ENGLISH PAST-TENSE -ED ALLOMORPHS AND L2 SPEECH INTELLIGIBILITY: A STUDY WITH BRAZILIAN LISTENERS

OS ALOMORFES DO -ED NO PASSADO DO INGLÊS E A INTELIGIBILIDADE DA FALA EM L2: UM ESTUDO COM OUVINTES BRASILEIROS

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Abstract: This study investigated the possible influence of the allomorphs [t, d, ɪd] in the intelligibility of 48 verbs ending in *-ed*, half in the first and half in the second intelligibility test, which were produced by eight speakers from four different L1 backgrounds (e.g., BP, Spanish, German, English) and orthographically transcribed by 14 Brazilian listeners in two intelligibility tests within a four-month interval. Results of the first intelligibility test indicated that verbs ending in the allomorph [t] were more intelligible than verbs ending in the allomorph [ɪd], which in turn were more intelligible than verbs ending in the allomorph [d]. However, results for the second intelligibility test did not follow the same tendency and indicated that the intelligibility of verbs ending in the allomorphs [t, ɪd] were very similar whereas the results for the intelligibility of verbs with the allomorph [d] increased since it had large room for improvement from the first to the second test. Moreover, results also indicated that there was variation in the intelligibility of verbs ending in the three allomorphs for each learner and among the learners, demonstrating that the language development is a dynamic, varied, and complex system, as the Dynamic System Theory proposes.

Keywords: Intelligibility. Verbs ending in *-ed*. Brazilian listeners. Variation. Dynamic System Theory.

Resumo: Este estudo investigou a possível influência dos alomorfes [t, d, ɪd] na inteligibilidade de 48 verbos terminados em *-ed*, metade no primeiro e metade no segundo teste de inteligibilidade, os quais foram produzidos por oito falantes de inglês com diferentes línguas maternas (e.g., PB, espanhol, alemão, inglês) e ortograficamente transcritos

por 14 ouvintes brasileiros em dois testes de inteligibilidade em um intervalo de quatro meses. Os resultados do primeiro teste indicaram que os verbos terminados no alomorfe [t] foram mais inteligíveis do que os verbos terminados em [ɪd], os quais foram mais inteligíveis que os verbos terminados no alomorfe [d]. Entretanto, os resultados referentes ao segundo teste de inteligibilidade não seguiram a mesma tendência e indicaram que a inteligibilidade dos verbos terminados nos alomorfes [t, ɪd] foi similar, enquanto os índices de inteligibilidade dos verbos terminados no alomorfe [d] aumentaram, uma vez que estes tinham grande margem para melhorar, comparando-se os resultados dos dois testes de inteligibilidade. Além disso, os resultados indicaram que houve variação na inteligibilidade dos verbos terminados nos três alomorfes para cada participante e entre todos os participantes, demonstrando que o processo de desenvolvimento da linguagem é dinâmico, variado e complexo, como propõe a Teoria dos Sistemas Dinâmicos.

Palavras-chave: Inteligibilidade. Verbos terminados em *-ed*. Ouvintes brasileiros. Variação. Teoria dos Sistemas Dinâmicos.

Introduction

Studies reviewed by Silveira et al (2017) with Brazilian learners of English demonstrated that they had mainly investigated perception and/or production of single segments in cross-sectional studies, and few of them had investigated suprasegmental features or the intelligibility of English sounds. Thus, according to Munro and Derwing (2015), intelligibility should be the new focus of second language (L2) learning due to the necessity English native and/or non-native speakers have to communicate and interact in this language (Babboni; Quast, 2020; Crystal, 2003; Kachru, 1985; Rosa, 2020; Roxas, 2018; Smith; Nelson, 1985). Studies on English verbs ending in the three *-ed* morphemes have focused on verb perception, verb production, or verb intelligibility. Thus, some previous studies that involved Brazilian Portuguese (BP) and/or Spanish L1 speakers learning English investigated (a) the production of English verbs ending in *-ed* (e.g., Alves, 2004; Araújo, 2020; Araújo; Barboza, 2021; Caballero; Rosado, 2018; Davila, 2018; Delatorre, 2006, 2010; Delatorre; Baptista, 2014; Delatorre; Gonçalves; Silveira, 2020; Fernandes, 2009; Frese, 2006; Gadêlha-Silva, 2019, 2022; Gomes, 2009; Mariano, 2009; Pereira, 1994; Silveira; Alves, 2009); (b) verb perception and/or production (e.g., Frese, 2006, Rossini; Fracaro; Brawerman-Albini, 2019; Rossini *et al.*, 2017; Silveira; Alves, 2009); (c) the effects of instruction or perceptual training on verb production (e.g., Alves, 2004;

Delatorre, 2009; Delatorre; Baptista, 2014; Mariano, 2009; Silveira; Alves, 2009) and, (d) verb intelligibility (e.g., Delatorre; Silveira; Gonçalves, 2017; Fernandes, 2009; Gomes; Brawerman-Albini; Engelbert, 2014; Riella, 2013).

Focusing on the intelligibility of English verbs ending in the three *-ed* morpheme allomorphs, this study seeks to answer the following research question:

How do the three *-ed* allomorphs affect the intelligibility of the English regular verbs in the simple past tense produced by Brazilian learners in a four-month interval?

Having concluded the introductory section of the study, the following sections will present the concepts of morpheme, allomorph, and intelligibility as well as a review of two representative studies on intelligibility in general and some on the intelligibility of verbs ending in the three *-ed* morpheme allomorphs. The third section of the study will describe its participants, and the method used to collect and analyze the data, whereas the fourth section will present the results and discuss them to answer the research question. The article will end with a brief conclusion highlighting implications for pronunciation learning and teaching.

Literature Review

This section begins by presenting the theoretical view of L2 learning adopted in the study. Next, it addresses the issues of intelligibility and its main concepts, as well as the concepts of morpheme and allomorph and some studies conducted in this field, including studies that investigated the intelligibility of English verbs ending in three *-ed* morphemes.

This study follows the Dynamic System Theory (DST), as it sees L2 learning as a never-ending process, affected by multiple variables. and undergoing several stages (De Bot, Lowie, Vespoor, 2007; Beckner *et al.*, 2009; Larsen-Freeman, Cameron, 2008; Zimmer, Silveira, Alves, 2009; Herdina, Jessner, 2012). Crucial to L2 phonological development is the linguistic background and the learning trajectory experienced by each learner. Learning how L2 sounds, syllabic patterns, phonotactics, and the grapheme-phoneme relations depend on how the learning targets are represented in the learners' memory, the characteristics of the learners' L1, their knowledge of additional languages, and the articulatory and neurological patterns learners have developed over time (Bybee, 2001).

The fact that multiple variables influence the development of L2 speech makes this process "dynamic, non-linear, self-organizing, open, emergent, sometimes chaotic, and adaptive" (Larsen-Freeman, Cameron, 2008, p. 4). Thus, it is important to observe how L2 speech develops over time and identify the factors that seem to be the main 'attractors', that is, the factors that play a major role in L2 speech development, as well as how these factors interact with others to build unique patterns of L2 development for each learner.

The present study adopts a dynamic view of L2 speech development and focuses on the learning of three allomorphs of English simple past. These allomorphs are known to pose difficulties to Brazilian learners since they require learning complex syllabic patterns with consonant clusters, as well as learning opaque grapheme-phoneme relations.

Concepts of morpheme, allomorph, and intelligibility

As the phenomenon investigated in this paper is the intelligibility of English regular verbs that end in one of the three *-ed* morpheme allomorphs in the past tense, the definitions of morpheme and allomorph are introduced here. For Carroll (1940, p. 102), morphemes are considered "the smallest meaningful phonetic units in language". Crystal (2008) adds that morphemes can "express grammatical relationships between a word and its context, such as plurality or past tense" (p. 313). Crystal (2008) also explains that morphemes can be realized as allomorphs, or variations of morphemes, such as voiced, voiceless, or even as irregular forms for plural formation in English words and the pronunciation of English regular verbs in simple past tense ending *-ed*.

Taking into account the pronunciation of the *-ed* morpheme in English regular verbs in the simple past tense, Rao (2018) gives a brief and simple explanation saying that it is influenced by the surrounded sounds, or by voicing of the preceding *-ed* context resulting in the three types of *-ed* morpheme pronunciation: [ɪd], [d], and [t], as described in pronunciation textbooks (e.g., Celce-Murcia; Brinton; Goodwin, 2010) and introductory manuals of English phonetics and phonology (e.g., Yavas, 2011). Thus, the *-ed* is pronounced as [ɪd] when the base form of the verb ends in an alveolar stop (e.g., 'voted', 'added'), as [d] when the verb ends in a vowel or a voiced consonant (e.g., 'tried', 'called'), and as [t] when the verb ends in a voiceless consonant (e.g., 'worked', 'wiped').

As we shall see in the next section, producing the English *-ed* allomorphs proves difficult to some Brazilian learners, who tend to produce all the allomorphs as [ɪd] or even delete the allomorphs. Both types of production may have a negative impact on the intelligibility of the English spoken by Brazilians. On the one hand, the productions with

[ɪd] alter the number of syllables of the verb, resulting in difficulties to understand, for example, the word 'called' [kɔld] when it is pronounced as [ˈkɔl.ed]. On the other hand, by deleting the *-ed* morpheme, important information about the verb tense is lost, which may result in miscommunication.

Regarding intelligibility, Catford (1950) considers that an utterance may be effective and intelligible when it establishes communication between the hearer and the speaker, thus inducing the speaker to make the correct or more adequate linguistic choices. Catford acknowledges that an utterance may be intelligible but ineffective if the hearer's response is not what the speaker was expecting to get.

Smith and Nelson (1985, p. 334) introduce the concepts of intelligibility, comprehensibility, and interpretability and define intelligibility as 'words/utterance recognition', comprehensibility as 'word/utterance meaning', and interpretability as 'meaning behind word/utterance'.

To Munro and Derwing (1995), the concept of intelligibility encompasses all Smith and Nelson's (1985) definitions since it involves "shared knowledge and social context" (Munro; Derwing, 2015, p. 379), which may affect understanding. Therefore, Munro and Derwing (1995) define intelligibility as the extent to which an utterance is understood, which may be assessed through the orthographic transcription of the utterance. Munro and Dewing (1995) also define additional dimensions of L2 speech, namely, 'comprehensibility' and 'accentedness'. Comprehensibility is defined as the perceived difficulty in understanding an utterance, and accentedness as how much a speaker's foreign accent is perceived to differ from the variety "commonly spoken in the community" (Munro, Derwing, 1995, p. 385). Both comprehensibility and accentedness are commonly assessed with the help of rating scales. Munro and Derwing's (1995) definition of intelligibility is adopted in the present study.

In the following section, we selected some representative studies on L2 speech intelligibility involving speakers of different L1 backgrounds to review. We start with Becker (2013) and Roxas (2018), which are studies that focus on overall intelligibility measures, and then review studies conducted by Delatorre, Silveira, and Gonçalves (2017), Fernandes (2009) and Riella (2013), which focus on the intelligibility of verbs that end in the three *-ed* morphemes.

Studies on speech intelligibility

We selected representative studies investigating L2 speech intelligibility and which included speakers and/or listeners from different L1 backgrounds, as this study acknowl-

edges the use of English as a language for international communication (Jenkins, 2000). Roxas (2018) investigated the intelligibility and comprehensibility of English by the members of the Association of Southeast Asian Nations (ASEAN) who use English as their official language to communicate and interact among themselves, with Great Britain, and with the United States (i.e., users of English as a Lingua Franca). Members of ASEAN are speakers of Philippine English, Brunei English, Singapore English, and Malaysian English. One university student speaker of Philippine English, one of Singapore English, and one of Malaysian English were the speakers[1] of Roxas' study, whereas 47 Filipino university students were the listeners. Each speaker recorded a script that was presented twice to the listeners who had to complete a fill-in-the-blanks task with the missing content words (intelligibility test) and answer five questions while listening to each script for the second time (comprehensibility test). They listened to the Singapore English speaker first, followed by the Malaysian English speaker, and, finally, by the Philippine English speaker. Roxas (2018) found that speakers of ASEAN English were highly intelligible to Filipino listeners since their pronunciation seems to follow the same rhythmic pattern and the speakers' utterances had few pronunciation features that seemed to affect listeners' ratings. In addition, the Singapore English speaker was the most intelligible speaker, followed by the Philippine English speaker, and then, by the Malaysian English speaker, suggesting that sharing the L1 is not the most important element of mutual intelligibility. Regarding comprehensibility, Roxas found high comprehensibility of Philippine, Singapore, and Malaysian Englishes for Filipino listeners, which the author attributes to the similarity between the speakers' L1, geographic proximity among the countries they come from, and interaction of ASEAN countries with other countries in Asia, Europe, or the Americas.

Becker (2013) investigated the intelligibility of English sentences produced by speakers of four L1s and transcribed by Brazilian learners. She asked 80 Brazilian learners of English to listen to a paragraph recorded by eight speakers of English, one male and one female native speaker of Mandarin, Japanese, German, and American English. Four groups of 20 Brazilian listeners analyzed the recordings of two speakers from the same L1, in which 10 listeners of each group analyzed the speech of the male speakers and 10 listeners analyzed the data of the female speakers. Listeners were asked to indicate, in percent, how much they understood from that reading passage; listen to the text divided into small parts and wrote down what they could understand; and finally, listen to the whole text again and indicate tokens that were the most difficult to understand. Becker's

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[1] The author explained that it was not possible to find an educated speaker of Brunei English to participate in the study (ROXAS, 2018, p. 2).

(2013) results indicate that 77.2% of all words produced by Germans, 77% of all words produced by Americans, 80.1% of all words produced by Mandarin speakers, and 61.3% of the words produced by Japanese speakers were intelligible to the 20 Brazilians who listened to each group of speakers, suggesting that English spoken by Japanese talkers was not as intelligible to Brazilian listeners as English spoken by Mandarin, German, and English speakers seemed to be.

Fernandes (2009) investigated the intelligibility of English verbs ending in the *-ed* morpheme produced by five Brazilian learners rated by five European Portuguese (Ep) and five Hindi L1 listeners. Fernandes recorded Brazilians describing a picture and reading short texts with *-ed* instances. Ep and Hindi listeners rated the storytelling task on a three-point Likert scale and orthographically transcribed the texts read by one Brazilian informant. Fernandes' (2009) results show that BP speakers' speech was rated as moderately comprehensible by both groups of listeners and that the intelligibility rates of Ep listeners were higher (around 70%) than the rates of Hindi listeners (around 40%). Both groups of listeners indicated that vowel epenthesis, rhythm, and intonation affected their intelligibility rating in the storytelling task.

Riella (2013) examined the intelligibility of English verbs ending in *-ed* produced by 46 Brazilians and two native speakers of English, focusing on epenthesized productions and whether they affected intelligibility. Thirty listeners were assigned to three groups. Group 1 had ten native speakers of English, Group 2 had ten Brazilian speakers of English, and Group 3 had ten English speakers from different L1s. Recordings of the text reading and spontaneous speech were presented to the listeners. First, participants orthographically transcribed the sentences they had listened to twice. Then, they were asked to rate ten sentences recorded by Brazilians in a previous study (Gomes, 2009). Orthographic transcriptions of these additional sentences were also presented to the listeners, who rated the sentences using a five-point Likert scale. Riella's (2013) results for group 1 and group 2 were the same and revealed 71% of correct transcription of verbs ending in *-ed*. According to Riella, this rate of correct transcriptions occurred even when there was vowel epenthesis in verb pronunciation. Results of group 3 were less homogeneous when compared to the other groups, as group 3's overall intelligibility rate dropped to 60%, and its overall blank answer percentage was higher (24%), suggesting a breakdown in communication. In addition, Riella's results for group 1 possibly indicate a lack of intelligibility and breakdown in communication due to vowel epenthesis, and both native and non-native speakers' accent familiarity. Brazilian listeners (group 2) easily understood other Brazilians' speech. As listeners in Riella's study understood Brazilians'

speech despite vowel epenthesis production and accent, Gomes, Brawerman-Albini, and Engelbert (2014), who analyzed Riella's data, observed that vowel epenthesis was not problematic for the three groups of listeners, since it causes fewer intelligibility problems than consonant deletion.

Delatorre, Silveira, and Gonçalves (2017) investigated the intelligibility of English verbs ending in *-ed*. Thirty-two sentences containing 24 regular and eight irregular verbs in the simple past were audio-recorded by eight speakers[2] of English from different L1 backgrounds (BP, Spanish, German, English). Each speaker read and audio-recorded the 32 sentences each containing either one irregular verb in the past or one regular verb with one of the three possible *-ed* pronunciations. Four sentences from each speaker were used to create the intelligibility test, which was completed by 13 Brazilian listeners. Participants listened twice to the 32 sentences and orthographically transcribed them. The transcriptions were analyzed and classified as (a) *intelligible* when it was transcribed exactly as it was produced by the speaker; (b) *other verb forms*, when it was transcribed in stem form, third person singular or *-ing* form; and, (c) *as causing a breakdown in communication*, when the verb was not transcribed, replaced by another word or when it or the entire sentence was not transcribed at all.

Results indicate that the breakdown in communication rate was higher than the intelligibility rate, which was higher than the rate for other forms for all verbs combined as well as for regular and irregular verbs individually. Delatorre, Silveira, and Gonçalves (2017) found a tendency for BP and Spanish speakers' productions to be more intelligible than German and English speakers' productions, which did not reach statistical significance. Both regular and irregular verbs produced in a target-like fashion by speakers from all four L1s had low intelligibility rates, which was attributed to subtle changes in the coda or overall accent that may affect intelligibility, as suggested by Bradlow and Pisoni (1999) and Munro and Derwing (1995).

The present study intends to investigate the intelligibility of the three *-ed* morpheme allomorphs found in the simple past tense of English regular verbs produced by speakers with different L1 backgrounds and rated by Brazilian listeners in two different moments. Details about the research method are presented in the next section.

Method

This study seeks to investigate how each type of *-ed* allomorph affects the intelligibility of English regular verbs for Brazilian learners within a four-month interval. Thus,

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[2] Speakers and sentences are the same as Delatorre's (2017) study.

following Frese (2006), the hypothesis stated that verbs with the allomorph [ɪd] would be more intelligible than verbs with the allomorphs [t], which in turn would be more intelligible than the allomorph [d] over time.

Participants

This study had two groups of participants, eight acting as speakers and 14 as listeners. Speakers were two native speakers of BP, two of Spanish, two of German, and two of English, one male and one female of each language, whose ages ranged from 20 to 55 during data collection conducted while they were living in Brazil. All speakers whose mother tongue was not English reported using English for studying or working; however, their length of time dedicated to the study of English ranged from 4 to 23 years. Speakers' productions were analyzed by Delatorre, Gonçalves, and Silveira (2020).

The listeners were all Brazilians, 12 females and two males, undergraduate students at a public university in the South of Brazil, and native speakers of Brazilian Portuguese, whose ages ranged from 18 to 46. They were enrolled in the 2nd and 4th semesters of the *Secretariado Executivo* program for the first data collection section and in the 3rd and 5th semesters for the second data collection session and had a period of 100 minutes of English classes two times per week every semester. Their proficiency level in English was estimated by the pen and pencil Oxford Placement Test (Allan, 2004) and ranged from beginner (16 points in the CEFR[3]) to Upper-Intermediate (44 points in CEFR)[4].

Data collection and analysis

Each of the eight speakers read and audio-recorded a list of short 96 sentences, containing one subject, a verb, either regular or irregular[5] one in the simple past, and a complement without past markers, such as "yesterday" or "last year". From each speaker, who produced three sentences for each of the three *-ed* allomorphs and three with irregular verbs, one verb with each of the three *-ed* allomorphs and one irregular verb were chosen and organized in three different files[6] of 32 sentences, which became the stimuli for three intelligibility tests.However, only two of these files were used in the first and another one in the second intelligibility tests[7]. None of the verbs or sentences were repeated in the

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[3] CEFR stands for Common European Framework of Reference. The OPT test allows placing the participants, using the CEFR overall proficiency scales.
[4] Table 3 presents their individual scores on the proficiency test.
[5] Irregular verbs were considered distractors in the present study.
[6] WAV type of file.
[7] The remaining 32 sentences were not included since the third intelligibility test was not conducted due to the loss of participants in the longitudinal study.

three files[8]. The recordings were conducted in a sound-attenuated room at *Laboratório de Fonética Aplicada* (Fonapli) from Ufsc. The selection of verbs that appeared in each test was made according to a list of sentences previously organized, in a randomized order of speakers' L1, including both target-like and non-target-like productions. Further details about the non-target productions are provided by Delatore and Silveira (2021). For this article, it is important to highlight that the *-ed* morpheme has other productions in addition to the three standard forms described in textbooks and manuals (Celce-Murcia *et al.*, 2010; Yavas, 2011). In the stimuli recorded for this study, the *-ed* morpheme is occasionally deleted (e.g., "caused" [kɔz]), produced with an epenthetic vowel (e.g., "looked" [ˈlukid]), or with coda change (e.g., "planned" [plænt]). It is important to highlight that variation in production was found for all speakers who recorded the stimuli, as explained in Delatorre and Silveira (2021) and Delatorre, Gonçalves, and Silveira (2020).

The first intelligibility test was administered to the participants, who also answered a background questionnaire and the proficiency test and signed the consent form, on the first day of data collection. To complete the intelligibility test, participants listened to each sentence twice and orthographically transcribed it according to what they had understood or did not transcribe it if they had not understood anything they had listened to. This procedure regarding the intelligibility test, the questionnaire, and the consent form was repeated in the second intelligibility test data-collection session, which took place within a four-month interval.

The intelligibility of the regular verbs was analyzed and the verbs classified as intelligible (i.e. verbs transcribed according to speakers' pronunciation for each verb); other verb forms (i.e. when verbs were transcribed not exactly as they were produced, that is, if they were produced in the past but were transcribed in the third person singular or the stem form), and as causing a breakdown in communication (i.e. when the verb or the entire sentence was not transcribed). After that, the verbs were grouped according to the allomorph and classified as intelligible, other verb form or breakdown in communication, and the descriptive statistics were run, revealing that the data were not normally distributed. Thus, the Friedman test was run to compare the intelligibility of verbs with allomorphs [t], [d], and [ɪd] in each of the two tests, separately. In addition, Wilcoxon tests also allowed pair-wise comparisons of the intelligibility levels for the three allomorphs in the two tests. In addition, the calculation of verbs with high and low intelligibility rates was also made by counting the number of times that each verb was considered intelligible by all 14 participants. Thus, verbs were considered as highly intelligible when the

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[8] See the complete list of sentences in Delatorre (2017) and the list of sentences for the first and the second intelligibility test in the Appendix.

14 listeners managed to transcribe the verb as it was produced (100%) or when at least 10 listeners did so (71.4%), and as unintelligible when none of the listeners managed to transcribe the verb (0%) or when a maximum of three listeners was able to transcribe the verb (21.4%). This calculation was conducted for both the first and the second intelligibility tests and the verbs were grouped according to type of allomorph.

Having concluded the Method section, the following section will address and discuss the results from the first and the second intelligibility tests.

Results And Discussion

This section addresses the results and discussion of the study according to the research question, which asks how the type of allomorph [t, d, ɪd] affects the intelligibility of the English regular verbs in the simple past tense for Brazilian learners in a period of four-month interval. The hypothesis stated that verbs with the allomorph [ɪd] would be more intelligible than verbs with the allomorph [t], which in turn would be more intelligible than verbs with the allomorph [d] over time. Thus, to analyze the intelligibility of verbs ending in one of the three *-ed* morpheme allomorphs, each of the 14 listeners completed an intelligibility task, which consisted of orthographically transcribing 24 verbs, that is, eight for each of the three *-ed* allomorphs [t, d, ɪd] in the first and in the second intelligibility tests. Table 1 displays the results for each of the 14 listeners in the first and second intelligibility tests organized according to the three *-ed* allomorphs.

Table 1 – Number of intelligible verbs for Brazilian listeners according to the three *-ed* allomorphs in the first and in the second intelligibility tests

Listener	Intelligibility Test One			Intelligibility Test Two		
	[t]	[d]	[ɪd]	[t]	[d]	[ɪd]
L1	6	2	6	6	3	5
L2	3	1	3	1	3	1
L3	3	1	2	1	2	2
L4	7	2	5	5	3	4
L5	2	0	1	1	1	0
L6	3	2	4	4	4	4
L7	1	0	1	1	2	2
L8	2	0	1	1	2	0
L9	6	1	5	4	5	6
L10	6	5	4	6	7	5
L11	5	3	5	7	6	7

L12	4	2	3	4	3	4
L13	5	4	6	6	6	7
L14	4	4	6	7	5	7
Total	57	27	52	54	52	54
Minimum	1	0	1	1	1	0
Maximum	7	5	6	7	7	7
M	4.07	1.93	3.71	3.86	3.71	3.86
Sd	1.81	1.59	1.89	2.41	1.81	2.50

Source: The authors

As the results of the intelligibility test displayed in Table 1 demonstrate, Brazilian listeners had less difficulty in listening and transcribing verbs with the allomorph [t], followed by verbs with the allomorph [ɪd] and then, followed by verbs with the allomorph [d] in the first intelligibility test. According to the results displayed in Table 1, (a) 57 verbs with the allomorph [t] out of 112 possible (50.89%) were considered intelligible by Brazilian listeners; (b) 52 verbs with allomorph [ɪd] out of 112 (46.42%) were considered intelligible by these listeners and, (c) 27 verbs with allomorph [d] out of 112 possible (24.10%) were considered intelligible by Brazilians in the first intelligibility test. In addition, Table 1 also demonstrates that the allomorph [d] had the lowest range of intelligibility rates, varying from zero to five, whereas the allomorphs [t] and [ɪd] had a range varying from 1-7 and 1-6, respectively, in the first intelligibility test.

Taking into account data for the first intelligibility test, the Friedman test was run to compare the intelligibility of verbs with allomorphs [t], [d], and [ɪd] and yielded a statistically significant result ($X^2(2, N = 14) = 19.17, p < .001$), Moreover, Wilcoxon tests were run and demonstrated that the difference between verbs with the allomorphs [t] and [d] ($z = -3.225; p = .001$) and [ɪd] and [d] ($z = -3.119; p = .002$) was statistically significant in the first test, whereas the difference between verbs with the allomorphs [t] and [ɪd] ($z = -1.115; p > .05$) was not statistically significant in the same test. The results of the pair-wised comparisons did not support the hypothesis based on Frese (2006) since the results did not follow the predicted tendency for the perception of the three allomorphs by Brazilians. However, results of the present study followed the same tendency found in Rossini et al (2017), in which the [d] was more difficult than the [ɪd], which in turn was more difficult than the [t] in the perception of verbs ending in -ed to Brazilian learners of English, and in Delatorre, Silveira and Gonçalves (2017) for the intelligibility of regular verbs ending in -ed for Brazilians.
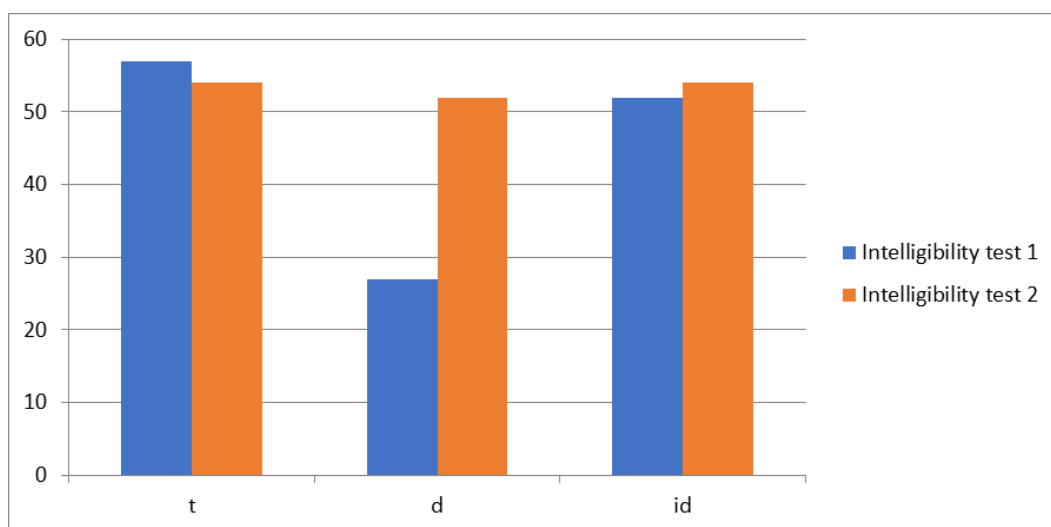
Considering the results for the second intelligibility test, Table 1 demonstrates that

the results for the intelligibility of the three *-ed* allomorphs were very similar. Thus, results in Table 1 demonstrate that 54 out of 112 verbs (48.21%) with the allomorphs [t] and [ɪd] were intelligible to Brazilian listeners whereas 52 out of 112 verbs (46.42%) with the allomorph [d] were intelligible to Brazilian listeners. In other words, Brazilian listeners had almost the same level of difficulty with the three types of allomorphs, suggesting that type of allomorph does not seem to interfere in the intelligibility of verbs ending in the three *-ed* morpheme allomorphs in the second intelligibility test.

Thus, the Friedman test was run to compare the intelligibility of verbs with allomorphs [t], [d], and [ɪd] and yielded a statistically non-significant result ($X^2(2, N = 14) = 0.18, p > .05$), which evidenced the lack of difference in the intelligibility of verbs in which the *-ed* was produced as one of the three allomorphs in the second intelligibility test. In other words, type of allomorph did not interfere in the intelligibility of regular verbs ending in *-ed* in the second intelligibility test. These results, however, did not support the hypothesis, based on previous studies (Frese, 2006; Rosini *et al.*, 2017; Delatorre; Silveira; Gonçalves., 2017). It is important to observe that these three studies are cross-sectional and there is a need for longitudinal studies to better understand pronunciation learning development over time.

Comparing the results for the first and the second intelligibility tests, Figure 1 demonstrates that the number of intelligible verbs with the allomorphs [t] and [ɪd] was similar in both tests and that the number of intelligible verbs ending with the allomorph [d] improved from the first to the second intelligibility test.

Figure 1 – Number of intelligible verbs grouped according to three allomorphs /t/, /d/, and /ɪd/ in both intelligibility tests

Source: The authors

Considering the results displayed in Table 1 and in Figure 1, we ran pair-wised comparisons across the two tests for each type of allomorph. The number of intelligible verbs with the [d] allomorph increased from 27 in test one to 52 in test two, and this difference was statistically significant, as attested by the Wilcoxon test ($z = -3.35$; $p = .001$). Examining the intelligibility of verbs with the allomorph [ɪd] across tests, there was a slight increase from 52 to 54, and this difference was not statistically significant, as attested by the Wilcoxon test ($z = - .462$; $p > .05$). Finally, the intelligibility of verbs with the [t] allomorph decreased from 57 to 54, but this difference was not statistically significant ($z = -.572$; $p = .05$). Moreover, the results displayed in Table 1 and Figure 1 indicate higher room for improvement for the intelligibility of the allomorph [d] in the four-month interval between the two intelligibility tests, indicating that more exposure to and contact with the language may improve intelligibility of verbs ending in the three -*ed* morpheme allomorphs, as suggested by Delatorre and Baptista (2014) and Gadêlha-Silva (2019) to verb production, Rossini, Fracaro and Brawerman-Albini (2018) to verb perceptionand Lima Jr. and Alves (2019) to pronunciation teaching development under a view of language as a dynamic system (Lowie, 2011, 2013).

To illustrate these differences, Table 2 presents the verbs organized according to the three -*ed* morpheme allomorphs and intelligibility rate (highly intelligible verbs between 71.4% and 100% and verbs with low intelligibility rates (between 0% and 21.4%) in the two intelligibility tests.

Table 2 – High and low intelligible verbs for the three -*ed* morpheme allomorphs in the two intelligibility tests

Intelligibility rate	First intelligibility test			Second intelligibility test		
	[t]	[d]	[ɪd]	[t]	[d]	[ɪd]
Higher than 71.4%	Kissed	-	Visited	Asked	Shared	Counted
	Watched	-	Waited	Crossed	Joined	Printed
	-	-	-	-	Tried	-
Lower than 21.4%	Washed	Trained	Voted	Danced	Proved	Sounded
	-	Saved	Guided	-	Planned	-
	-	Judged	Printed	-	-	-
	-	Spelled	-	-	-	-
	-	Screamed	-	-	-	-

Source: The authors

As observed in Table 2, the number of verbs with low intelligibility (9) was higher than the number of verbs with high intelligibility (4) in the first intelligibility test. However, Table 2 also shows that the results followed an opposite tendency in the second intelligibility test in which the number of high intelligible verbs (7) was higher than the number of low intelligible verbs (4). In addition, Table 2 demonstrates that the number of verbs (5) with the [d] allomorph with a low intelligibility rate was higher in the first test compared to the second test (2), whereas the number of verbs with the [t] allomorph with low intelligibility was the same (1) in the first and in the second tests and the number of verbs with allomorph [ɪd] with low intelligibility rate decreased from (3) in the first test to (1) the second intelligibility test. On the other hand, among verbs with high intelligibility rate, the number of verbs with the allomorphs [t] and [ɪd] was the same in both intelligibility tests (2) but the number of verbs with the allomorph [d] increased from zero in the first intelligibility test to three in the second intelligibility test, indicating the room for improvement in the intelligibility of verbs with this allomorph, as previously discussed.

Turning to the results of the intelligibility tests by leaner and *-ed* morpheme allomorph, Table 3 demonstrates that there was variability among the learners and *-ed* morphemes in each test and between the two intelligibility tests, which did not seem to depend on proficiency since variation in intelligibility occurred in participants with different proficiency levels[9].

Table 3 – Proficiency and intelligibility of verbs ending in the three *-ed* morpheme allomorph in the two intelligibility tests for the 14 Brazilian listeners

Listener	Proficiency level (CEFR)	Intelligibility test One				Intelligibility test Two			
		[t]	[d]	[ɪd]	Total	[t]	[d]	[ɪd]	Total
L1	36(B1)	6	2	6	14	6	3	5	14
L2	27(A2)	3	1	3	7	1	3	1	5
L3	19(A2)	3	1	2	6	1	2	2	5
L4	33(B1)	7	2	5	14	5	3	4	12
L5	20(A2)	2	0	1	3	1	1	0	2
L6	39(B1)	3	2	4	9	4	4	4	12
L7	18(A2)	1	0	1	2	1	2	2	5
L8	16(A1)	2	0	1	3	1	2	0	3

[9] The proficiency level follows the CEFR guidelines as follows: 1 Beginner (A1, 10-17 points); 5 Elementary (A2, 18-29 points); 5 lower Intermediate (B1, 30-39 points) and 3 Upper Intermediate (B2, 40-47 points).

L9	33(B1)	6	1	5	12	4	5	6	15
L10	42(B2)	6	5	4	15	6	7	5	18
L11	44(B2)	5	3	5	13	7	6	7	20
L12	23(A2)	4	2	3	9	4	3	4	11
L13	42(B2)	5	4	6	15	6	6	7	19
L14	33(B1)	4	4	6	14	7	5	7	19
Minimum	16(A1)	1	0	1	2	1	1	0	2
Maximum	44(B2)	7	5	6	15	7	7	7	20
M	30.43	4.07	1.93	3.71	9.71	3.86	3.71	3.86	11.43
Sd	9.88	1.81	1.59	1.89	4.79	2.41	1.81	2.50	6.41

Source: The authors

Regarding results for individual allomorphs, Table 3 demonstrates that the number of intelligible verbs for the allomorph [t] decreased from the first to the second test for six participants (L2, L3, L4, L5, L8, L9), increased for four participants (L6, L11, L13, L14) and remained the same for four participants (L1, L7, L10, L12). For the allomorph [ɪd], as Table 3 demonstrates, the number of intelligible verbs decreased from the first to the second test for five participants (L1, L2, L4, L5, L8), increased for seven participants (L7, L9, L10, L11, L12, L13, L14) and remained the same for two participants (L3, L6). For the allomorph [d], the results in Table 3 demonstrate that all participants improved from the first to the second intelligibility test.

In addition, Table 3 also demonstrates that, for the three *-ed* morphemes together, the number of intelligible verbs decreased for four participants (L2, L3, L4, L5), remained the same for two participants (L1, L8) and increased for eight participants (L6, L7, L9, L10, L11, L12, L13, L14). As we did not assess participants' proficiency in the second data collection session, we cannot discuss whether advances in the listeners' proficiency could account for the changes in intelligibility rates across tests. Nonetheless, our results do confirm a change in performance across time, similar to the results in Araújo and Barboza (2021) and Gadêlha-Silva (2019) for the production of verbs ending in the three *-ed* morpheme allomorphs, following the Dynamic System Theory proposed by different authors (e.g., Cameron; Larsen-Freeman, 2007; De Bot; Lowie; Verspoor, 2007; Ellis, 2007; Hiver; Al-Hoorie; Evans, 2021; Larsen-Freeman, 1997, 2014; Lowie, 2011, 2013, Trofimovich; Kenedy; Foote, 2015; Verspoor; Lowie; Vahtrick, 2017). Thus, Lima Jr and Alves (2019, p. 129) emphasize that language development is "typically complex, dynamic, non-linear, self-organizing, open, emergent, sometimes chaotic, and adaptive",

which may reflect this variability among learners and between tests in the learning process found in the present study.

Conclusion

This study investigated the influence of the allomorphs [t], [d], and [ɪd] in the intelligibility of verbs ending in *-ed* by Brazilian learners of English as listeners. Results demonstrate that the intelligibility of the verbs ending in the allomorph [t] decreased but remained very similar (from 57 to 54) from the first to the second intelligibility test, whereas the intelligibility of verbs ending in the allomorph [t] increased slightly and was very similar (ranging from 52 to 54) from first to second intelligibility test, and the intelligibility of verbs ending in the allomorph [d] had a large increase (from 27 to 52) from the first to the second intelligibility test. These results indicate that for the two allomorphs that already had high intelligibility rates in the first test remained stable across tests, but that the [d] allomorph, which yielded low intelligibility rates in the first test and had ample room for improvement, reached high intelligibility rates in the second test, thus indicating that the Brazilian listeners developed their phonological knowledge for this particular allomorph in a four-month period. Moreover, results also demonstrate variability in the intelligibility of the three allomorphs for some listeners and among them when the results of the two intelligibility tests are compared, indicating that language development differs for each learner, as proposed by the DST.

Regarding the limitations and suggestions for further studies, pronunciation teaching should be considered in the following studies focusing on the intelligibility of verbs ending in the three *-ed* morpheme allomorphs, making students aware of the three different pronunciations by using different strategies to achieve this goal. Another suggestion for further studies is to investigate the intelligibility of *-ed* ending verbs involving speakers and listeners with different L1 backgrounds, as well as assess proficiency development and word familiarity over time.

Regarding pedagogical implications, the results of the intelligibility test show that the *-ed* morpheme allomorphs pose listening comprehension difficulties to Brazilian learners. In addition to the three allomorphs listed in textbooks and manuals, the *-ed* morpheme is subject to phonetic changes that can be found in the speech of native speakers of English and users of English as an international language. Although listeners show improvement across tests, they still display difficulties to understand the pronunciation of verbs ending in *-ed,* which highlights the need for explicit pronunciation instruction to

help Brazilian learners notice the different *-ed* allomorphs. Furthermore, the study indicates the importance of bringing different speakers and accents to the classroom environment, so that the learners get familiar with different accents.

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Appendix

Sentences in the first intelligibility test

01 BPT2: She bought a new car.

02 ST2: They voted in the elections.

03 ET2: Students trained for the test.

04 GT2: Mary washed her dress.

05 ST1: They came by bus.

06 BPT1: The stadium cheered him.

07 GT1: Tom guided visitors.

08 ET1: Bob stopped smoking.

09 BPT2: She played piano.

10 GT2: He drove for 18 hours.

11 ST1: They watched a movie.

12 ET2: Helen painted her bedroom.

13 GT1: The audience laughed out loud.

14 BPT1: He needed a job.

15 ET1: She made a cake.

16 ST1: The pilot saved all passengers.

17 BPT2: I visited my family.

18 GT1: They took a trip.

19 ST2: She looked for a new job.

20 ET1: They judged a robber.

21 BPT1: They skipped some exercises.

22 ST1: Models avoided eating.

23 ET2: He wrote a letter.

24 GT1: The driver caused an accident.

25 ST2: The family had breakfast together.

26 BPT2: Suzy kissed her father.

27 GT2: The teacher spelled his name.

28 ET1: He recorded a video.

29. BPT1: Kids slept for 10 hours.

30 ST2: Children screamed a lot.

31 ET2: He missed some classes.

32. GT2: They waited for the train

Sentences used in the second intelligibility test

01 GT1: Jack proved his innocence.

02 ET1: The family attended a concert.

03 BPT2: She asked my name.

04 ST1: Lisa drew a bird.

05 ET2: Students danced all night.

06 ST2: Susan tried her best.

07 GT2: Kids saw a black dog.

08 BPT1: They rented a car.

09 ST1: They crossed a famous street.

10 GT1: John printed his paper.

11 BPT2: Boys shared a house.

12 ET2: They woke up late on Sunday.

13 ST2: They adopted a child.

14 BPT1: George brushed his teeth.

15 ET1: Anna taught English for years.

16 GT2: Ann and Bob planned a trip.

17 BPT2: They drank a lot.

18 ET2: His speech sounded fine to us.

19 GT1: The man clapped his hands

20 ST1: Students joined a group.

21 BPT1: They fought at school.

22 ST2:They worked hard.

23 GT2: The teacher added a new student.

24: ET1: He failed in the Math test.

25 ST1: This reminded me of his songs.

26 GT1: Journalists gave us bad news.

27 ET1: The chief jumped a wall.

28 BPT1: He changed his mind.

29 ST2: Paul sang for three hours.

30 BPT2: Police counted one million people.

31 ET2: James called his parents.

32 GT2: Helen dressed well