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Pronunciation and Aeronautical English: Brazilians' difficulties and possible routes to intelligibility.

Pronúncia e Inglês Aeronáutico: dificuldades de brasileiros e rotas possíveis para a inteligibilidade.

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ABSTRACT

Communications between pilot and air traffic controller (ATCO) are carried out via radiotelephony, without visual contact between the interlocutors. ICAO, a specialized agency of the United Nations, is responsible for the security of international civil aviation. ICAO's official documents (ICAO, 2004, 2009, 2010) mention the importance of English pronunciation in the intelligibility of pilot-ATCO communication. In 2017, Brazilian researchers analyzed the extent to which two international Aeronautical English (AE) textbooks, used in an ATCO training course in Brazil, address the pronunciation difficulties considered typical among Brazilians (CRISTÓFARO-SILVA, 2012). The analysis, based on the concepts of intelligibility, English as a Lingua Franca and the 'Lingua Franca Core' (JENKINS, 2000, 2002, 2005), showed that the analyzed books do not portray several of these difficulties. In this article, we first point out international air accidents and incidents in which pronunciation was one of the contributing factors, then, based on the Lingua Franca Core, we discuss the causes of some Brazilian pronunciation difficulties, aiming to increase teachers' and students' awareness and to contribute to pronunciation teaching in the field of AE. In addition, we problematize the non-critical use of textbooks by teachers and the inadequate training in English Language Phonology.

Keywords: Pronunciation, Aeronautical English, Brazilians, Pilot-ATCO Communication.

RESUMO

As comunicações entre piloto e controlador de tráfego aéreo (ATCO) são realizadas por radiotelefonia, sem contato visual entre os interlocutores. A OACI, agência especializada das Nações Unidas e responsável pela segurança da aviação civil internacional, menciona em seus documentos oficiais (ICAO, 2004, 2009, 2010), a importância da pronúncia do inglês na inteligibilidade da comunicação piloto-ATCO. Em 2017, pesquisadores brasileiros analisaram em que medida dois livros didáticos internacionais de Inglês Aeronáutico (IA), utilizados em um curso de formação de ATCOs no Brasil, atendem às dificuldades de pronúncia consideradas típicas entre brasileiros (CRISTÓFARO-SILVA, 2012). A análise, fundamentada nos conceitos de inteligibilidade, Inglês como Lingua Franca e no 'Lingua Franca Core' (JENKINS, 2000, 2002, 2005), evidenciou que os livros investigados não retratam

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várias dessas dificuldades. Neste artigo, apontamos alguns incidentes e acidentes aéreos internacionais nos quais a pronúncia foi um dos fatores envolvidos para, em seguida, discutirmos, com base no Lingua Franca Core, algumas dificuldades de pronúncia de brasileiros e suas causas, objetivando aumentar a conscientização de professores e alunos, e contribuir para uma reflexão acerca do trabalho com pronúncia na área de IA. Além disso, problematizamos a utilização não crítica de livros didáticos por professores e a formação inadequada em Fonologia da Língua Inglesa.

Palavras-Chave: *Pronúncia, Inglês Aeronáutico, Brasileiros, Comunicação Piloto-Controlador de Tráfego Aéreo.*

1. Introduction

Professionals who are responsible for the safety of our airspace need specific technical knowledge as well as efficient communication skills – especially pilots and air traffic controllers (ATCOs). In every phase of a flight – from the initial request to start up the engine, to taxiing, to taking off, to climbing, to crossing different sectors in the sky, to landing at the final destination – "a pilot deals with a dozen or more controllers, none of whom are known personally" (McMILLAN, 1998, p. 11). At the same time, in every work shift, an ATCO also speaks to dozens of different pilots.

Intelligible pronunciation is an essential part of oral communication: to understand and to make oneself understood allows one to perform well in interactional activities. In our context, pilot-ATCO communications via radiotelephony (RTF) must be precise and concise: messages should be short and sharp, without any ambiguous elements that may lengthen or delay the information exchange. ATCOs are always busy controlling, informing or, at the very least, suggesting alternatives to pilots – and the latter are busy asking for clearances, updating changes in their status and, at times, asking for help in emergency situations.

Even though communication between pilots and ATCOs is generally successful, miscommunication sometimes occurs and can lead to accidents, which may occasionally be fatal. It is worth pointing out, however, that merely focusing on accidents is not enough to have a picture of the relevance of communication issues in the routine of these professionals. Research suggests that there is a worrying under-reporting of language-related miscommunication or interactional problems and, even when they are reported, the narratives lack detail that could help understand the nature of such problems (e.g. CLARK, 2017)[3]; to this we would add the concern that language-related miscommunication is even less likely to be reported when it does not contribute to accidents or incidents. Such events are, nevertheless, a concern

[3] "Most troubling of all is the under-reporting of language-related miscommunication which contributes to incidents and accidents. Without such data, it is impossible to determine the extent to which language and communication contributes to incidents and accidents, and the relationship between English language proficiency and aviation safety." (CLARK, 2017, p. 18)

for pilots and ATCOs, contributing to increased workload and stress, even though they affect each professional differently (SCHOLLER, 2017).

Mathews (2012, paragraph 2) also points out that

> At the most fundamental level, if the link between language proficiency and safety is not made explicit, if only the most glaring language issues are detected and the more subtle, yet still powerful, influence of less obvious language and language awareness deficiencies goes unnoticed, then the industry will continue to misunderstand the critical need for language training to become a priority and a long-term, industrywide commitment.

Communication problems can range from failing to use Aviation Phraseology and resorting to 'plain English' (especially in the case of native speakers), using slang and idiomatic phrases, using local English, failing to build a shared understanding of the situation, expectation bias readback/hearback errors, call sign confusion, number confusion, spoonerisms, code-switching, ambiguity, speech rate, length and/or complexity of messages, lack of cultural awareness, politeness, etc., to pronunciation aspects (CLARK, 2017; ESTIVAL et al, 2016; GONÇALVES; PACHECO, 2017; KIM; ELDER, 2009; McMILLAN, 1998; MATHEWS, 2012; MONTEIRO, 2012; PRINZO; CAMPBELL, 2008; TAJIMA, 2004, among others). It is also worth highlighting that accidents are normally caused by a number of factors but miscommunication can be one of the aspects involved. Another aspect worth mentioning is that linguistic or communication problems are not the sole responsibility of non-native speakers (NNSs). In terms of pronunciation, heavy accents from native speakers (NSs) have been reported as causing comprehension problems even for NSs of other nationalities.

The analysis of accidents and incidents by aviation investigators has led to the realization that insufficient proficiency in English, the *lingua franca* of Aviation, was a contributing factor in several cases. As a result, in 2004, the International Civil Aviation Organization (ICAO) released the first edition[4] of Doc 9835, with general guidelines on how the teaching and testing of Aviation English should be carried out by all of its nearly 200 signatory members. Ever since, the Brazilian Air Force (*Força Aérea Brasileira* - FAB) has taken steps towards making sure their professionals improve their proficiency in English. Around the same time, in 2006, the deadliest airplane crash in Brazil took place, with a death toll of 154 people: miscommunication (and pronunciation) was one of the causes of the accident (see Section 2 for details) and it raised awareness towards communication issues. In 2009, there was a re-structuring of the English provision at FAB's ATCO Training Course in Guaratinguetá-SP: the ATCOs in-training started having Aeronautical English classes using two British textbooks (TBs), namely, *English for Aviation* by Ellis and Gerighty (2008) and *Aviation English* by Emery and Roberts (2008). As these TBs

[4] The second edition came out in 2010.

are published by Oxford and Macmillan in the UK for a global market, it is unreasonable to expect their contents to address the particular local needs of NNSs in every part of the world.

Babboni (2017) analyzed the pronunciation activities from these two TBs, aiming to find out which activities were useful (and to what extent) at reducing the difficulties in pronunciation that were more common amongst native speakers of Brazilian Portuguese (henceforth Brazilians) learning English. The analysis was conducted by means of quantitative and interpretative-qualitative approaches, and the results show that, out of eight pronunciation problems which are considered typical of Brazilians (see CRISTÓFARO-SILVA, 2012), the pronunciation activities in both TBs focus on only three: (1) contrast between long and short vowels, (2) aspiration of consonantal sounds /p/ /k/ /t/; and (3) insertion of an extra vowel /i/ *before*, in the *middle* of, and *after* consonant clusters. (Section 3 of this paper will cover these language aspects in detail.) The research indicated the need for teachers of Aeronautical English in Brazil to design extra activities focusing on the pronunciation difficulties that are more frequent amongst speakers of Brazilian Portuguese (BP).

The aforementioned analysis was done from the perspective of English as a *Lingua Franca* (ELF), which is acknowledged in ICAO's official documents (2004, 2009, 2010). In the field of ELF, the main point of reference is the work of British researcher Jennifer Jenkins, who set up experiments to observe the miscommunications between speakers of different L1s interacting in English and analyzed which aspects of the language tended to affect intelligibility and which aspects did not. Based on the evidence of her empirical sociolinguistic research, the author proposed a 'Lingua Franca Core' (JENKINS, 2000), as a list of language aspects that are both critical to intelligibility and 'teachable' and should therefore be part of any ELF or English as an International Language (EIL) syllabus. For Jenkins, EIL/ELF teachers should focus less on native-like standards of pronunciation and more on the intelligibility of communications between speakers of different L1s, as "phonology must be intelligible and acceptable to the target international, and therefore predominantly NNS, English-speaking community. This will involve the making of adjustments by NSs as well as NNSs of English, towards an agreed international (rather than NS) norm" (JENKINS, 2002, p. 85). Thus, another implication of Jenkins' work is that NSs should also be aware of those aspects of their own NS accents that may cause intelligibility issues outside their immediate speech community, an aspect which is especially relevant in pilot-ATCO communications.

Intelligibility is heavily influenced by the context: it is adaptable and mutual. "Intelligibility presupposes participants. In other words, intelligibility has as much to do with the listener as with the speaker" (KENWORTHY, 1987, p. 14). Jenkins (2000, p. 79) explains intelligibility as "dynamically negotiable between speaker and listener, rather than statically inherent in a speaker's linguistic forms".

Jenkins mentions two factors that could be used as a resource when facing communication problems: to rely on and process contextual (or cotextual) cues, and to use accommodation strategies (i.e. to adjust one's pronunciation in order to bring it closer to the interlocutor's) or, in other terms, to converge phonetically. However, the author notes, *processing overload* may interfere and lead to errors. In pilot-ATCO communications, one might expect that contextual cues would be clear enough to not allow misunderstandings to happen, particularly during uneventful situations when phraseology can be used and everyone understands each other. However, when something out of the ordinary occurs and communication strays from the 'script', high(er) levels of psychological pressure, nervousness and stress have a direct effect on the way people speak (mispronouncing words, for example) and the way people hear (mishearing, misunderstanding). In these unscripted scenarios, the 'negotiation of intelligibility' can become uneven: monolingual NSs of English may not see anything wrong with the way they are (mis)using the very language that they 'own', while L2 speakers, depending on their level of language competence, may assume it is their fault that they cannot understand a nervous, fast-talking NS, for example.

Regarding the use of accommodation strategies, Jenkins points out that speakers have to be aware of the aspects of their L1 which may affect intelligibility. As some other researchers have also highlighted (KIM; BILLINGTON, 2018; MITSUTOMI; O'BRIEN, 2003; SEILER, 2017, among others), it is important for speakers to be aware of the features of their own L1s that may cause misunderstandings while also being aware of the peculiarities that shape other accents. Referring to the 'Lingua Franca Core' (LFC) proposed by Jenkins (2000, 2002, 2005), Kim and Elder (2009, p. 14) state:

> […] there are core features of pronunciation, including initial consonants, that need to be mastered for mutual intelligibility between English users from different L1 backgrounds. These should be a focus of attention in teaching syllabi tailored to the needs of non-native English speaking aviation personnel, with particular emphasis paid to the sounds which are problematic for particular groups […]. Contrastive analyses of the kind conducted by Wang (2007) in relation to Chinese and English speakers of aviation English may provide useful insights for syllabus design.

The role of teachers is then to improve students' awareness of phonological aspects, highlight the differences between the L1 and English phonology, help them realize the place and manner of articulation of sounds, which in turn means teachers and other stakeholders must have proper training. In the words of Seiler (2017, p. 202), "There is a need for linguistically trained communication specialists who can assist in the training of national experts, language trainers and assessors, etc., as they will be aware of the particular language pitfalls faced by speakers of that speech community."

In this paper, we shall revisit the challenges that English pronunciation presents to Brazilians, particularly in terms of segmentals (vowels and consonants). Our main objective here is to shed light on the way English is generally spoken/pronounced by Brazilian speakers, indicating some of the causes for their difficulties with English pronunciation. This will highlight some areas teachers could concentrate their work on, so as to contribute to a general improvement in the safety of flights.

This paper is organized as follows: in the next section, we relate some examples of accidents, incidents and concerns involving pronunciation and miscommunication. In section 3, we present the theoretical underpinnings of the pronunciation of English vowels and consonants, the main English pronunciation difficulties for Brazilians, as well as the 'Lingua Franca Core' (JENKINS, 2000, 2002, 2005). In section four, we summarize some aspects that researchers have pointed out as deserving attention when planning classes in general and, more specifically, pronunciation classes. Finally, we present our interpretation of our findings, our conclusions, and the implications of the paper.

In the following section we describe some accidents in which pronunciation issues were involved and we also refer to some reports and research that indicate that, although it is not one of the most salient aspects when miscommunication is discussed, pronunciation does play a considerable role in terms of pilots and ATCOs' concerns and workload.

2. Accidents, incidents and miscommunication: the role of pronunciation

In terms of linguistic factors, our focus is phonology/pronunciation, which, as will be shown, has been pointed out as one of the causes of miscommunication resulting in some fatal accidents and has been reported by pilots and ATCOs as an area of great concern, generating distress for professionals who are already under cognitive overload. As Clark (2017, p. 45) remarks: "Accent affects clear and concise communication between pilots and controllers, resulting in excessive time on radio frequency, loss of situational awareness, and added stress."

In their research, Gonçalves and Pacheco (2017) investigated a series of books, materials and official sources in order to collect information regarding miscommunication and airline accidents. They divided the miscommunication problems into the four branches of linguistics: phonetics and phonology, semantics, syntax and pragmatics. The main source was the book *Fatal Words* (CUSHING, 1994). In the ten instances of miscommunication analyzed, the number of occurrences in each branch were as follows: syntax (1); semantics (1), pragmatics (8), phonetics/phonology (3). Even though Pragmatics was the area with the highest incidence, pronunciation problems were second on the list.

Estival and Molesworth (2012) also present samples from Cushing (1994), exemplified below[5]:

(1) ATC to another ATC talking about clearance
  (a) says: *I'll let you know*
  (b) understands: *Let him go*
(2) Instructor (a) and student (b), during landing
  (a) Instructor says: *Last of the power* (i.e. reduce power)
  (b) Students understands: *Blast of power* (i.e. increase power)
(3) Pilot to AC, requesting clearance to cross a runway: May we cross?
  (a) ATC replied: *Hold short* (i.e. Don't)
  (b) Pilot understands: *Oh sure* (i.e. You can)
(4) ATC (a) to Pilot (confusion between *west* and *left* in relation to the sides of the Tower:
  (a) *Pass to the left of the tower*.
  (b) *Pass to the west of the tower*.
(5) ATC to Pilot (involving the homophony between the words *two* and *to*):
  (a) ATC: *Climb **to** five zero* (FL 050)
  (b) Pilot understands: *Climb **two** five zero* (FL 250)

Numbers, as in example (5) above, are particularly troublesome, especially in the case of *homophones*, such as "two" ("to") and "four" ("for"). In another case, miscomprehension was responsible for a fatal accident involving a Boeing 747 on final approach to Subang Airport, in Kuala Lumpur, Malaysia, in February 1989. Among the communication problems, there was a phonological one: the crew misinterpreted the ATC's clearance of "descend *two* four zero zero" (descend *to 2,400 ft*) as "*to* four zero zero" (descend *to 400 ft*)[6]. According to McMillan (1998, p. 44), in this case, controllers resort to two different techniques in order to avoid confusion: they pronounce 'to' as 'tah' or emphasize the word 'to'.

Another incident, though inconsequential, involving the word 'to' was reported by a Cirrus SR22 pilot.

> During the descent ATC contacted [me], and I understood [that they] told me to turn west to 290 degrees. […] I later found out the Controller was saying, "Turn left to 090." The "to" caused me to understand 290. I did not hear the "0." The Controller was very busy and hard to understand, ... very excited, and talked very fast. (CALLBACK, 2019).

Pronunciation was also involved in an accident which took place in 1971, and is discussed by McMillan (1998, p. 36): the pilot of a Canadian Pacific Douglas DC-8 had landed at Sydney's Kingsford-Smith airport and requested permission to backtrack along Runway 16. The ATCO told him to "take taxiway right" and the pilot heard "you can backtrack if you like". At the same time a "Trans Australian

[5] The authors also relate instances involving prosody, intonation and pauses (or lack of pauses) which, due to space constraints, will not be covered in our discussion.
[6] For more detail, see https://www.tailstrike.com/190289.html

Airlines (TAA) Boeing 727 was cleared for take-off on the same runway — due to a hump in the runway the TAA crew were unable to see the DC-8. The fin and rudder of the DC-8 was torn off in the collision with the airborne B727's belly but there were no fatalities (JOB, 1992)". Other examples presented by McMillan (1998, p. 44) are: 'left' and 'west' and aerodromes such as 'Morawa' and 'Moora'; 'Cowra' and 'Corowa'.

In their technical report, Prinzo and Campbell (2008) asked 48 U.S. international airline pilots to share the difficulties that they had experienced when flying into countries where English is not the national or local language. Pilots cited 6 major problems: one of which was poor language proficiency hampering effective communication and "Pronunciation and naming conventions for locations and other identifiers lack a uniform pronunciation, and 3- or 5-letter identifiers may not be connected with the pronunciation" (p. i). Even though the accounts involve problems prior to 2008 (the deadline for the implementation of ICAO's language proficiency exam) and lack of proficiency in the language as a whole (including structure, vocabulary, pronunciation, fluency, comprehension and interaction) was cited, it is worth noticing the role of pronunciation, including a strong accent (also of NSs having trouble understanding other NSs (p. 15)), in miscomprehension. "Pronunciation and fluency were the primary factors that affected the ease of understanding, intelligibility, and comprehension of utterances" (p. v).

The pilots mentioned some specific problems such as the pronunciation of locations and other identifiers (such as waypoints, fixes, intersections, etc.), sometimes because the pronunciation was in the local language. This may be problematic, causing the pilot to have to go carefully over the points on the flight plan and try to anticipate what the points might sound like, placing more burden on the pilot.

One pilot stated that

> Accent and emphasis variations can make words sound completely different, but sometimes [NNS controllers'] use of consonants and vowels in certain combinations make them all sound the same. So there might be a list of five waypoints in my route that could have been any one of the ones that they said I was just cleared direct to. I might need to have them phonetically spell it out for me before I can understand what they're saying. I think that in some countries' airspace, the waypoint enunciation is difficult to catch without phonetics[7]. (PRINZO; CAMPBELL, 2008, p. 13).

Thus, when preparing for international flights, some pilots use Jeppesen charts, because some include the pronunciation of waypoints (p. 10). Another problem was the name of airports: "some airports share the same name (though with different 3-to-5 letter identifiers) as nearby location identifiers, which can make it difficult for a pilot to understand his/her route" (p. v).

[7] In this case, the pilot is referring to the "International Radiotelephony Spelling Alphabet", or ICAO alphabet, created in the 1950s. For example: A = Alpha; B = Bravo; C = Charlie; D = Delta, etc.

Evidently, even information which is purely numerical, involving, for instance, call signs, frequencies, altitudes, sometimes posed problems (p. 14). In another report, Prinzo *et al* (2010) also underscore problems concerning NAVAIDs, numbers, intersections, waypoints, call signs or fixes with similar sounds and close to one another. The interviewees cite examples involving controllers from different countries. In such cases, pilots not only have to take extra care when listening, ask for clarification several times, but must also go over dozens of pages of charts and gouges[8], consult their co-pilot, or ask the controller to spell it phonetically, which detracts them from the primary task. They also mention difficulties in pronunciation involving the letters <l>, <r>, <j>, <k> or <w>.

In her report, Clark (2017) also cites numbers and homophones as one of the problematic aspects in communication. Number-related confusion normally involved call signs and flight level and, outside the UK airspace, they occurred in France, Italy, Spain, Portugal, Austria, Turkey and Brazil. Homophone events relating to numbers involved call signs, waypoints and altitude deviation (p. 68). She also adds that countries such as Spain, France and Brazil "are known to be countries where language affects communication, including through multilingual radiotelephony transmissions in both local languages and English and others through a pervasive culture of substandard language proficiency." (p. 50).

Clark (2017, p. 39) also reports some incidences of waypoint confusion: (1) 'BASET/BADSI; OKTEM/OCKHAM', involving UK controllers and non-UK pilots; (2) 'BEPER/OBEPA in France; 'BANKY/BENTI' in Denmark; and (3) a clearance confusion in Israel: 'SHIRI/KEREN'. Another area of concern is that pilots may then hear what they *expect to hear*, and not what was really said, as the same procedures are followed every time. However, deviations from expected procedures or routines may then cause problems.

Prinzo and Campbell (2008, p. 40) conclude that

> […] there are differences in the inflection, dialect, accents, cadence, and other prosodic and linguistic features that distinguish the production of English geographically. Accents tend to be a problem for most pilots, even among native English speakers. These are but several characteristics of an oral language that can affect the pilot's ability to accurately decode message streams and parse their contents into something comprehensible.

Kim and Elder (2009), with the help of eight experienced Aviation professionals (five ATCOs and three pilots), analyze recorded discourse data from the main international airport in Korea, involving instances of communication which were considered non-routine, abnormal or emergency situations so

8 "A "gouge" is a collection of personal notes of a pilot that provides information about previous flights […]" (PRINZO et al, 2010, p. 13).

that they could identify factors that may contribute to misunderstandings. Even though under-utilization of phraseology was one of the main factors in miscommunication, pronunciation issues were also cited.

For her research, Faria (2017) interviewed six ATCOs in Brazil, inquiring about problems with the English language. In relation to pronunciation, they mentioned difficulties in comprehending words not included in the Phraseology, homophony, problems with pronunciation in general and some types of accents, and also names of hangars, companies, etc. (FARIA, 2017, p. 80).

In an effort to try to identify the main causes of miscommunication, Scholler (2017) interviewed 96 Brazilian pilots who fly internationally, as well as 20 Brazilian ATCOs who interacted with both foreign pilots and ATCOs. Among other aspects, the study revealed that both pilots and ATCOs had more difficulties when plain English was used and that failing to use Phraseology in routine situations is still an issue. While it must be considered that most respondents marked more than one cause, in terms of linguistic aspects, the highest percentage of causes for miscomprehension was attributed to accent (even though it was also associated with background noise), followed by unintelligible pronunciation, and then rate of speech, unfamiliarity with vocabulary and pilots or ATCOs having problems in expressing themselves, followed by other aspects. Supporting the findings of Prinzo and Campbell (2008), Scholler's interviewees also reported problems with the pronunciation of waypoints and intersections. An example from Brazil, is the fix 'MOXEP', being pronounced as '*moshepy*'. As Scholler highlights, mispronouncing these words can affect the operations, since they are components of the routes and cause a pilot to direct the aircraft to the wrong location, and be more susceptible to accidents.

Speaking specifically of South America and Brazil, one pilot in Prinzo et al. (2010)'s study clearly says:

> I think my problem understanding Brazilians is the influence of the Portuguese language. In Brazil and Chile, the letter "E" is added to words and it takes some getting used to. In Peru and Ecuador, it's difficult for me to understand everything spoken in English with a Spanish accent particularly when the letter "V" is pronounced like our letter "B." "Victor" is "Bictor."

Prinzo and Campbell (2008) highlight a major accident, mentioned above, that occurred in Brazil in 2006, in which the US pilots of a business jet (Embraer Legacy 600) had trouble understanding the pronunciation of the Brazilian ATCOs and asked for clarification on 3 separate occasions. The jet and a Boeing 737-800 collided over the Amazon rainforest, killing 154 people: this illustrates how accent can generate miscommunication.

According to Mathews (2012, paragraph 1), even though several human and operational factors led to the accident, "a number of subtle — but significant — language factors helped create an atmosphere in

which a series of communication failures was allowed to develop." Even though insufficient knowledge of the English language by the Brazilian ATCOs was stated in the Brazilian Aeronautical Accident Investigation and Prevention Center's (CENIPA) report, the accent of the Brazilian controller was influential in miscommunication, according to Mathews' analysis:

> Although the message was brief and consisted entirely of routine phraseology (so that it should be very familiar to the controller), the controller stammered and repeated himself, compounding the challenge to understanding English spoken with an accent not easily understood by the Legacy pilots.
> In response, although the Legacy first officer replied, "Roger, radar contact," the area cockpit voice recording registered the pilot's expression of frustration: "I've no idea what the hell he said." (par. 37-38)

Pronunciation is, thus, a concern in (mis)communication, and studies in Linguistics and Applied Linguistics, specifically in the area of phonetics and phonology can help, as Seiler (2017) points out.

3. Theoretical underpinnings

The Grammar of a language is composed of Phonology, Syntax and Semantics; however, more often than not, pronunciation has been neglected by L2 teachers and researchers who have been more interested in other aspects of the language, namely, grammar and vocabulary. For this reason, pronunciation has been referred to as "Cinderella" (KELLY, 1969, p. 87), "poor relation" (UNDERHILL, 2010, p. 1) and the "orphan" of language teaching (GILBERT, 2010, p. 1). In the history of pronunciation teaching,

> [...] the language teaching profession changed positions many times […]. Various methods and approaches placed this skill either at the forefront of instruction, [...] or in the back wings [...]. Other methods and approaches either ignored pronunciation [...] or taught pronunciation through imitation and repetition [...], or through imitation supported by analysis and linguistic information [...]. (CELCE-MURCIA *et al* 1996, p. 5).

These ongoing oscillations in the relevance of pronunciation to L2 researchers are like "methodological 'swings of the pendulum'" (PRATOR, 1991 *apud* CELCE-MURCIA *et al* 1996, p. 14). Undeniably, pronunciation plays an essential role in oral communication – however, to this day, many studies show that pronunciation is still being treated as a lesser important part of L2 teaching. For example, in the US,

> [p]ronunciation is frequently neglected or ignored in teacher preparation, with a *minority* of programs around North America requiring any knowledge of pronunciation, phonetics or phonology beyond what is learned in introductory survey classes (LEVIS, 2012, p. 4, emphasis added).

A similar scenario occurs in the UK:

> For various reasons, pronunciation has been neglected for 50 years, so teachers have little confidence in how to teach it. [...] [In 1991] Barbara Bradford and Joanne Kenworthy [...] informally surveyed a number of British ESL/EFL teachers, asking them how they felt about their training for teaching pronunciation, and the result could be summed up as "not good". Little has changed. (GILBERT, 2014, p. 7).

The situation is similar in Brazil. Most teachers have no proper knowledge and/or training regarding English Phonology and hope that students will simply acquire pronunciation by listening and repeating, ignoring all the cognitive processes involved, the need to (re)conceptualize phonological aspects, influences of the first language etc.

Nevertheless, ICAO (2009) describes pronunciation as one of four "foundation skills" in language learning, along with structure, vocabulary and listening comprehension (which also involves pronunciation knowledge). "These four foundation skills are in a way the essential building blocks from which actual communication will be carried out" (ICAO, 2009, p. 40). When ATCOs are controlling aircraft, they communicate with pilots through spoken messages via radiotelephony (RTF), without face-to-face interactions or any visual clues of their interlocutors. For this reason, those

> […] who want to work as air traffic controllers [...], will need to have a pronunciation which is easily understood in less-than-ideal conditions. In these situations there is a limited opportunity for repetition and second tries; indeed, these can be dangerous. (KENWORTHY, 1987, p. 3).

"Lack of plain language proficiency [...] is often cited as having played a contributing role in some accidents" (ICAO, 2010, p. 1-2). Some of these language-related accidents are (**I**) a 1977 runway collision in Tenerife with 583 deaths: pronunciation was one of the factors involved (McMILLAN, 1998, p. 51-53); (**II**) a 1990 fuel exhaustion crash in New York (COOKSON, 2019) with 73 dead; (**III**) a 1995 airplane/mountain crash in Colombia (*op. cit.*) with 159 dead; (**IV**) a 1996 mid-air collision in India (*op. cit.*) with 349 dead, and, (**V**) a 2006 mid-air collision in Brazil with 154 victims, in which pronunciation problems also played a role (MATHEWS, 2012). These five accidents killed over 1,300 people altogether.

ICAO first decided to

> address language proficiency for pilots and air traffic controllers [...] in the 32nd Session of the Assembly in September 1998 as a direct response to several fatal accidents, including one that cost the lives of 349 persons, as well as to previous fatal accidents in

> which the lack of proficiency in English was identified as a contributing factor. (ICAO, 2008, p. 2).

ICAO (2010, p. 2-6) fully embraces the concept of "(EIL) or lingua franca, which sets its own standards of proficiency to ensure mutual understanding between multi-cultural users with different levels of proficiency". When talking about what a test of English as a Lingua Franca should include, Harding (2012) cites, among several aspects, the "ability to tolerate and comprehend different varieties of English (e.g., accents, syntax, discourse styles, etc.)" and the "ability to use (or adjust) phonological features crucial for intelligibility between speakers of different first language backgrounds."[9] These aspects were then included in Douglas' list of tasks in an "ELF-enhanced test of aviation English" (DOUGLAS, 2014, p. 10). When these authors mention "phonological features crucial to intelligibility", they are pointing to the 'Lingua Franca Core' (LFC), which "drastically simplifies the pedagogic task by removing from the syllabus many time-consuming items which are either unteachable or irrelevant for EIL" (JENKINS, 2000, p. 160), while, at the same time, allowing for substitutions which do not affect intelligibility, as is the case of /u/ being used in place of [ɬ] ('dark l', as in 'call'), for example. In the list below, we bring the phonological aspects that may interfere in intelligibility and should be part of every ELF syllabus according to Jenkins (2000, 2002, 2005). The aspects are not listed in order of importance: they are numbered (I to VIII) mainly because we want to match them to the information in Table 1.

(I) **aspiration when producing /p/, /t/ and /k/** in word-initial and syllable-initial positions (so they do not sound like their voiced counterparts /b/ /d/ /g/);

(II) **distinction between long x short vowels** (seat x sit);

(III) **consonant clusters**: no omission of sounds in word-initial clusters; omission in word-medial and final positions is permissible provided they follow L1 English rules of syllable structure; addition is acceptable;

(IV) all consonant sounds are important, with the *exception* of both pronunciations of <th>[10] and the syllable-end and word-end <l> ('dark l': [ɬ]);

(V) GA-like[11] /r/, or rhotic /r/, is preferred over RP-like, or non-rhotic /r/[12];

(VI) RP-like intervocalic /t/ (without a flap) is preferred over its GA-like equivalent [ɾ] (with a flap);

[9] It is important to bear in mind that when Jenkins mentions 'adjustments', they apply to NNSs and NSs alike, which is also proposed by ICAO.

[10] In this paper, angled brackets < > indicate letters of the alphabet, bars / / indicate phonological symbols, and [ ] indicate allophones.

[11] We use "GA-like" here meaning "sounding similar to General American, or to the way American people say it".

[12] We use "RP-like" here meaning "sounding similar to British Received, or to the way British people say it". It is worth mentioning that GA /r/ is preferred because it is rhotic and is pronounced pre-consonantly and at the end of words, thus being closer to the spelling and more teachable.

(VII) vowel quality: L2 regional qualities are acceptable when used consistently (except substitutions for /ɜː/, as in *first*); and,

(VIII) knowing where to place the nuclear stress (prominence) is critical for intelligibility.

In relation to vowels, Jenkins also mentions the shortening of vowels before voiceless (fortis) consonants and the maintenance of length before voiced (lenis) consonants, as in *sat* / *sad*, *seat* / *seed* as an important aspect. In the non-core areas Jenkins mentions weak forms, i.e., the use of *schwa* instead of the full vowel in words such as 'to', 'from', 'of', 'do', etc. (as they are, in fact, unhelpful to intelligibility).

As the focus of this paper is the segmentals (vowels and consonants), we are particularly interested in the first seven items on the list (since nuclear stress is a suprasegmental aspect), and whether they pose problems for Brazilians. Table 1 presents the most common Brazilian traits when pronouncing certain phonemes in English (in general terms); the occurrences of these differences are due to the characteristics of the BP phonological system, but we shall look into each of these features individually.

Table 1. Typical pronunciation difficulties for Brazilians.

(I) **Lack of aspiration** in /p/ /t/ /k/ in word-initial and syllable-initial positions.
(II) **Lack of contrast** between long and short vowels (e.g. heat/hit).
(III) **Adding an extra vowel sound** [i] in **consonant clusters** in word-initial, word-medial and word-final positions[13].
(IV) Velarization of the glottal fricative /h/ (i.e. pronouncing English /h/ as a Brazilian velar [x]).
(V) Palatalization of alveolar stops /t/ and /d/ before /i/ (i.e. pronouncing /t/ as [tʃ] and /d/ as [dʒ]).
(VI) Vocalization of the nasal /m/ and /n/ (i.e. pronouncing them as nasal vowels [ã, ẽ, ĩ, õ, or ũ]).
(VII) Vocalization of the syllable-final and word-final /l/ (i.e. pronouncing it as /u/).
(VIII) Labiodentalization of the <th> interdental fricative (i.e. pronouncing <th> as /t/, /d/, /f/, /s/, /z/ or /v/).

Source: Based on Cristófaro-Silva (2012)

As we can observe, the top three items on the LFC list and on Table 1 are almost a perfect match. It is worth mentioning that, in this study, when we compare the segmental aspects (phonemes) of BP and the English language (EL), we are speaking in terms of 'theoretical concepts', in a generic manner, in order to describe phonological peculiarities: phonemes are an abstraction and each person will produce them in a slightly different way, according to social, individual or regional characteristics (which, due to space constraints, will not be covered herein).

Before we can analyze the 'Brazilian English' according to the LFC, we would like to address one aspect as to why there is interference from the L1 in the pronunciation of EL as L2. It is important to bear in mind that oral production in the L2 can be partly dependent on the L1 system, more so in the early

[13] Even though this is not a problem according to the LFC (which is more concerned with the omission of sounds), according to the narratives presented herein, they may cause miscomprehension in certain situations or, at the very least add stress.

stages of L2 acquisition. Speakers of various L1s face distinct difficulties (and can adopt different strategies) when dealing with new sounds from the L2 (see LUCENA; ALVES, 2010; ZIMMER, 2003). In the case of Brazilians, we need to look into a few of the differences in syllable structure between BP and EL so as to understand why certain tendencies in pronunciation come to exist.

The most characteristic syllable pattern in BP is *consonant+vowel* (CV) as in the following examples: *piloto* (CVCVCV), *educado* (VCVCVCV), and *cigarro* (CVCVCCV). BP words can only start with up to *two* consonantal sounds, as long as the second sound is either /l/ or /r/, and they can end in no more than two consonant sounds. Unlike most words in the EL, only a few consonantal sounds can appear in word-final position in BP (see CRISTÓFARO-SILVA, 2012; SHEPHERD, 2002); for this reason, Brazilians may add an extra /i/ sound after certain consonantal phonemes, such as: /b/, /k/, /d/, /f/, /g/, /p/, /t/ and /v/. There are no BP words that end with these consonantal sounds and, when Brazilians add the extra vocalic sound in English, they are unconsciously reproducing BP's characteristic CV pattern[14]. However, as Souza Silva and Barboza (2018) highlight, there are some new syllable patterns emerging in BP in terms of pronunciation.

3.1 Aspiration in /p/ /t/ /k/ in word-initial and syllable-initial positions

"Voiceless plosives are unaspirated [in BP], as in other Portuguese varieties" (BARBOSA; ALBANO, 2004, p. 228). In EL, however, voiceless plosives are aspirated in word-initial and syllable-initial positions, like /p/ in *pilot* and *empire*, /k/ in *cabin* and *un**k**ind*, and /t/ in *tip* and *creative*. Godoy et al (2006, p. 92) explain this aspiration as "the extra puff of air that is released with some sounds".

When Brazilians fail to produce the aspiration in /p/, /k/ or /t/ in English, these phonemes may be confused with /b/, /g/ and /d/, respectively, hindering the intelligibility of the message: ***p**a**c**king* is perceived as ***b**acking*; ***c**ra**t**e* as ***g**reat*; **t**art as **d**art (CRISTÓFARO-SILVA, 2012; GODOY et al, 2006; GOMES, 2013; MAJOR, 1982, 1987; SHEPHERD, 2002; YAVAS, 2011). Not to mention the fact that most pilot-ATCO communications are done via radiotelephony (RTF), which can be susceptible to noise interference or poor sound quality. Adding to the problem, in some BP accents, a phoneme /t/ preceding an /i:/ sound can undergo a process called *palatalization*, and the /t/ phoneme is changed into a [tʃ], as we will see in section 3.5.

3.2 Contrast between long and short vowels

[14] Even though this is not an issue according to the LFC, in some instances it may be problematic, as is the case of place names and waystages, for instance.

Vocalic sounds are always the center (nucleus) of the syllable and they can have different durations in English: for example, the /æ/ in *land* is longer than the /e/ in *lend*. Similarly, /iː/ in *leave* is longer than /ɪ/ in *live*, and /uː/ in *pool* is longer than /ʊ/ in *pull*. The distinction between long and short vowels in English often causes problems for Brazilians since, as Cristófaro-Silva (2012, p. 23) postulates; some BP vowels are "extended" but not "long" in the same sense that English vowels are. "In some languages – including Portuguese – only the stressed or tonic vowels are extended – but not long. This is a recurring phenomenon in natural languages: tonic (or stressed) vowels are longer than unstressed (or reduced) vowels[15]".

The stressed vowel /ɛ/ in ***pé***, ***até***, *Pel**é***, which is considered an "extended" vowel in BP, in terms of articulation (i.e. where/how it is produced), falls somewhere between the long English phoneme /æ/ from *d**a**d*, *b**a**ck*, *f**a**ct* and the short /e/ from *acc**e**pt*, *b**e**d*, *alr**ea**dy*, *br**ea**d*. By this, we mean that an "extended" vowel in BP is neither as long as a *long* phoneme in English, nor as short as a *short* phoneme (see GODOY et al, 2006; MAJOR, 1982; MELO, 2014). Therefore, as Jenkins suggests, it is recommended to practice shortening long vowels before voiceless consonants and maintaining length before voiced consonants.

3.3 Insertion of extra vowel /i/ or a schwa in consonant clusters

English words can start with up to *three* consonantal sounds as in 'screech', 'splash', 'spray', 'strings', and end with up to *four*, as in 'attempts', 'sculpts', 'contexts'. However, BP words can only start with up to *two* consonantal sounds, as long as the second sound is either /l/ or /r/ (***c-l-***ube, ***p-r-***ato), and they can end in no more than two consonant sounds either (garage***-n-s)***. Due to this distinction between the two languages, Brazilians tend to add a vowel sound /i/ or /ə/ either *before*, or in the *middle*, or *after* consonant clusters in English (BETTONI-TECHIO, 2008; CRISTÓFARO-SILVA, 2012; GODOY et al, 2006; LANE, 2010; MAJOR, 1982; NASCIMENTO, 2016; SANT'ANNA, 2008; SILVEIRA, 2004), whereas, for instance, Japanese, Cantonese, and Korean speakers tend to reduce clusters.

An extra /i/ or schwa may be added immediately *before* some word-initial clusters in English, such as: /sk/, /sf/, /sl/, /sm/, /sn/, /sp/, /st/, and /sv/, generating words such as /iskaɪ/, /ismaːl/. The consonantal sounds that normally appear in word-medial (i.e. syllable-final) position in BP words are /l/ (*cal-mo*), /r/ (*par-que*), /m/ (*tam-bém*), /n/ (*can-to*), /s/ (*cis-ne*) and /z/ (*fe-liz-men-te*), and for that reason, "BP speakers tend to make syllable-final obstruents pronounceable via the insertion of a vowel after them, bringing the sequence to the CV pattern characteristic of the L1" (KOERICH, 2002, p. 51). Any other consonant, such as /b/, /k/, /d/, /f/, /g/, /m/, /n/, /p/, /t/, /v, in the same position may lead to the insertion of the extra vowel.

[15] Our translation: "Em algumas línguas - e dentre elas temos o português - somente as vogais tônicas ou acentuadas são mais prolongadas - mas não longas. Esse é um fenômeno recorrente nas línguas naturais: vogais tônicas (ou acentuadas) são mais longas que as vogais átonas (ou não acentuadas)".

Besides these two positions, Brazilians may also include the extra /i/ at the end of English words, immediately *after* clusters, as in 'jump' [dʒʌmpi]. In fact, except for words ending in /l/ *bowl*, /m/ *them*, /r/ *car*, /s/ *bus* and /z/ *quiz*, all other word-final consonantal sounds in English may be given an extra vowel /i/ (see DELATORRE, 2017; GOMES, 2009).

Jenkins postulates in her LFC that word-initial consonant clusters are relevant to intelligibility, should not be simplified, and, therefore, should be taught. Adding an extra vowel is considered acceptable if it helps production. Omission in middle and final clusters are permissible according to English rules of syllable structure, which means that /t/ or /d/ could be deleted in phrases such as 'first light', 'most people', 'pushed them', etc. BP speakers do not omit sounds; instead, they add one, which is not considered problematic in the perspective of EIL. In fact, the common 'error' of pronouncing the 'e' in '-ed' endings is not listed as causing communication problems. We must, however, stress the fact that the inserted vowel also adds an extra syllable to the word: for example, the word stop may be pronounced as [stɔpid], [stɔped], or even [stɔpidi] or [stɔpedi] (DELATORRE, 2006, p. 3). The word *parked* /pɑːrkt/, is pronounced by some Brazilians as [pɑːrkit] with the added vowel sound. Adding an extra syllable generally causes change in word stress, which is also not considered an issue, according to the LFC. The question as to whether this really does not interfere in comprehension in the context of AE needs further investigation, in our opinion.

The Brazilian tendency of adding a vowel in word-final position is the reverse of what advanced learners or native speakers tend to do, which is reducing consonant clusters in final position. However, this reduction is not approved by ICAO, suggesting instead "the avoidance of simplification or reduction of some consonant clusters (e.g. the cluster "st fl" linking the two words of "test flight" may be reduced in rapid speech to "tes' flight")" (ICAO, 2010, p. 2-6).

Another aspect concerning BP speakers, as Shepherd (2002, p. 116) reminds us, is that "[s]pelling and pronunciation are very closely related in Portuguese". Due to this, Brazilians tend to pronounce many of the silent letters in English, such as <b> in *climb*, <c> in *muscle*, <d> in *Wednesday*, <g> in *high*, <h> in *honest*, <k> in *knot*, <l> in *talk*, <m> in *mnemonic*, <p> in *pneumonia*, <s> in *island*, <t> in *listen* and <w> in *answer*. The question remains, however, as to what extent this is an intelligibility issue, especially in a scenario involving NNSs, or whether pronouncing a word closer to its spelling enhances intelligibility.[16]

3.4 Velarization of /h/

[16] We would like to thank one of the reviewers for bringing this aspect into our attention.

The letter <h> in English is pronounced as a glottal fricative, while in BP it is considered a rhotic sound (CRISTÓFARO-SILVA, 2007), thus some Brazilians tend to pronounce it as a velar [x] (see GODOY et al, 2006; MAJOR, 1982), which can also be used for the letter <r> (see section 3.9). In this case, words such as 'head' and 'red' may sound alike.

3.5 Palatalization of alveolar stops /t/ and /d/ before /i/

In some BP dialects, when the phoneme /t/ appears immediately before the sound /i:/, as in ***t**ia* and *men**t**ira*, the phoneme /t/ may be palatalized and transformed into [tʃ]. A similar palatalization also occurs in English: "that you" becomes /ðæ**tʃ**ə/ and "what you" becomes /wɒ**tʃ**ə/. This is sometimes transferred into English, and Brazilians may pronounce words like "**tʃ**iːtʃə(r)" (teacher), "æk**tʃ**ɪv" (active).

The same principle applies to the phoneme /d/ in the BP words *dia* and *coitadinho*: /d/ before /i:/ is palatalized and pronounced as [dʒ]. In English, "would you" becomes /wʊ**dʒ**ə/ and "need you" becomes /niː**dʒ**ə/. Therefore, Brazilians may say "**dʒ**ɪfɪkəlt" (difficult) or "**dʒ**ɪnəɾ" (dinner). (see BARBOZA, 2013; GODOY et al, 2006; GOMES, 2013; MAJOR, 1982; SHEPHERD, 2002; YAVAS, 2011).

3.6 Vocalization of the nasal /m/ and /n/

Brazilians speaking English do not usually have problems producing /m/ or /n/ in word-initial position, but they tend to mispronounce these phonemes in syllable-final and word-final positions (CRISTÓFARO-SILVA, 2012; GODOY et al, 2006; KLUGE, 2009; LANE, 2010; YAVAS, 2011), as they are not produced when in final position: the preceding vowel is simply nasalized. A different way of explaining this is that Brazilians tend to *vocalize* /m/ and /n/, instead of producing them *nasally*: this makes the English word '*from*' rhyme with the French word '*garçon*', and the English word '*one*' rhyme with the Spanish pronunciation of '*Juan*'.

When Brazilians vocalize the final /m/ and /n/, the EL words *sun*, *some*, and *sung* will all sound alike. The same thing happens with *scheme*, *skim*, *skin* and *skiing*: they will all be pronounced the same way with the vocalized /m/ and /n/, and the lack of contrast between long and short vowels (see 2.2).

3.7 Vocalization of the syllable-final and word-final /l/

In most BP dialects, the words *mal* (badly) and *mau* (bad) have the same pronunciation, since /l/ in word-medial and word-final positions is generally pronounced as /u/. Brazilians tend to transfer this to English and may pronounce /u/ instead of /l/ in the middle of syllables: milk [miuk]; at the end of syllables: belt [beut]; and at the end of words: install [ɪnstɔːu] (see GODOY et al, 2006; LANE, 2010; MAJOR,

1982; YAVAS, 2011). For the LFC this substitution does not need to be corrected as it does not interfere with intelligibility.

3.8 Labiodentalization of the <th> interdental fricative

The two pronunciations of <th> in English are not part of the BP consonantal inventory: /θ/ in ***th**anks*, *any**th**ing*, *bo**th***, and /ð/ in ***th**at*, *al**th**ough*, *brea**the***. Because of this, Brazilians may tend to replace these phonemes with their closest sounds in BP: /t/, /d/, /f/, /s/, /z/ or /v/. (see GODOY et al, 2006; LANE, 2010; MAJOR, 1982, among others). This happens in some English dialects as well and, according to the LFC, should not affect intelligibility. However, more research should be conducted in this respect in the area of Aviation English, especially concerning placenames[17].

3.9 Other challenging sounds in the English consonantal inventory

Word-initial <r> (***r**unway*, ***r**oger*) may present a big challenge, according to Major (1982, p. 179): "American English /r/ is often pronounced as [ɦ] or [x] by speakers of Portuguese whose initial or intervocalic /r/ is not trilled". The trill is generally produced only in the south of Brazil (CRISTÓFARO-SILVA, 2007). Actually, depending on the dialect, and its position in a word, the letter <r> in BP may correspond to different potential spoken realizations: the velar fricatives [x, ɣ], the glottal fricatives [h, ɦ], and an "unvoiced trill" or flap [ɾ], for instance (see CRISTÓFARO-SILVA, 2007; SHEPHERD, 2002; YAVAS, 2011). This means that there would be no clear distinction between *red* and *head*; or *right* and *height*. The rhotic /r/ occurs in some dialects of BP.

Brazilians speaking English do not usually mispronounce the following word-initial consonantal sounds: /b/ ***b**oy*, /f/ ***f**ood*, /g/ ***g**o*, /s/ ***s**ee*, /v/ ***v**oice*, /z/ ***z**oo*, /ʃ/ ***sh**e*, /dʒ/ ***j**ob*, /tʃ/ ***ch**ild*, and the semi-vowels /w/ ***w**alk* and /j/ for ***y**es*. As mentioned in section 3.3, when these sounds appear in syllable-final or word-final positions, Brazilians may add a vowel /i/. Also, Brazilians may pronounce them when silent (see 3.3).

There are very few words in English beginning with /ʒ/ and they are usually of French origin: *genre*, for example. The phoneme /ʒ/ is more common in word-medial positions: *u**s**ually*, *plea**s**ure*, *equa**t**ion*, *massa**g**e*, *sei**z**ure*. Brazilians may mispronounce them due to the different spellings: s, t, g, and z.

3.10 Vowel quality

[17] We would like to thank one of our reviewers for pointing this aspect out and citing the example of 'little x lethal'.

The quality of vowels refers to how and where vowels are produced according to the shape of the mouth and lips, the position of the tongue and lower jaw, and whether or not air is released through the nose ('nasal' vowels). The tongue may be high or low, it may be pushed forward or pulled back; and the lips may be rounded or spread. Obviously, the vowel *letters* are five in both languages: a, e, i, o, u. But in terms of sounds, English has twelve non-nasalized vowels, whereas BP has seven 'pure' vowels plus five nasals [ã, ẽ, ĩ, õ, ũ] (see GODOY et al, 2006; MELO, 2014; KIVISTÖ-DE SOUZA, 2015; SHEPHERD, 2002; SANT'ANNA, 2008). For the LFC, intelligibility may not be affected by differences in vowel quality: "While vowel quantity is reasonably stable across varieties of English, vowel quality is not" (JENKINS, 2000, p. 144), as long as their realizations are consistent, except for /ɜ:/. Emphasis is then given to quantity (length) and rhoticity (since the presence of a preconsonantal /r/ after a vowel helps intelligibility, as in 'cat' and 'cart', for instance).

4. RTF communication and pronunciation: focal points

The specific pronunciation issues identified in the previous section have consequences for course design in Aviation English. Some researchers who interviewed pilots and ATCOs, analyzed data from reports, or investigated features related to the exams, highlighted aspects to focus on. Some such aspects are the disparity between the content of courses and lessons and the 'real' interaction between pilots and ATCOs, the problem with an idealized pilot/controller and the need to try to simulate the real conditions of work (CLARK, 2017). Moskalenko and Didenko (2018, p. 190) recommend the use of authentic material and remind us that an "ICAO requirement concerning organizing ICT [Information and Communications Technology]-classes is blended learning, which refers to the combination of computer-based and classroom learning with a view to optimizing the efficiency and effectiveness of a training program." ICAO (2009) recommends the use of blended learning and individual self-study so that more time can be used in class to improve "speech production, fluency and interactive skills" (p. 6). The use of technology certainly increases students' contact with the language, with authentic material, and time to work on specific items that pose problems to them. This could also be monitored through Learning Management Systems or Learning Content Management Systems.

Prado (2018, p. 71) also criticizes the adequacy of international teaching materials because the linguistic content is "superficial and prolix" due to the use of plain English even in situations where Phraseology should have been used and also due to its disconnection from real situations. She also discusses the importance of working with pilot-ATCO RTF corpora in situations where Phraseology was not enough to tackle the situation. We advocate the same for pronunciation work.

Citing Farris et al. (2008, p. 408), Clark (2017, p. 54) mentions that they

> suggest using scenarios in aviation language courses and lessons which would replicate or simulate workload conditions similar to those which students may experience on the job. Similarly, teachers of aviation language should collect and analyse discourse samples to better understand the communicative setting and develop enhanced course materials.

In terms of segmental aspects, Kim and Elder (2009, p. 23.13), who investigated miscommunication events in the Korean airspace, make reference to the core features of pronunciation (in the LFC), specifically citing the need to master the sound of initial consonants, an aspect which is also highlighted by Clark (2017). Kim and Elder also advise that attention should be paid to the specific needs and sounds which pose difficulties for speakers of a certain language, as is the case of the /r/- /l/ distinction for Korean and Japanese speakers. The authors also add that perhaps computer-based teaching and training could be used to supplement classroom instruction in such cases.

On her report, Clark (2017, p. 80), lists a series of recommendations when planning classes. In terms of pronunciation, she mentions:

- Include in aviation English classes training to understand different accents heard in English, including so-called 'native' varieties (e.g. Indian English, South African English) as well as non-native speaker varieties […];
- Address variations in intonation, rhythm, and pauses that native and nonnative English speakers have […];
- In teaching syllabi tailored to the needs of non-native English speaking aviation personnel, focus attention on core features of pronunciation, including initial consonants […];
- In English for aviation lessons, make numbers and number fluency a significant focus[18].
- Include in pilot and controller training familiarisation with non-native English-speaking accents. Replicate real-life conditions in training conditions, e.g. include noisy flight deck environment, poor sound quality, busy tower environment.

This means that teachers need to have a solid knowledge base in English phonology and, in terms of segmental aspects, they should understand how sounds are articulated to be able to help their students. They must be familiar with various pedagogical techniques and have a good repertoire of strategies, procedures, activities and resources to be used or implemented according to their students' needs. They must also be aware of the characteristics of their L1 phonology and of which aspects may affect intelligibility in the context of RTF communication, as suggested by several researchers brought to this

18 Prinzo *et al* (2010)'s report has several examples of number miscomprehension, depending on the speakers' L1.

discussion. In this sense, we still need to investigate the relationship between specific pronunciation difficulties, specific lexical items and miscommunication in AE in the Brazilian context.

However, in terms of pronunciation work, especially when dealing with segmental aspects, there is a tendency to work solely with isolated words. As has been pointed out, it is important to develop students' awareness in terms of the production of the phonemes, their place and manner of articulation, contrast the L1 and English phonemes, etc. As Fraser (2001, p. 18) affirms, "[p]ronunciation teaching requires thorough preparation through work on the perception of English sounds and contrasts, and the formation of concepts of English phonology." Pronunciation problems are not related to physical, articulatory causes, but derive from cognitive causes, that is, our brain has the concepts for the sounds of our L1 (if we are monolingual) and will interpret the new sounds in accordance with those concepts. That is the reason why no matter how many times you repeat a sound, students will not perceive how it differs from a similar one.

The problem is that they "don't conceptualise the sounds appropriately – discriminate them, organise them in their minds, and manipulate them as required for the sound system of English" (FRASER, 2001, p. 20). Teachers must then help learners categorize sounds, make mental representations, develop the concepts for the sounds of the L2.

Thereby, working with phonemes and words in isolation (preferably words that students will most likely use in their real interactions) is part of the process. In this respect, our review of the most common pronunciation difficulties faced by BP speakers can help teachers when selecting the most crucial aspects regarding their specific students. Nevertheless, pronunciation teaching does not end with raising to consciousness unfamiliar phonemic contrasts. Sounds and words should be used in real and meaningful situations (even if simulated). What the authors that we reviewed propose is that activities be developed out of real data, real interactions between pilots and ATCOs, using audio recordings and videos, based on corpus linguistics, focusing on standard phraseology and also on non-routine events, so that students can have contact with a variety of situations, emergencies, incidents, scenarios, and accents[19] [20]. In this way, the practice of specific sounds can occur while also practicing the suprasegmental aspects of pronunciation, such as syllable stress (even though it is not part of the LFC), nuclear stress, chunks or meaningful units, rhythm, intonation (covering those aspects which are crucial for AE, however).

[19] It is imperative, then, that researches and teachers work together, sharing their findings.
[20] So that they can cope with L1 transfer from other L1 speakers, develop a "tolerance of difference", adjust their expectations according to the interlocutor, and develop productive and receptive accommodation skills (i.e. "productively the replacement of core transferred items with more target-like forms, and receptively the mental adjustments that render a listener more able to cope where such transfer replacement fails", as Jenkins (2000, p. 81) points out.

Also, pronunciation work should not be disconnected from other aspects involved in miscommunication. Even though it is being treated separately here and, due to space constraints, only the segmental aspects have been examined, when devising pronunciation activities, other language aspects could also be taken into consideration as, in real situations, they may well be interconnected. At the same time, we believe pronunciation practice should also contribute to the appropriation of other features of RTF communication, such as the appropriate length of utterances, the amount of information in each utterance, the use of different communication strategies, for example[21]. Besides that, the more we use the words, phrases, collocations in different interactional and meaningful events, the more associations will be made by the students and thus more chances for the appropriation and retention of the language.

Activities (in pairs or small groups) could involve the exchange of short (and direct, concise)[22] messages, hearbacks, readbacks, message clarification, confirmation or repetition, paraphrasing utterances, repair of miscommunication, collocations (or multiword units), etc., and include numbers (reinforcing the need to stick to ICAO's rules) which, research has shown, are still an important aspect in miscomprehension.

Learning another language is not an easy task and learning is not merely a cognitive endeavor, i.e., there is no separation between cognitive and affective aspects. That is why activities should be varied, contextualized, relevant, meaningful and enjoyable – which does not mean easy and facile: on the contrary, they should be reasonably challenging (i.e., not too easy and not too difficult, in accordance with the learners' level).

Final remarks

Observing the LFC and the most common pronunciation challenges faced by Brazilians and then cross-checking them against the aspects focused on the pronunciation activities of two international textbooks used in Aeronautical English classes, the analysis revealed that, out of eight categories, only three were covered in the textbooks.

We can then conclude that it is imperative that teachers analyze textbooks more critically and not purely rely on them, and develop their own supplementary materials and activities which suit the specific needs of their students. It is important to be aware that, due to phonological differences, people's accents may be influenced by their L1 and different languages have some characteristics which might stand out,

[21] When discussing accommodation, Jenkins (2000, p. 81-82) mentions some conditions for it to be put into practice, including being "linguistically and affectively able to signal non-comprehension", which is an aspect worth keeping in mind, as it may also involve relations of power and face saving.

[22] In this respect, Kim and Elder (2009)'s paper, for instance, brings interesting accounts of instances when verbose sentences and lack of objectivity were responsible for miscomprehension and extreme delay in resolving the situation.

which are then covered in international textbooks as, for instance, the /r/ - /l/, /b/ - /v/, /w/ - /v/, /z/ - /s/ distinctions. Hancock (2018, p. 4) highlights that if students are aiming for intelligibility, the focus should be the essential features (phoneme distinctions, syllables and tonic stress); as they "are for the benefit of the listener – these features serve to make the intended communication clearer and less ambiguous."

Kim and Elder (2009) point out:

> As Jenkins (2002, 2005) has proposed, there are *core features of pronunciation*, including initial consonants, that need to be mastered for mutual intelligibility between English users from different L1 backgrounds. *These should be a focus of attention in teaching syllabi tailored to the needs of non-native English speaking aviation personnel*, with particular emphasis paid to the sounds which are problematic for particular […]." (KIM; ELDER, 2009, p. 23-13, emphasis added)

Following the authors' suggestion (above), it is time for us to start thinking of such a teaching syllabus, tailored to the needs of our L1 Brazilian Portuguese (BP) speakers. When designing classroom materials to enhance the listening and pronunciation skills of pilots and ATCOs, it will be crucial to focus critically on the aspects of ELF discussed in this paper. As we mentioned earlier, several researchers (KIM; BILLINGTON, 2018; MITSUTOMI; O'BRIEN, 2003; SEILER, 2017, among others) have highlighted the importance of being aware of the features of one's L1 that may cause misunderstandings. A lot of research has been carried out in Brazil from the perspective of EFL, focusing on aspects which are not crucial according to the LFC. That being said, there remain some questions to be answered, however: considering BP speakers' pronunciation difficulties (most of them discussed herein), which phonological aspects should be prioritized? What are the most effective ways to deal with them? What types of activities can be designed? What kind of knowledge should teachers have in order to do so? Answering these questions calls for other actions. Firstly, further research has to be conducted in order to investigate whether our students' pronunciation peculiarities – even some of those not considered core items in the LFC –, may lead to miscomprehension in the context of AE or enhances cognitive stress in pilot-ATCOs communications (which can then lead to other problems).

Secondly, another dimension has to be taken into consideration. Just as in general teaching of EL in Brazil and in other countries (as pointed out in section 3), the teaching of pronunciation is not usually seen as urgent or relevant and, often, it is cast aside. Teacher training courses rarely cover phonetics and phonology (KOERICH, 2002a, among others). As far as ATCOs in training, Chini (2014) reveals that shortage of instruction/practice aimed specifically at English pronunciation was pointed out by the students. That indicates the need for more pronunciation practice and activities, including outside the classroom, as ICAO suggests.

In our opinion, in order for this current scenario to be changed and, as a consequence, to help improve safety in international airspace, there are some points to be taken into consideration concerning pronunciation work. Professionals involved in the teaching of Aeronautical English should have: (1) adequate communicative competence in English[23] and AE-related aspects; (2) ongoing training in English phonology, as well as in the specifics of AE; (3) a more discerning view of the teaching materials used, so as to adapt and/or design contents in view of their students' needs; and (4) a teaching-learning theory guiding the process of pronunciation work that considers the cognitive and metacognitive processes involved and does not view it merely as a process of 'listening and repeating/parroting'; (5) training in material design and evaluation.

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References

BABBONI, C.A. 2017. Atividades de Pronúncia em Livros Didáticos de Inglês Aeronáutico: reflexões sob o prisma de falantes de português brasileiro. Master's Thesis. Universidade de Taubaté. Available at: <https://geia.icea.gov.br/geia/artigos/Babboni.pdf>. Access: 06 Jan. 2020.
BARBOSA, P.A.; E.C. ALBANO. 2004. Brazilian Portuguese. Journal of the International Phonetic Association, 34.2: 227-232.
BARBOZA, C.L.F. 2013. Efeitos da Palatalização das Oclusivas Alveolares do Português Brasileiro no Percurso de Construção da Fonologia do Inglês Língua Estrangeira. Doctoral Thesis. Universidade Federal do Ceará.
BETTONI-TECHIO, M. 2008. Perceptual Training and Word-Final /s/-Clusters in Brazilian Portuguese/English Interphonology. Doctoral Thesis. Universidade Federal de Santa Catarina.
CALLBACK. 2019. Communication Challenges. Issue 471.
Available at: <https://asrs.arc.nasa.gov/docs/cb/cb_471.pdf>. Access: 18 Dec. 2019.
CELCE-MURCIA, M.; BRINTON, D.; GOODWIN, J. 1996. Teaching English Pronunciation - A Reference for Teachers of English to Speakers of Other Languages. Cambridge: CUP.
CHINI, M. R. R. C. 2014. Ensino-aprendizagem de inglês para o controlador de tráfego aéreo brasileiro: em busca de novos rumos. Master's Thesis. Universidade de Taubaté.
CLARK, B. 2017. Aviation English Research Project: Data analysis findings and best practice recommendations (CAP 1375). Civil Aviation Authority, West Sussex, UK.
Available at: <https://publicapps.caa.co.uk/docs/33/CAP1375%20Mar17.pdf>. Access: 02 Jan. 2020.
COOKSON, S. 2019. Learning from the Past: Airline Accidents & the ICAO Language Proficiency Program. 20th International Symposium on Aviation Psychology, 229-234.
CRISTÓFARO-SILVA, T. 2012. Pronúncia do Inglês Para Falantes do Português Brasileiro. São Paulo: Editora Contexto.
_____. 2007. Fonética e fonologia do português (9. ed). São Paulo: Editora Contexto.

[23] And ICAO's Doc 9835 and Circular 323-AN/185 (2009), with guidelines developed by ICAEA, are essential documents in this respect.

CUSHING, S. 1994. Fatal words: Communication clashes and aircraft crashes. Chicago: University of Chicago.
DELATORRE, F. 2017. Intelligibility of English Verbs Ending in -ed For Brazilian Learners of English as Listeners. Doctoral Thesis. Universidade Federal de Santa Catarina.
DOUGLAS, D. 2014. Nobody seems to speak English here today: Enhancing assessment and training in aviation English. Iranian Journal of Language Teaching Research, 2.2: 1-12.
ELLIS, S.; T. GERIGHTY. 2008. English for Aviation. Oxford: OUP.
EMERY, H.; A. ROBERTS. 2008. Aviation English. Oxford: Macmillan.
ESTIVAL, D.; C. FARRIS; B. MOLESWORTH (Eds.). 2016. Aviation English: A lingua franca for pilots and air traffic controllers. London: Routledge.
ESTIVAL, D.; B. MOLESWORTH. 2012. Radio Miscommunication: EL2 pilots in the Australian General Aviation environment. Linguistics and the Human Sciences, 5.3: 351-378.
Available at: <https://pdfs.semanticscholar.org/1691/9fcbad26da95cbd9c10d4faebf5a72c01c16.pdf>. Access: 08 Jan. 2020.
FARIA, S.C. 2017. 7600 - (Mis)Communication: Ameaça à segurança de voo sob o olhar da Linguística Aplicada. Master's Thesis. Universidade Federal de Lavras.
FARRIS, C.; TROFIMOVICH, P.; SEGALOWITZ, N.; GATBONTON, E. 2008. Air traffic communication in a second language: Implications of cognitive actors for training and assessment. TESOL Quarterly, 42.3: 397-410.
FRASER, H. Teaching Pronunciation: A handbook for teachers and trainers. Sydney: TAFE NSW Access Division, 2001.
GILBERT, J.B. 2010. Pronunciation as orphan: what can be done? Speak Out!, 43: 3-7.
_____. 2014. Memories and conclusions from across the Pond. Speak Out!, 50: 6-7.
GODOY, S.M.B.; GONTOW, C.; MARCELINO, M. 2006. English Pronunciation for Brazilians. The Sounds of American English. São Paulo: Disal.
GOMES, M.L.C. 2013. Understanding the Brazilian way of speaking English. In: LEVIS, J.; K. LeVELLE. (Eds.). Proceedings of the 4th Pronunciation in Second Language Learning and Teaching Conference. Iowa State University, p. 279-289.
GONÇALVES, G.M.; A. PACHECO. 2017. Problemas de linguagem em inglês aeronáutico: uma análise de comunicação técnica sob diferentes ramos linguísticos. Aviation in Focus, 8.1: 3-13.
HANCOCK, M. 2018. Pronunciation Teaching Post-ELF. Available at: <http://hancockmcdonald.com/ideas/pronunciation-teaching-post-elf>. Access: 22 Jan. 2020.
HARDING, L. 2012. Language testing, World Englishes and English as a Lingua Franca: The case for evidence-based change. University of Copenhagen: CIP symposium 2012. Copenhagen. Available at: <https://video.ku.dk/language-testing-world-englishes-and-english-as-a>. Access: 08 Jan. 2020.
INTERNATIONAL CIVIL AVIATION ORGANIZATION/ICAO. 2004. Manual on the Implementation of ICAO Language Proficiency Requirements. Doc 9835. First edition.
_____. 2008. Language Testing Criteria for Global Harmonization. Cir 318.
_____. 2009. Guidelines for Aviation English Training Programmes. Cir 323.
_____. 2010. Manual on the Implementation of ICAO Language Proficiency Requirements. Doc 9835. Second edition.
JENKINS, J. 2000. The Phonology of English as an International Language. Oxford: OUP.
_____. 2002. A Sociolinguistically Based, Empirically Researched Pronunciation Syllabus for English as an International Language. Applied Linguistics, 23.1: 83-103.
_____. 2005. Teaching Pronunciation for English as a Lingua Franca: A Sociopolitical perspective. In: GNUTZMANN, C.; F. INTEMANN (Eds.) The Globalisation of English and the English Language Classroom. Oxford: OUP.
JOB, M. 1992. Air Crash. Volume 2. Aerospace Publications, Weston Ck., ACT.

KELLY, L.G. 1969. 25 Centuries of Language Teaching: 500 BC – 1969. USA: Newbury House Publishers.
KENWORTHY, J. 1987. Teaching English Pronunciation. London: Longman.
KIM, H.; R. BILLINGTON. 2016. Pronunciation and Comprehension in English as a Lingua Franca Communication: Effect of L1 Influence in International Aviation Communication. Applied Linguistics, 39.2: 135-158.
KIM, H.; C. ELDER. 2009. Understanding Aviation English as a lingua franca: Perceptions of Korean aviation personnel. Australian Review of Applied Linguistics, 32.3: 23.1-23.17.
KIVISTÖ-DE SOUZA, H. 2015. Phonological Awareness and Pronunciation in a Second Language. Doctoral Thesis. Universitat de Barcelona.
KLUGE, D.C. 2009. Brazilian EFL Learners' Identification of Word-final /m-n/: Native/Nonnative Realizations and Effect of Visual Clues. Doctoral Thesis. Universidade Federal de Santa Catarina.
KOERICH, R. D. 2002. Perception and Production of Word-final Vowel Epenthesis by Brazilian EFL Students. Doctoral Thesis. Universidade Federal de Santa Catarina.
_____. 2002a. Ensinar Pronúncia? In: COSTA, M. J. D.; M. E. ZIPSER; M. E. ZANATTA; A. MENDES (Eds.). Línguas: ensino e ações. Florianópolis: UFSC/NUSPPLE, 2002.
LANE, L. 2010. Pronunciation: A Practical Approach. White Plains, NY: Pearson Longman.
LEVIS, J. M. 2012. The Room of Requirement for language teacher education. Speak Out!, 46: 4-8.
LUCENA, R. M.; U. K. ALVES. 2010. Implicações dialetais (dialeto gaúcho vs. paraibano) na aquisição de obstruintes em coda por aprendizes de inglês (L2): uma análise variacionista. Letras de Hoje, Porto Alegre, 45.1: 35-42.
MAJOR, R.C. 1982. Teaching English Pronunciation to Speakers of Brazilian Portuguese. PUC-SP/Washington State University, Estudos Germânicos, 3. 2: 175-189.
_____. 1987. English voiceless stop production by speakers of Brazilian Portuguese. Journal of Phonetics, n.15: 197-202.
MATHEWS, E. 2012. Language Gap. Flight Safety Foundation. AeroSafety World. December 2011 – January 2012. Available at: <https://flightsafety.org/asw-article/language-gap/>. Acessed: 10 Jan. 2020.
McMILLAN, D. 1998. "...Say again?..." Miscommunications in Air Traffic Control. Master's Thesis. Queensland University of Technology, Brisbane, Australia.
MELO, N.J.F. 2014. Estratégias Conscientes de Ensino-Aprendizagem Para Automação da Pronúncia do Inglês. Doctoral Thesis. Universidade Federal de Santa Catarina.
MITSUTOMI, M.; K. O'BRIEN. 2003. The critical components of aviation English. International Journal of Applied Aviation Studies, 3.1: 117-129.
MONTEIRO, A.L.T. 2012. Radiotelephony communications: Threats in a multicultural context. Aviation in Focus, 3.2: 44-66.
MOSKALENKO, O. I.; O. V. DIDENKO. 2018. A computer tool for training pilots' listening skills in Aviation English. Information Technologies and Learning Tools, 67.5: 187-197.
NASCIMENTO, K.R.S. 2016. Emergência de Padrões Silábicos no Português Brasileiro e Seus Reflexos no Inglês Língua Estrangeira. Doctoral Thesis. Universidade Estadual do Ceará.
PRADO, M.C.A. 2018. A pesquisa refletida no ensino (e vice-versa): a Linguística de Corpus e o inglês aeronáutico. In: SCARAMUCCI, M.V.R.; P. TOSQUI-LUCKS; S. M. DAMIÃO. (Ed.). Pesquisas sobre inglês aeronáutico no Brasil. 1ed. Campinas: Pontes Editores, p. 69-88.
PRATOR, C. H. 1991. The cornerstones of method. In: M. CELCE-MURCIA (Ed.). Teaching English as a second or foreign language. Boston: Heinle & Heinle.
PRINZO, O.V.; A. CAMPBELL. 2008. U.S. Airline Transport Pilot International Flight Language Experiences, Report 1: Background Information, General/Pre-Flight Preparation. (DOT/FAA/AM-08/18). Washington, DC: Federal Aviation Administration.

PRINZO, O.V.; CAMPBELL, A.; HENDRIX, A.; HENDRIX, R. 2010. Report 2: Word Meaning and Pronunciation. In: United States Airline Transport Pilot International Flight Language Experiences. Washington, D.C.: Federal Aviation Administration, Office of Aerospace Medicine.
SANT'ANNA, M.R. 2008. A Pronúncia das Consoantes Inglesas em Final de Vocábulo por Falantes Brasileiros. Doctoral Thesis. USP.
SCHOLLER, L. 2017. Aviation radiotelephony miscommunication in an environment with a multilingual background. Unpublished Final Monograph paper. Aeronautical Science. PUC-RS.
SEILER, W. 2017. Linguistics in Aviation. In: PERRIN, D.; U. KLEINBERGER. Doing Applied Linguistics: Enabling Transdisciplinary Communication. Berlin: Walter de Gruyter GmbH, p. 200-206.
SHEPHERD, D. 2002. Portuguese Speakers. In: SWAN, M.; B. SMITH (Eds.) Learner English: a teacher's guide to interference and other problems. Cambridge: CUP, p. 113-128.
SILVEIRA, R. 2004. The Influence of Pronunciation Instruction on the Perception and Production of English Word-final Consonants. Doctoral Thesis. Universidade Federal de Santa Catarina.
SOUZA SILVA, A. R.; C. L. F. BARBOZA. 2018. Padrões silábicos emergentes no Português Brasileiro e seus efeitos na aquisição do Inglês Língua Estrangeira. Revista Colineares, Mossoró, 5.2: 65-79.
TAJIMA, A. 2004. Fatal miscommunication: English in aviation safety. World Englishes, 23.3: 451−470.
UNDERHILL, A. 2010. Pronunciation - the poor relation? British Council, Teaching English. Available at: <https://www.teachingenglish.org.uk/article/pronunciation-poor-relation>. Acessed: 04 Feb. 2020.
WANG, A. 2007. Teaching aviation English in the Chinese context: Developing ESP theory in a non–English speaking country. English for Specific Purposes, 26.1: 121-128.
YAVAS, M. 2011. Applied English Phonology. Second Edition. Oxford: Wiley-Blackwell.
ZIMMER, M.C. 2003. A Transferência Do Conhecimento Fonético-fonológico do Português Brasileiro (L1) Para o Inglês (L2) na Recodificação Leitora: Uma Abordagem Conexionista. Doctoral Thesis. PUC-RS.

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