there a positive correlation between TL experience and the accurate perception of the TL glottal fricative as /h/ in onset position?

The hypotheses (H) that derived from the research questions are:

H1 Given that Brazilian learners’ L1 rhotic production in onset position is /h/, they are likely to perceive the English glottal fricative in onset position as a rhotic.

H2 The higher the participants’ experience with the TL, the more accurate their perception of the glottal fricative /h/ as different from the retroflex [ɹ] will be.

This article begins with a brief review of literature that discusses the creation of phonological categories, the notion of cross-linguistic influence (CLI), Flege’s Speech Learning Model (SLM) and Cowan’s Embedded Processes Model of Working Memory. All of these aspects will be tackled bridging the literature to the study at hand. Next, the main findings regarding Osborne’s study on the perception of the English consonant /h/ by BP learners will be highlighted, as well as the influence of L1 orthography in the perception of L2 sounds. Then, we present the methodology used in the study, the results and discussion, concluding with final remarks, limitations of the study and suggestions for further research.
Review of Literature

Common sense is the assumption that knowledge stored in LTM influences the real-time processing of information captured from the environment via sensory systems. Within the realm of this study, we propose that this knowledge (i.e. prior knowledge) might be the driving force that triggers Brazilian EFL learners’ perception of the English glottal fricative /h/ in onset position as a rhotic. In other words, we assume that participants’ continuous use of the glottal fricative /h/ when realizing the initial <r> of BP words (i.e., rádio (radio), raquete (racket), rato (rat)) creates a well-established phonological category for rhotics in LTM, and that this well-established category promotes a cross-linguistic influence between these two phonetic realizations. Therefore, we predict that low-frequency words such as “hype”, “hound” and “hoard”, just to mention a few, are likely to be perceived as “rype”, “round” and “roard”, respectively. For that to occur, we assert that participants’ previous knowledge and experience with the TL must be poor. Nevertheless, orthographic and phonological mental representations will favor their more accurate perception, an assumption that matches Colantoni et al.’s definition of CLI as “the interaction of the individual’s various languages in both comprehension/perception and production”. Therefore, this study’s main proposition is that Brazilian EFL learners, influenced by well-formed L1 categories in LTM, will accommodate the perception of L2 sounds to those categories (i.e., English glottal fricative /h/ in onset position as rhotic). In addition, the study holds that the higher the experience of these learners with the TL, the lower the CLI will be due to these individuals’ expertise in differentiating between L1 and TL sound categories.

The SLM presents several accounts to ground the previous rationale. As explained by Colantoni et al., in the same work above mentioned, this model proposes that

\[ \text{The more similar a TL category is to an L1 category, the more likely it will be equated to an L1 category and the less likely it will be for the learner to form a new, target-like L2 category.} \]

According to what this model proposes, new TL categories, when in stage of assimilation, are assumed to pass through processes of equivalent classification in which they tend to be harmonized with knowledge already stored in LTM. In that sense, individuals who have become skillful at perceiving phonetic realizations in their L1 will have more difficulty in noticing less-salient differences between these phonetic realizations and those of the TL.

Theoretically speaking, the model proposes that the source of difficulty in distinguishing between sounds resides in the
fact that both L1 and TL categories are represented in a common phonological space in LTM. The implication of such assumption as regards to perception is that if a common place is shared for the storage of both L1 and TL sounds, these sounds will tend to form a composite representation in LTM (i.e., merged L1-TL category). Simply put, a unique mental representation containing some of the features of each of the sounds will be formed. Therefore, such mental knowledge organization is assumed to hinder the perception of differences between the L1 and TL phonological categories due to their mutual influence. It is noteworthy, however, that, according to the SLM, even though skillful L1 phonetic realization may prevent the formation of new TL categories in memory, it is still possible for adult EFL learners to achieve native-like proficiency in perception if their learning experiences favor so. It is because of this reason that we predict that the more exposure with the TL, the lower the chances of learners to confound the realization of the glottal fricative /h/ as a rhotic in onset position.

Another way to understand the phenomenon investigated in this study is by comprehending some of the interactions theorists propose between LTM and working memory (WM). Cowan's Embedded Processes Model of Working Memory, for instance, provides good insights concerning that. According to this model, WM can be operationalized as a set of processes which, during the conduction of tasks with mental components, and under the control of a central executive (CE): (a) binds habituated or novel information to already crystallized knowledge of LTM, respectively strengthening, modifying and enriching old mental representations, or forming new ones; (b) activates a not measurable amount of relevant LTM schemata web according to their relevance in relation to the task at hand; and (c) processes a limited subset of this not measurable amount of activated information, which actually composes the very core of what is in the real-time focus of attention. Broadly speaking, Cowan's proposal is of a unitary WM system since it puts higher emphasis on the relationships among parts of LTM, which, triggered by a stimulus, are simultaneously activated or left readily available for further activation. Cowan's model, thus, appears to speak directly to the phenomenon observed in this study when it comes to the assertion that no new knowledge can be processed in WM without passing through and being associated with some preexisting knowledge in LTM.

From that point of view, EFL learners, when involved in the perception processes of the English glottal fricative /h/, might retrieve features of the most common Brazilian-Portuguese realization of a rhotic stored in LTM into WM, thus promoting CLI. Because of that, the WM perception product will possibly present trade-offs between the sound realization expected to be captured, the glottal fricative /h/, and the grapheme, activated from LTM. Nonetheless, as it can be implied by our second hypothesis, the
more exposure with the TL, the higher the possibility of learners to consolidate more distinct phonemic mental representations within the structures of LTM (i.e. different phonemic categories), and, consequently, the more accurate their realization of the glottal fricative /h/ as a rhotic in onset position will be.

As far as research is concerned, to the best of our knowledge, Osborne’s study is the only investigation on the perception of English /h/ by Brazilians. In this study, the author uses discrimination, identification and cross-language assimilation perception tests to examine if Brazilians (English learners and monolinguals) perceive the distinction between the English /h/ and /ɹ/ in onset position. Osborne found that, in the discrimination test, which was completed by the English learners, both high and low proficiency learners managed to successfully distinguish between the two English phonemes. As for the identification test, also taken by the English learners, the author found that the high-proficiency learners outperformed low-proficiency learners, thus indicating that proficiency helps learners get better at identifying English words containing the target sounds. Finally, in the cross-language assimilation test, Brazilian English learners and monolinguals were asked to match the initial sound of some English words with one of two BP word categories represented on the screen. The results revealed that the high-proficiency learners and the monolinguals match the target English sounds to two different categories in Portuguese, thus indicating that they perceive the English /h/ and /ɹ/ as different categories. However, low-proficiency learners assimilated both /h/ and /ɹ/ to BP /h/ and /ɹ/ without distinction. According to her, the fact that lower learners performed worse can be explained by the difficulty that beginners have in associating a familiar sound in their L1 to a new phonetic environment in the L2 being learned.

The design of our study differs from the one adopted by Osborne above mentioned; however, it goes in line with her findings that at initial learning stages, Brazilians face difficulties in perceiving the English /h/ and /ɹ/ as distinct phonemes. Furthermore, our investigation aimed at extending Osborne’s study with the use of the transcription test and by investigating how L2 experience may affect the perception of the target sounds. Although her study did not investigate the influence of orthography, she recognized that this factor might have influenced learners’ difficulties in her study. Similarly, we predict that since we adopt a transcription test including orthographic information, it may also have influenced learners’ perceptions of L2 sounds. Moreover, the fact that the participants in this study are adults who are not in the country where the TL is spoken and are provided with written input in L2 may also reinforce learner’s recoverability through literacy from their L1.

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Method

In this section, we present essential information about (i) participants, (ii) instruments for data collection, (iii) pilot study and (iv) procedures for data analysis.

Participants

There were 15 participants in this study. Eight of them were males and seven were females, with ages ranging from 26 to 42 years old. All of them were Brazilians and had Brazilian Portuguese (BP) as their mother tongue. Two of them were German descendants and one was an Italian descendant, but none of them reported speaking these languages.

Participants were from four different Brazilian states: seven of them were from Santa Catarina, four from Paraná, two from Rio Grande do Sul (i.e. south of Brazil) and the remaining two from São Paulo (i.e. southeast of Brazil). All participants had lived in Santa Catarina for at least seven years. All of them were working at a port in Santa Catarina, where they received a partial scholarship to invest in English learning. When this study took place, three participants were studying with private teachers, nine were studying in language schools, and three were not studying English. At the time of the study, they presented different levels of knowledge in English, which was not measured by proficiency tests, but self-reported in the questionnaire,21 in terms of length of time studying English and hours of input per week.22

Instruments

Three instruments were used in this study: a questionnaire, an L1 production task, and an L2 perception task. The steps for data collection were divided into three parts, as summarized in table 1 and explained in the following paragraphs.

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Production Task in Portuguese</th>
<th>Perception Task in English</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 open-questions in BP</td>
<td>Picture Elicitation containing 30 words (20 distractors and 10 words with the rhotics in onset position)</td>
<td>Transcription containing 36 words (26 distractors and 10 words with the glottal fricative /h/ in onset position)</td>
</tr>
</tbody>
</table>

22. Cf. table 4, on p. 61.
At first, participants were contacted and invited to take part in the study. They were informed that one of the researchers would meet them individually at a quiet place to collect the data. Moreover, they were informed that the data collection procedures would take about 15 minutes to be completed. All data collection took place in November 2016.

**Questionnaire** – It was designed to collect participants’ background data. The questionnaire\(^{23}\) had 12 open-questions in Portuguese, and it was used to verify the participants’ L1 dialect and contact with other languages. Moreover, there were questions to examine their experience as English learners, namely, age of onset of English learning, length of time studying English, experience and amount of time of English input per week. These L2 experience variables were correlated with the participants’ performance on the L2 perception task.

**L1 Production Task** – This instrument consisted of an elicited production test in the informants’ L1.\(^{24}\) Its main purpose was to identify what type of rhotic production participants would display in their mother tongue. The task involved a PowerPoint presentation of 30 images depicting L1 words containing 20 distractors and 10 rhotics in onset position. All the 10 words selected in the L1 Production Task were carefully chosen having in mind that the images needed to lead participants to produce Brazilian Portuguese (BP) words that had rhotics in onset positions. This Task was individually administered by one of the researchers. The participant was instructed to look at the images shown on a PowerPoint presentation and was required to orally produce the words that represented these images in BP as soon as they appeared on the screen. Participants’ productions were audio-recorded using a Samsung GT-18552B mobile phone. A familiarization session preceded the conduction of the task.

**L2 Perception Task** – Right after the L1 Production Task, each participant received a handout\(^{25}\) to carry out the L2 Perception Task, in which 8 participants did version A, and 7 participants version B.\(^{26}\) The task consisted of listening to each word only once while writing the first letter (which was missing) that represented the first sound participants heard. This task also brought a familiarization section and the task itself. In Section I, the familiarization part comprised nine words. In Section II, the participants needed to listen to 36 low-frequency words in the TL (10 words with the glottal fricative /h/ in onset position and 26 other words used as distractors), and, while listening, they were asked to write down the first letter that represented the onset sound of each of these words. The reason for opting for low-frequency words in the L2 Perception Task is that participants should rely on their auditory perception instead of their memory (in case they had a previous contact with the word). Therefore, none of the 10 words with the glottal fricative /h/ from the L2 perception task were
present in the list of the top 5000 words corpus of contemporary American language available on The Word Frequency website.\(^{27}\)

The speech materials used for the perception task were recorded by a male proficient Brazilian English speaker (age: 27), at that time concluding his PhD studies in an English Program. His experience as an English teacher, as a researcher from phonetics and phonology and his experience with the recording procedures at the laboratory were factors taken into account for selecting his participation. The speaker produced the words at a natural speech rate, reading from a slide presentation (one at a time in the same order as the two versions). There were a total of 45 words (9 for familiarization and 36 as target words). The words were read twice, once in order and another time in the inverse order, as explained above.

The words were recorded at a sound-proof booth at an acoustic laboratory in a university using as hardware an iMac (model iMac9.1), version Mac OS X 10.6.8, Intel Core Duo, 2GHz, 4GB 1067MHz DDR3. The sound card model was MOTU UltraLite-mk3 Hybrid (Hybrid FireWire – USB audio interface with on-board effects and mixing) for Mac OS X systems. The microphone was an AudioTechnica PRO 8Hex hypercardioid vocal dynamic (200 - 18,000 Hz frequency). With reference to the software, the following programs were employed: Ocenaudio version 2 rc 1 (build 5141), with the sampling rate set at 44100Hz, mono, 16 bits, and CueMix version FX 1.6 57985.

In this study, instruments 2 and 3 attempt to answer RQ1: “How often do the L1 rhotic productions of Brazilian EFL learners affect their perception of the TL glottal fricative /h/ when in onset position?”, while instrument 1 (the questionnaire), together with the results of Instrument 3, attempts to answer RQ2: “Is there a positive correlation between TL experience and the accurate perception of the TL glottal fricative as /h/ in onset position?”

Consent forms were designed for all the participants of the study\(^{28}\) and applied before all instrument procedures.

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**Pilot Study**

There were five purposes for piloting the instruments: (1) to check if the consent form was appropriate to explain the research to participants; (2) to make sure that the questions in the questionnaire were clear and suitable for the research; (3) to check if the L1 Production Task and the L2 Perception Task were well designed, and if the instructions were clear to the participants; (4) to find out how much time each participant would need in order to complete the whole process; and (5) to verify if the recording device would capture a clear sound.
The pilot study was administered to 13 EFL learners from different learning stages, who did not take part in the final data collection. As they were in-company students, the tests were conducted in a quiet meeting room. The L1 Production Task was administered individually, with the images being projected on a TV screen, and the mobile phone captured the participants’ audio with quality. The L2 Perception Task was also administered individually. Each participant took about fifteen minutes to complete the whole procedure. The results of the pilot study showed the following: 1) While reading the consent form, the participants had no doubts regarding the explanation of the research and their participation in the study; 2) Regarding the questionnaire, some words needed to be boldfaced in the questions to highlight the importance of answering each one of those questions; 3) In the L1 Production Task, all participants produced a fricative /h/ in the L1. However, two words and respective images needed to be changed because some participants nominated them with two words which did not contain as the first letter. Therefore, the words rosa (rose), named as flor (flower) by 2 participants, and rinoceronte (rhino), named as hipopótamo (hippo) by 2 participants were replaced by relógio (watch) and raquete (racket), respectively. (4) Concerning the L2 Perception Task, the researcher noticed that some participants were relying on their previous knowledge of some words instead of attentively listening to the onset sound of each word in the audio file. Therefore, the researchers included in the instruction the following sentences: ‘Do not try to guess the letter which is missing. Listen to the word and then write down what you heard’. The researcher in charge of data collection also highlighted this observation when orally instructing the participants in the real task.

Data Analysis Procedure with the Rhotic Sound in Onset Position

First, the L1 Production Test was examined to verify participants’ rhotic productions in BP. The researchers listened to the target words as often as needed, focusing on the production of the word-initial rhotic. This analysis showed that all L1 rhotic productions were indeed a fricative sound (either [h, h] or [X, ã]); but no attempt was made to provide a narrow transcription for the rhotic. The researchers reached an agreement of 100% in the classification of the rhotic sound.

Second, the questionnaire data were examined to gather information about the participants’ background (age, sex, city of residence) and experience as English learners. The following questionnaire items were deemed relevant for the present study: amount of time dedicated to the study of English, amount of experience in an English-speaking country, and amount of English input per week. We added the information about these questionnaire items
to a spreadsheet to allow correlating the participants’ L2 experience variables with their performance on the L2 Perception Task.

Finally, the L2 Perception Task data were analyzed by checking the grapheme used for the transcription of each word-initial rhotic in the target words. Based on this analysis, a spreadsheet was created, portraying each target word and the different types of orthographic transcription provided by the participants, namely: the expected <h>, <r>, and also unexpected <f>, <b>, <w>, and <t>, which we assume were produced by participants based on familiarity with other words that displayed these graphemes (see more details in the discussion section).

The data were then submitted to statistical analysis using the SPSS program. The descriptive statistics and the normality tests (Shapiro-Wilk, \( p < .001 \) for the L2 input variable) indicated that the data lacked normal distribution. Thus, a decision was made to utilize non-parametric tests for the statistical analyses. To answer RQ1, we calculated the percentage of correct transcriptions for each participant, the percentage of transcriptions containing the grapheme, as well as the percentage of other graphemes that appeared in the transcriptions. To examine the results per type of word, we also calculated the percentage of errors for each word.

As for RQ2, we calculated basic descriptive statistics (mean \([ m ]\), standard deviation \([ S.D. ]\)) for the L2 experience variables and the L2 Perception Task. Then, non-parametric Spearman correlations were run using data from the following variables: L2 Perception Task scores, Years of English study, Hours of English input per week. Note that, for this analysis, we had to exclude one of the English experience variables, namely, experience in an English-Speaking country, due to the lack of variance in the data set (only two participants reported having experience abroad).

**Results and Discussion**

This section aims at presenting the results of the study gathered from the data collection and at discussing these results according to each of the two research questions. Tables 2 and 3 were constructed to better display these results.

The first research question examines how often BP learners of English perceived the TL glottal fricative /h/ in onset position as a rhotic. The L1 Production Task showed that 100% of the participants pronounced the L1 in onset position as fricatives. This may be explained by the fact that no participants are from (or have lived for long in) regions where L1 rhotics in onset position are pronounced as flaps or trills. Therefore, the only CLI from participants’ L1 regarding rhotic productions in onset position which can be observed in this study are fricatives.
Regarding the L2 Perception Task, table 2 reveals that 73.3% of the participants transcribed the words beginning with <h> using <r>. More specifically, 11 out of 15 participants have orthographically represented <h> as <r>. Note that four participants (P2, P7, P10, P13) successfully transcribed all target words using <h>, which indicates that these participants perceived the difference between the glottal fricative and the rhotic in the L2. However, two participants (P8 and P11) consistently transcribed the target words with the <r> grapheme to represent /h/, thus showing a high degree of CLI in the perception of the English glottal fricative. The mean of correct transcriptions (i.e., /h/ transcribed as <h>) reached 4.93, which indicates that about 50% of the target words containing the glottal fricative were perceived and transcribed correctly. The high value for the standard deviation (S.D. = 3.67) mirrors the fact that a few participants obtained very high rates of correct responses (100%), while others had a very poor performance (from 0% to 10% of correct responses). Furthermore, the mean of transcriptions representing /h/ with the <r> grapheme was 4.26 (S.D = 3.53), which indicates that nearly 50% of the occurrences of /h/ words were perceived as having /r/, thus confirming a high degree of CLI for this group of BP learners of English.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Perception Outcomes</th>
<th>/h/ words represented by &lt;r&gt;</th>
<th>/h/ words represented by other graphemes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percentage (%)</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>P1</td>
<td>3</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>P2</td>
<td>10</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>P3</td>
<td>5</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>P4</td>
<td>4</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>P5</td>
<td>4</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>P6</td>
<td>3</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>P7</td>
<td>10</td>
<td>100</td>
<td>0</td>
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<tr>
<td>P8</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>P9</td>
<td>1</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>P10</td>
<td>10</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>P11</td>
<td>0</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>P12</td>
<td>2</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>P13</td>
<td>10</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>P14</td>
<td>7</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>P15</td>
<td>5</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td><strong>4.93</strong></td>
<td><strong>4.26</strong></td>
</tr>
<tr>
<td><strong>S.D.</strong></td>
<td></td>
<td><strong>3.67</strong></td>
<td><strong>3.53</strong></td>
</tr>
</tbody>
</table>

Moreover, as table 2 shows, from the 76 misrepresented tokens, 65 (85.52%) were represented by <r> and 11 (14.43%) were represented by other graphemes (<f>, <t>, <w>, <l>, <b>). The types of transcription provided by the participants are displayed in table 3, which shows a more detailed list of the target words from a rank of

Table 2: Participants’ L2 Perception Task results.
highest (66.66%) to lowest (33.33%) percentage of orthographic misrepresentation.

<table>
<thead>
<tr>
<th>Words</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
<th>P9</th>
<th>P10</th>
<th>P11</th>
<th>P12</th>
<th>P13</th>
<th>P14</th>
<th>P15</th>
</tr>
</thead>
<tbody>
<tr>
<td>hoard</td>
<td>W</td>
<td>✓</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>✓</td>
<td>R</td>
<td>✓</td>
<td>R</td>
<td>R</td>
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Table 3: Orthographic Misrepresentation Word Rank.

As table 3 suggests, most of the low-frequency words included in the L2 Perception Test were sometimes misrepresented in writing (the first letter) maybe due to participants’ interference of previous knowledge of L2 vocabulary. For example, P14 represented ‘hoard’ as ‘board’, and P1, P5 and P14 represented ‘hollow’ as ‘follow’, possibly placing overreliance on top-down rather than data-driven processing (i.e., relying on predictions based on previous knowledge to guess the words, rather than being attentive to the details of the listening input). This happened despite the fact that the researcher instructed the participants not to rely on previous knowledge, but to pay attention to the first sound they heard.

In a general panorama, the results provide support to the hypothesis that BP learners’ L1 rhotic productions may affect their perception of the TL glottal fricative /h/ in onset position. However, the presence of L2 written input in the L2 Perception Task may have played an important role in learners’ recoverability through literacy from their L1. In other words, participants may have retrieved knowledge from their L1 spelling and related it to the words listened from the files.

In order to answer the second research question, which investigates the existence of a positive correlation between L2 experience and the accurate perception of the L2 glottal fricative as /h/, the results from the perception task together with the information of the background questionnaire (amount of time dedicated to the study of English, amount of experience in an English-speaking country, and amount of English input per week) were analyzed in order to inquire if the type of L2 experience could be related to a better performance on the L2 Perception Task, and thus higher rates of perception.
Four participants (P2, P7, P10, and P13) had 100% of correct responses in the L2 Perception Task, representing 26.6% of the total of participants. Three of them reported the highest numbers of years devoted to studying the TL: P2, five years, P7, seven years and P13, eight years. The exception was P10, who reported four years of study; however, this participant reported having spent three months studying English in Canada, which might explain the result. P1 also reported having experienced six weeks studying English in London. Moreover, P2 reported having 3 hours of input a week, and P10 reported six hours, P13, nine hours, and P7, more than forty-four hours. As reported by P7, the forty-four hours are distributed as follows: 30 minutes doing English homework; 14 hours watching series in English; 10 hours listening to music in English, 14 hours using English at work; and 5 hours reading books and articles in English.

Conversely, there were eight participants (P1, P4, P5, P6, P8, P9, P11, P12) who performed poorly by scoring below 50% of the correct answers in the L2 Perception Task. These participants reported that they had studied English for no longer than 5 years and had no experience abroad. Among them are P8 and P11, who scored 0% of correct answers in the L2 Perception Task and reported having zero hours of target language input per week.

Participants 3, 14 and 15 were the ones who obtained from 50% to 70% of correct answers in the L2 Perception Task. More specif-
ically, P4 scored 50%, P14, 70% and P15, 50% of correct answers. Concerning experience with the TL, these participants studied the TL from two years and eight months to five years. Additionally, they all reported having two hours of L2 input a week, the lowest quantity of hours apart from the ones who reported zero input.

With the aim to provide an answer for RQ2, we ran nonparametric Spearman correlations with the L2 Perception Task scores, and the questionnaire variables displayed in table 4. The original intention was to include three participants' L2 experience variables in this analysis. However, as we already pointed out, the Study Abroad variable showed a lack of variance (only two participants reported having some experience abroad) and therefore, it was excluded from the analysis. Thus, the correlational analysis included three variables, namely, L2 Perception Task scores of correct responses, Years of English Study, and Amount of Target Language Input per week.

Figures 1 and 2 display the correlational data graphically, making it easier to identify the positive correlations, as well as some outliers. For example, in figure 1, we can see that even a participant who reported having few years of English study (P14) obtained high scores of correct responses in the L2 Perception Task (70%). On the other hand, figure 2 shows a clear outlier, P7, who reported having over 40 hours of English input per week and obtained the maximum score of correct responses, different from P1, who reported the second highest number of hours of input per week (12:40) and obtained a low level of correct responses (30%).

Figure 1: Scatterplot displaying positive correlation between L2 Perception Task scores and Years of English Study. Elaborated by the authors based on SPSS analyses.

Figure 2: Scatterplot displaying positive correlation between L2 Perception Task scores and English input per week. Elaborated by the authors based on SPSS analyses.
Figure 3 displays the correlational analysis between Input and performance in the L2 Perception Task excluding data from P7, given his clear outlier status concerning the Input variable. The scatterplot indicates a weak positive correlation between the two variables when data from P7 is excluded.

The results displayed in table 5 show that the correlation between Years of English Study and L2 Perception were positive, moderate, and significant \( (p=.05) \). Furthermore, the amount of English Input per week and L2 Perception yielded a positive, moderate correlation, which did not reach significance \( (p=.09) \). Furthermore, when we reran the correlational analysis excluding data from P7, a clear outlier, the correlation became weak \( (r=.26) \) and failed to reach significance \( (p=.36) \). These results show partial support to Hypothesis 2, which predicted that extensive L2 experience can help BP learners of English to reduce the level of CLI and perceive the English glottal fricative as a different category from the English rhotic. Indeed, only one variable (years of English study) used to examine L2 experience was significantly correlated with performance on the L2 Perception task.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Years of English study</th>
<th>English input per week</th>
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<tr>
<td>Correl. = .50</td>
<td>Correl. = .40</td>
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<tr>
<td>( p = .05 )</td>
<td>( p = .09 )</td>
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</tbody>
</table>

Table 5: Correlations and probability values for L2 Perception and L2 Experience variables.

Final Remarks

In this study, we began with the assumption that Brazilian learners of EFL have the tendency to mispronounce the English
retroflex /ɾ/ as the glottal fricative /h/. With the use of a Picture Elicitation L1 Production Task, a Background Questionnaire and an L2 Transcription Perception Task the following was investigated: 1) Participants’ L1 rhotic productions variations in onset position, and possible CLI of this production to their perception of the English glottal fricative /h/; and 2) Participants’ experience with the TL and its influence in their perception of the English glottal fricative /h/.

The L1 Production Task revealed that participants massively produced rhotics as glottal fricatives, even though the Brazilian pronunciation of rhotics is varied in onset position (flaps, trills or fricatives). Therefore, apart from L1 fricative productions representing the rhotics, it was not possible to show evidence that these specific productions would reflect different L2 perceptions of the glottal fricative /h/ in English.

The L2 Perception Task showed that 73.3% of the participants transcribed the words beginning with <h> using <r>. The mean of transcriptions was 4.26 (S.D = 3.53), which indicates that nearly 50% of the participants perceived the target words containing the glottal fricative as words containing a rhotic sound, thus confirming a high degree of CLI for this group of BP learners of English. These results provide support to the hypothesis that BP learners’ rhotic productions may affect their perception of the TL glottal fricative /h/ in onset position. However, as previously mentioned, the presence of L2 written input in the L2 Perception Task may have played an important role in learners’ recoverability through literacy from their L1. In this sense, this study is in consonance with previous ones which show that participants retrieved knowledge from their L1 spelling and related it to the words listened in the L2.

When correlating participants’ experience with the TL and its influence in their perception of the English glottal fricative /h/, the variables Experience abroad, years of English study and amount of input a week, information retrieved from the background questionnaire, were analyzed and related to the percentage of correct answers from the Perception task. In this regard, the results show that the correlation between Years of English Study and L2 Perception were positive, moderate, and significant (p=.05). However, the amount of English Input per week and L2 Perception yielded a positive, weak correlation, which did not reach significance when an outlier concerning the Input variable was excluded from the study. These results offer partial support to Hypothesis 2, which predicted that amount of L2 experience can help BP learners of English to reduce the level of CLI and perceive the English glottal fricative as a different category from the English rhotic. Further studies should seek for alternative ways to assess the amount of L2 input learners are exposed to, given that the present study faced difficulties to address this variable.
To sum up, results indicate that all the participants in this study produced a glottal fricative /h/ when in onset position in the L1, which indicates possible interference in the perception of the glottal fricative /h/ when in onset position in the L2. In this vein, this study showed that there is a positive correlation between experience with the L2 and correct perception of TL glottal fricative as a rhotic in onset position, since participants with a higher experience performed at ceiling level, whereas participants with little experience in the L2 had a great percentage of misperception.

Limitations of the Study and Suggestions for Further Research

One limitation of this study, which was already mentioned in the results section, is the fact that there were no participants in this study whose L1 rhotic production in onset position displayed Flaps or Trills. Therefore, it was not possible to give evidence that these specific productions, apart from L1 fricative productions representing the rhotics, would reflect different L2 perceptions of the glottal fricative /h/ in English. Having participants with these specific rhotic pronunciations onset productions would then be interesting so as to investigate if these influences are carried out to their L2 perceptions of the fricative /h/ in English.

Besides, proficiency level of participants was not investigated; instead, we used participants’ self-reported answers on experience with English, including experience abroad, length of time studying English and amount of input per week. Therefore, the outlying results of the study could be explained by a lack of more accurate criteria in determining participants’ proficiency in English.

One more setback was the fact that there was an orthographic input in the perception test, which might have impacted in some participants’ bias towards a familiar word, thus misrepresenting the sound they heard. As a suggestion for further studies, it would be interesting to request that participants only represent the first sound they hear.

Another drawback is the fact that this study failed to further investigate other covariates, such as kind of input, learning styles, methods used in EFL learning, as well as individual differences in terms of cognitive skills. Hence, the importance of studies which take these variables into account and have a study design that can contemplate them.

One final limitation of this study was the non-provision of recordings doubled-checked by a native speaker or by acoustic analysis in the perception task. Such a procedure would have provided more reliable stimuli for the experiment. Consequently, it would have possibly affected participants’ phonological perception and thus, possibly affected the outcomes obtained.
References


Credits of the images

All images were created by the authors.
Appendix

Consent form

TERMO DE CONSENTIMENTO LIVRE E ESclarecido

Introdução: Você está sendo convidado a participar do projeto de pesquisa que busca estudar características específicas da pronúncia da língua inglesa e suas relações com o português. Este formulário contém dados relacionados ao consentimento para utilização de informações coletadas durante a realização da pesquisa. Os pesquisadores são os alunos _____ e a Professora Doutora _____.

Objetivos: Este estudo visa contribuir ao ensino de Língua Inglesa, uma vez que os dados coletados podem servir para a elaboração e melhoria de materiais didáticos, adequando-os às necessidades dos alunos brasileiros aprendizes do idioma e, também, contribuindo para o ensino nas áreas de Fonética e Fonologia de modo geral.

Seleção dos participantes: O participante desta pesquisa precisa ter mais de 18 anos de idade, e não ter problemas auditivos.

Procedimentos: Se aceitar participar da pesquisa, você (i) responderá a um questionário que busca compreender melhor seu perfil como aprendiz da língua inglesa, (ii) verá imagens de objetos e enquanto fala (em português) o nome dos objetos apresentados o áudio será gravado, (iii) ouvirá a alguns arquivos de áudio (em inglês) e escreverá algumas letras das palavras apresentadas.

Riscos ou desvantagens: Não existem riscos ou desvantagens associados à sua participação; entretanto, pode haver raros casos de desconforto de natureza psicológica, caso ansiedade, nervosismo ou estresse. A participação nesta pesquisa não acarretar, de forma alguma, em prejuízos ou em privilégios. Além do mais, asseguramos que esta pesquisa está submetida aos critérios da Resolução 196/96 e suas complementares. Se houver quaisquer dúvidas referentes ao seu desenvolvimento, os pesquisadores estarão à disposição para esclarecimentos através dos contatos dispostos abaixo.

Voluntariedade na participação: O participante pode, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os dados de desistente.

Confidencialidade: Não haverá identificação nominal dos participantes, nem divulgação de quaisquer informações que podem revelar sua identidade.

Divulgação dos resultados: Todos esses dados integrarão o corpus da pesquisa. Esta pesquisa será concluída em Dezembro de 2016 e o estudo tornar-se-á público.

Quem contatar: Se você tiver qualquer dúvida sobre a pesquisa, podemos conversar sobre ela agora ou você pode entrar em contato conosco.

Se você estiver de acordo em participar desta pesquisa, assine por extenso no espaço abaixo.

Eu, ____________________________, concordo em participar deste estudo e autorizo o pesquisador a utilizar os dados por mim fornecidos.

_____________________________
Assinatura do Participante

_____________________________
Assinatura do Pesquisador

_____/____/____
Local/Data
Questionnaire

1. Nome: ____________________________ 2. Idade: ______________

3. Em quais países, estados e cidades você já morou por mais de 01 ano? (Inclua a duração de tempo em que residiu lá e intervalo de idade que tinha quando residiu nestes locais)

__________________________________________________________________________

4. Com que idade você começou a aprender inglês?

__________________________________________________________________________

5. Descreva onde você aprendeu inglês e quanto tempo estudou esse idioma em cada local (escola regular, escola de idiomas, outro) e a idade que tinha?

__________________________________________________________________________

6. Se você já morou em algum país de língua inglesa, especifique onde, por quanto tempo e quais atividades exerceu nesse país durante o tempo em que lá viveu.

País: ____________________________ Tempo de permanência: ______
Atividade: ____________________________

País: ____________________________ Tempo de permanência: ______
Atividade: ____________________________

7. Quantas horas de aula por semana você faz? ____________________________

8. Você gosta de estudar inglês? ( ) Sim ( ) Não

9. Você pratica a língua inglesa fora da sala de aula? ( ) Sim ( ) Não

Se afirmativo, como e quanto tempo por semana?

( ) Faço as tarefas relativas a minhas aulas de inglês. ______ horas por semana.

( ) Assisto a filmes e/ou seriados em inglês. ______ horas por semana.

( ) Ouço música em inglês. ______ horas por semana.

( ) Prático conversando com amigos e/ou colegas. ______ horas por semana.

( ) Jogo jogos de computador ou vídeo games em inglês. ______ horas por semana.

( ) Outros. Especifique ____________________________. ______ horas por semana.

10. Por qual motivo você estuda inglês?

( ) Por hobby. ( ) Preciso para o meu trabalho. ( ) Preciso para os meus estudos.

( ) Outros. Especifique:

11. Você fala outro(s) idioma(s) além de português e inglês? ( ) não ( ) sim

Caso sim, Quais?

__________________________________________________________________________

12. Seus pais e avós são de descendência brasileira (se não, qual é a descendência deles)?

__________________________________________________________________________

Você percebe que eles pronunciam algumas palavras de acordo com essa descendência? Se sim, quais?

__________________________________________________________________________

Você tinha ou tem o costume de ouvi-los conversando em outro(s) idioma(s)? Quais idiomas?

__________________________________________________________________________

Muito obrigado pela sua contribuição!
Production Task (in Portuguese)

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Perception Task (in English), version A

SEÇÃO I

a) Primeiramente, vamos nos familiarizar com a atividade e após isso faremos a atividade proposta.

Em todas as palavras listadas abaixo falta a primeira letra.

Ouça atentamente a cada palavra e escreva (em CAIXA ALTA) a letra que falta.

* Não tentem adivinhar a letra que está faltando. Ouça a palavra antes de responder.

1. ___AME  
2. ___OLD  
3. ___ELL  
4. ___ALL  
5. ___IVE  
6. ___AT  
7. ___OSE  
8. ___RAY  
9. ___EAL

Ok! Agora vamos começar ▼

SEÇÃO II

Ouça atentamente a cada palavra e escreva (em CAIXA ALTA) a letra que falta*:

1. ___ELT  
2. ___RIM  
3. ___OMAIN  
4. ___ARK  
5. ___URID  
6. ___ERT  
7. ___AZY  
8. ___AR  
9. ___OME  
10. ___ITE  
11. ___AWN  
12. ___ILT  
13. ___EAP  
14. ___UST  
15. ___LEAD  
16. ___ETTLE  
17. ___IVE  
18. ___IST  
19. ___UDDLE  
20. ___LUNT  
21. ___AST  
22. ___OARD  
23. ___EIZE  
24. ___ERK  
25. ___OUND  
26. ___ENT  
27. ___UFF  
28. ___EIL  
29. ___UST  
30. ___YPE  
31. ___EST  
32. ___OLLOW  
33. ___LASP  
34. ___EURAL  
35. ___EN  
36. ___LIP

Muito Obrigado! ☺
Perception Task (in English), version B

SEÇÃO I

a) Primeiramente, vamos nos familiarizar com a atividade e após isso faremos a atividade proposta.

Em todas as palavras listadas abaixo falta a primeira letra.

Ouça atentamente a cada palavra e escreva (em CAIXA ALTA) a letra que falta.

* Não tentem adivinhar a letra que está faltando. Ouça a palavra antes de responder.

1. ___AME  
2. ___OLD  
3. ___ELL  
4. ___ALL  
5. ___IVE  
6. ___AT  
7. ___OSE  
8. ___RAY  
9. ___EAL

Oki! Agora vamos começar ▼

SEÇÃO II

Ouça atentamente a cada palavra e escreva (em CAIXA ALTA) a letra que falta*:

1. ___LIP  
2. ___EN  
3. ___EURAL  
4. ___LASP  
5. ___OLLOW  
6. ___EST  
7. ___YPE  
8. ___UST  
9. ___EIL  
10. ___UFF  
11. ___ENT  
12. ___OUND  
13. ___ERK  
14. ___EIZE  
15. ___OARD  
16. ___AST  
17. ___LUNT  
18. ___UDDLE  
19. ___IST  
20. ___IVE  
21. ___ETTLE  
22. ___LEAD  
23. ___UST  
24. ___EAP  
25. ___ILT  
26. ___AWN  
27. ___ITE  
28. ___OME  
29. ___AR  
30. ___AZY  
31. ___ERT  
32. ___URID  
33. ___ARK  
34. ___OMAIN  
35. ___RIM  
36. ___ELT

Muito Obrigado! ☺