Intelligibility research in Brazil:
empirical findings and methodological issues

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Abstract

The current paper addresses intelligibility, a dimension used to assess second language speech, which has also been proposed as one of the goals in pronunciation instruction. Studies carried out on this construct in Brazil are revisited (BECKER, 2013; CRUZ, 2005; 2006; 2008, 2012a, 2012b; CRUZ; PEREIRA, 2006; GONÇALVES, 2014; REIS; CRUZ, 2010; RIELLA, 2013; SCHADECH, 2013), and their main findings are discussed taking into account Jenkins' (2002) Lingua Franca core. Furthermore, methodological issues are discussed, pointing out the different foci of the studies conducted in Brazil, the variables examined by the Brazilian studies at present, and the myriad of variables contemplated by international studies that still need investigation in the Brazilian context. Some of these variables are related to the speaker/listener or are of linguistic nature (e.g., L2 proficiency, accent familiarity, lexical frequency), all of which could help us to understand the intelligibility construct. Finally, the paper brings concluding remarks about the investigation of intelligibility and possible implications for the classroom and the research realms.

Keywords: Intelligibility; Brazilian English; Research method; Pronunciation assessment.

Resumo

Este artigo tem como foco a inteligibilidade, uma dimensão utilizada para avaliar a fala na segunda língua, que também foi proposta como uma das metas para o ensino de pronúncia na sala de aula. Estudos realizados no Brasil são revisitados BECKER, 2013; CRUZ, 2005; 2006; 2008, 2012a, 2012b; CRUZ; PEREIRA, 2006; GONÇALVES, 2014; REIS; CRUZ, 2010;

RIELLA, 2013; SCHADECH, 2013) e os principais achados desses estudos são discutidos, levando-se em consideração a proposta de Jenkins (2002), o *Lingua Franca core*. Por fim, questões metodológicas são discutidas, ressaltando os diferentes focos estabelecidos nos estudos sobre inteligibilidade, assim como a miríade de variáveis contempladas em estudos internacionais que ainda precisam ser incorporadas em investigações no território nacional. Algumas dessas variáveis estão relacionadas ao falante, ao ouvinte, ou são de natureza linguística (proficiência na língua estrangeira, familiaridade com o sotaque, frequência lexical). Por fim, são apresentadas conclusões sobre os estudos envolvendo inteligibilidade e possíveis implicações para a sala de aula e para a pesquisa de cunho aplicado.

Palavras-chave: Inteligibilidade; Inglês brasileiro; Método de pesquisa. Avaliação da pronúncia.

1 Introductory remarks

Understanding how speech is dealt with in the L2[1] classroom is not a trivial undertaking. When acquiring a new sound system, the learner is challenged by new sound contrasts, new restrictions on where these sounds occur, and a new prosodic system (BROSELOW; KANG, 2013). More recently, researchers have also started to pay attention to how certain speech features are more likely to affect interactions among individuals who have different first languages (L1s), given the outstanding number of speakers of English worldwide (CRYSTAL, 2003). However, much is yet in need to be investigated concerning phonological aspects that hinder or contribute to understanding speech intelligibility in L2 interactions.

Speech intelligibility has been little investigated in Brazil. Initial empirical efforts have concentrated on how native speakers of English assess Brazilians' pronunciation (e.g., CRUZ, 2004, 2005, 2006, 2008), which might have overlooked crucial pronunciation aspects of Brazilian-Portuguese speakers of English (BPSE) (JENKINS, 2012), as native speakers are not necessarily the main interlocutors for Brazilians in interactions conducted in English. More recent research has also investigated the reactions of BPSE to speech

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[1] L2 is to be used as a cover term to account for any languages acquired after one's first language.

of other non-native speakers of English (e.g., BECKER, 2013; CRUZ, 2012b). There is a limited number of studies in which BPSE speech tokens were submitted to the reactions of L2 users from other linguistic backgrounds (CRUZ, 2006; 2006; 2008; REIS; ; CRUZ, 2008; GONÇALVES, 2014; SCHADECH, 2013).

Applied research trends have now revolved around the issue of intelligibility, which has been pointed out as one of the main goals in L2 pronunciation teaching. Scholars have claimed that classroom-relevant research must be undertaken (DERWING; MUNRO, 2005) so that L2 phonology also attends to the listener (MUNRO, 2011). One can envisage that when a relevant number of studies on intelligibility are available, L2 practitioners and material-developers will be able to make evidence-based decisions in relation to what is worth teaching in the L2 classroom.

Many of the intelligibility studies carried out in Brazil were a response to Jenkin's (2002) proposal of a *Lingua Franca* core (LFC). In the LFC, the scholar highlights some L2 phonological components that are essential to avoid communication breakdowns in English, such as (1) most consonant phonemes (except [ð] and [θ]), (2) tonic or nuclear stress, (3) vowel length, and (4) consonant clusters (JENKINS, 2002)[2].

The current study presents a review on research efforts regarding intelligibility conducted in Brazil, with the purpose of discussing tentative pedagogical implications of their finding. Furthermore, this paper addresses the methodology employed by different Brazilian researchers and possible implications for further research. Before reviewing the Brazilian studies, we shall discuss different definitions for the intelligibility construct and how it differs from related concepts.

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[2] Concerning consonant clusters, Jenkins (2002) stresses the importance of avoiding simplification processes that are not found in English as a first language, such as the deletion of the first consonant in /s/ clusters (e.g., 'snow' [noʊ]), or that may hinder comprehension, such as omitting the /t/ in ‚<nt> clusters (e.g., 'enter' [ˈɛnəɹ]). For more details, please refer to the core features presented by Jenkins (2002).

2 Understanding the dimension

A number of studies has demonstrated that the goal of many L2 learners is to achieve native-like pronunciation (CRUZ, 2007a, 2011; JENKINS, 2005; KANG, 2010; LEVIS, 2005, 2015; SCALES et al, 2006; TIMMIS, 2002; WATERS, 2007). However, literature has confirmed that native-likeness is a phenomenon restricted to a small number of individuals, who started acquiring the L2 early in life (BIRDSONG, 2007; BONGAERTS et al, 1997; FLEGE, MUNRO,; MACKAY, 1995; HYLTENSTAM; ABRAHAMSSON, 2000; LONG, 1990). Hence, encouraging native-likeness is incongruent with research evidence, and thus, learners should not be pushed to pursue such a goal.

Therefore, intelligibility has been proposed as one of the main goals of pronunciation instruction (DERWING; MUNRO, 2005). Language instructors should then be concerned with encouraging learners to pursue intelligible output, as "students whose L2 production is not entirely native-like but who are able to communicate effectively are clearly successful L2 users" (KENNEDY; TROFIMOVICH, 2008, p. 460). Similarly, Munro (2008) remarks that "rather than acquiring native-sounding oral output, L2 learners need intelligible speech, and the latter does not necessitate perfect formal 'correctness' (MUNRO, 2008, p. 213)". Graddol (2006) states that "intelligibility is of primary importance, rather than native-like accuracy" (GRADDOL, 2006, p. 87).

This construct has received different definitions[3]. Catford (1950) and Smith and Nelson (1985) define it as the hearer's understanding of the speaker's words (or utterances), focusing on the decoding of words, whereas Smith and Rafikizad (1979) present a similar definition, but also specify that intelligibility involves the capacity to understand word(s) spoken/read in the context of a sentence. On the contrary, Jenkins (2000) defines intelligibility as the production and recognition of formal property of words and utterances, placing her focus at the phonological level. Jenkins' definition takes into account the performance of both speakers and listeners, given that

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[3] See Cruz (2007b) for a detailed discussion.

her research method requires face-to-face interactions and examines the mispronunciations that cause communication breakdowns. We hereby favor the definition coined by Derwing and Munro (2008, p. 479), who regard intelligibility as "the degree of a listener's actual comprehension of an utterance". We side with these researchers as their definition of the construct might shed light on either the listener's performance, the speaker's performance, or the utterances themselves (or possibly the three of them).

When discussing intelligibility assessment, Munro (2008) remarks that "the choice of a particular approach depends on the type of speech material that is available or that can be elicited, the kinds of demands that can be placed on listeners and speakers, and the specific research questions to be addressed" (MUNRO, 2008, p. 201-2). Word transcription has been regularly used for intelligibility assessment as this method is seen as an index of the speaker's intelligibility (MUNRO, DERWING,; MORTON, 2006). Another common procedure is to record face-to-face interactions and later scrutinize breakdowns in conversation in order to analyze the specific utterance or mispronunciation that led to the breakdown. Nevertheless, evidence garnered on transcription data provides only one perspective on intelligibility (MUNRO, DERWING,; MORTON, 2006), as "there is no universal way of assessing it" (MUNRO; DERWING, 1995, p. 76). As for the procedure of analyzing episodes of communication breakdown in recorded interactions, one has to deal with the fact that very often listeners pretend to understand. In other words, it is not possible to examine all actual occurrences of communication breakdown as the listener may disguise the lack of understanding in order to keep face or to encourage the interlocutor to speak, for example.

The use of orthographic transcription to assess intelligibility has been considered suitable as it allows the researcher to observe the "extent to which a word or utterance is recognized at the level of finer acoustic-phonetic detail" (MOYER, 2013, p. 93), which is fitting for dealing with the specificities of each phonological feature that is tested here. For this reason, we consider that transcriptions may be an appropriate alternative to collect intelligibility data, given that these data are expected to inform L2 pedagogy about the essential phonological features to include in the pronunciation curriculum.

However, such a technique incorporates one more empirical variable to be looked at, as the transcriber's knowledge of the L2 orthographic system might influence the results obtained, especially when the language that is being transcribed has a highly opaque orthography, such as English, which might yield great difficulty for learners from more opaque language backgrounds (ESCUDERO, 2015).

Literature has sometimes been ambiguous regarding what is understood as intelligibility and how this construct differs from other relevant dimensions in the field, including comprehensibility and accentedness. According to Derwing et al. (2007), comprehensibility refers to "the ease or difficulty with which a listener understands L2 accented speech" (p. 360). Tasks used to measure this dimension usually employ a Likert scale to inform how easy or difficult a speech sample is. In addition, accentedness refers to "a listener's perception of how different a speaker's accent is from that of the L1 community" (DERWING; MUNRO, 2005, p. 385). This dimension seeks to evaluate listeners' perception of accent in the L2, usually through a scalar measure that varies from "no accent" to "heavy accent".

Another difficulty in intelligibility studies is to deal with the perception construct. Intelligibility and perception are different dimensions in L2 speech research, and involve quite different methodological issues. Crystal (2008) defines perception as "[…] the process of receiving and decoding spoken, written or signed input. The underlying process is one of matching a set of cues to a stored representation" (CRYSTAL, 2008, p. 356). Thus, as regards perception, language is decoded in favor of a stored representation, which directly leads to the notion of phonology. As previously stated, Derwing and Munro (2008) define intelligibility as "the degree of a listener's actual comprehension of an utterance" (p. 479). Hence, these scholars show that the focus of research on intelligibility is broader and relies on the comprehension of a certain utterance, which presents varied phonological features. By focusing on the understanding of utterances, the agenda of research on intelligibility can be broader given its focus on (L2) interaction. Also, when focusing on intelligibility at different levels, research can demonstrate more accurately the phonological traits that influence communication mostly. Nonetheless, the perceptual ability of the listener is at play when performing an intelligibility task, which means that both

intelligibility and perception are intertwined. Yet, research has not always succeeded in making it clear whether the two constructs differ, and many perception-related features (e.g., acoustic cues, noise) that may influence intelligibility have not been examined in detail.

The specificities of each of these two constructs (intelligibility and perception) should be crystal-clear when it comes to research methodology. As research has not paid attention to more refined approaches on intelligibility, research findings on intelligibility have been inaccurately explained on the base of "perception(s)" of listeners, when actually intelligibility was measured on the base of listeners' "impressions", "judgments" or performance on transcription tasks. Thus, it is our understanding that at least in speech research, "perception" and "impressions" or "judgments" should not be used interchangeably. Furthermore, acoustic phonetic research has also used the term intelligibility (e.g., BRADLOW; PISONI, 1999; FLEGE, 1992; REIS; KLUGE, 2008) when reporting data collected with identification and discrimination tasks of perception studies. In this case, the authors are focusing on auditory perception, and the use of the word 'intelligibility' can be misleading.

As regards the variables related to the intelligibility and the perception constructs, the former does involve auditory perception, but it also incorporates other factors, such as the context, lexical frequency, speech production and its acoustic features, and learners' individual differences (e.g., listeners' familiarity with one's accent, listeners' and speakers' use of the L2, listeners' and speakers' proficiency, listeners' willingness to interact with speakers etc.). Moreover, Munro (2011) states that intelligibility is "a well-established construct with a firm foundation in empirical and pedagogical traditions" (MUNRO, 2011, p. 08). Research focusing on intelligibility should be concerned with pronunciation aspects that influence communication in order to inform L2 pedagogy, as Munro (2011) discusses that intelligibility "[…] is the single most important aspect of communication. If there is no intelligibility, communication has failed" (MUNRO, 2011, p. 13). Research on intelligibility takes up a social role (e.g., by considering speakers' and listeners' backgrounds, and the role of language use in a communicative context), in order to shed light on the field of Applied Linguistics to come up with pedagogical implications. On the other hand, perception studies bear on a cognitive

approach and are generally more focused on linguistic and/or language processing variables, being more concerned with drawing conclusions about L2 phonology acquisition, although a few of these studies also aim at informing L2 pedagogy (e.g., SILVEIRA, 2004).

Recapping, in the present paper, we distinguish between the terms intelligibility, comprehensibility, accentedness, and perception, as shown in Table 1.

Table 1 - Definitions for intelligibility and related terms

Intelligibility	Involves demonstrating the actual understanding of an utterance by providing an orthographic transcription (or possibly repetition), or by responding appropriately to the speakers' utterance (face-to-face interaction studies).
Comprehensibility	Involves judging how easy or how difficult it was to understand an utterance by using a rating scale.
Accentedness	Involves judging how much L2 production differs from L1 production by using a rating scale.
Perception	Involves perceiving and decoding spoken sounds, syllables or words by performing identification or discrimination tasks.

Source: Authors

Some intelligibility studies conducted in Brazil have not drawn these distinctions and used the term intelligibility when referring to other dimensions (especially comprehensibility and perception), and these studies were excluded from our review in section 3. In order to better understand the current scenario for intelligibility studies in Brazil, we turn now to a review on empirical studies conducted in the country. In addition, we discuss some issues regarding the methods used by the researchers to assess intelligibility, whereas tackling aspects worth of warranting further research.

3 Studies on intelligibility in Brazil

We begin this section by reviewing studies conducted by Cruz and her colleagues. Then we move on to studies conducted by Becker (2013), Riella (2013), Schadech (2013), and Gonçalves (2014). As

explained in section 2, we left out all studies in which the intelligibility construct was not defined (implicitly or explicitly) according to our definition presented in Table 1, or in which the data was solely collected by means of rating scales.

Cruz has published a number of studies in which she investigated the intelligibility of BPSE. We shall now review Cruz' studies by firstly presenting all studies in which native speakers of English were the judges for intelligibility (CRUZ, 2004, 2005; 2006a; 2008; CRUZ; PEREIRA, 2006; CRUZ, 2011); and, then we present the studies in which there were no judges, but in which the author investigated pronunciation aspects which led to communication breakdowns during real-time interaction (CRUZ, 2006b; CRUZ, 2012b; REIS; CRUZ, 2010). The findings of these studies are presented last, as the pronunciation aspects that hindered intelligibility were overall similar (and also grouped by the researcher in one of her studies). Besides, Becker (2013), Gonçalves (2014), Riella (2013), and Schadech (2013) have also developed studies investigating intelligibility. Their studies are reviewed last[4].

Cruz (2004) was the first doctoral dissertation addressing the intelligibility of English spoken by Brazilians. Her main goal was to investigate the intelligibility of utterances mispronounced tokens produced by 10 Brazilian leaners of English who were interviewed by a British English speaker. Her listeners were 25 native speakers of British English residing in England, without any contact with spoken Brazilian English. The interview data were examined and the researcher selected 32 samples containing mispronunciations to prepare the tests for the listeners. The listeners completed three tasks: (a) listening to samples and rating them for comprehensibility, (b) listening again and transcribing, and (c) answering a questionnaire with three items (guessing speakers' nationality, mentioning whether background noise disturbed them, and explaining how they managed to understand the speakers' utterances). The same data were reanalyzed by Cruz (2008), focusing on the listeners' familiarity with Brazilian

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[4] Silva (1998) and Oliveira (2014) were not included in the review given the construct of intelligibility adopted by these authors. Both studies measure what is actually conceived as comprehensibility in the present study.

English by adding a second group of listeners: 10 Americans and 2 British, all of them familiar with English spoken by Brazilians.

In a small-scale study, Cruz (2005) investigated the pronunciation of the word "comfortable" with stress falling on the third syllable [kʌmfəˈteibou]. The researcher examined the reactions of English native speakers to the intentionally mispronounced word, in which eight listeners (out of 14) did not comprehend what the speaker meant. Cruz (2006a) investigated the intelligibility of Brazilian-accented-English to twenty-five English listeners in a study in which they evaluated how intelligible the samples were (what we consider comprehensibility), and also transcribed them. The researcher also interviewed the listeners in search for more detailed descriptions of their reactions to the speech samples. Cruz and Pereira (2006) looked into the pronunciation patterns of *Letras* undergraduate students that hindered intelligibility according to the judgments of native speakers of English (7 American and 1 British) who had been living where the study was carried out, and thus, were familiar with the speakers' accent. The listeners were required to transcribe the stimuli, to highlight words which they considered difficult to understand, and reason on why they considered such words difficult.

Cruz (2006b) examined the intelligibility of English in informal interactions between a Brazilian, a Japanese, a German, and two Thai speakers. From the communication breakdowns the research mapped, she created distinct categories of pronunciation features that require attention, and related them to Jenkins' LFC, remarking that two (out of 4) of her categories are contemplated by the LFC (word stress and consonants, which are discussed below). A similar methodology was followed by Reis and Cruz (2010), who scrutinized interactions between French and Brazilian users of English in order to identify pronunciation features that led to miscommunication. The authors found that mispronunciations of specific consonants and vowels hindered intelligibility.

Cruz (2012b) investigated which pronunciation aspects of English spoken by a Japanese hindered intelligibility the most according to the reactions of seven Brazilian undergraduate students enrolled in a *Letras* program. The study required the listeners to transcribe the reading passage they had listened to, indicate words

which they considered difficult to understand, and explain why they considered those words difficult.

Generally, findings from Cruz and colleagues' studies that had Brazilians as speakers are mapped in the following categories[5]:

- **Word-stress**: stress falling either on the second or third syllable instead of falling on the first (e.g., 'vegetables' pronounced as [vəʒˈteibous]) hinders intelligibility;
- **Orthographic influence:** the grapheme <u> pronounced as [u] instead of /ʌ/ (e.g., 'production' produced as [proˈdukʃən]) causes misunderstandings, as well as final /l/ pronounced as [w] (e.g., 'feel' pronounced as [fiw]), and /z/ produced as [s] (e.g., 'mixes' produced as [ˈmɪkis][6]);
- **Consonants:** the voiced alveolar fricative /ð/ produced as the voiced alveolar stop /d/ in 'other' [ˈʌdɛɾ]; and the voiceless fricative /θ/ produced as /f/, when combined with the omission of /ŋ/, (e.g., 'think' produced as [ˈfĩk]), also hindered intelligibility;
- **Vowels:** the sources of unintelligibility were the neutralization of the difference between tense and lax vowels (/i/ and /ɪ/pronounced as [i]; e.g., 'live' understood as 'leave';); the back vowel /ʊ/ produced as /u/ (e.g., 'cooks' pronounced as [kuks]; and final position /i/ pronounced as a reduced vowel (e.g., 'many' pronounced as [mɛnⁱ];

Taking into account the results listed above, Cruz (2012a) discusses that these should be the priority in teaching pronunciation to Brazilians, according to her intelligibility phonological model. A

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[5] All examples involving phonetic transcriptions were taken from Cruz' studies.

[6] Clearly this example shows that the word had other pronunciation deviations (consonant cluster simplification and vowel quality) that might have impacted the listeners' performance.

poignant aspect in Cruz' research is the fact that the speech traits considered unintelligibility sources were judged mostly by native speakers of English. On the other hand, Jenkins' (2002) LFC accounts for interactions mostly among non-native speakers of English. In addition, it has been evidenced that non-native speakers of English nowadays outnumber native speakers (CRYSTAL, 2003; GRADDOL, 2006). Although native speakers of English are not and shall not be excluded from research on intelligibility, it is also relevant to draw attention to intelligibility involving non-native speakers assessing the intelligibility of Brazilians' spoken English.

As for Cruz' and colleagues' findings in studies with Brazilians as listeners or interlocutors with speakers whose L1 was not English, they concluded that:

- When Brazilians are listeners, they found it difficult to understand when (a) German speakers of English devoiced word-final consonants; (b) Japanese speakers produce /f/ as a flap or a tap, /v/ as [β], /ð/ as [z] and /θ/ as [s]; (c) Thai and French speakers produced diphthongs as monophthongs or deleted final consonants; (d) Thai speakers misplaced word stress or produce /ɹ/ as [l]; and (e) French speakers changed vowel quality.
- When listeners whose L1 is not English listened to Brazilian English, they found it difficult to understand productions that contain (a) changes in vowel quality (French listeners); (b) vowel paragoge (French listeners); (c) word-final consonant deletion (French and Japanese listeners); (d) and lack of aspiration combined with changes in vowel duration (Brazilian listeners).

Similar to Cruz (2012b), Becker (2013) also carried out a study on intelligibility having Brazilians as listeners. The researcher collected samples of different types of accented English from the *Speech Accent Archive* (WEINBERGER, 2013)*,* and presented them to *Letras* undergraduate students. The stimuli used by the researcher (a paragraph read by each speaker) encompassed American, Chinese, Japanese, and German accented English, which were chosen, as stated

by Becker (2013), for being varieties frequently present in the commercial relations Brazil currently has. The listeners, Brazilian students, were required to perform three tasks: (1) listen to all the stimuli and report a percentage of how much they could comprehend, (2) listen to each stimulus and transcribe the missing words; (3) indicate the items which, according to their point of view, hindered intelligibility. The researcher prepared the stimuli by splitting the text in short phrases from which a number of words were removed. Then, the stimuli were presented to the listeners, who were asked to complete the blank spaces with the missing words. Notwithstanding, Becker (2013) was careful with the way she organized her analysis, looking at words according to their intelligibility rate and also indicating their frequency according to different corpora.

Becker (2013) reports that the fricatives /θ/ and /ð/ when replaced by their alveolar counterparts /s/ and /z/ by the Japanese speakers caused intelligibility to be compromised. Interestingly, this feature is not included in the LFC. The fact that these consonants may hinder intelligibility was also reported by Cruz (2012a), indicating that for BSE, this might constitute scope for future research with intelligibility[7]. Furthermore, /ɹ/ replaced with /l/ in this group of speakers notably affected intelligibility, as well as the high front vowel pair which was misrecognized (e.g., in the word 'peas', pronounced as [pɪz]). Moreover, Becker (2013) discusses that vowel quality is an important characteristic for L2 intelligibility. The researcher presents cases where, for instance, 'snack' was produced with the vowel [a], resulting in [snak], and in unintelligible speech.

With the German speakers, Becker (2013) shows that the most recurrent problem was final voicing in segments such as /g/ in 'big' (pronounced as [bik]), which also hindered the understanding of words such as 'frog'. Clusters, as seen in the LFC, also caused misunderstandings in words such as 'Stella', 'snow', and 'spoons'. With the group of American speakers, the English flap /ɾ/ also hindered intelligibility in passages such as "meet her" pronounced as

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[7] Schadech and Silveira (2013) developed a study examining the comprehensibility of these phonemes by NSE.

[miɾɚ]. With this group, the factor which hindered intelligibility most of times was not phonological, but took on the pragmatic competence of listeners instead. When unable to make sense of the stimulus heard, listeners tried to adapt it, such as in the case of 'blue cheese' being transcribed as 'oat cheese'. With the group of Chinese speakers, Becker (2013) reports that the fricatives /θ/ hindered intelligibility when replaced with /s/. The diphthong /ei/ in 'train' was produced as a monophthong, according to the auditory analysis conducted by the researcher, and it also affected intelligibility, similarly to the case in which 'snake' was produced with no diphthongization.

As Becker (2013) was unable to control for speakers' proficiency level, and due to the limited number of speakers of each L1 background (two for each nationality), her results are difficult to interpret according to different L1s. Still, as no acoustic analysis of the stimuli used is presented in the study, it is difficult to understand if intelligibility was affected by a phonological factor, by a pragmatic factor, or by the fact that the listener did not know the words being tested. Moreover, given the great number of words which were analyzed and their variability in the frequency rank, it was difficult to draw considerations regarding the role of frequency in the tasks developed by the author.

Riella (2013) investigated the intelligibility of verbs containing the –ed morpheme produced by Brazilians, which frequently produce this morpheme with an epenthetic vowel (e.g., 'named' pronounced as [ˈneImId]). This study included three groups of listeners: 10 native speakers of English (mostly Americans), 10 Brazilians, and 10 speakers from different L1 backgrounds. These listeners had to transcribe 10 sentences read by 8 BP speakers from different English proficiency levels and 2 by natives speakers of English (one American and one British). Only 6 sentences produced by the BP speakers contained a token of –ed produced with the epenthesized pronunciation and we will focus on these tokens. The results show that the NSE transcribed correctly between 65% and 90% of the BP data. The Brazilian listeners presented a similar performance regarding the BP speakers' –ed tokens (between 70% and 90% of correct transcriptions), while the third group of listeners (varied L1 backgrounds) transcribed correctly between 40% and 100% of the BP –ed tokens. We can see

from these results that the epenthesized production may hinder intelligibility to a certain extent, but as the productions contained other non-target pronunciation features and as the listeners also faced difficulties when transcribing the tokens produced by the native speaker (with percentages of correct transcriptions varying from 20% to 50%), the results reported by Riella (2013) have to be regarded with caution due to methodological limitations.

Gonçalves (2014) tested the intelligibility of English high front vowels [i] (tense) and [ɪ] (lax), produced by Brazilian learners of English. The listeners were 32 users of English from 11 different language backgrounds (Arabic, Danish, Dutch, Dutch-French, Finnish, French, German, Italian, Polish, Russian, and Spanish). Listeners took an intelligibility test in which they had to fill in the last word in the sentences that carried the stimuli. The researcher found out that the tense vowel was usually mistranscribed as its lax counterpart due to the fact that the tense vowel did not present durational cues salient enough to be distinguished from the other vowel. In addition, in Gonçalves's (2014) study, intelligibility was notably hindered by processes of phonetic-phonological transfer from Brazilian Portuguese that were present in the tested words. For example, the scholar reports that deaspiration of initial stops (e.g., "**p**it" transcribed as "**b**itch"), and palatalization of final stops (e.g., "pi**t**" transcribed as "bit**ch**") accounted for most of the sources of unintelligibility. Vowel length is included in Jenkins' (2002) core, and also present in Cruz' (2012b) core for Brazilians. Aspiration of [p] [t] [k] is also highlighted by Jenkins (2002) as being relevant for successful communication, as the author discusses that these consonants, when non-aspirated, can be heard as their voiced counterparts. On the other hand, miscommunication due to consonant production influenced by processes of transfer from speakers' L1 have not been thoroughly investigated in other studies investigating intelligibility and still are worth of attention in the field, specially, in studies in which speakers and listeners have different proficiency levels.

Gonçalves (2014) also investigated a myriad of variables which are believed to influence speech decoding tasks. Related to the listeners who took part in the study, the relationship between their level of L2 proficiency and intelligibility was investigated, as well as

their length of residence in Brazil as an indicator of accent familiarity. Besides, linguistic variables related to the stimuli were also accounted for. Lexical familiarity, lexical frequency, and spectral proximity of the first formant frequency (F1) of the tokens used were controlled. The scholar could attest that as listeners' proficiency level increased, so did the intelligibility scores for both vowels. On the other hand, no significant relationship was found between length of residence and intelligibility. Gonçalves (2014) also observed that lexical familiarity, lexical frequency[8] and intelligibility were all correlated and are good predictors of one another. As concerns spectral proximity, the variability of the first frequencies, which are related to vowel height, did not have any influence on the recognition of the tested vowels, attesting for the fact that non-native listeners tend to rely on acoustic cues other than formant frequencies, such as durational cues; .

Schadech (2013) dealt with the production of word-initial /ɹ/ by Brazilians and the issues of intelligibility and comprehensibility. The stimuli consisted of tokens of Brazilians' productions of sentences that could make sense if they contained minimal pairs such as 'head' [hɛd] or 'red' [ɹlɛd]. The researcher had seventy-three listeners divided into three groups: (1) native speakers of English; (2) advanced Brazilian speakers of English, mostly MA and PhD students; and, (3) students enrolled at an advanced level from an English extension course. Data collection occurred through a website where the participants were requested to transcribe the target words containing rhotics and a few distractors for the intelligibility assessment. Schadech (2013) found that the replacement of word-initial /ɹ/ with the fricative /h/ really hindered intelligibility. Similarly, Jenkins (2002) advocates in the LFC for the preservation of the rhotic 'r' rather than its non-rhotic varieties (such as the British variety, in which the rhotic is not realized in syllable-final position).

Although the listeners who took part in Schadech's (2013) study did not take any proficiency tests, the author grouped listeners according to their linguistic background (language students enrolled in extension courses, native speakers, and MA and PhD students from a graduate program in English). She found that intelligibility scores were

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[8] See Gonçalves and Silveira (2015) for a detailed discussion.

higher in the groups from which listeners were likely to have higher proficiency levels, showing that proficiency is an important variable to be observed when it comes to language decoding tasks. Moreover, accent familiarity was investigated by the author, who found that length of residence is not, indeed, a good predictor of such a variable. Lastly, Schadech (2013) observed the role of lexical frequency by showing that the most frequent and the less frequent lexical items in her task were the words with the best and worst scores on intelligibility, respectively.

Few are the studies in which the intelligibility of English spoken by Brazilians was investigated. To date, besides the findings listed in the core proposed by Cruz (2012b), non-target production of rhotics in initial position, and processes of phonetic-phonological transfer from Brazilian-Portuguese into English also compromised intelligibility. Following a suggestion made by Derwing and Munro (2005), we stress that empirical studies on intelligibility can inform the classroom as concerns the focus of pronunciation teaching. These can help identify the focus and set the priorities, taking into account Brazilian learners' needs both as speakers and as listeners of English. As some of the reviewed studies have shown, Brazilians, when acting as listeners of speakers from other L1s, may find it difficult to understand speech that contains phonetic-phonological features that are commonly found in Brazilian English. Thus, familiarity with specific pronunciation features does not necessarily guarantee increased intelligibility.

Notwithstanding, many of the examples displayed above show that more than one type of mispronunciation occurs in a single word, which makes it difficult to decide whether a specific aspect is affecting intelligibility or a combination of many, which also draws attention to the need for more controlled studies on intelligibility. Studies in which Brazilian speakers of English judged speech intelligibility of other non-native speakers of English have contributed considerably to modeling how Brazilian speakers react to L2 accented-speech. However, it is not fitting to mix up findings of unintelligibility as judged by native speakers to findings of unintelligibility as judged by non-native speakers. Jenkins (2002) claims that native speakers' norms of pronunciation have a negative effect on intelligibility for L2 speakers, given the fact that L2 speakers have different needs when it

comes to mispronunciation leading to unintelligibility. Similarly, Hülmbauer, Böhringer, and Seidelhofer (2008) claim that native speakers of English over-rely on English as their L1, and when they do not accommodate to the needs of English as a lingua franca "it often represents an obstacle in intercultural communication" (p. 27).

In the next section, we discuss a recurrent issue found in empirical studies, which is the need for clearer study designs to explain findings on intelligibility.

4 Future paths for intelligibility research in Brazil

The studies reviewed in the previous section allow us to have a better understanding about how Brazilian researchers have investigated the intelligibility construct. Based on this understanding, we intend to (a) highlight the main focus guiding the studies conducted in Brazil, (b) identify the types of variables that have been investigated so far, and (c) suggest possible variables for future studies.

One of the major debates regarding intelligibility studies is whether they should focus on segments or suprasegments. As we saw in section 3, most studies conducted by Cruz and colleagues focus on segments, with the exception of a few studies conducted by Cruz (e.g. 2005), which investigate the role of word stress. The most common practice is to record speakers and select samples of these recordings to present to a group of listeners (e.g., CRUZ, 2004, 2006; 2008; CRUZ; PEREIRA, 2006). Another frequent procedure is to avoid *a priori* decisions regarding what pronunciation aspects should be included in the intelligibility test. Rather, Brazilian researchers tend to present listeners with samples taken from extemporaneous speech containing different types of pronunciation features (e.g., regarding data from Brazilian speakers: unaspirated plosives, palatalized productions of /t/ and /d/, clusters with vowel epenthesis). Afterwards, these studies discuss whether specific types of pronunciation deviations caused intelligibility problems. One exception was Cruz (2005), who examined the role of word stress based on the production of a single word. Furthermore, Gonçalves (2014), Riella (2013), and Schadech (2013) opted for more controlled designs and tested specific segments (vowels, epenthetic vowel, and rhotics, respectively), which were

present in target words used to design sentences read and recorded by speakers. Another study that relied on reading data was Becker (2013), but this author also adopted the procedure of not pre-defining what kind of pronunciation feature would hinder intelligibility. From this brief analysis, we can conclude that most studies in Brazil seem to be highly influenced by Jenkin's (2002) research, in the sense that they are trying to identify the essential pronunciation features that may hinder communication taking into account Brazilians as speakers (the vast majority of studies), but also as listeners. However, due to the different methodologies, the results of different studies seem to go in different directions and no definite conclusions are available about a common core to guide pronunciation teaching in Brazil yet. An example of the controversial results is seen in Cruz (2008), who found that familiarity with speakers' accent facilitates intelligibility, whereas Schadech (2013) and Gonçalves (2014) obtained conflicting results, for the correlations these authors found between intelligibility levels and accent familiarity were weak and non-significant.

Intelligibility studies also differ regarding whether they focus on the listener, the speaker, the productions that lead to miscommunication, or all of these factors. The authors reviewed in section 3 seem to be mostly concerned with the Brazilian speakers' performance, trying to identify the pronunciation features that may lead to miscommunication (e.g., CRUZ, 2004, SCHADECH, 2013; GONÇALVES, 2014). Two exceptions are Becker (2013) and Cruz (2012b), whose focus is on the Brazilian listener and how this listener deals with the pronunciation features of speakers from different L1 backgrounds. Most studies rely on native speakers of English as listeners (e.g., CRUZ, 2004, 2005, 2006a, 2008; CRUZ; PEREIRA, 2006), yet others focus on users of English from different L1 backgrounds as listeners (e.g., CRUZ, 2006b; GONÇALVES, 2014; RIELLA, 2013), including Brazilians (e.g., BECKER, 2013; CRUZ, 2012b; REIS; CRUZ, 2010; RIELLA, 2013; SHADECH, 2013). Table 2 summarizes the variables investigated in Brazilian studies. It is important to say that we only included studies whose methodology actually made it possible to draw conclusions about the role played by the listed variables.

Table 2 - *Brazilian studies Intelligibility variables*

Variables	Status in Brazilian Studies
Listener's proficiency	Gonçalves, 2014;; Schadech, 2013
Familiarity with speaker's L1/accent	Cruz, 2008; Gonçalves, 2014; Schadech, 2013
L1 background	- Listeners: Gonçalves, 2014; Schadech, 2013 - Speakers: Becker, 2013 - Listeners and speakers: Cruz, 2006; Reis; Cruz, 2010
Acoustic cues	Gonçalves, 2014;
Word familiarity	Gonçalves, 2014;
Word frequency	Becker, 2013; Gonçalves, 2014; Schadech, 2013

Source: Authors

A myriad of variables have been investigated by international intelligibility studies. Among the most popular are listeners' or speakers' proficiency levels (e.g., BENT; BRADLOW, 2003), familiarity with the speakers' L1 or English accent (DERWING; MUNRO, 1997), speech rate (ANDERSON-HSIEH; KOEHLER, 1988; DERWING; MUNRO, 2001; MUNRO; DERWING, 1998), word familiarity or lexical frequency (BENT; BRADLOW, 2003; BRADLOW; PISONI, 1999), and listeners' L1 (BENT; BRADLOW, 2003). Furthermore, a few studies have investigated general variables such as level of education (SMITH; RAFIQZAD, 1979; MUNRO, DERWING,; MORTON, 2006;), while others have addressed more specific linguistic variables such as the role of acoustic cues (e.g., HAHN, 2004 (primary stress); JOTO, NAGASE,; FUNATSU, 2007 (VOT)), the phonological context surrounding the target word (e.g., BENT, BRADLOW,; SMITH, 2007 (voicing quality of following consonant), and type of error in the speakers' data (e.g., phonemic, phonetic, grammatical errors) or present in the listeners' transcriptions (e.g., substitutions, omissions) (MUNRO; DERWING, 1995). Most of these variables still need to be addressed by Brazilian studies investigating intelligibility, either having Brazilians as speakers or as listeners, or as both.

5 Closing remarks

To provide insight on the intelligibility of BPSE, more empirical research needs to be undertaken. The available research findings are too limited if one considers the many phonological features that have not been tested yet, and the existing cross-linguistic variation, which might affect communication that takes place among speakers of different L1s. Available empirical findings can enable researchers to set the focus and the right amount of instruction when it comes to L2 pronunciation, which has not yet reached a consensus.

Furthermore, it is still controversial whether native speakers of English are to take part in intelligibility studies. Research can come up with answers whether native listeners' judgments are harsher given that they may use norms from their own pronunciation when evaluating non-native speakers, as advocated by Jenkins (2012). Experimental studies shall compare findings garnered from native speakers and from non-native speakers in order to observe their influence on intelligibility. Researchers from the field of Applied Linguistics and L2 practitioners also need to develop a nuanced view on the many linguistic and non-linguistic variables that influence speech intelligibility, so that this concept can be effectively applied.

Amano-Kusumoto and Hosom (2011) advocate that research needs to bring to light findings that elucidate how acoustic features can have an influence on speech intelligibility. The scholars elucidate that "phoneme intelligibility does impact word intelligibility" (AMANO-KUSUMOTO; HOSOM, 2011, p. 02). Thus, speech research shall have as its foci different levels (such as vowel level, and word level) in order to make available refined findings of phonetic nature, tested under more controlled circumstances, and also presenting acoustic analyses to better inform the field.

Moreover, the role of the context used in intelligibility assessment allows the listener to draw on different kinds of knowledge (e.g., syntactic and semantic clues are offered to the listener within the context), and "the availability of semantic cues, which are present in meaningful sentences, is an important factor that influences speech intelligibility" (AMANO-KUSUMOTO; HOSOM, 2011, p. 03), specially for the compensation of unclear speech. As regards language processing, Griffin and Ferreira (2006) discuss that the context clearly

influences word selection probably due to a combination of pragmatic, semantic, and syntactic constraints. Derwing and Munro (2005) observe that when equal contextual information is assumed, L2 practitioners shall wonder "why is one utterance understandable and another unclear?" (DERWING; MUNRO, 2005, p. 386). The answer to the authors' wonder would pedagogically inform teachers on the aspects of pronunciation that should be covered in their lessons. Furthermore, auditory perception tasks make use of different types of tests (discrimination, identification, and goodness-of-fit tests, for instance), which present single isolated pieces of linguistic information to test for contrasts, where contextual information is not of importance.

Research on intelligibility is still vital as "much more work must be carried out to determine whether listeners from diverse backgrounds share similar responses with regard to intelligibility" (MUNRO, DERWING,; MORTON, 2006, p. 114). In some areas of Applied Linguistics, the function of this construct remains controversial. Moyer (2013), for instance, suggests that intelligibility should function at the level of suprasegmental accuracy (prosodic information). The author also advocates that "controlled tasks do not capture the dynamic qualities of intelligibility" (MOYER, 2013, p. 98). Moyer (2013) concludes that research interests should rely on the adjustments listeners make when a speaker is difficult to understand, and whether such adjustments correspond to communicative problems alone. Thus, the author sheds light on intelligibility as being negotiated in interactions. We consider Moyer's position relevant, but if only this is taken into account, results then are too limited. Research can profit from the many techniques to deal with intelligibility, at the segmental or suprasegmental level.

To warrant further research, we also suggest that speech intelligibility should be looked at from the perspective offered by processing tasks, instead of methods that only take into account an off-line measure. The enterprise of language processing has been facilitated by significant advances in the experimental toolkit. Recent techniques and tools are quite powerful because "they rely little on conscious attention to or metalinguistic awareness of linguistic stimuli" (SEKERINA, FERNANDEZ,; CLAHSEN, 2008, p. viii). Therefore, more would be known on how accented speech is handled by the listener in early stages of processing, whereas the necessary

dialogue between Phonetics/Phonology and Psycholinguistics would also be evidenced.

Finally, it is our understanding that the search for a common core for pronunciation teaching could be a very complex and demanding task. Thus, we consider that L2 pedagogy should not overlook the importance of providing learners with basic knowledge of the phonetic-phonological features of the target language as produced by speakers of different varieties of the target language, being them L1 or L2 speakers. This information is expected to help L2 learners to act as both speakers and listeners of the target language in their pursuit for successful communication.

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