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Phonological Awareness and Pronunciation in a Second Language

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The understanding of human consciousness is the toughest intellectual problem with which we are set.

N.C. Ellis (2008)

Consciousness as an object of intellectual curiosity is the philosopher's joy and the scientist's nightmare.

(Tulving, 1993)

Isälleni Timolle

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Abstract

The objective of this dissertation is to increase knowledge about L2 phonological awareness through three research agendas: to investigate the nature of L2 phonological awareness in adult language learners and its relation to some individual differences, to examine the relationship between L2 phonological awareness and L2 pronunciation, and to create novel language-specific instruments to measure L2 phonological awareness reliably. Research on phonological awareness has focused on L1 literacy acquisition, where it has been understood as the ability to manipulate speech segments. In SLA, phonological awareness has been examined in its explicit dimension. Nevertheless, due to the special nature of L2 speech acquisition, L2 learners are rarely able to elaborate explicitly on aspects of pronunciation. Consequently, the present study advocates that L2 phonological awareness mainly consists of proceduralized knowledge. L1 Brazilian Portuguese learners of English (n=71) were tested on their awareness about the L2 phonological system through three domain-specific (segmental, suprasegmental and phonotactic) tasks. Performance in the L2 phonological awareness tasks was related to the participants' L2 pronunciation (measured with a Foreign Accent Rating Task) and to individual differences in the amount of L2 experience, L2 use and L2 proficiency. Additionally, 19 L1 American English speakers performed the same phonological awareness tasks, enabling comparison between L1 and L2 phonological awareness. The results revealed that L2 learners manifested significantly lower degrees of phonological awareness than L1 speakers. Moreover, L2 phonological awareness explained 32.8% of the variance in L2 pronunciation. As for the individual differences, L2 proficiency explained unique variance in L2 phonological awareness, whereas the role of L2 experience and use remained unsettled. Apart from contributing to our understanding of the nature of L2 phonological awareness, the findings of the present study have important pedagogical implications. Knowing the gaps in a language learner's L2 phonological awareness enables the instructor to bring them to the learner's attention, which in turn could be positively reflected in improved L2 pronunciation. Finally, the instruments developed for the present study are expected to guide further studies on L2 phonological awareness.

Keywords: phonological awareness, L2 speech learning, second language acquisition

Resumen

El propósito de esta tesis es incrementar el conocimiento de la consciencia fonológica en L2 a través de tres objetivos: estudiar la naturaleza de la consciencia fonológica en L2 y su relación con diferencias individuales, examinar la relación entre la consciencia fonológica y la pronunciación en L2, y desarrollar instrumentos para medir eficazmente consciencia fonológica en L2. La investigación previa sobre consciencia fonológica se ha centrado en la adquisición literaria de L1. En el ámbito de SLA, consciencia fonológica ha sido examinada en su dimensión explícita. No obstante, aprendices de L2 rara vez son capaces de explicar aspectos de la pronunciación. En consecuencia, el presente estudio postula que la consciencia fonológica en L2 consiste mayoritariamente de conocimiento procedimental. Testamos la consciencia fonológica en L2 de 71 aprendices brasileños del inglés a través de tres tests específicos (fonémico, prosódico y fonotáctico). El rendimiento en estos tests fue relacionado con la pronunciación en L2 (medida como el grado de acento extranjero) y con experiencia y uso de L2 y competencia lingüística en L2. Además, 19 hablantes nativos de inglés realizaron los mismos tests de consciencia fonológica, posibilitando la comparativa de consciencia fonológica entre L1 y L2. Los resultados revelaron que los aprendices de L2 manifestaron un grado de consciencia fonológica significativamente menor que los hablantes nativos. Además, la consciencia fonológica en L2 explicó 32.8% de la varianza en la pronunciación en L2. Con respecto a las diferencias individuales, la competencia lingüística en L2 explicó variación única en consciencia fonológica en L2, mientras que el rol de la experiencia y uso de L2 resultaron inconclusos. Aparte de contribuir al conocimiento de la naturaleza de la consciencia fonológica en L2, los resultados tienen implicaciones pedagógicas importantes. El conocimiento de las lagunas en la consciencia fonológica de un aprendiz de L2 posibilita al profesor atraerlas hacia su atención, lo que podría reflejarse en la mejora de la pronunciación. Por último, se espera que los instrumentos desarrollados guíen futuros estudios en consciencia fonológica en L2.

Palabras clave: consciencia fonológica, adquisición de habla de L2, adquisición de lengua extranjera

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Introduction

Interacting with people from other language backgrounds and cultures is an everyday phenomenon in the 21st century globalized world. So much so that monolinguals are in the minority in comparison to people who speak more than one language. We identify foreigners speaking our first language (L1) as non-native speakers due to their foreign accent in the blink of an eye. Likewise, when we speak in our second language (L2), we are aware of the fact that we may not sound the same as native speakers.

For decades, researchers in the field of second language acquisition (SLA) have been intrigued about why learning the pronunciation of a second language is a much less successful endeavor than learning grammar and vocabulary. Even if the L2 speakers have a native-like control of syntax and the lexicon, they will, in the vast majority of the cases, perceive and produce the L2 differently from native speakers. Because of this, L2 speech learning has been considered to enjoy a special status within L2 learning.

It has been suggested that this occurs because, contrary to grammar and vocabulary, pronunciation does not render itself easily to conscious reflection (R. Ellis, 2004). Whereas, language learners are generally able to state grammatical rules, explain why a given sentence is ungrammatical, and to define the meaning of words, they are rarely able to state pronunciation rules, describe how a given sound is produced, explain the difference between two rhythmic patterns or state why is it that someone has a foreign accent. Yet, they possess a large amount of non-verbalizable knowledge which enables them to perceive and produce the L2 speech differently from the L1 speech, to understand implications conveyed by intonation, and to identify native-like and non-native-like pronunciations. In other words, they show manifestations of underlying awareness about the phonological system of the L2. The present research was sparked by this disparity between how little L2 learners claim to know about the L2 phonological system and how much they actually know about it, and what implications this could have for L2 speech learning.

Language awareness is the field of research within SLA that has been concerned with determining what L2 speakers know about the target language (TL) in general. The central postulate in this field is that in order to learn aspects of the foreign language, these aspects have to be initially *consciously noticed* by the learner. Only this way can awareness about them develop and be transferred into the accurate use of the features in everyday communication. A large body of research has examined what L2 learners *notice*, what facilitates *noticing* and what L2 learners *know* about the target language once the noticed features have become consolidated memory representations.

Whereas research on L2 learners' awareness on grammar and the lexicon has been extensive, phonology has been left aside, and only a handful of studies exist which have specifically aimed to investigate L2 learners' awareness about L2 phonology. However, a better understanding of L2 learners' phonological awareness is of great interest to the fields of SLA in general, and L2 speech research in particular for two reasons. On the theoretical side, examining language learners' L2 phonological awareness can help us to understand the acquisition of L2 speech better, and to see how the underlying phonological knowledge is organized. More importantly, knowing what language learners are aware of the L2 phonological system and especially, what they are *not* aware of, has far-reaching practical implications: language learners can be aided to *notice* features they do not have awareness on, thus improving their overall L2 speech accuracy, fluency and comprehensibility.

This dissertation follows the view that L2 phonological awareness consists mainly of proceduralized knowledge which is not available for conscious reflection and cannot be articulated. Thus, it will be proposed that in order to obtain a comprehensive view of a language learner's L2 phonological awareness, the testing methods should include implicit measures which do not require verbalization.

Previous studies have mainly focused on the explicit and verbalizable side of L2 phonological awareness. Whereas information about L2 learners' encyclopedic and verbalizable knowledge of pronunciation rules is of great interest, I believe that focusing on this side only is not representative of the construct as a whole. My proposal on the mainly proceduralized nature of L2 phonological awareness, which will be fully developed in *Chapter 4,* is based on the inherently unconscious nature of speech, the lack of pronunciation instruction in the foreign language (FL) classrooms and the difficulty phonetically naïve language users have when having to explain or describe speech phenomena.

Consequently, due to the general lack of studies about L2 phonological awareness and to the existing studies about it focusing on its explicit manifestations, research on the proceduralized aspect of L2 phonological awareness is in need. The scientific study of awareness is in itself a challenging task because it is based on a subjective experience and thus, it is not readily accessible for the researcher. Examining L2 phonological awareness based on proceduralized knowledge, is even more challenging due to its non-verbalizable nature: the researcher cannot simply ask the language learners to tell which aspects of the L2 phonology they are aware of. Instead, indirect testing measures, focusing on the observable L2 speech behavior need to be employed.

The present study set to address the lack of research about L2 phonological awareness and to investigate it with three specific objectives in mind: first, to examine the very nature of L2 phonological awareness, second, to determine whether it is related to L2 pronunciation, and third, to develop reliable tasks to measure L2 phonological awareness.

Within the first objective, the main aim was to gain more insight into *what* and *how much* advanced L2 learners know about the target phonological system and whether factors such as language experience, language use, phonological self-awareness (awareness about own pronunciation) and L2 proficiency are related to their degree of L2 phonological awareness. In order to investigate these issues, 71 L1 Brazilian Portuguese learners of English as a Foreign Language (EFL) were tested. L2 phonological awareness was measured through three perceptually based tasks focusing on the segmental, phonotactic and prosodic aspects of English. Measures of language experience and use, as well as phonological self-awareness were obtained through specific questionnaires. General L2 proficiency was measured through the participants' L2 vocabulary size. With the objective of seeing how the L2 learners' phonological awareness compared to native speakers, 19 L1 American English (AmE) speakers performed the same phonological awareness tests.

In order to determine whether L2 phonological awareness would be related to L2 pronunciation, the EFL learners also produced a speech sample which was evaluated for its degree of foreign accent by L1 AmE speakers. Participants' performance in the L2 phonological awareness tasks and their foreign accent ratings were then compared with the aim of determining whether the two domains would be related. It was hypothesized that language learners with higher L2 phonological awareness would also have a more native-like L2 pronunciation. This hypothesis was based on the large body of research showing the effectiveness of explicit instruction on L2 pronunciation. Although this line of research offers indirect evidence for a relationship between the two (consciousness-raising activities → improved L2 speech), these studies have not included a direct measure of L2 phonological awareness. Consequently, the aim in the present study was to investigate whether a relationship between the two would exist in the absence of phonetics instruction.

Finally, as research about L2 phonological awareness has been scarce, development of reliable tasks was considered of crucial importance. Previous studies examining L2 phonological awareness have employed mainly instruments targeting explicit knowledge. However, these measures might not be the most adequate to measure L2 phonological awareness based on proceduralized knowledge, and consequently, adequate instruments to examine phonological sensitivity are needed. With this aim, development of tasks able to measure L2 phonological awareness without the need for explicit verbalization was undertaken.

To the date, very little is known about L2 phonological awareness. Whereas some research has been carried out on the explicit aspect of L2 phonological awareness, much less is known about its proceduralized aspect. The present research aimed to address this need. The findings of the study shed light to some central issues about the nature of L2 phonological awareness. They also suggest that L2 phonological awareness is related to L2 pronunciation. The implications of these findings are of theoretical and practical nature. In relation to the theoretical views on L2 speech acquisition, based on the results observed in the present study, L2 phonological awareness could be included in studies examining the effect of individual differences in L2 speech learning. The practical contributions of the study are of potentially remarkable nature. Should future studies confirm the causality of the relationship between L2 phonological awareness and L2 pronunciation, researchers, teachers and language learners would be benefitted: by knowing the gaps in learners' L2 phonological awareness, these can be targeted with specific instruction which has the potential of improving the learner's overall L2 pronunciation. Finally, the study succeeded in developing reliable instruments to examine non-verbalizable L2 phonological awareness in L1 Brazilian Portuguese learners of English. These tasks are expected to serve the purpose of guiding future studies set out to learn more about L2 phonological awareness.

Organization of the Dissertation

The dissertation is divided into three parts: *Background to the Study*, *The Study* and *Discussion and Conclusions*.

Part I: Background to the Study consists of five chapters and presents the theoretical framework for the dissertation. *Chapter 1* begins the discussion from the general field of foreign language learning and cognition. *Chapter 2* then continues with the presentation of the more specific field of language awareness. *Chapter 3* offers yet a more specific view by moving to the realm of L1 phonological awareness. In *Chapter 4* the construct of L2 phonological awareness is discussed in depth by drawing from the earlier discussions on cognition, language awareness and L1 phonological awareness. Finally, *Chapter 5* presents Brazilian Portuguese – General American cross-linguistic comparisons for the relevant aspects of the three phonological awareness subdomains (segmental, phonotactic and prosodic). *Part I* ends with the presentation of the research design.

Part II: The Study presents the methodology employed in the dissertation. *Chapter 6* introduces the objectives and the research questions. *Chapter 7* presents the participants of the study. *Chapter 8*, *Materials*, consists of several subsections, one for each instrument. The three first sections discuss extensively the rationale and the creation of the L2 phonological awareness measures. The remaining sections present the measures employed for the independent variables of the study as well as for L2 pronunciation. *Chapter 9* describes the data collection procedure. In *Chapter 10*, the results are discussed following the order of the research questions.

The final part of the dissertation, *Part III* consists of two chapters. *Chapter 11* offers a general discussion of the findings of the study. Finally, *Chapter 12* provides the concluding remarks.

PART I

BACKGROUND TO THE STUDY

This first part of the dissertation will focus on establishing the background and rationale for the study. It is divided into five chapters.

In the first chapter, we will discuss L2 learning in general. We will review the role of attention and knowledge at different stages of learning. The role of explicit and implicit learning and knowledge in second language acquisition is discussed in depth.

In the second chapter, the role of awareness in L2 acquisition is discussed. We will especially focus on the influential framework proposed by Richard Schmidt. We will then discuss the concepts of *noticing* and *metalinguistic knowledge* and how they have been studied to the date.

The third chapter builds on the previous two chapters by discussing the concept of language awareness in the realm of phonology. The chapter situates L1 phonological awareness within language awareness by examining instruments and findings from previous research focused mainly on L1 literary acquisition.

Chapter 4 presents the author's view on L2 phonological awareness. Here, the previously discussed issues of attention, knowledge and awareness are applied to the realm of L2 phonological acquisition. The author's hypothesis on the existence of a relationship between L2 phonological awareness and L2 pronunciation is then presented. Finally, the methodological issue of how to access L2 phonological awareness is treated in depth by discussing instruments used in previous studies and by drawing on theories of cognitive processing.

Chapter 5 presents cross-linguistic comparisons between the two languages of the study, Brazilian Portuguese and General American in the three phonological awareness subdomains studied: segmental, phonotactic and prosodic.

1. Attention and knowledge in second language acquisition

This chapter presents a concise review of the different cognitive stages in second language learning. The first section provides an overview of the stages involved in human information processing from the point of view of language learning. This is done by discussing the stages of input, central processing and output, and the role of attention at the three stages. The second section discusses theories of implicit and explicit knowledge by examining differences in processing, storage and retrieval by focusing especially on the processing of language.

The aim of this chapter is to provide the reader with a solid understanding of the role of attention and implicit and explicit learning and memory in order to lay ground for the description of L2 phonological awareness in *Chapter 4*.

1.1. Attention and information processing

Generally speaking, human information processing is divided into three main stages. Skehan (1998) calls them: *input*, *central processing* and *output*. We will shortly review these stages from the point of view of language processing.

For any processing or learning to take place, some sort of stimuli (usually auditory or visual) is required. Since our discussion involves language learning, this stimuli takes the form of (usually) verbal input. Sharwood Smith (1993) defines ***input*** as "potentially processible language data which are made available by chance or by design to the language learner" (p.167). From this definition it follows that not all input is attended to.

Although we are surrounded by various types of input, we rarely run into cognitive overload because only part of the perceived stimuli is selected through focal attention for further processing (VanPatten, 1996). Our working memory allocates attention and extracts the input that is considered relevant (Skehan, 1998). What type of input is likely to be paid attention to and selected is discussed further in *Chapter 2* (cf. *2.2*). For the moment being, it is sufficient to say that at this initial stage of processing, attention is allocated to some stimulus over other because of its larger salience and communicative value for the language user in comparison to the surrounding stimuli.

Attention plays a central role at this initial stage of information processing. The commonly held view in the field of cognitive psychology and second language acquisition is that attention is necessary for long-term memory storage and consequently, learning, and that no learning can take place without initial conscious registration of a stimuli through focal attention (e.g., N. C. Ellis, 2005; Robinson, 2003; Schmidt, 1990 and elsewhere; VanPatten, 1996). The key term here is *conscious* registration. Whereas most researchers in the field of second language acquisition believe that awareness is required at this very initial stage of learning, some researchers disagree. We will return to this issue in *Chapter 2*. At this initial encoding stage, attention is partially subjected to voluntary control (Schmidt, 2001): on occasions we can choose to pay attention to something, for example when we try to follow a complicated lecture. However, on other occasions, such as being startled by a sudden loud noise, we do not have a choice to not to notice.

The empirically supported and widely accepted view on attention is that it is limited and selective in nature. Leow and Bowles (2005) present a review of models of attention from cognitive psychology and second language acquisition. According to them, two views exist, the already mentioned classical view that attention is limited, and a more recent view that attention is potentially unlimited depending on the task at hand. In the latter view, the idea of multiple pools of attentional resources has been positioned, so that the difficulty of carrying out several tasks at the same time will depend on whether they draw attentional resources from the same pool (more effortful) or from separate pools (less effortful). An alternative account, put forward by Robinson (2003) among others, states that task demands have a strong effect on allocation of attention and that by controlling these, attentional resources can be redirected, and as a consequence, processing can become more efficient. In the present study, the former view, namely, that attention is a limited capacity is adopted. From this, it follows that certain trade-off effects are observed both at the initial processing stage (meaning vs. form, VanPatten, 1996) as well as at the later output stage (accuracy vs. complexity vs. fluency, Skehan, 1998).

Once part of the input has been attended to and selected by focal attention, it becomes intake. ***Intake*** as defined by VanPatten (1996) is "the subset of filtered input that serves as the data for accommodation by the developing system. It is the input that has been processed in some way by the learner during the act of comprehension" (p.10). This corresponds to the second stage of Skehan's model: *central processing*. At this stage, working memory and long-term memory interact and the intake is transferred to long-term memory where it is further processed and made available for later retrieval.

The role of attention at this stage is different than at the initial registration stage. Consolidation and creation of new memory traces is an automatic and largely unconscious process which does not require attention (N. C. Ellis, 2005). However, conscious attention is required at the retrieval stage if the built memory representation is explicit. The issue of consciousness in the retrieval of memories is further discussed in *Section 1.2* when implicit and explicit knowledge are reviewed.

The last stage of information processing corresponds to *output*. In order for daily communicative situations to be successful, output is required to be fairly fluent.

Otherwise, if the output is filled with long periods of silence during which the speakers try to retrieve the necessary words and structures to get their message through, communicative failure is likely to occur. At this stage, working memory is employed to retrieve the long-term memory representations needed for communication. Skehan (1998) reviews some models which aim to explain how the retrieval process becomes more fluent. He distinguishes three approaches: *accelerating*, *restructuring* and *instance-based*.

According to *accelerating models*, increased fluency of information retrieval is the result of the transformation of explicit knowledge into implicit. The processing becomes automatized, quicker and less conscious. Anderson's (1983) ACT* model is an example of this view, which holds that automatization does not involve only faster access but also qualitative changes in the nature of processing.

Restructuring approaches see fluency in information processing as the result of using better algorithms. As a consequence, performance is more effective and the underlying rule-based system is differently organized.

Finally, the *instance-based approaches* regard fluency as the result of performance being based on contextually coded exemplars (memory-based chunks). In this view, learning is based on the creation of instances which are chunked together as learning progresses. In SLA, this view has been defended by N. C. Ellis (e.g., 2002a, 2005) who claims that language learning is exemplar-based, rather than rule-based. Fluency is the result of the increasing and strengthening of associations between the exemplars which are bound together and can be retrieved as a chunk fast. As learning progresses, more useful chunks are accumulated and retrieval will become faster.

Independently of which model is adopted, all of them posit that practice is necessary for automatized processing. Consequently, a clear difference in fluency can be observed between L1 speakers and L2 speakers on the one hand, and between beginner L2 learners and advanced L2 learners on the other hand. Whereas L1 speech is mostly effortless, fast, and can be performed in parallel with other tasks, L2 speech rarely enjoys such degrees of automatization until higher proficiency levels have been attained (Kormos, 2006).

At this final stage, the role of attention corresponds to that of retrieval and monitoring. As stated earlier, attention is less employed in L1 speech and by highly proficient language learners than by less proficient L2 learners. Attention is required when automatized and fluent language processing has yet not been reached. Attention is also required in monitoring the output. Monitoring involves the employment of attention in comparing the output to the L2 input and to performing modifications or self-repairs if mismatches are found.[1] Conscious attention can be used for further learning through *noticing the gap* between one's output and the target language input (cf. *Ch. 2.2*). Attention is partially subjected to voluntary control during monitoring: a speaker can make a conscious decision to focus on the output and self-monitoring, but these actions can also occur automatically, without conscious attention.

In this section we have shortly reviewed how new language items are processed from the initial encounter in the input to their use in the output. We saw that attention is limited, selective and essential for learning. More importantly, attention is partially subject to voluntary control and it controls the access to awareness (Schmidt, 2001). We also reviewed how attention works at the different stages of L2 learning. Namely, that it is required at the initial noticing stage and also at the final output stage, whereas the

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[1] It should be noted that monitoring can also occur before the output has been articulated (covert monitoring) in which case the speaker notices the error at the conceptualizing (meaning) or formulation (form) phase and repairs it before articulation. Not all noticed mismatches are repaired. Learners can notice a problem and decide to proceed with the intended message because they do not know how to repair the problem or because they do not consider repairing it a priority. (Kormos, 2006)

cognitive processing in the middle is largely unconscious. In the next section we will discuss how knowledge resulting from L2 learning is stored and retrieved.

1.2. Knowledge in second language acquisition

Humans have two separate but connected memory systems: implicit and explicit memory. Implicit and explicit knowledge are stored in different areas in the brain and they are created and retrieved differently. [2] They are frequently referred to as procedural and declarative knowledge. In the next section, we will discuss the differences between the two knowledge systems. In the last section we will see how these systems are connected.

1.2.1. Differences between procedural and declarative knowledge

We will begin by defining both types of knowledge. ***Procedural knowledge*** is implicit (unconscious) knowledge. It is used when automatized actions are performed. R. Ellis (2004) sees procedural knowledge as the basic linguistic competence which underlies everyday language use. Skilled behavior such as speaking in the first language, riding a bike or tying shoe laces are usually seen as deriving from procedural knowledge. Procedural knowledge is intuitive and it cannot be verbally described. In fact, as R. Ellis (2005) points out, any attempt to verbalize implicit knowledge requires the creation of an explicit memory trace first.

Procedural knowledge is a kind of primitive memory which is constrained by age-

[2] *Knowledge* and *memory* are used as synonyms in the course of the section

effects so that implicit memories cannot be created at any age (R. Ellis, 2005). Contrary to L1 acquisition, L2 acquisition is age-constrained, and after a certain age, an L2 will not be successfully acquired implicitly. Although the implicit learning mechanisms remain accessible, they are non-optimal for adult L2 learning (N. C. Ellis, 2008; Robinson, 2001; Skehan, 1998).

Declarative knowledge, on the other hand, corresponds to conscious knowledge, and together with episodic (autobiographical) memory, it is seen to form explicit memory. Declarative knowledge is knowledge the learners know they possess, and it can be potentially verbalized. However, it exists independently of whether it can be verbalized or not, and the verbalization does not need to involve metalinguistic terminology (R. Ellis, 2004). Declarative knowledge is frequently imprecise and inaccurate, and becomes more accurate (in breadth and depth) as proficiency increases (R. Ellis, 2004). Being seen as knowledge of facts, it is no different from encyclopedic knowledge of any other kind. Explicit knowledge does not suffer from age-constrains, contrary to implicit knowledge, and it can be potentially acquired at any age (R. Ellis, 2009). Ontogenetically, explicit knowledge appears later than implicit knowledge.

Procedural and declarative knowledge are located in different areas in the brain.[3] Declarative knowledge is situated in the hippocampus and related limbic structures. Procedural knowledge on the other hand, is located in various areas of the perceptual and motor cortex (N. C. Ellis, 2008). Evidence for the different locations of declarative and procedural memory is obtained by brain imaging studies as well as from amnesics who cannot form new explicit memories but whose implicit memory abilities are nevertheless unaffected (N. C. Ellis, 2002b).

[3] This is a rather harsh simplification as knowledge is not a static representation but a network of dynamic processes involving interrelated information (N. C. Ellis, 2008).

The formation of implicit and explicit memories is also different. Implicit knowledge results from small changes in synapses which participate in the processing of the given stimulus. These changes facilitate the processing of identical or related stimuli (N. C. Ellis, 2002b). Implicit knowledge is acquired from language experience, rather than from exposure to rules (N. C. Ellis, 2008). The learner is unaware that any learning has taken place, the only evidence being a change in the performance. Creation of implicit knowledge does not make demands on attentional resources or require awareness (R. Ellis, 2009).

Explicit knowledge is formed through initial conscious *noticing* of the stimulus. According to N.C. Ellis (2005) this usually corresponds to a prototypical exemplar with high functionality. Associations between co-occurring exemplars are primed and strengthened in the hippocampus with subsequent encounters, and exemplars are stored as formulas or *chunks* which make their retrieval easy (cf. 'instance based approaches' *Section 1.1.*). Consequently, the creation of explicit knowledge makes high demands on working memory, attention and awareness (R. Ellis, 2009). From this it follows that, individual differences in attention control and working memory play a role in the formation of explicit knowledge.

The access and retrieval of implicit and explicit memories is also different. Procedural knowledge involves automatic processing and it is rapidly and easily accessed (R. Ellis, 2005). Declarative knowledge, on the other hand, requires controlled processing and because of this its retrieval is slower (R. Ellis 2004). However, declarative knowledge can become automatized over time, an issue which will be discussed in *Section 1.2.2*, which noticeably speeds up the retrieval.

Explicit and implicit knowledge can be tapped into with different types of tasks (e.g., R. Ellis, 2005; Han & Ellis, 1998). Robinson (2003) suggests that implicit knowledge can be examined in test situations in which the participants are not asked to remember the test material for a later recall test. Explicit knowledge, on the contrary, can be accessed by asking the students to pay attention to the test material in order to complete a later recall test.

As access to implicit memory is fast, whereas access to explicit memory is usually more time-consuming, implicit memory tasks are frequently timed. The same task can also be used to measure both types of knowledge. For example, R. Ellis (2005) used two versions of a grammaticality judgment task, a timed one and an untimed one. Through factor analysis, the two versions of the task were found to tap into two different factors, which the author identified as implicit and explicit knowledge, respectively.

Error repair (without provision of rules), perceptual priming, imitation (R. Ellis, 2005) and tasks in which responses are provided based on intuition rather than knowledge of rules are other examples of tests that examine implicit knowledge. However, the examination of implicit knowledge is challenging as it is not verbalizable or accessible for conscious analysis, contrary to explicit knowledge which can be verbalized at least to some extent. Because of this, implicit knowledge is frequently studied through the language learner's *use* of the target features (performance).

Tests to measure explicit knowledge usually involve metalinguistic knowledge of some kind: naming parts of speech, correcting grammatically incorrect utterances and explaining rules. Examination of explicit knowledge is more straight-forward than that of implicit knowledge because learners are aware of what they know and they are able to confirm it with a verbal report (differing in degrees of explicitness and metalanguage).

It is important to note, as R. Ellis (2005, 2009) argues, that there is no guarantee that the participants use the type of knowledge the researcher is pretending to tap into. It is probable, that the learners use whatever resources are available to them to complete the task, even if they would resort to knowledge which would not be the optimal for the task type. He further states that although implicit and explicit knowledge are psychologically and neurologically distinct, they will never be entirely distinct in performance.

We will finish the discussion on the differences between implicit and explicit knowledge by summarizing the main issues in the following Table 1.1.

Characteristic	**Procedural (implicit)**	**Declarative (explicit)**
Cerebral location	neocortex	hippocampus
Access	automatic and fast	controlled and slower
Type of knowledge	intuitive	encyclopedic
Verbalizable?	no	yes, to different degrees
Role of awareness	unconscious	conscious
Order of acquisition	1	2
Age-constrained?	yes	no
Affected by individual differences?	no	yes
Example test	most reliably evident through performance	evident through explanation of what is known*

Table 1.1. Differences between procedural and declarative knowledge.
* Verbalization of knowledge is widely used in testing, but not everything that is consciously known can be easily verbalized.

1.2.2. Relation between procedural and declarative knowledge

In the previous section, we saw how humans have two distinct yet related memory systems. We examined them through the differences they present and finished with an idea that although cognitively speaking we possess two types of knowledge, in performance it is difficult to separate them.

The issue which has long divided researchers is how can the relation between the two systems be described? Can explicit knowledge become implicit and the other way around? This is an especially relevant question for SLA because although it is under debate whether L2 learning is implicit or explicit, resulting in implicit, explicit, or both types of knowledge, the vast majority of adult L2 learners has attended formal language instruction, which is (at least to some extent) based on the creation of explicit knowledge. As was seen earlier, access to declarative knowledge is effortful and slow, which puts strains on fluent performance, compromising effective communication.

The interaction between explicit and implicit knowledge has divided researchers in SLA for decades. R. Ellis (2005) reviews two accounts on L2 acquisition, the *Universal Grammar*, in which language is learnt implicitly by processing the input for the principles and parameters with the help of an innate language faculty, and the *Connectionist* account, in which language learning is like learning of any other kind, consisting of an elaborated network of interrelated nodes which have been created through exposure to input. Independently of which position one follows, both theories agree that L2 includes implicit knowledge. How this implicit knowledge has come to exist and how it is related to explicit knowledge is a matter of heated debate. Three views on the relation between the two can be identified and they will be summarized next, following the account from R. Ellis (2005).

The non-interface position views explicit and implicit knowledge as completely distinct. They are acquired differently and retrieved differently and they are not related. The strong form of this position states that explicit knowledge cannot become implicit or the other way around. The weaker form of this position suggests that implicit knowledge can become explicit through conscious reflection of the output. The non-interface position seems implausible: as noted by N. C. Ellis (2006), at least some relation between the two systems exists because although L1 acquisition is implicit in the sense of not requiring metalinguistic awareness, older children and adults come to develop some degree of metalinguistic knowledge of the L1. He exemplifies this by discussing the *wug-test*. In this test, a child is presented with a toy which is named as a *wug*. Another similar toy is presented and the child is asked what the two toys are called. Usually, even a young child has no problem in applying implicit knowledge to form the correct plural form and responding that the toys are *wug*s. However, at this point the child would not be able to provide rules or explanations for the morpheme choice. Children develop metalinguistic awareness around the age of five (R. Ellis, 2004) and after that stage, they are able to consciously discuss some aspects of their L1, for instance, explaining how plurals are formed.

The strong interface position states that implicit knowledge can become explicit and explicit knowledge can become implicit through practice. A memory can also exist simultaneously in implicit and explicit form. The strong interface position is related to the *accelerating model of automatization* we saw earlier in the chapter, which states that fluent output is due to explicit knowledge having been converted into implicit knowledge. The strong-interface position also seems implausible because there would be a lot of parallel processing leading to inefficient and slow retrieval if all memory could be represented as explicit and implicit or could convert from one to another without restrictions. R. Ellis (2004) suggested that some linguistic forms may render better to being represented as explicit knowledge (e.g., grammar) whereas others are better stored as implicit knowledge (phonology).

Finally, ***the weak interface position*** states that implicit and explicit knowledge are related but that some limitations apply. Three versions of the *weak interface position* are encountered. The first version considers that explicit knowledge can become implicit through practice when the learner is ready to acquire the linguistic form (R. Ellis, 1993). The second version states that explicit knowledge can be used to produce controlled output which can be further used as auto-input and subsequently processed by using the unconscious learning mechanisms (Sharwood Smith, 1981). The third version states that explicit knowledge can contribute indirectly to the creation of implicit knowledge. Explicit knowledge facilitates the initial and final stages of learning. This posture is followed by many of the researchers in SLA and this is the posture we will adopt in the present study. Let us briefly discuss the implications of this view for the three stages of learning we saw at the beginning of the chapter, namely, *input, central processing* and *output.*

The authors adopting this view believe that conscious noticing and attention are required for input to become intake. They also assume that the central processing stage during which the consolidation of the knowledge occurs corresponds to unconscious processing. At the final stage, the output can be either effortful or fluent. Especially in low proficiency learners, the output is slow, effortful and requires a large amount of conscious attention. The slow and ineffective retrieval is due to the reliance on solely, or mostly, explicit knowledge. In advanced language learners and native speakers, the output tends to be fluent and effortless.

This version of the *weak interface position* is related to the *instance-based model on automatization* which we shortly discussed at the beginning of the chapter. We saw that automatization according to this model is seen as the result of strengthening of association between exemplars which will be chunked and retrieved together faster. The resulting output is fast and automatized but does not involve the conversion of explicit knowledge into implicit. Rather, the explicit knowledge loses its characteristic slow processing and becomes fast, being easily confused in performance with implicit knowledge. What may appear as unconscious and implicit knowledge in output, may in fact correspond to ***proceduralized explicit knowledge*** (R. Ellis, 2004). [4]

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[4] The terms *proceduralized knowledge* and *automatized knowledge* will be used as synonyms throughout the dissertation to refer to knowledge which has been acquired explicitly but which through practice is applied faster and more precicely, and which will make less demands on attentional resources.

One of the characteristics of explicit knowledge, verbalizability, does not apply anymore for this automatized explicit knowledge. Kormos (2006, p.41) points out that a rule that has once been learnt explicitly and memorized as declarative knowledge, may not be retrievable and verbalizable anymore once the application of the rule has become automatic. R. Ellis (2005, 2009) also criticizes the view that all explicit knowledge can be verbalized because the ability to verbalize knowledge depends partly on the degree of metalanguage the subject possesses. Consequently, classifying already existing knowledge into explicit and implicit based on verbalization is a gross, and potentially misleading, simplification.

Once explicit knowledge becomes automatized, it is functionally equivalent to implicit knowledge (DeKeyser, 2003) in the sense that it is fast, applied without conscious attention and cannot be verbalized. The only way to differentiate automatized explicit knowledge from implicit knowledge at this stage would be to determine whether the learner has initially stored the memory as a factual, verbalizable piece of information or as an intuitive implicit memory trace. The results of such experiments and whether this would be empirically possible are clearly beyond the scope of the present study, leading us back to the mere acceptance that implicit and explicit knowledge are difficult to separate in everyday performance.

Chapter summary:

To recapitulate, in this chapter we have discussed the role of attention and memory in relation to second language acquisition. We saw that attention is necessary for all learning, including L2 acquisition, at the initial 'input to intake' stage, and that it can also be employed in the output stage.

Whereas we reached the conclusion that L2 learning is explicit in the sense of requiring conscious attention at the initial stage, we encountered problems when we tried to define the type of knowledge resulting from this learning, because the main theories on L2 acquisition see that L2 also contains implicit knowledge. We reviewed the main differences between implicit and explicit knowledge and saw that the formation of implicit knowledge is age-restricted, and that implicit learning mechanisms are non-optimal for L2 learning (e.g., N. C. Ellis, 2008). We then concluded that how this implicit knowledge has come to its existence is a controversial issue which cannot be easily settled.

The matter is further complicated when we consider the relation between implicit and explicit knowledge, and especially if we believe that originally explicit knowledge can become implicit. The view which we adopted in this study is that three types of knowledge can coexist in an L2 learner's mind: implicit, 'purely explicit' and 'proceduralized explicit'. The implicit knowledge corresponds to procedural knowledge manifested in performance rather than in tests requiring conscious retrieval or verbalization. The explicit knowledge is declarative, factual knowledge which does not differ from encyclopedic knowledge of any other kind. 'Proceduralized' or 'automatized' explicit knowledge can come to exist through subsequent encounters with the stimulus: the explicit knowledge is thus primed, strengthened and made easily retrievable. As a consequence, its retrieval will be fast and unconscious, not requiring attention. Finally, we concluded that in performance, implicit and proceduralized explicit knowledge cannot be fully separated.

The aim of this chapter has been to provide the reader with a basic understanding of the L2 learning process. In the next chapter we will discuss the role of awareness in second language acquisition.

2. Language awareness

In this chapter we will see how awareness has been investigated in the field of second language acquisition. The chapter is divided into three parts. In the first part, the theoretical framework for awareness in SLA is provided through the examination of Richard Schmidt's influential postulations. The remaining two parts of the chapter follow the stages of information processing. *Section 2.2* focuses on the *input-to-intake* stage and discusses studies involving *noticing*. *Section 2.3* corresponds to the *central processing* and *output* stage, and provides a review of language awareness at the stage of consolidated knowledge. We will begin by discussing some terminological issues and provide a short historical review of the study of awareness in the field of SLA.

The Association for Language Awareness (ALA) defines *language awareness* as "explicit knowledge about language, and conscious perception and sensitivity in language learning, language teaching and language use" (Association for Language Awareness, 2012). Whereas some studies have used the term *language awareness*, others have referred to the same construct as ***metalinguistic knowledge*** (or *metalinguistic awareness*): "learner's explicit knowledge about the syntactic, morphological, lexical, phonological and pragmatic features of the L2." (Roehr, 2008, p.179; Roehr & Gánem-Gutiérrez, 2009a, p.165). However, metalinguistic knowledge is sometimes used to refer to knowledge about metalinguistic terminology only (Alderson, Clapham, & Steel, 1997). Gutiérrez (2013a) suggests that the latter type of knowledge is referred to as ***metalingual knowledge***. Additionally, some authors have preferred to use the term ***metalinguistic ability*** to refer to "an ability to look at language as an object" (White & Ranta, 2002, p.261).

What the previous definitions about language awareness have in common is that they view it as consisting of explicit knowledge, with the exception of the first definition which also entails 'conscious sensitivity'. In the present chapter, we will include all these constructs under the term *language awareness* and understand that ***language awareness*** consists of explicit, potentially verbalizable (with or without metalinguistic terminology) knowledge about language, as well as of intuitive awareness of language which cannot be verbalized. R. Ellis (2004, 2005) distinguishes these two types of awareness as metalinguistic and epilinguistic, respectively. ***Metalinguistic awareness*** corresponds to explicit knowledge about language which is potentially available for verbalization and conscious reflection. It is evident through conscious manipulation of language and through metalinguistic justifications and explanations. ***Epilinguistic awareness*** corresponds to intuitive awareness which is manifested, for example, in the ability to recognize a foreign accent or to judge a sentence as ungrammatical, but without the ability to explain or elaborate rules to why this is so. Epilinguistic awareness thus corresponds to implicit or proceduralized explicit knowledge (cf. *Ch.1.2.2*), and can be thought about as sensitivity to language. Following the ALA, we adopt the position that both, metalinguistic knowledge and intuitive awareness, form part of language awareness.

Let us conclude this introduction to language awareness by shortly reviewing its history in second language acquisition. The study of awareness in language learning and processing truly began in the 1980s. Until then, the dominant position represented by Behaviorism was that the studying of awareness was irrelevant and unreliable, as it corresponded to the subjective experience which, according to them, could not be scientifically measured (Schmidt, 1990).

Krashen's (1985, and elsewhere) view on second language learning positioned that L2 acquisition is just like L1 acquisition in that it is implicit. Awareness is only required at the last stage, during which the learner can consciously monitor his output. Initial registration of a stimulus to be learnt does not require conscious attention according to his position. He viewed comprehensible input as a sufficient condition for L2 learning, and this view was influential for the creation of the communicative teaching methods (N. C. Ellis, 2008). The idea that languages could be learnt simply by listening encountered problems when the competence of learners in Canadian immersion programs was scrutinized. It was discovered that although these students had native-like receptive skills, their productive skills were deficient (Skehan, 1998). From this, it followed that researchers in SLA began to consider that successful L2 learning might require conscious attention after all.

Schmidt and Frota (1986) first suggested that awareness is involved at the initial stages of foreign language learning in a paper describing the former’s experience with the acquisition of Brazilian Portuguese. Their findings showed that neither input nor teaching and subsequent controlled practicing were enough for learning to take place. The authors discovered that learning was most likely to take place when the target feature had been consciously noticed in the input. Their conclusion was that conscious noticing is a necessary prerequisite for learning to take place.

The idea of awareness playing a crucial role in foreign language learning was not met without objections. After all, the position that had long dominated SLA stated that conscious attention was not needed. This idea was further developed in a widely cited paper by Tomlin and Villa (1994) in which the authors provided a fine-grained model of attention consisting of three stages: *alertness*, *orientation* and *detection*. The most relevant stage of attention in their model for the purpose of the present discussion is *detection*. ***Detection*** is defined as the cognitive registration of an incoming stimulus in the working memory and it alone is claimed necessary and sufficient for further processing and subsequent learning. Most importantly, detection does not involve awareness. From this it follows that according to their view, detection is the initial step in learning and it does not require awareness. In other words, learning without awareness is possible.

The issue of learning without awareness was vigorously objected by Schmidt in a series of papers for over two decades (Schmidt 1990, 1993a, 1993b, 1994a, 1994b, 1995, 2001, 2010). His extensive argumentation had a remarkable impact on the field, and the scientific study of awareness in SLA was consolidated in the 90s. In 1992, the first issue of the journal of *Language Awareness* appeared, and in 1994, the ALA was founded. The 1990s also saw the rise of the application of the theoretical views on awareness into foreign language instruction with the emergence of *Focus on Form* (Long, 1991) and *Consciousness Raising* (Sharwood Smith, 1981). These methodologies were designed to bring aspects of language into the learners' consciousness with the aim of encouraging learning.

2.1. Schmidt's view on awareness in SLA

Since Richard Schmidt's views have formed the foundation for the research of awareness in SLA, we will review the main aspects of his theory. The main ideas behind Schmidt's position can be summarized as 1) awareness is gradient, 2) no learning can occur without focal awareness, 3) focal awareness can be encouraged through instruction. Let us discuss these ideas in detail.

Awareness is gradient

Schmidt (1990) distinguishes three levels in his view of awareness. These levels are crucial to the understanding of his theory.

The lowest level is *perception*. *Perception* involves the registration of a stimulus, but this registration does not entail awareness. This definition of *perception* can thus be compared to Tomlin and Villa's *detection*. Schmidt frequently refers to this level as ***subliminal perception*** in order to highlight its unconscious nature. He states that subliminal perception is possible, but it cannot lead to the learning of new items (Schmidt, 1990).

The second level of awareness is *noticing*. ***Noticing*** is viewed as focal awareness during which a stimulus event is registered by the consciousness and subsequently stored in long-term memory (Schmidt, 1994a). It is a surface level phenomenon and corresponds to item learning. Noticing does not imply the detection of a form-meaning relationship (Schmidt, 1994a), and it is the necessary and sufficient step for input to become intake. From this it follows, that Schmidt's definition of ***intake*** is "the part of the input that the learner notices" (Schmidt, 1990, p.139). This type of noticing can be more specifically termed *noticing the form,* which is contrasted with the notion of *noticing the gap*. ***Noticing the form*** corresponds to the before mentioned moment of focal attention during which the learner becomes aware of some form (feature or aspect) in the target language input.[5] Consequently, *noticing the form* corresponds to the initial input-to intake stage of information processing. ***Noticing the gap*** refers to the noticing of a mismatch between the learner's interlanguage and the target language, and thus corresponds to the output

[5] In the present study when *noticing* is discussed, it refers more specifically to *noticing the form,* unless otherwise stated.

stage of information processing. *Noticing the gap* becomes evident when learners monitor their output and become aware of, and possibly correct, their errors.

Finally, the highest level of awareness according to Schmidt is *understanding*. ***Understanding*** is the analyzing, organization and restructuring of the noticed material in long-term memory (Schmidt, 1992). It can be viewed as hypothesis formation or as 'thinking' and it involves the recognition of a general principle, rule or a pattern underlying the learnt material.

Let us illustrate the levels of awareness by considering a few examples from the acquisition of L2 pragmatics, vocabulary, grammar and pronunciation. Let us think about an L2 learner who has just arrived to Brazil. He is constantly exposed to Brazilian Portuguese input but cannot understand a word of what he hears. He is *perceiving* the auditory stimuli around him, but he is unable to consciously pay attention to specific aspects of the input, and is thus not engaging in any learning yet. One day, he *notices* that native speakers frequently end their utterances with an expression *tá?* Such as in '*Então, ela chegou na festa, tá? E todos acharam estranho porque ela não trouxe presente, tá*?' ('So, she came to the party, *tá*? And everyone thought it was weird that she didn't bring a gift, *tá*?'). At this point, the learner in question has passed from simply *perceiving* the expression (it has always existed in the input) to consciously *noticing* it. From this point on, the learner can begin to try to incorporate the expression into his interlanguage through trial and error. At some point, through exposure or instruction, he might *understand* that *tá* is used as a discourse marker to seek for confirmation from the listener to what has been said and to confirm that the listener is paying attention ('right? 'OK?''). He might also *understand* that *tá* is an abbreviation derived from *está bom/está bem*? > *tá bom/tá bem?* > tá? ('*Is it ok?*') and if wanting to answer, the same form with non-rising intonation can be used, *tá* 'right'.

The second example involves vocabulary acquisition. Again, *perception* can be viewed as simply perceiving the speech stream without paying attention to any particular instances in it. *Noticing* occurs when the learner consciously registers the orthographic or phonological form of the word, for example <news> or /njuz/. *Understanding* involves knowing the syntactic and semantic properties of the item. For example, that *news* is an uncountable noun which is treated as if it were a singular noun. It cannot appear with an indefinite article and if we want to further divide it, we have to say *a piece of news* instead of **a new* or **a news*. Semantically, it can refer to information about recent events or to presentation of such events in a TV or newspaper, for example. It can also refer to new information of any kind or to newsworthy material. Of course, *understanding* can be, and frequently is, partial.

In grammar, becoming aware of the occurrence of an expression such as '*he goes to the beach a lot'* is *noticing* but the knowledge that *goes* is a form of *go* inflected in person and tense is *understanding* (Schmidt, 1995).

Let us consider one last example from the field of L2 speech acquisition. A Spanish EFL learner may come to *notice* that in English, voiceless plosives sound different (long Voice Onset Time) than in the learner's L1 (zero VOT). *Understanding* may occur through instruction. The learner may attend an English phonetics class in which, for example, distributional rules of English voiceless plosives, theoretical accounts on the working of vocal folds in the production of plosives and crosslinguistic comparisons between Spanish and English are discussed. The issue of awareness in L2 phonological acquisition is discussed in detail in *Chapter 4*, but for now it is useful to keep in mind that in this example, if noticing does not occur, the learner will continue to produce the L2 voiceless stops with the VOT values of the L1.

The view of language awareness as a continuum, consisting of degrees of awareness rather than of a dichotomy of being aware/unaware is supported by empirical studies (e.g., Bell, 2009; Martínez-Fernández, 2008; Rosa & Leow, 2004; Rosa & O'Neill, 1999).

L2 learning requires awareness

Schmidt argues that unconscious (subliminal) learning is not possible. This is because for him, no learning of any kind can take place without awareness. In order to support this view, Schmidt builds a case against subliminal learning by reviewing results from studies involving, subliminal perception, blind-sight, implicit memory and sequence learning in amnesiacs (1995, and elsewhere), and concludes that ***implicit learning*** (in the sense of unconscious) does not exist.

Some authors, nevertheless, have taken the existence of the two memory systems (explicit and implicit, as seen in *Chapter 1*) as evidence for implicit, in the sense of unconscious, learning.[6] Studies with artificial grammars have investigated whether learning without awareness (implicit learning) is possible in adults. Whereas some studies suggest that some implicit learning can take place (Leung & Williams, 2014; Williams, 2005), most of the studies conclude that only the participants who manifested awareness of what had been learnt, had interiorized some of the artificial grammar rules and performed above-chance (Hama & Leow, 2010; Rebuschat, Hamrick, Sachs, Riestenberg, & Ziegler, 2013; Rebuschat & Williams, 2012). Additionally, it should be noted that these studies have tested participants with artificial languages and focused on a very specific

[6] Schmidt (1995) points out that his theory states that awareness is required at the time of learning (noticing), but the issue of what happens to the learnt material *after* it has been noticed, whether it is stored as an explicit or implicit memory or whether its retrieval is conscious or unconscious is not addressed by his theory.

feature (such as articles) instead of testing the participants with complex natural languages. As a consequence, there is no evidence to the date that adult language learning could be implicit.

Whereas implicit L2 learning is not possible according to this view, incidental L2 learning is. Schmidt used the term ***incidental learning*** to refer to situations in which something is learnt without the intent of trying to learn as a by-product of doing something else. L1 acquisition is an example of incidental learning (Schmidt, 1990, 1992, 1994a). L2 learning can be incidental or intentional. For example, vocabulary can be learnt incidentally as a by-product of extensive reading (Schmidt, 1995), whereas grammar learning is more likely to be intentional.

From this it follows that whereas the intention to learn is not crucial for learning, attention (voluntary or involuntary) in the form of *noticing* is (Schmidt, 1993a).[7] Thus, all learning is explicit in the sense of requiring initial noticing. ***Explicit learning*** should not be confused with explicit instruction (Schmidt, 1994b) because noticing can occur in instructed contexts or in uninstructed contexts. Schmidt's argument is that awareness at the level of *noticing* is necessary for learning, whereas awareness at the level of *understanding* is beneficial but not necessary.

The idea of *noticing* as the necessary initial step for learning is further developed as Schmidt states that being aware of the input in the global sense is not enough for learning to occur, but that the learner must notice the *specific* aspects in the input which are to be learnt. So that, in order to learn grammar, one must attend to grammar and in

[7] Attention and *noticing* are frequently seen as flip sides of the same coin, in the sense that if you pay attention to something you will also become aware of it (Schmidt, 1995). However, Schmidt argues that attention and awareness can be defined separately. Awareness is the subjective correlate of attention. For Schmidt, attention and *noticing* are isomorphic: they coincide in performance, but cognitively they are separate constructs, the former being related to information processing and the latter being related to the subjective experience of information processing (Schmidt, 1995).

order to learn phonology one must attend to phonology (Schmidt, 1993a). As noticing is deemed facilitative to learning, the consequence is that more noticing leads to more learning. Awareness at the level of *understanding*, in other words, knowledge of rules and metalinguistic awareness, is not necessary for learning, but it can be facilitative.

Awareness can be encouraged through instruction

Whereas incidental learning is possible, as discussed earlier, many aspects go unnoticed in L2 learning and Schmidt as well as other researchers (e.g., N. C. Ellis, 2005; R., Ellis, 2002; Long, 1991; Sharwood Smith, 1981, 1991) suggest that noticing can be encouraged by making the target items in the input more salient. The issue of how this can be achieved and which items are likely to be noticed is further developed in *Section 2.2* when studies examining noticing are discussed. For the time being, it is important to consider that Schmidt believes that noticing, and thus learning, can be encouraged, instead of adopting a view that language learners' noticing abilities are fixed and unmalleable.

Let us conclude by discussing some of the problems Schmidt's theory methodologically supposes. Researchers have criticized that the study of awareness is challenging or even impossible because it corresponds to a subjective experience of the individual which cannot be easily measured from the 'outside'. We will review methods to examine awareness in the following sections, together with their limitations, but for the time being, we can safely say that although the scientific examination of awareness in L2 acquisition is challenging, it is not impossible.

The second criticism involves the construct of *noticing*. Noticing is the process through which the knowledge enters into the learner's awareness. Pinpointing a prior moment of noticing is usually not possible and in cases in which a learner can trace the noticing of some aspect (through a language learning diary, for example), the experience is subjected to memory constraints. Additionally, noticing is based on the initial encounter with the stimulus. Confirming that the subject in fact had ***zero awareness*** of the target before this encounter is nearly impossible. This concern is undoubtedly valid and acknowledged by Schmidt who moved from the noticing hypothesis to a less radical view of ‘more noticing results in more learning’ (Leow, 2013). Leow (2013) additionally notes that not all that is noticed becomes intake, a position which Schmidt recognizes: “The noticing hypothesis claims that learning requires awareness *at the time of learning* [emphasis in the original]. It does not require that memory of that event be preserved, much less recalled each time the learned material is encounted” (Schmidt, 1995, p. 26).

The third criticism is centered on the levels of awareness. Schmidt views awareness as a continuum with *perception* (no awareness) on one end and *understanding* on the other end with *noticing* somewhere in between. This gradient view on awareness has been praised and widely accepted, but some concerns have been posed on the limits between the levels. Truscott and Sharwood Smith (2011) as well as Loschky and Harrington (2013) question how we can accurately set the limits between *noticing* and *understanding* and *perception* and *noticing*. In other words, where do we set the upper and lower limits of *noticing*? This concern is without a doubt real, and although Schmidt provides examples and elaborations about each level, some variation is most likely to occur when researchers apply these notions. This is an issue which perhaps may not be empirically solved, the responsibility thus remains with the researcher in providing definitions and examples so that it is clear which phenomenon is under study.

In spite of Schmidt’s works having received criticism, his work has been extremely influential in SLA as evidenced by the large body of research examining language awareness. His view on the role of awareness in L2 acquisition is considered as a mainstream construct in SLA (Yoshioka, Frota, & Bergleithner, 2013).

In this section we discussed the main ideas behind Richard Schmidt's work on awareness in second language acquisition, and the importance these views have had on SLA research. The central idea around his work is the *noticing hypothesis*, namely, that learning requires conscious attention to the aspect to be learnt at the initial stage of information processing. Noticing is thus defined as the necessary and sufficient condition for learning. Schmidt also discusses higher level awareness, *understanding*, and states that *understanding* is not necessary for learning to take place, but it can be facilitative. Following his view, more noticing leads to more learning. We concluded the section by discussing the role of instruction. It was seen that Schmidt believes that noticing can be encouraged through instruction and that explicit instruction may also increase awareness at the level of *understanding*. This in turn would result in higher awareness and consequently in better (in terms of quantity and quality) learning.

Having reviewed the historical and theoretical framework to language awareness, we will conclude this section by discussing some of the problems in its study. The observation and measurement of language awareness have been recognized to be challenging. One the one hand, as language awareness corresponds to the subjective experience of an individual, making this experience available for the researcher can be difficult. Most likely because of this, the majority of the studies have focused on the metalinguistic, explicit, aspects of language awareness, which can be made evident through verbalization.[8]

On the other hand, the rapidity of the experience of 'becoming aware' makes measuring language awareness difficult. (Leow, 1997, Robinson, 1995, 2003). The cognitive processes underlying awareness are fast, and unless the researcher has the

[8] After a careful revision of the language awareness literature over the last three decades I could not find a single study focusing only on epilinguistic language awareness (excluding studies with artificial grammars), which cannot be taken to mean that such studies do not exist but it seems safe to say that they are in minority.

opportunity to tap into them at their moment of occurrence, they may become inaccessible. Recall that becoming aware requires awareness at the initial noticing stage, but once the stimulus has been noticed, awareness is not necessarily needed anymore: the stimulus can be processed and its use can become automatized, making conscious access to it difficult, or the stimulus can be disregarded or simply forgotten (cf. *Ch. 1.2.2*). For this reason, most researchers have approached language awareness at the initial stage of noticing by creating an environment in which a novel stimulus is encountered for the first time and the language learner's conscious processes at this initial encounter can be recorded. Others have examined the already consolidated knowledge by determining the general state of language awareness the learner possesses. Noticing is the topic for the next section whereas awareness about the consolidated knowledge is discussed in *Section 2.3*.

2.2. Awareness during the acquisition of L2: Noticing

In this section, methodology and findings of language awareness studies focusing on the initial moment of conscious intake are discussed. First, however, we will reviewe some factors affecting noticing, namely what is noticed and how noticing can be increased.

Noticing, as already mentioned in the previous section, makes reference to the "conscious registration of the occurrence of some event" (Schmidt, 1995, p.29). Noticing has been seen as the first step of learning, but not everything that is noticed will necessarily become intake. Schmidt's separation between *noticing the form* and *noticing the gap*, presented in the previous section, is further elaborated by Izumi (2013), who additionally discusses ‘noticing holes’ and ‘noticing the gap in one’s ability’, both of which make reference to learner-internal processes (noticing that something is missing in the interlanguage for adequate output). Schmidt’s two uses of *noticing*, on the other hand, take place in interaction.

Studies examining *noticing the gap* have found that it promotes learning (Mackey, 2006). The extent to which the gap between interlanguage and target language production is noticed has also been shown to be associated to study-abroad gains (Golonka, 2006). *Noticing the gap* can be promoted through instruction providing error correction. Research has indicated that in order for error correction to be useful, the learners have to understand that they are being corrected. Nevertheless, the majority of the research suggests that only a part of error correction is actually noticed by the learners (e.g., Roberts, 1995). However, some findings (Ellis & Mifka-Profozic, 2013; Mackey, 2006) suggest that creating favorable conditions for *noticing the gap* in classroom settings is possible.

Skehan (2013) states that noticing is the starting point for learning in two possible scenarios. On the one hand, noticing a new feature can change the existing interlanguage system leading to its reorganization. This would be the case of noticing a grammatical aspect such as tense or mood. On the other hand, noticing a new feature can simply add up to the existing interlanguage system. This would the case of noticing a given word being used to refer to a given object, for example. In other words, noticing affects the interlanguage system in size and/or in organization. As will be seen in the course of this section, noticing has been shown to be highly beneficial for language learning. With this in mind, let us first discuss what factors affect noticing.

Noticing depends on learner-internal and learner-external factors (Izumi, 2013; Schmidt, 2001). In terms of learner-internal factors, three issues have been raised. Firstly, some notice more than others. In other words, there are individual differences in the quantity and quality of noticing (Schmidt, 2010). Research on these factors is discussed later in this section. Second, the developmental readiness of the learner has been raised as an important prerequisite for noticing. The simple forms need to be noticed first, before noticing of complex aspects can take place. In other words, depending on the proficiency level of the learner, different aspects become available for noticing. For this reason, we would not expect a beginner learner of Spanish to notice the subjunctive, for example. Finally, as was discussed earlier, attention is necessary for noticing and it is partially subject to voluntary control. Thus, the learner can decide, up to some extent, to what attention is allocated to (Schmidt, 1990).

Two learner-external factors exist which have a great impact on what is noticed: characteristics of the stimuli and task demands. The stimuli need to stand out in some way in order to be noticed. Schmidt (1990) argues that unexpected stimuli or events are noticed easier than events that are so stable that they become part of the context (cf. a loud sudden noise vs. a constant humming of a fan). Perceptually salient items stand a bigger chance of being noticed (Kim, 1995) as do items that occur frequently in the input (Schmidt, 1990). Salience has also been shown to be related to the position within the utterance: initial (VanPatten, 2002) and final positions (Kim, 1995) are the most salient. If the stimuli is uninterpretable, too complex to be processed, presented too quickly or too softly, it is not likely to be noticed (Schmidt, 1993b).

Because of the limited capacity of attentional resources, some trade-offs need to occur as not everything can be attended to. VanPatten (1996) has put forward a widely accepted idea that meaning is noticed before form and items with higher communicative value are noticed before items with lower communicative value. Form and items with lower communicative value can only be noticed if there are enough attentional resources to allocate attention to them in addition to allocating attention to the high-value items. This generally is possible only in higher proficiency levels or by reducing the task demands to allow for more processing time.

Skehan (2013) has advocated for the importance of taking into account task demands in order to encourage learners' noticing. He raises two issues in relation to task design: task difficulty and task orientation. Simply put, the easier the task, the more attention is available for noticing to take place. In terms of task orientation, form-specific tasks, in which the task focuses on a particular target area make noticing more likely to occur. In addition, the teacher can encourage noticing at different task stages by providing planning time, feedback and post-task activities, for example.

The ideas that noticing is beneficial for learning and that noticing can be enhanced has led to the creation of several instructional approaches which aim at increasing learners' consciousness of the target language. Among these approaches are *processing instruction* (VanPatten, 2002), *consciousness-raising* (e.g., Sharwood Smith, 1981), *input enhancement* (e.g., Sharwood Smith, 1991) and *focus on form (*e.g., Long, 1991). The common idea behind these approaches is that the learners' attention is drawn explicitly to the target forms or structures with the aim that the learner will develop an explicit understanding of the feature (R. Ellis, 2002). An important difference to traditional grammar approaches is that the target forms are presented in a meaningful context instead of occurring in isolation. Another important feature of this type of instruction is that it is frequently aimed at developing learner autonomy by providing the learners with the necessary data but by expecting them to figure out the underlying rules (R. Ellis, 2002).

Empirical studies support the effectiveness of consciousness-raising activities.[9]

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[9] Through the course of the section the aforementioned approaches aiming at increasing the language learner's awareness will be referred to as 'consciousness-raising' independently of the adopted methodology.

More explicit learning conditions (e.g., [+ feedback], [+ provision of rules], [+ formal instruction]) have been shown to lead to more awareness (Rosa & Leow, 2004; Rosa & O'Neill, 1999; White & Ranta, 2002) and to higher accuracy (Alanen, 1995; Leeman, Arteagoitia, Fridman, & Doughty, 1995; Robinson, 1995; Rosa & O'Neill, 1999; White & Ranta, 2002).

Some studies have sought to determine whether increasing the salience of the target items in more implicit terms, through textual or aural enhancement, is beneficial for noticing and performance. The results have been inconclusive so far. Some studies have found textual enhancement to be positively related to accuracy of performance of the target forms (e.g., Jourdenais, Ota, & Stauffer, 1995) whereas others have failed to observe such an effect (e.g., Alanen, 1995).[10] The effectiveness of aural input enhancement is yet to be determined. Cho and Reinders (2013) tried to determine whether reducing speed or adding pauses around targets (passive structures) would increase their perceptual salience in an extensive listening task (90 min audiobook). Their results failed to prove the effectiveness of aural input enhancement, which might be due to the task design (extensive reading for meaning).

Noticing the form has been widely studied in SLA. Usually the research design is a pre-test/exposure/post-test/ (delayed post-test). A pre-test is administered in order to determine that the target structure is in fact novel (and thus available for noticing). Then exposure to the target form is provided, either through a task or instruction, and finally any learning and noticing are assessed through a post-test.

The target population has frequently been university students either majoring in languages or other subjects. In the vast majority of the studies, English has been either

[10] Textual enhancement= manipulation of font size or type, use of italics, bold face, capital letters, underlining or color coding in order to increase the typographical salience of the targets.

the L1 or the TL.[11] Other L1s which have been studied are Brazilian Portuguese (Bergsleithner & Borges Mota, 2013; Frota & Bergsleithner, 2013), Dutch (Godfroid, Housen, & Boers, 2010; Godfroid & Schmidtke, 2013) and Korean (Cho & Reinders, 2013; Kim, 1995). Besides English, the most frequent TLs have been Spanish (Calderón, 2013; Jourdenais et al., 1995; Leeman et al., 1995; Leow, 1997, 2000; Martínez-Fernández, 2008; Rosa & Leow, 2004; Rosa & O'Neil, 1999) and other Romance languages: French (Bell, 2009; Simard & Foucambert, 2013) and Italian (Spinner, Gass, & Behney, 2013).

Noticing studies have centered on grammar. From the 21 studies reviewed for this section, only three involved the noticing of vocabulary (Godfroid et al., 2010; Godfroid & Schmidtke, 2013; Martínez-Fernández, 2008). The target grammatical structures have been matched to the students' proficiency level and have ranged from simple structures like gender assignment (Bell, 2009) to complex structures such as subjunctive (Calderón, 2013).

The majority of the research in the area has investigated performance in the target forms through written tasks such as sentence completion (Alanen, 1995), grammaticality judgment (Cho & Reinders, 2013; Robinson, 1995), multiple choice (Godfroid et al., 2010; Rosa & O'Neil, 1999), fill-in-the-blank (Leow, 1997, 2000) or written essay (Jourdenais et al., 1995; Leeman et al., 1995). Oral tasks as a measure of performance have been rarely employed and after extensive literature review they were only found in three studies: Leeman et al. (1995), who employed in-class debates in combination with written measures, Bergsleithner and Borges Mota (2013) who examined participants' accurate use of indirect questions before and after consciousness-raising instruction

[11] In this section only studies involving natural languages are reviewed, with the exception of Alanen (1995) who employed semi-artificial (simplified) Finnish as the target language.

through oral picture descriptions, and Mackey (2006) who studied ESL learners' proficiency on simple grammatical structures in oral tasks before and after interactional feedback in order to see whether this had an effect on the oral performance.

As with the measures of performance, the tasks used to expose the participants to the target structures have favored written presentation. At least two subtypes can be found: written text (passage or sentences) in which the targets are embedded (Alanen, 1995; Godfroid et al., 2010; Godfroid & Schmidtke, 2013; Jourdenais et al., 1995; Martínez-Fernández, 2008; Robinson, 1995; Simard & Foucambert, 2013) and problem solving tasks consisting of crossword or jigsaw puzzles (Bell, 2009; Leow, 1997, 2000; Rosa & Leow, 2004; Rosa & O'Neil, 1999). Perhaps surprisingly, taking into account the primarily oral nature of language, only few studies have employed aural presentation of the target structures (Calderón, 2013; Cho & Reinders, 2013; Kim, 1995). A possible reason to the favoring of written exposure tasks over aural ones is that the processing of auditory input is seen as cognitively more demanding than the processing of textual input (Cho & Reinders, 2013).

As already mentioned, the nature of awareness makes it a difficult object to study since it involves a subjective cognitive experience which may occur very fast, making recognition, recollection and verbalization of such experience potentially difficult. Consciousness reacts to investigation (N.C. Ellis, 2008), so care has to be taken that what is measured is not an artifact of the experimental situation. In other words, by inquiring about 'awareness' the subject automatically becomes more aware of the experience than if the experience is let to unfold naturally without researcher's intervention. In spite of these problems, and perhaps in part, because of them, researchers have employed a wide variety of instruments in order to examine the moment of noticing as well as individual's awareness of the noticing. These instruments can be divided into those employed concurrently with the task (online) and those which are employed retrospectively after the exposure (offline).

Let us first consider the tasks which have been used to examine noticing after the exposure task has been completed. Offline measures to examine noticing include the use of learning diaries (Mackey, 2006; Schmidt & Frota, 1986), questionnaires (Cho & Reinders, 2013; Robinson, 1995; Rosa & Leow, 2004), uptake recall charts (Godfroid & Schmidke, 2013; Frota & Bergsleithner, 2013), and grammaticality judgment tasks (Alanen, 1995).

In studies employing learning diaries, the learners are asked to record their thoughts about language learning on a regular basis. Schmidt and Frota's (1986) study was the first to investigate noticing. In this case study, the learner kept a language learning diary during his stay in Brazil in which he recorded instances of noticing new language features, which the authors later examined in order to gain insight into the learner's linguistic progress.

Questionnaires are easily administered and analyzed for instances of noticing. Robinson (1995) employed a post-exposure questionnaire in which participants were asked whether they had noticed any rules, whether they had been looking for any rules and whether they were able to verbalize any rules.

Finally, uptake recall charts have been employed especially in studies involving the noticing of vocabulary, but they can also be used in grammar studies (Frota & Bergsleithner, 2013). They present the learner with a list of words or phrases from which the learner has to mark those that occurred during the exposure task.

Although offline measures have been widely employed, their problem lies in their very nature: they are employed after the noticing has occurred, thus subjecting the data for memory decay. Another limitation this type of measures present, with the exception of diary studies, is that the learner is limited to respond based on the given options, which means that more fine-grained data may get lost.

In order to obtain more detailed data, introspective verbal reports (also *verbal protocol* and *think-aloud*) have been frequently used to measure noticing. The idea behind this method is that instead of limiting the learners' answering options, the learners themselves are asked to verbalize what was noticed. This method lies heavily on the idea that language awareness can be verbalized. Verbal reports present the additional advantage that they can be employed either concurrently or retrospectively. They can be further divided into those in which subjects are simply asked to verbalize any thoughts aloud (*free think-alouds*) and into those in which the subject is given specific instructions to verbalize only linguistic information (*metalinguistic think-alouds*). *Offline verbal reports* can be further divided into immediate and stimulated recalls. In *immediate verbal recall*, the learners are asked to verbalize their thoughts either after each trial or immediately after the task. *Stimulated verbal recalls* involve the use of auditory and/or visual cues to prompt the learner to recall either their thoughts during the moment of exposure or the strategies they employed in order to complete the task. The cues can consist of audio or videotaped records of the participant performing the task or the learners can be re-exposed to the original stimuli and their answers to it. Online verbal reports are usually recorded without the researcher's interference whereas retrospective verbal reports usually take the form of an interview (Roehr, 2006).

Alanen (1995) was the first to use the think-aloud method in order to examine online what her participants were noticing. After this pioneer study, verbal reports have been widely employed. Initially, concurrent think-alouds were employed in reading tasks (Alanen, 1995; Jourdenais et al., 1995; Martínez-Fernández, 2008), but Leow (1997) suggested that a problem solving task would render more naturally to this type of instrument than thinking aloud while reading. He introduced a task design in which the participants completed a cross-word puzzle in which they filled in Spanish 3rd person preterit forms. The task was designed so that it encouraged noticing of the irregular stem-change in these verb forms. While filling in the crossword puzzle, the participants were asked to verbalize their thoughts, which were recorded. The analysis of the think-aloud data showed that the measure was able to capture different levels of awareness successfully (no verbal report/noticing/understanding). The problem-solving/concurrent think-aloud method was adopted in several later studies (Bell, 2009; Leow, 2000; Rosa & Leow, 2004; Rosa & O'Neil, 1999).

Concurrent think-alouds cannot be employed in tasks involving aural stimuli as it is not possible to listen to input and think aloud at the same time. The suitability of online verbalization is also questionable when writing is required, but at least one study, Jourdenais et al. (1995) employed concurrent verbalization in a writing task. In these cases, the use of retrospective verbal reports does not pose a problem, however. Calderón (2013) used an immediate offline verbal protocol to measure the noticing of Spanish past perfect subjunctive structures in an aural passage. Kim (1995) employed the same technique by asking the participants to explain why they had chosen a given answer immediately after each listening trial. Godfroid et al. (2010) chose the stimulated verbal recall protocol method during which the researcher presented the participants with their answers and asked why a given form was chosen. Stimulated recall protocols have been frequently used in studies examining *noticing the gap*. Mackey (2006) employed stimulated recall protocols, among other measures of awareness, in order to examine how much of the error-correction learners were able to notice.

Although verbal reports have been widely and successfully employed in language awareness studies, they have been a target of substantial criticism. The strongest case against recurrent verbal reports is that of memory constraints (Egi, Adams, & Nuevo, 2013). As noticing is fleeting, it is very likely that it cannot be accurately reported after the experience has passed, affecting thus the accuracy and completeness of the report.

Stimulated recall protocols have been used in order to reduce memory-load, but they have been criticized on the basis of the participants receiving extra exposure to the stimuli, which might give them additional input and additional opportunities to notice issues which were not noticed during the actual task (Egi, 2004). Researchers have expressed concerns that this additional exposure to stimuli might alter the contents of the reports. Additionally, as recurrent verbal reports are usually carried out as an interview with the researcher, it is possible that the learners report what they believe the researcher wants to hear instead of reporting their actual thoughts during the task (Egi, 2004). Egi (2004) compared the performance in immediate and stimulated retrospective recall conditions and found no differences in the performance between the two groups. However, she recognized that the small sample size disallowed generalizations to other learner populations.

Concurrent verbal reports do not present the aforementioned problems, but they face various issues which might affect the accuracy of the data. Concerns about the effect of thinking aloud while performing a task have been frequently voiced. Researchers are concerned whether the fact of thinking aloud (especially if the think-aloud is metalinguistic in nature) affects the performance during the task. Several effects may come to play. Thinking aloud might result in a negative influence due to a cognitive overload or it might induce more noticing which would not occur without the process of thinking aloud. Most of the empirical research in SLA suggests that thinking aloud while performing a linguistic task does not alter the degrees of awareness or the subsequent performance (Egi et al., 2013; Leow & Morgan-Short, 2004). However, some conflicting results have been found (Sanz, Lin, Lado, Wood Bowden, & Stafford, 2009; Sachs & Polio, 2007), and for the moment being, the general recommendation seems to be to include a control group to studies employing think-aloud measures (Leow, 2013).

With a careful task design, many of the problems of verbal protocols can be minimized or avoided, and valuable data on awareness can be obtained. Nevertheless, one important case against verbal reports, which cannot be avoided is veridicality, the issue of whether a verbal report forms a valid representation of the cognitive processes the individual has undergone (Egi et al., 2013). Whether verbal reports are faithful representations of the subject's language awareness is difficult, or even impossible to refute or to prove. Schmidt (1990) stated:

> There are also conscious experiences that are inherently difficult to describe. We may notice that someone has a regional accent without being able to describe it phonetically, or notice a difference between two wines without being able to describe the difference. (p.132)

He also noted that: "verbal reports (even when concurrent) cannot be assumed to include everything that is noticed" (Schmidt, 2001, p.24). Verbalization also depends to some extent on the verbalization skills, confidence to verbalize (Rebuschat et al., 2013) and knowledge of metalinguistic terminology of the learner. Moreover, even if we assume that explicit language awareness can be accurately verbalized, we will be missing out on all the data about epilinguistic, or implicit, awareness. For these reasons, the recent years have observed the employment of new methods to measure language awareness without the need of verbalization.

A growing understanding of language awareness and some technological and psycholinguistic advances have allowed the creation of new online measures to examine noticing while it is taking place without the need to resort to verbalizations. These include reaction time measures, eye-tracking and brain imaging.

Reaction time data can be used to examine whether the participant has developed a statistical sensitivity to the input (Leow, Grey, Marijuan, & Moorman, 2014). They have been used in studies involving implicit learning (Leung & Williams, 2011, 2012) and in studies examining phonotactic sensitivity (Trapman & Kager, 2009). Reaction time data is thus especially suitable for measuring epilinguistic awareness, but it is unable to tease apart different degrees of awareness (low-level noticing vs. high-level understanding, for example).

Eye-tracking has been successfully used in several studies as a measure of noticing (Godfroid et al., 2010; Spinner et al., 2013). The use of eye-tracking combined with verbal reports has been found to be especially successful in teasing apart the lower end of awareness (registration vs. noticing) (Godfroid et al., 2010). However, whether eye-tracking used in isolation is truly a measure of awareness or attention is debatable, as shown by previous research which has used it to measure both phenomena (Godfroid et al., 2010; Godfroid & Schmidtke, 2013). Eye-tracking alone cannot determine whether higher level of awareness (*understanding*) has taken place or not and its strength lies in pinpointing the exact moment of noticing and peripheral attention (Leow et al., 2014).

Finally, an interesting approach to examine language awareness was put forward by Loschky and Harrington (2013). They argue that by examining certain event-related brain potentials (ERPs), language awareness can be testified. They identify three ERPs (LAN, N400, P600) which are related to morphosyntactic and semantic processing difficulties, and which can be used to determine the noticing of grammatical violations. Other two ERPs (Ne and Pe) have been identified to be related to the noticing of own speech errors, in other words, *noticing the gap*. Their examination can tease apart conscious and unconscious error processing. The authors conclude that ERPs are especially suitable for examining awareness for several reasons. First, they are the purest sort of measures that can be obtained about metalinguistic and epilinguistic language awareness. Second, they are suitable for *noticing the form* and for *noticing the gap.* Third, they can be collected in real time. This line of research offers interesting potential to examine language awareness, but due to the cost of the equipment and the training involved in operating them and interpreting the data, we still need to wait for studies employing this methodology in the field of language awareness.

The research objectives of noticing studies have centered around three main areas: to determine whether noticing can be increased by a given stimuli presentation or instruction, to determine whether noticing and different degrees of language awareness are related to subsequent performance, and to determine which factors affect an individual's noticing abilities.

In relation to the first topic, we have already discussed the demonstrated advantages of consciousness-raising activities (cf. *Ch.2.2*, p.41). It seems that more explicit teaching conditions lead to more noticing, whereas there is still a debate whether more implicit manipulations, such as input enhancement, can encourage noticing.

As for whether there is a relation between noticing a given target structure and its accurate subsequent performance, the short answer is 'yes'. Learners who have demonstrated awareness have been consistently found to perform better than learners who have not demonstrated awareness, and those who have manifested more awareness have been shown to perform better than those who have demonstrated less awareness (Alanen, 1995; Bergsleithner & Borges Mota, 2013; Leow, 1997, 2000; Robinson, 1995; Rosa & Leow, 2004; Rosa & O'Neill, 1999). It thus seems safe to say that Schmidt's theoretical postulation of 'more noticing leading to more learning' is accurate.

Since the beginning of noticing research, researchers have been curious to discover why some individuals seem to notice more than others. Factors such as working memory, phonological short-term memory, attention control and aptitude have been examined in relation to noticing. We will finish the discussion about noticing research by reporting the findings from these studies.

As working memory is necessary for ongoing language processing, it has been suggested to have an effect on noticing. Working memory capacity has been examined in relation to *noticing the form* as well as *noticing the gap*. In both areas, no conclusion has been reached on whether individuals with higher working memory capacity notice more. Trofimovich, Ammar and Gatbonton (2007) and Bell (2009) found that working memory capacity was unrelated to noticing. However, Mackey, Philp, Gujii, Egi and Tatsumi (2002) and Bergsleithner and Borges Mota (2013) found a positive relation between working memory and noticing, so that learners with higher working memory capacity reported more noticing. These mixed results are likely to be due to the methodology as noted by the authors who did not find a positive relation between the two. Trofimovich et al. (2007) and Bell (2009) used less demanding tasks than the two studies which found a positive relation between working memory capacity and noticing, and state that working memory might be more important in tasks which are more demanding.

Phonological short term memory refers to the individual's capacity to hold spoken sequences temporarily in short-term memory (Trofimovich et al., 2007). As with working memory, studies on the relation between phonological short term memory and noticing have given mixed results. Whereas some studies have not found a relation between phonological short-term memory and noticing (Bell, 2009; Trofimovich et al., 2007), other studies have found a positive relation between the two (Mackey et al., 2002). Again the differences may be due to task demands and further research is needed on the issue.

Attention control refers to the individual's ability to efficiently shift attention between different aspects of language or different cognitive processes (Trofimovich et al., 2007). As with the previous factors, some studies which have investigated noticing and attention control (Bell, 2009; Trofimovich et al., 2007) have failed to find a relation between the two, whereas others have observed a positive relation (Simard & Foucambert, 2013). Consequently, further studies are needed to either refute these results or to confirm that attention control does not play a part in noticing.

Conflicting results can also be observed for language aptitude (or subparts of it, namely language analytic ability) and noticing: Trofimovich et al. (2007) failed to observe a relation between the two, whereas Bell (2009) and Robinson (1995) found that learners with higher aptitude noticed more than learners with lower aptitude.

So far we have discussed language awareness at the initial *input-to intake* stage of learning, namely, noticing. We have seen what factors contribute to noticing, how noticing can be encouraged in a classroom setting, and we have looked into the methodology and findings of several studies involving noticing. Noticing is however only the initial manifestation of language awareness, and as learning progresses, the noticed features became part of the individual's interlanguage system. At this stage, learners' awareness of their consolidated knowledge about language can be examined. This is the topic for the next section.

2.3. Awareness about the L2: Metalinguistic knowledge

The focus of metalinguistic studies is on the end product of the learning, knowledge, not on the learning process itself. As defined at the beginning of the chapter, *metalinguistic knowledge* refers to explicit knowledge about language, and together with epilinguistic awareness it constitutes language awareness.[12] A considerable terminological confusion exists in the field in relation to the concepts of *metalinguistic knowledge* and *noticing* and researchers do not always separate between the two. Although both are manifestations of the same underlying construct, language awareness, in this study, we will deal with them separately, as the underlying cognitive processes between the initial registration of an event and the storage and retrieval of existing knowledge are very different. In spite of this difference, it will be seen that some of the findings reported for noticing have also been reported for metalinguistic knowledge.

In this section we will review some key studies about metalinguistic knowledge in adult foreign language learners. Metalinguistic knowledge has been frequently studied in children, especially the phonological subcomponent, which will be reviewed in the next chapter, but because the target population in the present study is adult foreign language learners, studies involving young learners are not the focus of this section.

It is important to distinguish between metalinguistic knowledge and metacognition. *Metacognition* refers to one's knowledge about one's own cognitive processes and products and anything related to them (Goh & Hu, 2014). Although self-awareness is a very promising field of research within language awareness and several researchers have undertaken its examination (e.g., Goh & Hu, 2014; Muñoz, 2014), this section will focus on language learners' awareness about the language itself, not about one's meta-awareness.

As with noticing studies, studies about metalinguistic knowledge have been frequently carried out with English as the L1 or the L2. Other L1s include Brazilian

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[12] The term *metalinguistic knowledge* rather than *metalinguistic awareness* will be used in the course of the section to underline the explicit, factual nature of this subtype of language awareness.

Portuguese (Puntel Xhafaj, 2011) and Polish (Zietek & Roehr, 2011). Apart from English, German (Roehr, 2006, 2008; Roehr & Gánem-Gutiérrez, 2009a, 2009b), French (Alderson et al., 1997; Renou, 2001), Spanish (Gutiérrez, 2013b; Roehr & Gánem-Gutiérrez, 2009a, 2009b) and Chinese (Elder & Manwaring, 2004) have been among the target languages. Contrary to noticing studies in which the design usually includes a pre- and a post-test, metalinguistic studies do not often employ instruction which is why the research design usually focuses around the testing phase only.

Studies about metalinguistic knowledge have centered on grammar or, less frequently, on grammar and lexico-semantics (Roehr, 2008) or grammar, lexico-semantics and pragmatics (Roehr & Gánem-Gutiérrez, 2009a, 2009b). Contrary to noticing studies which usually focus on a specific target structure, metalinguistic knowledge studies usually take the whole (grammatical) system as the target.

The instruments used to measure metalinguistic knowledge have been less varied than in noticing studies. Some studies have required the learners to identify parts of speech (Alderson et al., 1997; Elder & Manwaring, 2004). Others have employed stimulated recall protocols in which the learners are asked to explain their answers to error correction tasks (Roehr, 2006) or to grammaticality judgment tasks (Ammar, Lightbown, & Spada, 2010). However, most frequently the participant is asked to perform a written task involving error correction. At least the following types can be identified ranging from the least cognitively demanding to the most cognitively demanding: *error explanation* (Gutiérrez, 2013a), *error correction* (Roehr, 2008; Roehr & Gánem-Gutiérrez, 2009a, 2009b; Zietek & Roehr, 2011) and *grammaticality judgment tasks* (GJTs). In *error explanation*, the participant is presented with sentences in which errors have been highlighted in some way. The participant's task is to explain the error but it is not necessary to provide a correction. In *error correction task*, the highlighted error has to be corrected in addition to be explained. Since grammaticality judgment tasks are the most frequently used metalinguistic knowledge task, let us take a closer look at this instrument.

GJTs are usually written tests (although oral GJTs are also possible, Renou, 2001) in which the participant is presented with target language sentences. Some task designs have employed only ungrammatical sentences (e.g., Alderson et al. 1997), however, most frequently part of the sentences are ungrammatical (containing at least one error) and another part are grammatically correct. GJTs differ in the amount of elaboration expected from the learner. The learner can be simply asked to indicate whether a given sentence is grammatical or ungrammatical (Gutiérrez, 2013b). Slightly more demanding is a version in which the participant is additionally asked to identify the error (Puntel Xhafaj, 2011). Most demanding versions ask the learner to also correct the error or to correct the error and state the underlying rule (Alderson et al., 1997; Lightbown & Spada, 2000; Renou, 2001).

It has been put into question whether GJTs measure only explicit knowledge about language. Versions which ask the learner to state rules clearly cannot be performed without explicit knowledge of the target rules, but mistake identification and correction does not need to involve explicit knowledge.

Timed and untimed GJTs have been suggested to rely on epilinguistic and metalinguistic knowledge respectively (Han & Ellis, 1998). This is because, as seen in the previous chapter, declarative knowledge is usually employed slower than procedural knowledge which is readily available. However, explicit knowledge can be proceduralized, thus making the separation based on time constraints ineffective. In fact, some studies (Gutiérrez, 2013b) have not found evidence that different types of knowledge are used in timed and untimed GJTs.

Research also suggests that responses to grammatical sentences and ungrammatical sentences tap into different factors, namely epilinguistic and metalinguistic knowledge, respectively (Gutiérrez, 2013b; R. Ellis, 2005). Additionally, some studies report on low task-retask reliability (Han & Ellis, 1998) and it has been suggested that this is because participants are lacking implicit knowledge about the target and try to use incomplete metalinguistic knowledge (rules) to respond (R. Ellis, 2004).

Altogether, there is some evidence that GJTs do not measure only metalinguistic knowledge. Consequently, studies wishing to measure only the explicit side of language awareness should consider using other instruments in addition to GJTs. On the other hand, research suggests that this type of tasks constitute a measure of epilinguistic awareness as well. As language awareness consists not only of conscious knowledge about rules but also of intuitive awareness about language, examining both dimensions is deemed crucial for the understanding of the construct. Unfortunately, due to the difficulty of measuring unverbalizable, intuitive epilinguistic awareness, research in the area is lacking. Let us conclude the discussion of the instruments with some suggestions to measure epilinguistic awareness.

In addition to GJTs, any task which does not require explicit verbalization or explanation can be potentially used to measure epilinguistic awareness. It is also possible to use the learners' performance as a measure of epilinguistic awareness as it is assumed that output reflects the learners' awareness about the target language system. In other words, in order to produce target-like output, the learners have needed to consciously notice the linguistic features at some previous point and to incorporate them into their interlanguage system.

Suggestions have been made to ask the participants to provide confidence ratings and source contributions to their answers in order to determine whether their responses are based on metalinguistic or epilinguistic awareness (Rebuschat et al., 2013). Confidence ratings ask the participant to indicate the degree of certainty about their decision in a GJT, for example. In source attributions, the participant is asked what their decisions in the task were based on (guessing, intuition, memory or knowledge of a rule). Answering these questions is not difficult for the participants, and they are believed to provide interesting insights into what type of awareness, epilinguistic or metalinguistic, the participant was resorting to during the task. Reporting high confidence and responding based on memory or rule knowledge is associated to the use of metalinguistic awareness. If the participant on the other hand reports guessing or using intuition or lack of certainty in the responses, even though the accuracy of the responses does not reflect guessing, the most likely source has been epilinguistic awareness. Rebuschat et al. (2013) compared confidence ratings and source attributions to traditional verbal recall in forced-choice sentence completion tasks targeting an artificial determiner system. Whereas the verbal report data divided the participants into unaware and aware based on the ability to verbalize the underlying rules, the subjective measures of awareness were able to provide more fine-grained results showing that the resulting knowledge was both implicit and explicit and although participants were aware of having acquired some knowledge, they were at least partially unaware of what this knowledge was.

Let us conclude this section by discussing the findings from studies on metalinguistic knowledge. The development of metalinguistic knowledge has been found to be related to explicit instruction: different degrees of L2 metalinguistic knowledge have been reported in participants depending on the learning context. Elder and Manwaring (2004) compared the metalinguistic knowledge of learners of Chinese from two learning backgrounds: those who had begun the TL study during secondary education and those who had only began to learn the language at a university level. Although the former had larger language experience, the university-only learners showed more metalinguistic knowledge about the TL. The authors explain this by stating that most likely the approach during secondary education had been communicative rather than form-focused, and that metalinguistic knowledge develops as a result of formal study of the language.

Renou (2001) examined L1 English learners of French with two language learning backgrounds, communicative and grammar-based, by employing oral and written GJTs. Her results showed that the learners with the communicative language learning background performed better in the oral GJT and the learners who had received grammar-based instruction performed better in the written GJT. The author concludes that different types of instruction can be used to develop different aspects of language awareness.

Finally, in examining young learners, Lighbown and Spada (2000) and Ammar et al. (2010) discovered that the degree of metalinguistic knowledge present in young ESL learners in immersion context was low. To summarize, the aforementioned studies suggest that metalinguistic knowledge is positively related to explicit instruction of the target language (grammar).

Metalinguistic knowledge has been frequently found to be positively related to performance in the target test structure (Ammar et al., 2010; Puntel Xhafaj, 2011; Roehr, 2006; Roehr & Gánem-Gutiérrez, 2009b). In other words, awareness about the target structures is related to their more accurate performance. Metalinguistic knowledge has also been shown to be positively related to language proficiency in a more general sense (Renou, 2001; Roehr, 2008). However, other studies have not found a relation between metalinguistic knowledge and L2 proficiency (Alderson et al., 1997), or they have found a relation to written proficiency measures only, but not to oral (Elder & Manwaring, 2004; Gutiérrez, 2013a). What these studies suggest is that metalinguistic knowledge is beneficial for language learning, in more restricted and potentially also in a more global sense, at least when it comes to written proficiency.

Large variation has been observed in language learners' amount of metalinguistic knowledge (Alderson et al., 1997; Gutiérrez, 2013a; Roehr, 2006). Apart from the earlier mentioned learning environmental outcomes, the effect of some cognitive factors, such as working memory capacity, cognitive style and aptitude, has been studied.

Roehr and Gánem-Gutiérrez (2009a) examined the relation between working memory (measured through L1 and L2 reading span test) and metalinguistic knowledge in L1 English learners of Spanish or German. No relation was observed between the two. Taken these results together with those observed for working memory and noticing (cf. *Ch.2.2*, p.51), more research is required to determine whether larger working memory capacity is related to higher degrees of language awareness.

Zietek and Roehr (2011) tested L1 Polish EFL learners for metalinguistic knowledge as well as cognitive style. Cognitive style (learning style) was defined as individual's preferred and habitual approach to organize and represent information, and was divided into wholist and analytic approaches. Their findings indicate that wholist cognitive style was positively related to the amount of metalinguistic knowledge: organizing information at a global level rather than as discrete parts was found to be more beneficial for the development of metalinguistic knowledge.

Finally, the relation between language learning aptitude and metalinguistic knowledge has intrigued researchers. Medium positive correlations have been observed between the two (Alderson et al., 1997; Roehr & Gánem-Gutiérrez, 2009a) indicating that language learners with high language learning aptitude also have high metalinguistic knowledge. However, this is not surprising because aptitude and metalinguistic knowledge are partially overlapping constructs.

Language aptitude, according to its traditional definition, consists of four components: phonetic coding ability, rote-learning ability, grammatical sensitivity and inductive language learning ability (Harley & Hart, 1997). Performance in these tasks has been found to predict the individual's success in language learning. Grammatical sensitivity and inductive language learning ability are of special interest to language awareness. Grammatical sensitivity refers to the ability to recognize the grammatical functions of words within sentences and inductive language ability makes reference to the ability to infer rules from samples of unknown languages. Skehan (1989) saw that these two measure the same underlying construct, as evidenced by their high intercorrelation, namely the ability to infer language rules and make linguistic generalizations, and termed them ***language analytic ability***.

As Ranta (2002) states, language analytic ability and metalinguistic knowledge are overlapping constructs, so much so that they employ some of the same tasks (*identifying grammatical functions* and *error correction*, among others), although the instruments in aptitude studies employ materials in the L1 whereas L2 metalinguistic studies employ TL material. Despite the similarities between the two, they also present differences as noted by Ranta (2002). Whereas language aptitude is considered a stable trait, metalinguistic knowledge is seen to emerge through instruction. The methodology in the studies also differs: whereas in language aptitude studies the aim is to relate individual differences in aptitude to other factors through correlational studies mainly, metalinguistic studies frequently examine differences among groups or different types of tasks (Ranta, 2002).

To conclude, few studies have investigated individual differences and metalinguistic knowledge, and the information to date offers a rather inconclusive picture of how these variables may be related to metalinguistic knowledge.

<u>*Chapter summary:*</u>

In the present chapter we have reviewed the main aspects of language awareness. We began by defining the construct and providing the historical background in which language awareness research developed.

Next the theoretical background employed in many language awareness studies put forward by Richard Schmidt was presented. His main theoretical postulations, namely, that all learning requires awareness at the level of noticing, and that more noticing leads to more learning, were shortly presented.

We then examined language awarenss at two stages: the intake-to-input stage (noticing) and the consolidated knowledge stage (metalinguistic and epilinguistic knowledge). We began Section 2.2 by discussing the difference between 'noticing the form' and 'noticing the gap' as well as the learner-internal and -external factors that affect noticing. We saw that the target of noticing studies has been grammar, and to a lesser extent vocabulary.

In the final section, we focused on the metalinguistic aspect of language awareness, as epilinguistic awareness has not been the focus of research. We saw that contrary to noticing, metalinguistic knowledge requires formal instruction. In other words, we do not need training to be able to notice (although it can be helpful as shown by the reviewed studies), but we do need some training in order to develop metalinguistic knowledge of the target language. It was seen that in metalinguistic knowledge studies, the focus has frequently been on the grammatical system as a whole, rather than on its individual aspects. It was also seen that the favored instruments have been error correction and grammaticality judgment tasks. We then proceeded to discuss the characteristics of the latter and concluded that GJTs cannot be taken to be a measure of explicit linguistic knowledge only.

Noticing and metalinguistic knowledge studies share many similarities. Both have mainly focused on university students and in the vast majority of the cases, English has been either the L1 of the participants or the target language. Both areas have favored written presentation and proficiency measures. Both have also relied to a great extent on subjects' ability to verbalize their underlying knowledge. In relation to this, we discussed several of the problems arising with verbal protocols and using them as the sole measure of language awareness.

We learnt that both, noticing and metalinguistic knowledge have been found to be positively related to performance and overall language proficiency. We also saw that learners differ greatly in their ability to notice, and also on the amount of metalinguistic knowledge they possess. It was seen that some research has been carried out in order to determine the reasons behind this individual variation, but that such research is rather inconclusive. The role of working memory, phonological short term memory and attention control in relation to noticing and metalinguistic awareness require further studying. The amount of explicit instruction favors the development of metalinguistic knowledge, and noticing has also shown to benefit from explicit instruction. Research to the date suggests that language learning aptitude is most likely related to both, noticing and metalinguistic knowledge.

Overall, language awareness has intrigued many researchers, but many issues involving it remain to be investigated due to the methodological problems in examining awareness. The first issue arises with how noticing, language awareness and metalinguistic knowledge are conceptualized.

The second, and perhaps most important issue, arises with the instruments. A considerable number of instruments and methods have been employed to examine noticing and metalinguistic knowledge, leading to the lack of comparability between *studies. The confusion is evident in that same instruments have been employed for noticing and metalinguistic knowledge (e.g., verbal protocols and GJTs) as well as to measure awareness about a given feature and performance in a given feature (e.g., GJTs). In order to remedy this methodological problem, we saw that some promising instruments, such as eye-tracking, reaction time data and ERPs, are being developed and tested as measures for language awareness.*

From the studies examining individual differences, it became clear that more research is needed in the area in order to understand what affects noticing and metalinguistic knowledge, and how can that information be used to enhance both.

A final issue requiring research in the area of language awareness is that of epilinguistic awareness. Much of the tasks used in language awareness research are designed to tap into explicit knowledge. However, we know that epilinguistic awareness develops earlier in children than metalinguistic knowledge (e.g., R. Ellis, 2004; Jessner, 2006), that not all aspects of language awareness render to verbalization or explanation (Schmidt, 1990, and elsewhere) and that proceduralized knowledge is behind fluent language behavior (cf. Ch.1.2.1). Consequently, examining the epilinguistic side of language awareness can increase our understanding of the construct of language awareness.

3. Phonological awareness in L1

In this chapter we will move from the general realm of language awareness to one subarea of language awareness, namely, phonological awareness. The chapter provides a summary of studies examining phonological awareness in the first language, the vast majority of which have centered on children's literacy acquisition. The aim of the chapter is to provide the reader with a good understanding of how *phonological awareness* has been most commonly understood and examined, as a preparation for the following chapter which focuses on phonological awareness in the L2 as defined by the author.

The chapter is organized into four sections. In the first section the development of L1 phonological awareness and the instruments used to examine it are discussed. In *Sections 3.2* and *3.3* contextual factors and learner factors having an impact on L1 phonological awareness are examined. Finally, in *3.4.*, implicit L1 phonological awareness studies are shortly reviewed. We will begin by defining phonological awareness and we will then proceed to discuss the instruments and the findings of studies about L1 phonological awareness.

Nearly all definitions of phonological awareness in the L1 literature entail the notion that it is manifested through detection, segmentation and manipulation of sounds. Oakhill and Kyle (2000, p.152) for example, define ***phonological awareness*** as "the ability to detect, distinguish between and manipulate the constituent sounds of words: syllables, onsets, rimes and phonemes". The majority of the researchers also consider that L1 phonological awareness involves explicit knowledge and the ability to think about the sound structure of the language as an object. However, some researchers (e.g., Anthony & Francis, 2005; Cunningham & Carroll, 2015; Geudens, 2006; Lance, Swanson, &

Peterson, 1997) acknowledge that phonological awareness also entails implicit knowledge, or ***phonological sensitivity***, about the sound structure of the L1. This type of sensitivity is evident in tasks which do not require explicit manipulation of the sound structure. Nevertheless, the vast majority of the tasks used to measure L1 phonological awareness, as well as the researchers' definitions for phonological awareness, only tap into explicit knowledge, manifested through the ability to carry out given manipulations on the spoken language. Consequently, as with language awareness, the focus in L1 phonological awareness studies has been on explicit, verbalizable knowledge.

Phonological awareness is seen to consist of multiple levels: syllable awareness, rime-onset awareness and phonemic awareness.[13] ***Syllable awareness*** refers to the ability to perceive and manipulate language at the level of a syllables (McBride-Chang, Bialystok, Chong, & Yanping, 2004). ***Onset-rime awareness*** entails the ability to divide syllables further into onsets and rimes and to recognize which words alliterate or rhyme. ***Phonemic awareness*** refers to "the insight that a spoken word can be viewed as consisting of successive speech sounds and the skill in manipulating these sounds" (van Bon & van Leeuwe, 2003, p.195).

These levels have been shown to follow a clear developmental order so that children first become aware of larger units (words, syllables, rimes and onsets) and then proceed to smaller and more abstract units (phonemes) (Goodrich & Lonigan, in press). Syllable awareness is usually found to develop before onset-rime awareness (Anthony & Francis, 2005; Chien, Kao, & Wei, 2008; McBride-Chang et al., 2004) and rime awareness develops before onset awareness (Cisero & Royer, 1995). However, not all studies have found syllable awareness to develop before onset-rime awareness, instead a

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[13] Depending on the script, variations can be observed. Throughout the chapter, unless otherwise stated, the discussion about L1 phonological awareness is based on languages employing an alphabetic script.

simultaneous developmental pattern has been observed (Carroll, Snowling, Hulme, & Stevenson, 2003). Independently of the order of these two abilities, it is well established that phonological awareness develops from larger units to smaller units and phonemic awareness is the last to develop.

The next question to arise is whether these levels are independent from each other or whether they build on essentially the same ability, more specifically, whether phonemic awareness is built upon onset-rime awareness. Research seems to point to the direction that onset-rime awareness and phonemic awareness are related, but independent abilities (Carroll et al., 2003; Foy & Mann, 2001, 2003). This is evident in that awareness of syllables and rimes can develop spontaneously without instruction (Foy & Mann, 2001) whereas phonemic awareness cannot. Moreover, phonemic awareness is a better predictor of reading proficiency than onset-rime awareness is (Geudens, 2006; Foy & Mann, 2003), and onset-rime awareness is more strongly related to speech perception than phonemic awareness, which in turn is more strongly related to vocabulary and letter knowledge (Foy & Mann, 2001).

We will now turn to examine how L1 phonological awareness has been measured.

3.1. Measuring L1 phonological awareness

Participants in L1 phonological awareness studies have been pre-literate, learning to read or literate children, most participants falling between three and eleven years of age. However, concerns about adults' phonological awareness have also sparked studies investigating the nature of phonological awareness in literate (Lehtonen & Treiman, 2007; Scarborough, Ehri, Olson, & Fowler, 1998; Serrano, Defior, & Martos, 2003) and illiterate adults (Morais, Cary, Alegria, & Bertelson, 1979). The vast majority of the studies involves monolingual children with English as their L1, but studies on L1 Dutch (van Bon & van Leeuwe, 2003), Spanish (Defior, Gutiérrez-Palma, & Cano-Marín, 2012) and Chinese (Cheung, Chen, Lai, Wong, & Hills, 2001; McBride-Chang et al., 2004) have also been carried out. An interesting venue of research involves the development of phonological awareness in early bilinguals (Bialystok, Majumder & Martin, 2003; Cisero & Royer, 1995; Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004; Gottardo, Chiappe, Yan, Siegel, & Gu, 2006; Verhoeven, 2007) as well as the comparison of L1 and L2 phonological awareness in foreign language settings (Chien et al., 2008; Puntel Xhafaj, 2011).

A large variety of instruments have been used to measure L1 phonological awareness. Table 3.1 on the following page presents a summary of tasks used in 30 influential studies revised for this chapter extending over three decades. The different levels of phonological awareness occupy the columns and the lines indicate the subskill involved in the task. It should be noted that not all researchers have employed the same terminology and that the grouping here is for illustrative purposes only, and by no means a comprehensive account of the types of tasks and skills employed in L1 phonological awareness research. Not all tasks are possible at all levels (for example, it is not possible to have a rime blending task) and not all level-skill combinations were testified in the present review, which does not mean that these combinations have not been employed to the date or could be employed in the future. Let us take a closer look at the tasks by skills, as frequently the same skill is employed at several levels.

The various types of tasks used have been grouped here into four main categories: those which involve some kind of manipulation of the stimuli, those involving the comparison of the stimulus with other stimuli, those which require a more objective approach, and those that involve speech perception or production.

Skill		Level of analysis			
		Phoneme	**Onset/Rime**	**Syllable**	**Word**
MANIPULATION	**Segmentation**	Phoneme segmentation (Verhoeven, 2007)	-	-	-
	Blending	Phoneme blending (Mayo et al., 2003)	-	Syllable blending (Carroll, et al., 2003)	Word blending (Goodrich & Lonigan, in press)
	Adding	Phoneme addition (Morais et al., 1979)	-	?	?
	Deleting	Phoneme deletion (Chien et al., 2008)	?	Syllable deletion (McBride-Chang et al., 2004)	Word deletion (Goodrich & Lonigan, in press)
	Substituting	Phoneme substitution (Foy & Mann, 2001)	?	?	?
	Exchanging	Spoonerism* (Serrano et al., 2003)	?	?	?
COMPARISON	**Matching**	Phoneme matching (Goodman et al., 2010)	Rhyme matching (Wood & Terrell, 1998)	Syllable matching (Cheung et al., 2001).	-
	Discrimina-tion	Phoneme oddity (Whalley & Hansen, 2006).	Rhyme oddity (Gottardo et al., 2006) Onset oddity (Oakhill & Kyle, 2000)	?	-
ANALYSIS	**Counting**	Phoneme counting (Lehtonen & Treiman, 2007)	-	Syllable counting (Serrano et al., 2003)	?
	Position analyzing	Phoneme position analysis (McBride-Chang, 1995)	-	?	?
	Objectifying	?	-	?	Word objectification (Verhoeven,2007)
PERCEPTION & PRODUCTION	**Recognizing/ Detecting**	Phoneme recognition (van Bon & van Leeuwe, 2003) Phoneme deletion detection (Dickinson et al., 2004)	?	?	-
	Producing/ Repeating	Nonword repetition (van Bon & van Leeuwe, 2003)	Rhyme production (Foy & Mann, 2001)	?	-

Table 3.1. Instruments in L1 phonological awareness research. Example of a study where the instrument has been employed appears between brackets. * Spoonerism also involves a component of *comparison*. A dash indicates an impossible combination and a question mark an area for which no task was registered in the present review.

Despite the diversity of the measures, phonological awareness tasks frequently share three characteristics as noted by McBridge-Chang (1995). First, the participant is asked to listen to one or more aurally presented words or nonwords. Next an operation of some sort on the stimuli or set of stimuli is required. Finally, a response is made, which by the very nature of phonological awareness is verbal, although sometimes pointing to the answer (in young children) or indicating it in writing (usually in adults - Lehtonen & Treiman, 2007; Serrano et al., 2003) can be employed .

The *manipulation* category involves the most frequently used tasks in L1 phonological awareness, namely those that require segmenting, blending, adding, deleting, substituting or exchanging. *Phoneme segmentation* is one of the most frequently used measures of phonemic awareness (Lance et al., 1997; McBridge-Chang, 1995; Mayo, Scobbie, Hewlett, & Waters, 2003; Puntel Xhafaj, 2011; van Bon & van Leeuwe, 2003; Verhoeven, 2007). In a phoneme segmentation task the participant is presented with a word and asked to segment it into its phoneme constituents (e.g., *cat* → [k][æ][t]). The answers are most often given orally, but also written answers (circling, multiple choice) have been employed (Lehtonen & Treiman, 2007; Scarborough et al., 1998). *Blending* is the opposite of segmentation and it can be employed at the phonemic level (Goodman, Libenson, & Wade-Woolley, 2010; Goodrich & Lonigan, in press; Lance et al., 1997; Verhoeven, 2007), syllable level (Carroll et al., 2003) and word level (Goodrich & Lonigan, in press). In it, the participant is presented with sounds (phones, syllables or words) in isolation and asked to resynthesize them in order to form a word (e.g., [k][æ][t] → *cat*). In *phoneme addition tasks,* the participant is asked to add a given sound to the beginning or ending of a word. *Deletion tasks* work the other way around and in them the task is to remove a phone, a syllable or a word from the aurally presented target item. The task has been widely employed at the phonemic level (e.g., Chien et al., 2008; Foy & Mann, 2001, 2003; Holliman, Wood, & Sheehy, 2008; McBride-Chang et al., 2004; Wood & Terrell, 1998), but also syllables (Hogan, Catts, & Little, 2005; McBride-Chang et al., 2004) and words can be deleted (Goodrich & Lonigan, in press). Substituting and exchanging phonemes essentially involve the same operation. In *phoneme substitution tasks*, the researcher presents the target word and gives the phoneme with which the initial or final phone is to be substituted (e.g., ‘change the initial sound for /k/’, Foy & Mann, 2001). Phoneme exchanging tasks are frequently called *spoonerisms* and they involve the presentation of two words whose initial phonemes are to be exchanged (e.g., *cat – leg* → [læt, kɛg]).

Tasks involving the *comparison* of several stimuli can be divided into two: matching and discriminating. In *matching* tasks, the participant is presented with a target word and asked to match it to one of the answering options which shares the same phone (Cheung et al., 2001; Foy & Mann, 2003), rime (Dickinson et al., 2004; Holliman et al., 2008; Wood & Terrell, 1998) or syllable (Carroll et al., 2003; Cheung et al., 2001). *Discrimination tasks* also present several answering options but the task is to identify from them the ‘odd one out’, namely the one that does not share the phone (Chien et al., 2008; Whalley & Hansen, 2006) or rime (Defior et al., 2012; Gottardo et al., 2006; Oakhill & Kyle, 2000) with the others.

The remaining two categories, *analysis* and *speech perception and production*, are slightly different from the ones seen this far. We have grouped the *analysis* category to include tasks which highlight the ability to treat the language as an object without requiring manipulation of the stimuli. *Phoneme counting* (Bialystok et al., 2003; Lehtonen & Treiman, 2007; Serrano et al., 2003) and *syllable counting* (Chien et al., 2008; Wood & Terrell, 1998) have been widely used in L1 phonological awareness research. In *phoneme position analysis*, the participant is asked what sound comes before or after a given sound (McBride-Chang, 1995) or they can be asked to repeat or write down a given sound within the word (e.g., 'write down the letter representing the second sound in the word', Serrano et al., 2003). *Word objectification* taps into the ability to focus on the word form rather than the meaning. In this type of task, the child is presented with two words differing in length and asked to decide which word is longer (e.g., *cat-caterpillar,* Verhoeven, 2007).

Finally, *perception and production* category involves tasks in which more implicit knowledge is tapped into. *Recognition tasks* ask the participant simply whether a given sound was heard in the target word (van Bon & van Leeuwe, 2003) or whether a given manipulation already performed in the word was detected (Dickinson et al., 2004). *Production tasks* can be employed in the nonword paradigm (read aloud or repeat a nonword) in order to determine the participant's awareness of the segmental level (van Bon & van Leeuwe, 2003), or they can be employed in free responses, such as asking the participant to provide words with a given sound, syllable or rhyme (Foy & Mann, 2001, 2003).

As can be seen from this review, although some skills have been investigated across various levels (e.g., *deletion*), a large variety of skills has been employed to examine L1 phonological awareness. Whereas the relative independency of the levels of analysis has been established, so that phonemic awareness, onset-rime awareness, syllable awareness and word awareness develop differently and tap into different type of knowledge, within each level, the tasks have been found to measure the same construct independently of the type of skill employed (Anthony & Francis, 2005; McBridge-Chang, 1995; van Bon & van Leeuwe, 2003). To put in another way, the variety of measures employed appear to tap into a single cognitive construct (phonological awareness) which is manifested behaviorally in a wide variety of skills (Anthony & Francis, 2005).

The skills have been found to develop differently. Detection of similar or dissimilar words, syllables or sounds has been shown to develop before the ability to manipulate develops (Anthony & Francis, 2005). This is because detection does not require the use of explicit knowledge, and implicit phonological awareness is known to develop before the explicit kind (Cunningham & Carroll, 2015). Also, blending has been found to be accomplished before segmenting (Anthony & Francis, 2005; Goodrich & Lonigan, in press).

Consequently, although the tasks have been found to tap into the same construct, the researcher cannot just select one among many. An important factor of reliability of phonological awareness measures involves matching the task type (both level- and skill-wise) to the children's developmental level (Anthony & Francis, 2005). Moreover, the variation within tasks can have a large impact on the subjects' performance. Manipulation of the characteristics of the stimuli and their presentation has been shown to have a substantial effect on the difficulty level of the task (McBridge-Chang, 1995).

So far, we have defined L1 phonological awareness, briefly looked into its development and discussed the methodological issues involving its testing. The next two sections will discuss the most widely studied factors affecting L1 phonological awareness. We will begin by looking at factors arising from the subject's environment (*Section 3.2.*) and we will then end the discussion on explicit L1 phonological awareness with the examination of some individual differences that have been studied in relation to L1 phonological awareness (*Section 3.3.*)

3.2. Contextual factors and L1 phonological awareness

Research about L1 phonological awareness has been abundant, mostly due to its well-established relation to literacy acquisition: phonological awareness is a positive correlate and a strong predictor of reading achievement (e.g., Bradley & Bryant, 1983; Bryant, MacLean, Bradley, & Crossland, 1990; Goswami & Bryant, 1990; Stanovich, 1992; Wagner & Torgesen, 1987; Yopp, 1988). The relationship between reading and phonological awareness is considered to be causal as well as reciprocal (Serrano et al., 2003): literacy increases phonological awareness, but a certain level of phonological awareness is necessary for reading to be successful: the child has to understand that words are made up of individual sounds, and to know how letters map into sounds and the other way around (Geudens, 2006).

Out of the phonological awareness levels, phonemic awareness is most closely related to reading, whereas rime-onset awareness and syllable awareness have been found to correlate with reading skills to a smaller extent (van Bon & van Leeuwe, 2003). In fact, word, syllable and onset-rime awareness arise spontaneously through language development and do not require exposure to written texts (Cheung et al., 2001; Cisero & Royer, 1995; Foy & Mann, 2001). Phonemic awareness, on the other hand, develops only through literacy acquisition, or explicit instruction of other kind, as evidenced by studies comparing literate and illiterate adults matched for socioeconomic conditions (e.g., Morais et al., 1979). What this line of research shows is that illiterate adults perform comparably to literate adults in tasks involving implicit phonological awareness and rhyming, but are unable to perform phonemic awareness tasks (Tarone & Bigelow, 2005).

It should be noted that until now we have discussed the acquisition of L1 phonological awareness in languages employing alphabetic script, which is based on the idea that letters represent phonemes. Readers of languages that do not employ alphabetic scripts, such as Chinese, which employs a logographic script in which each character corresponds to a morpheme and a syllable, do not become phonemically aware in the same way as readers of alphabetic languages. In fact, they have been shown to have as low phonemic awareness skills as pre-literate children of alphabetic scripts (e.g., Cheung et al., 2001; McBride-Chang et al., 2004). However, Chinese children who have learnt the phonemic transcription system (*pinyin*) have a degree of phonemic awareness comparable to readers of alphabetic languages (Cheung et al., 2001; McBridge-Chang et al., 2004), which further corroborates the earlier discussed finding that phonemic awareness develops only through explicit instruction.[14] Furthermore, not all alphabetic scripts promote phonemic awareness to the same extent: readers of languages with more transparent orthographies (e.g., German, Italian) develop phonemic awareness faster than readers of languages with more opaque orthographies (e.g., English) (Anthony & Francis, 2005; Geudens, 2006).

Phonological awareness can be used to evaluate current literacy achievement but more often it is used to predict future literacy skills and to identify children who are likely to experience problems with reading. Poor readers have been shown to perform badly in phonological awareness tasks (Anthony & Francis, 2005). However, instruction has been shown to increase phonological awareness, which in turn is reflected on improved reading and spelling skills (National Institute of Child Health and Human Development, 2000), making the early evaluation of phonological awareness deficiencies important.

[14] Exposure to logographic script appears to primarily promote syllable awareness, as evidenced by syllable awareness being the best predictor of reading achievement in Chinese and the finding that Chinese EFL learners perform as well or better than English age-matched peers in tasks involving syllable awareness (McBride-Chang et al., 2004).

Nevertheless, if phonological awareness is to be employed to predict future literacy outcomes, the testing needs to be carried out before extensive literacy exposure has taken place. Hogan et al. (2005) discovered that whereas phonological awareness measured in kindergarten is a good predictor of reading at the second grade, phonological awareness measured at the second grade is not a predictor of 4^{th} grade literacy skills. In other words, the relationship between phonological awareness and reading changes over the course of literacy development. The authors suggest that once children begin reading, phonological awareness might not be a useful predictor anymore.

The changing nature of phonological awareness over the course of reading achievement is further evidenced by studies carried out with literate adults. Adults who have a high literacy level, such as university students, have been shown to perform poorly in tasks involving phonemic awareness (Puntel Xhafaj, 2011; Scarborough et al., 1998; Serrano et al., 2003). These findings present an apparent contradiction to the earlier discussed positive relation between reading and phonological awareness.

It has been suggested that phonological awareness skills remain fixed or decrease once the child has learned the grapheme-to-phoneme conversion rules (Defior et al., 2012). This can occur because decoding skills are not that useful once literacy has been acquired because there is no need to attend to and manipulate phones anymore, or because orthographic representations gain more ground and become more useful tools to think about language (Scarborough et al., 1998).

An alternative explanation was put forward by Lehtonen and Treiman (2007). They claim that adults' errors in phonemic tasks are not based on orthographic influence but can be tracked back to phonological factors, such as sonority. A 10-minute implicit training (phoneme counting) prior to the main task (phoneme segmentation), led the participants (university students) to improve their phonemic segmentation skills to a great extent. Thus, the authors conclude that adults do not have poor phonemic skills, but that adults are able to use flexible strategies depending on the task at hand, and that the strategy use can be modified with implicit training.

Although literacy instruction is the most studied factor in relation to phonological awareness development, other factors arising from the child's environment have also been examined. We will end this section by looking at three of these factors, namely home literacy, early spoken language experience and bilingualism.

Home literacy environment refers to the access and opportunity to reading practices at home. Shared reading experiences, parental beliefs and parents' own reading habits have been shown to be positively related to phonological awareness development (Foy & Mann, 2003), even after socioeconomic factors and parental education level have been equalized (Dickinson et al., 2004; Foy & Mann, 2003).

In relation to early spoken language experience, two issues have been found to be related to phonological awareness: the phonological structure of the L1 and bilingualism. As for the first issue, the native language of the child appears to play a certain role in decreasing or accelerating the development of certain phonological awareness levels. Whereas the order of development (large units → small units) is fixed, the rate at which syllable awareness, onset-rime awareness and phonemic awareness are attained has been shown to vary to some extent across languages.

Languages which give high saliency to syllables have been shown to promote syllable awareness in comparison to languages which are not syllable-timed. Studies comparing L1 Italian, French and Chinese children to L1 English children show that the former, speakers of languages with a salient syllable structure, outperformed the English children in syllable awareness tasks, an effect which was visible also in pre-literate children, ruling out the possible confounding effect of orthography (Bruck, Genesee, &

Caravolas, 1997; Cheung et al., 2001; Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; McBride-Chang et al., 2004).

Similarly, languages with complex consonant clusters seem to accelerate the development of onset-rime awareness. L1 Czech pre-literate children have been shown to outperform L1 English peers in tasks involving manipulation of onset clusters (Caravolas & Bruck, 1993), and L1 English pre-literate children have been shown to outperform L1 Chinese children in the same task (Cheung et al., 2001). This pattern corresponds to how the languages in question employ consonants clusters: Czech has the most complex consonant cluster structure, Chinese does not allow any clusters and English falls in the middle.

Finally, vowel harmony has been identified as another phonological factor affecting phonemic awareness. L1 Turkish children, speakers of a language which requires vowel harmony, have been found to perform better than L1 English children in phonemic awareness tasks involving phoneme deletion (Durgunoglu & Öney, 1999). Anthony and Francis (2005) suggest that the constant monitoring and matching of phonemes in roots, prefixes and suffixes heightens the awareness of phonemic units in speakers of languages employing vowel harmony.

We will end this section with discussing the role that exposure to multiple languages has on phonological awareness. It has been suggested that because bilingual children are exposed to two linguistic codes simultaneously, they may develop higher awareness of the phonological structure of the language than monolingual children (Verhoeven, 2007). Results on the matter are inconclusive. Bialystok et al. (2003) compared monolingual French children to French-English bilinguals from kindergarten to the second grade in several measures of phonological awareness. No differences were found between the groups, indicating that bilinguals did not have an advantage over monolinguals in phonological awareness tasks.

Although more research is required to examine whether bilingualism provides a direct advantage for phonological awareness development, an indirect advantage of the knowledge of more than one language on phonological awareness has been observed. Numerous studies have found L1 phonological awareness to be transferrable to the L2 (Chien et al., 2008; Cisero & Royer, 1995; Dickinson et al., 2004; Gottardo et al., 2006; Verhoeven, 2007). The transfer of phonological awareness skills has been shown to occur in both, immersion settings (Cisero & Royer, 1995; Dickinson et al., 2004, Verhoeven, 2007) and in foreign language settings (Chien et al., 2008; Puntel Xhafaj, 2011), as well as across languages differing in the script (Chien et al., 2008; Gottardo et al., 2006). The consequence of this is that enhancing L1 phonological awareness is beneficial for the development of L2 phonological awareness, and consequently to reading in both languages (Chien et al., 2008). However, it also appears that not all aspects of phonological awareness are automatically transferrable (Cisero & Royer, 1995). It would thus seem that phonological awareness consists of at least two parts: an abstract cognitive ability, which facilitates language processing across language boundaries, and language-specific skills, requiring language-specific exposure and training.

This section has provided a summary of contextual factors affecting phonological awareness: literacy development, writing systems, home environment and phonological characteristics of the L1. Additionally we saw how L1 phonological awareness can be transferred to the L2. In the remaining section, the relationship between learner factors and phonological awareness is discussed.

3.3. Learner factors and L1 phonological awareness

Although L1 phonological awareness research has focused on literacy acquisition, some individual differences have been shown to have an impact on individual's degree of phonological awareness after reading proficiency has been accounted for. In this section we will discuss some of them, namely: vocabulary size, cognitive resources, and speech perception and production.

The Lexical Restructuring Model (Metsälä & Walley, 1998) claims that the development of phonological awareness is due to the gradual restructuring of the lexicon. As children's vocabulary increases, their lexicon needs to be refined in order to accommodate the new items and to keep them separate from each other. The focus shifts from a holistic organization to a more segmented lexicon in which words with earlier age of acquisition, higher frequency, phonotactic probability and neighborhood density become stored in smaller and smaller bits. This leads children to be able to tell words apart based on suprasyllabic, syllabic, subsyllabic and phonemic levels (Goodrich & Lonigan, in press). Supporting the relationship between lexical restructuring and increased phonological awareness, vocabulary size has been shown to be strongly related to the child's degree of phonological awareness (e.g., Dickinson et al., 2004; Foy & Mann, 2001; Goodrich & Lonigan, in press). Because of this many phonological awareness studies include a measure of vocabulary size, so that its effect can be statistically removed (e.g., Goodman et al., 2010; Foy & Mann, 2003; Wood & Terrell, 1998).

Cognitive abilities such as non-verbal intelligence (Goodman et al., 2010; McBridge-Chang, 1995) and working memory capacity (McBride-Chang, 1995; Oakhill & Kyle, 2000) have been shown to be related to performance in phonological awareness tasks. McBride-Chang (1995) reasoned that performance in phonological awareness tasks depends on at least three cognitive components: non-verbal intelligence (the child must be able to think about and operate on the stimuli), working memory (the stimuli needs to be remembered for some time) and speech perception (the stimuli must be perceived correctly). Following this three-fold postulation, her results showed that the three cognitive factors were all positively related to phonological awareness, and that together they explained 60% of the variance of the performance in the phonological awareness tasks. However not all studies examining working memory and phonological awareness have found a relation between the two. Most likely this is because phonological awareness tasks differ greatly in the demands they put on working memory. For example, tasks involving comparison and discrimination require all the auditory stimuli to be held in memory long enough so that the given operations can be performed on them and thus put more demands on working memory than simpler tasks such as *phoneme adding*.

Finally, speech perception and production have been studied in relation to L1 phonological awareness with inconclusive results. Foy and Mann (2001) employed an auditory discrimination test with minimal pairs to measure accurate speech perception and a consonant articulation test to measure accurate articulation in order to determine whether a relation between the two and phonological awareness could be found. Their results failed to show a clear pattern between accurate perception and articulation, and phonological awareness. Instead what was observed was a complex interplay of relationships showing that different phonological areas were related to different aspects of speech perception and articulation, and that these relationships were mediated by vocabulary and reading measures.

Gottardo et al. (2006) examined Chinese-English bilinguals phoneme categorization (/b/-/p/), naming speed and phonological awareness (phonemic and onset-rime levels) in both languages. No relation was found between accurate perception or articulation and phonological awareness.

Mayo et al. (2003) on the contrary, found a relation between acoustic cue-weighting strategies and phonological awareness development. It has been suggested that children and adults differ in cue-weighting strategies for some contrasts, such as /s-ʃ/ and that, as children gain experience with the native language and become more phonemically aware as the result of the restructuring of the lexicon proposed by Metsälä and Walley (1998), their cue-weighting strategies move from more global to more analytical (Nittrouer, 1996). Mayo et al. (2003) conducted a longitudinal study with the aim of determining whether these changes in cue-weighting were related to phonological awareness development. Their findings showed that changes in phonemic awareness took place earlier than changes in cue-weighting and the authors concluded that early phonemic awareness might contribute to later changes in cue-weighting.

3.4. Implicit L1 phonological awareness

We will end the chapter by discussing the small number of studies examining the implicit aspects of L1 phonological awareness. As mentioned at the beginning of the chapter, phonological awareness in the L1 has been understood as explicit knowledge about the L1 phonology, manifested as the ability to manipulate and operate on sound segments of varying sizes. A large body of research has shown that this type of phonological awareness is positively related to reading development, and this is the primary context in which it has been studied. However, some researchers have suggested that L1 phonological awareness also consists of implicit knowledge (Cunningham & Carroll, 2015; Geudens, 2006; Gombert, 1992; Lance et al., 1997). This type of knowledge is not evident in conscious manipulation of segments but in sensitivity to acceptable and unacceptable L1 phonological patterns (Lance et al., 1997) and in accurate speech perception and production (Goodman et al., 2010).

Implicit phonological awareness develops naturally through language contact and does not require instruction, contrary to explicit phonological awareness. Very young infants have been shown to manifest implicit phonological awareness, or sensitivity, to the phonological patterns of their L1 in the suprasegmental and segmental domains. At birth, babies employ universal speech perception mechanisms not showing special preference for the L1 phonology. However, around 6-months of age, babies' speech perception changes from universal to language-specific, and the infants begin to show preference for the L1 speech patterns (Kuhl et al., 2008 and elsewhere). Sensitivity to L1 prosody arises from 8 months of age onwards and infants are able to identify L1 word boundaries, and to discriminate between strong and weak stress patterns successfully (Johnson & Jusczyk, 2001; Jusczyk, Houston, & Newsome, 1999). Sensitivity to L1 phonotactics arises soon after, and 9 month-olds have been shown to be sensitive to phonotactic violations of the L1 (Jusczyk, Friederici, Wessels, Svenkerud, & Jusczyk, 1993; Jusczyk, Luce, & Charles-Luce, 1994; Mattys & Jusczyk, 2001). By the end of their first year of life, infants' phonemic representations have been shown to be neurally committed to the L1 (Kuhl et al., 2008).

Lance et al. (1997) is one of the few studies examining the relation between explicit and implicit L1 phonological awareness. Explicit phonological awareness was measured with phoneme deletion, phoneme segmentation and phoneme blending. Implicit phonological awareness was measured with a nonsense-word-pair task. In this task, two nonwords, one conforming to English phonotactics and the other violating them, were aurally presented and the child had to decide which one of them presented the permissible sequences. A medium strong positive correlation between the two phonological awareness dimensions was found. Additionally, implicit phonological awareness was found to be related to reading skills to the same extent as explicit phonological awareness.

Other studies examining implicit L1 phonological awareness have been conducted indirectly under the term *prosodic awareness* (also *rhythmic awareness*, *stress awareness* or *stress sensitivity*). Whereas these studies do not frequently state as their aim measuring implicit L1 phonological awareness, the tasks they employ can be characterized as measuring implicit, rather than explicit, phonological awareness.

Within prosody, several sub-areas have been examined. Wood and Terrell (1998) studied awareness of speech rhythm with *rapid speech perception task* in which the children's accuracy of perceiving words presented in a speeded-up manner was measured. Whalley and Hansen (2006) included a measure of non-speech rhythm, namely *drumbeat discrimination task* in which the child was presented with two drum beats and was asked to decide whether they were the same or different.

The awareness of phrasal stress assignment has been examined with *rhythmic matching* (Wood & Terrell, 1998) and *DEEdee task* (Whalley & Hansen, 2006), among others. In the *rhythmic matching task*, the children were presented with a low-pass filtered utterance and two normal utterances conserving all auditory cues. The children's task was to decide which of the normal utterances corresponded to the low-pass filtered utterance. The *DEEdee task* employed a similar technique, but in this case the phonemic cues were erased by reiterating the syllable *dee*. In this task the children were auditorily presented with a familiar phrase (book or movie title) which was followed by two DEEdee phrases, one of which was a match in stress, rhythm and intonation of the original phrase.

Finally, word stress has been studied, among others, with *auditory stress discrimination* (Gutiérrez-Palma & Palma-Reyes, 2007), *stress awareness* (Defior et al., 2012), *a compound noun task* (Goodman et al., 2010; Whalley & Hansen, 2006) and *a mispronunciation task* (Goodman et al., 2010; Holliman et al., 2008). In the *auditory stress discrimination task* the children listened to nonword minimal pairs differing in stress assignment (*mípa-mipá*) and had to repeat the sequence by pressing the corresponding keys. Defior et al.'s (2012) task employed a similar nonword paradigm in which the children listened to three-syllable nonwords and were asked to indicate which syllables bore the stress. In the *compound noun task* employed in Goodman et al. (2010) and Whalley and Hansen (2006) the children listened to phrases which depending on the stress assignment could be interpreted as compound nouns (*ice-cream*) or as noun phrases (*ice*, *cream*) and had to match the auditory phrase into one of two pictures depicting the two possibilities. Finally, *the mispronunciation task* has been employed to examine the ability to recognize common disyllabic nouns with erroneous stress patterns (e.g., *sofa*, [ˈsoʊ.fə] pronounced as [səˈfɑ]). The child was presented with a drawing of a house in which they had to identify the objects 'mispronounced' by the researcher.

As can be seen from the above task descriptions, the tasks differ greatly from those discussed earlier measuring explicit phonological awareness. Findings from prosodic awareness studies employing implicit measures suggest that it is related to word and nonword reading (Defior et al., 2012; Gutiérrez-Palma & Palma-Reyes, 2007; Whalley & Hansen, 2006; Wood & Terrell, 1998), although after controlling for explicit phonological awareness, it only appears to account for a small (but unique) amount of variance in reading performance (Holliman et al., 2008).

Whether prosodic awareness, measured with the earlier discussed implicit tasks, and phonological awareness, measured with tasks involving explicit knowledge, are related requires more research. Defior et al. (2012) did not find a relation between the two in L1 Spanish ten year olds, whereas Holliman et al. (2008) examining L1 English 5-6 year olds found a strong positive correlation to phonemic and rime-onset awareness. The differences between the participants' ages, first languages or the tasks employed might account for the mixed findings, making more research on the area necessary.

<u>*Chapter summary:*</u>

In this chapter, studies involving phonological awareness in the L1 were reviewed. It was seen that L1 phonological awareness has been, with few exceptions, defined as an ability to manipulate sound units based on explicit knowledge about the L1 phonology. As such, L1 phonological awareness has been extensively studied in relation to literacy acquisition. It was stated that L1 phonological awareness is frequently divided into syllable awareness, onset-rime awareness and phonemic awareness following the sequence they develop in. We discussed some findings from studies examining illiterate adults and pre-literate children, and saw that whereas awareness of the larger units arises spontaneously through language experience, phonemic awareness does not develop without explicit instruction.

A large body of instruments has been employed to research L1 phonological awareness and we took a closer look to some of them, grouping them according to the skills they measure. Some of the contextual and learner-internal factors related to L1 phonological awareness were also reviewed. It was seen that apart from literacy instruction, the type of print (alphabetic/non-alphabetic) and sound-to-spelling correspondence (transparent/opaque) affects the speed at which phonological awareness *develops. It was also seen that the language environment, namely the phonological characteristics of the L1, and the access to more than one languages in childhood, may have an effect on the development of L1 phonological awareness. It was also seen that aspects of phonological awareness transfer across languages, having a positive impact on multilingual literacy development.*

Apart from the contextual factors, we saw that the child's vocabulary size, non-verbal intelligence, working memory capacity, and speech perception and production abilities have been found to be somewhat related to L1 phonological awareness. We ended the chapter by looking at the less examined side of L1 phonological awareness, namely, 'phonological sensitivity' or 'implicit phonological awareness'. We saw that the tasks employed in this area of interest differ greatly from those used to examine explicit phonological awareness, and concluded that more studies about implicit L1 phonological awareness are needed.

So far we have discussed the role of explicit and implicit memory and learning (Chapter 1), language awareness (Chapter 2) and finally, how phonological awareness in the first language has been studied within the explicit memory paradigm as part of language awareness. The aim of these chapters has been to provide the necessary theoretical and methodological background to how (L2) awareness and (L1) phonology have been studied in language acquisition so far. In the next chapter, we will examine awareness and phonology in second language acquisition and will discuss how L2 phonological awareness can be best defined taking into account the cognitive issues seen in Chapter 1 as well as the methodological issues and findings from studies involving language awareness and L1 phonological awareness.

4. Phonological awareness in L2

In this chapter we look into the concept of L2 phonological awareness, after having begun our review with more general topics related to cognition (*Ch. 1*), language awareness (*Ch. 2*) and L1 phonological awareness (*Ch. 3*). The present chapter is divided into three sections. In the first section, the nature of L2 phonological awareness is discussed taking into account the specific nature of L2 speech acquisition in comparison to L1 phonological awareness and L2 language awareness. The second section presents theoretical motifs for the main hypothesis of the dissertation, namely that L2 phonological awareness and L2 pronunciation are related.[15] Finally, the last section is centered on methodology and how L2 phonological awareness has been studied to the date, and what issues should be taken into account when designing instruments to examine it.

4.1. The nature of L2 phonological awareness

Whereas language awareness and L1 phonological awareness have been extensively studied, research about phonological awareness in adults learning a second language is extremely scarce. This is rather surprising, taking into account the number of studies about the effectiveness of pronunciation instruction and perceptual training, both of which are based on the general idea that raising the learner's awareness of the target

[15] The term L2 refers here to the strongest foreign language of the speaker after the L1, not necessarily acquired chronologically in the second place. Much of the discussion is likely to be applicable to multilingual speakers as well, but in the lack of empirical evidence, the discussion will focus on the L2 only. Finally, no distinction is made here between a foreign language (instructed setting) and a second language (immersion setting), both being referred to as L2.

language phonology through explicit instruction is beneficial for L2 perception and production.

The present section aims at providing an overview of the nature of L2 phonological awareness. In this section, it is argued that L2 phonological awareness consists of mainly proceduralized, non-verbalizable knowledge, and manifests itself in different phonological domains (suprasegmental, phonotactic and segmental). Apart from discussing the nature of L2 phonological awareness, we will also speculate how the knowledge underlying it has been acquired, and how it may be related to issues such as language experience and use, and learners' individual cognitive differences. The discussion in the present section is backed up by empirical research whenever possible, but given the lack of research in the area, the discussion of some aspects is speculative in nature.

A considerable terminological confusion exists in the field of phonological awareness (Piske, 2008), and several terms have been employed rather interchangeably to refer to L2 phonological awareness: *pronunciation awareness* (Kennedy, Blanchet, & Trofimovich, 2014), *phonological metacompetence* (Wrembel, 2006), *metaphonetic awareness* (Wrembel, 2011) and *phonetic/phonological sensitivity* (Piske, 2008). As with language awareness and L1 phonological awareness studies, researchers have mainly viewed L2 phonological awareness as consisting of explicit, verbalizable knowledge (Kennedy, 2012; Kennedy & Blanchet, 2014; Kennedy et al., 2014; Kennedy & Trofimovich, 2010; Moore, 1997; Ramírez Verdugo, 2006; Venkatagiri & Levis, 2007; Wrembel, 2011, 2013, 2015). In other words, the view on L2 phonological awareness has been that it is based on *metalinguistic data* rather than e*pilinguistic data*.

However, several authors have acknowledged that L2 phonological awareness also entails epilinguistic data, namely, intuitive knowledge, which cannot be verbalized

(Alves, 2009; R. Ellis, 2004; Mora, Rochdi, & Kivistö-de Souza, 2014; Piske, 2008). Thus, in the same manner as we saw that language awareness can be divided into metalinguistic and epilinguistic knowledge (cf. *Ch. 2*, p.26), and that L1 phonological awareness contains not only the ability to manipulate sounds but also the sensitivity to tell apart accurate and inaccurate L1 speech (cf. *Ch. 3.4*, p.82), L2 phonological awareness entails both declarative and proceduralized knowledge. The declarative aspects of L2 phonological awareness are evident in verbalizations and provision of pronunciation rules, whereas the proceduralized aspects of L2 phonological awareness are evident in accurate L2 speech performance and sensitivity to acceptable and inacceptable L2 speech patterns.

In the following section we discuss the proposal that L2 phonological awareness consists of mainly proceduralized knowledge, and that declarative knowledge is secondary and not necessarily manifested in all L2 users.[16]

4.1.1. L2 phonological awareness is mainly based on proceduralized knowledge

In this section, the idea that L2 phonological awareness consists of mainly non-verbalizable, proceduralized knowledge is developed. This argument is based on three issues which will be discussed in detail: the special nature of L2 speech learning, the proceduralized knowledge underlying L2 speech behavior, and the difficulty of developing explicit knowledge about L2 phonology.

[16] Although frequently used as synonyms, the term proceduralized rather than the more commonly used term *procedural* or *implicit*, will be employed here in order to highlight that the origin of such knowledge is likely to be in conscious noticing and not in implicit learning.

4.1.1.1. The special nature of L2 speech learning

The acquisition of L2 pronunciation is generally viewed as a more challenging task than the acquisition of L2 grammar or vocabulary. For example, Jilka (2009) states the following: “the phonetic subsystem is generally thought to be more difficult to acquire, as it is assumed to rely mostly on hard-wired biological processes that cannot easily be influenced by conscious learning efforts” (p.5). Obtaining an accurate or native-like L2 pronunciation is viewed as an arduous, if not impossible, task for many adult L2 learners. Consequently, a general agreement exists in the field of SLA that pronunciation enjoys a special status in L2 acquisition. At least three reasons for why this is the case can be thought of.

First, the adult L2 learner’s brain has already been committed to the configurations of the L1 phonological system, so that the accurate perception of L2 phonology requires the overriding of the pre-existing L1 neural connections (N.C. Ellis, 2002b). Second, contrary to morphosyntax and the lexicon, the acquisition of L2 speech is partially dependent on the speaker’s motoric skills. Accurate L2 production entails the reconfiguration of articulatory movements, which since early infancy have been wired for the pronunciation of the L1. Finally, native-like speech behavior implies a high degree of fluency: the speech is to be delivered effortlessly, without hesitations and pauses that interfere in the communication.

In other words, the operations the L2 learners need to carry out in order to approximate their pronunciation to a target-language model require a considerable effort from the part of the learner. This effort, taken into account the current views of the maturational constraints on implicit learning, most likely is possible only through explicit learning mechanisms (cf. *Ch.1.2.1*). Whereas L1 speech has been acquired incidentally and without conscious attention to the phonological form, the implicit learning mechanisms needed for the reconfiguration of the L1 phonetic categories and the re-training of the articulators are not likely to be available or optimal anymore in adult learning (Abrahamsson, 2012; N. C. Ellis, 2002b, 2005, 2008). Consequently, adult L2 learners need to **consciously** *notice the form* in the L2 phonology and consciously *notice the gap* between their interlanguage perception and production, and the target language.

To summarize what we have discussed this far, adult L2 learners do not start the L2 speech learning from a blank slate-state, but they have to override the perceptual and articulatory settings of the L1 to accommodate the L2. Because the implicit learning mechanisms used for the acquisition of the L1 speech are most likely no longer available at this stage, the successful re-organization requires that conscious noticing of the L2 phonological form has occurred at some prior point during the learner's learning trajectory. In other words, the acquisition mechanism for L2 phonological awareness is explicit in the sense of requiring conscious attention, following the widely held view in SLA that awareness at least to some degree is required at the initial stages of L2 learning (cf. *Ch.2.1*).

4.1.1.2. Cognitive processes behind L2 phonological awareness and L2 speech

The key issue to be developed in this section is what happens to the information about the L2 speech system once it has been consciously noticed: will it be stored as declarative knowledge or as proceduralized knowledge? How is it employed in L2 speech production and perception? If stored as declarative knowledge, the L2 learners will know that they possess it and will be able to verbalize it (to a certain extent) like any other encyclopedic knowledge (cf. *Ch.1.2*). Knowledge about phonology is likely to be organized like this only in the mind of speech researchers and professionals, and phonetics students.

In the case of the vast majority of L2 language learners who have not received phonetics/phonology instruction, phonological awareness may be represented as declarative knowledge in the initial stages (i.e., right at the moment of noticing). In some occasions it may be possible for the learner to pinpoint the exact moment when a given L2 pronunciation feature was noticed. For example, a learner of Zulu may be able to state that on his first day in South Africa he noticed the presence of clicks. Likewise, a beginner learner of French might report noticing the presence of uvular <r>s on the first day of the class.

However this is rarely the case. When dealing with speech, which unravels non-stop, in most cases, we do not know when the initial moment of noticing has occurred. In order to find that out, the L2 learners would need to constantly monitor themselves for noticing, a task which is impossible as one cannot monitor oneself for noticing something whose existence one is not aware of. Another possibility would be that a researcher would tail the L2 learner around the clock and constantly inquire whether something was noticed, because as was earlier discussed, noticing can occur at any moment depending on several learner and stimulus characteristics (cf. *Ch.2.2*). From this we can see that in most of the cases, pinpointing the moment of noticing of L2 phonological features is a rather unrealistic task. And if (most likely *when*) that initial conscious registration of the phonological feature of the L2 has escaped the L2 learner's and the L2 speech researcher's attention, the explicit bit of information is most likely to go through extensive unconscious cognitive processing until it becomes fully proceduralized and cannot be distinguished in behavior from implicit knowledge.

To put in another way, we propose that the development of L2 phonological awareness is based on *the weak interface position* reviewed in *Chapter 1* (cf. *Ch.1.2.2.*). Thus, consciousness in the form of noticing in the initial stage is required, but the consolidated memory representations are predominantly proceduralized, rather than declarative. In most cases the learner is not likely to retain the original explicit representation present at the moment of noticing. Instead it is most likely to be further processed through subsequent encounters with the same or similar stimulus leading to its gradual strengthening and most likely to noticing of additional aspects.

As a consequence, the learner becomes gradually aware of the differences between the L1 and the L2, a process which leads to subtle changes in the interphonology. Let us take as an example the acquisition of L2 vowels. Initially, the learners assimilate given vowels to the L1 as they have not yet noticed differences between the quality of the vowels in the two languages. However, after exposure to more and more exemplars and most likely following some kind of communication failure (*sixty*/*sixteen*, *pool/pull*), the learners may notice some distinctive features which lead to the approximation to more target-like pronunciation. However, there is no guarantee that the learner will notice all the relevant aspects (in the case of vowels, quality, quantity and tenseness) or that the final state of the representation is complete and accurate.

At this point, the knowledge about the L2 phonology (be it accurate or not) has become proceduralized so that it can be applied automatically and effortlessly in speech perception and production. It is no further available for conscious reflection and it cannot be verbalized. In this way it behaves like any other linguistic knowledge that has become proceduralized.

In what has been discussed so far, we have drawn from research on general cognitive processes and learning, and have applied it to the field of L2 phonological awareness. Empirically proving that L2 phonological awareness in phonetically-naïve learners is mostly based on proceduralized rather than declarative knowledge may be possible with adequate equipment and research methods focusing on human cognition, but such research is beyond the scope of the present research project. Instead, we will offer support to the presented claims by describing the processes underlying L2 production, perception and fluency development, and review some studies to support them.

When speaking in our L1 or our L2 we are rarely, if ever, conscious about the movements of our articulators. In the middle of a conversation about pets, an advanced L1 Spanish EFL learner will not stop to *think* that in order to make the pronunciation of the word *cat* sound more native-like, he needs to maintain his vocal folds close together for at least 30 ms before allowing them to vibrate after the release of the consonants, and to move his tongue to a more fronted position for the vowel so that the result will be something like [kʰætʰ] rather than [kɑt]. It is highly unlikely that if asked, the learner in question could *explain* the articulatory movements behind his production. However he will manifest at least some degree of L2 phonological awareness if his pronunciation reflects English, rather than Spanish, VOT timing and/or the quality of the vowel approximates more to the English /æ/ than to the native /ɑ/.

Empirical evidence shows that native and non-native speakers possess phonological awareness based on proceduralized knowledge about non-distinctive phonetic categories. Flege and Hammond (1982) examined whether L1 English speakers would show phonological sensitivity to two native allophonic features: VOT and final-syllable vowel lengthening. They employed a *delayed mimicry paradigm*, in which the participants read aloud L1 sentences pronounced with ‘a typical Spanish accent’. Their findings indicated that native English speakers showed awareness about English as well as Spanish phonologies through their ability to successfully mimic Spanish-accented English with short VOTs and equally long non-final and final syllables.

The same task was employed in Mora et al. (2014) with L1 Spanish EFL learners. The researchers compared the timing of the VOT in L1 reading, L2 reading and L2-accented L1 reading. As in the Flege and Hammond (1982) study, the L1 Spanish EFL learners were shown to be aware of the VOT differences between Spanish and English as evident by the larger VOTs in English-accented Spanish reading than in the normal Spanish reading. Additionally, this change in VOT was found to be large enough to be perceivable for native Spanish speakers rating the samples for their degree of foreign accent.

Whereas the aforementioned studies dealt with L1 and L2 phonological awareness through L1 tasks, Shoemaker (2014) examined L1 French majors of English in their L2 perception only. Her aim was to determine whether L2 speakers are sensitive to allophonic variation signalling word boundaries. Awareness was measured with a forced-choice identification task which presented potentially ambiguous phrases in which word boundaries were marked either by aspiration or glottal stops (‘Lou stops’ vs. ‘loose tops’). The global mean accuracy was over seventy percent, indicating that L2 speakers were aware of the underlying rules for word boundary signalling, although not to the same extent as native English speakers.

Moving to the realm of L2 speech perception, occasionally we may reconsider the acoustic characteristics of the speech we are presented to, mainly in situations in which comprehension is compromised (‘Did you say *feel* or *fill*?’ ‘Are you asking or stating?’).

Nevertheless, in our daily communication, we do not consciously *analyze* the phonetic make-up of the sounds and suprasegmental features we hear, or compare and classify them according to their articulatory, acoustic and rhythmic properties. However, we are *sensitive* to foreign and regional accents, we are able to detect divergent intonation patterns and we can identify, discriminate and categorize L2 speech material to a greater or lesser accuracy when presented with a task evaluating our perception.

Studies examining the perception of prosodic features of the L2 have indicated that whereas L2 learners are able to perceive prosodic differences, they experience difficulties when having to explain them. Moore (1997) taught intonation through drama instruction to beginner learners of Japanese. Comments in learning journals indicated that the participants had gained a large sensitivity to the L2 intonation evident in their ability to perceive differences in their own and native speakers' production, but they were having a hard time to elaborate explicitly what the differences were due to. One of her participants also pointed out the experience many L2 users can identify with: "In my head I can hear exactly how the tape sounded and try to repeat it. I don't know why it doesn't come out right sometimes, but I can hear the difference in my voice from what is in my head" (Moore, 1997, p.249).

In her study, Ramírez Verdugo (2006) examined the effect of intonation instruction on L1 Spanish EFL learners' degree of intonation awareness. She in fact, defined intonation awareness as "knowledge which has progressively become implicit through the learning process" (p. 142). She further argues that learning the language-specific features of foreign language intonation involves complex perceptive and productive processes which are beyond the common level of awareness. The observation of significant improvement in participants' L2 oral production from the pre- to the post-instruction test offered support to the usefulness of intonation training. This let the researcher to conclude that without explicit instruction the speakers' awareness about the L2 intonation would have remained low.

Finally, proceduralized knowledge is the main source behind automatic and fluent speech behavior (cf. *Ch. 1.2.1.*). Depending on our proficiency level in the L2, we may occasionally have to monitor our output consciously. This is especially true in the initial levels when fluent behavior has yet to be reached. We may notice that we have pronounced something incorrectly and will try to repair it. Most of the times, our monitoring efforts however center on the meaning and not the form. Nevertheless, as our proficiency level in the L2 increases, so does the extent to which our output becomes automatized (cf. *Ch. 1.1*), and the more automatized our speech production processes become, the less we employ conscious attention to them.

Evidence for the existence of proceduralized knowledge at the level of output comes from studies involving Schmidt's notion of *noticing the gap*. Noticing a mismatch between the interlanguage production and the target language is a clear indication of the speaker's awareness of the L2 phonology. As is the possible intent to repair a faulty pronunciation. Saito (2013a, 2015) examined Japanese EFL learners' ability to notice the gap in their English /ɹ/ production through the teacher's corrective feedback prompts. His results indicate that whereas the corrective feedback was able to bring the errors to the learners' consciousness effectively, as most of the recasts were noticed, the success of repairing the own faulty production after having noticed the mistake was very low (10.2%, Saito, 2015). This suggests, that the learners' awareness of the L2 is higher than their actual pronunciation abilities. The issue of self-perception (noticing the gap without the need to try to correct it) was examined in L1 Korean EFL learners by Baker and Trofimovich (2006). Participants were recorded performing a picture naming task. Their productions, together with native speaker productions, were presented back to them in a word identification task. The findings showed that accurate perception of own errors was related to accurate perception of other's speech.

To summarize, in the preceding paragraphs the idea that L2 phonological awareness is mainly based on proceduralized knowledge has been defended. It was argued that the underlying phonological knowledge in the mind of a non-phonetically trained L2 learner is mainly proceduralized, and most clearly evident in the ability to perceive and produce target-like speech. Moreover, it was claimed that most of the processes underlying our L2 perception and production are implicit in the sense that we perform them without conscious attention to them, and some examples from common speech situations together with empirical evidence were provided.

However, taking into account that implicit learning mechanisms in adults are thought to be inoperative (or at least not as successful as explicit), it was argued, following Schmidt, N. C. Ellis and R. Ellis, that the initial encounter with the L2 phonological stimulus needs to be conscious (*noticing*). This led to the hypothesis that rather than being implicit, the majority of the knowledge underlying L2 phonological awareness is proceduralized knowledge. From this view it follows that if a feature has not been *noticed*, L2 phonological awareness for that feature does not develop.

Schmidt's noticing hypothesis thus gives a partial explanation to why L2 learners rarely achieve a completely native-like L2 pronunciation: most adult L2 learners do not consciously notice all the features of the L2 phonology and/or perceive their own faulty output. This incomplete L2 phonological awareness is attested in numerous perception and production studies in which L2 learners have been found to identify, discriminate, categorize and produce L2 speech differently than native speakers. Consequently, according to this view, what separates target-like pronunciation from non-target-like is phonological awareness about the feature. Those pronunciation features which are not perceived or produced accurately simply have not yet been noticed. They might be noticed in the future, or the learner might never come to notice them. This difficulty of noticing L2 phonetic information is developed in the next section.

4.1.1.3. The difficulty of noticing L2 phonology

As was discussed in the previous sections, phonology is in nature less susceptible to conscious processing than other aspects of L2 acquisition such as grammar and vocabulary. We found reasons as to why this is so in the very nature of L2 perception, production and fluency behavior. It thus could be concluded that the very inherent nature of speech makes the conscious noticing of phonological features difficult for L2 learners. However, two other reasons contribute to this arduous task: the trade-offs between form and meaning, and the scarcity of explicit pronunciation teaching available for language learners.

VanPatten's (1996) postulation about the primacy of the meaning over form was already discussed in *Chapter 2* (cf. *Ch.2.2*,), but will be re-examined here from the point of view of phonology. The widely-held idea that language learners attend to meaning over form and to form only when attentional resources have not been depleted has important implications for the learning of L2 pronunciation.

On the one hand, it implies that only more proficient language learners, whose attentional resources are not needed anymore on deciphering the meaning, are able to focus on the formal characteristics of the L2. Once at this stage, attention on the form of L2 speech will need to compete for attention on the form of L2 grammar (e.g., morphemes) and the lexicon (e.g., orthography) as well as other aspects. On the other hand, this view suggests that once attention is freed for pronunciation, comprehensibility is preferred over accuracy. Finally, it implies that within pronunciation accuracy, meaning bearing units are attended to before non-contrastive units (phonemes vs. allophones, for example). In other words, the learner has to have a given proficiency level before phonological features of the L2 become salient enough for noticing to be possible, and once that level has been reached, the allocation of attention to pronunciation will compete with other formal domains. Taking this into account, it is not surprising that learners may never come to notice L2 phonological features.

The above-mentioned issues make the noticing of L2 phonological features challenging in normal daily communication situations. Noticing could be enhanced, to some extent, if those language learners who learn the L2 in a classroom setting would receive explicit instruction about the pronunciation of the L2. Nevertheless, it is widely acknowledged that this is not the case.

In the once to twice a week language lessons, primacy is given to grammar and the lexicon, and no time appears to be left for pronunciation teaching. When that time is encountered, pronunciation activities are crammed to a 5-10 minute time-frame and the activities are usually removed from the context preferring mechanic imitation after the teacher or a tape (Silveira, 2004). In a regular language class, pronunciation is most often addressed systematically only in relation to item-learning and when communication is endangered (‘Did you say *feel* or *fill*?). One of the reasons for the lack of pronunciation instruction in the foreign language classroom might be that teachers feel insecure about teaching phonetics and phonology because they themselves have not received instruction about the topic (Saito, 2012).

As a consequence, explicit knowledge about pronunciation is not developed. Learners who do develop explicit and verbalizable knowledge about L2 pronunciation are those learners who attend specific pronunciation or phonetics/phonology classes. These learners are a very small minority among second language learners.

In this section, further evidence was seen for the mainly proceduralized nature of L2 phonological awareness: phonology is not readily attended in the input due to supremacy of the meaning, and it is not frequently taught in classroom settings. These issues also explain why the acquisition of L2 phonological awareness, underlying target-like perception and production, is such a complex task.

So far, one aspect of the nature of L2 phonological awareness has been argued, namely the underlining cognitive representation and how it has come to exist. In the next section another aspect of L2 phonological awareness will be presented, and at the end of it, a definition to L2 phonological awareness will be provided.

4.1.2. L2 phonological awareness is gradient and domain-specific

In this section it is proposed that L2 phonological awareness is gradient and domain-specific in nature based on the existing views on language awareness and L2 phonological awareness, as well as empirical evidence. We end this section with the author's definition of L2 phonological awareness.

When language awareness was earlier discussed, we saw that Schmidt considers awareness to be gradient rather than dichotomous (cf. *Ch.2.1.*). This postulation has been supported by empirical evidence as researchers examining the explicit aspects of language awareness have found indications that it consists of different degrees of awareness as evident in the participants' verbalizations.

In the field of L2 phonological awareness, some researchers have also adopted the notion of *degrees* or *levels of* awareness. Wrembel (2013, 2015) examined explicit phonological awareness in multilinguals and coded the participants' responses as *noticing*, *understanding* or *metacognition* (self-reflection), which was understood as the highest level of L2 phonological awareness. Kennedy and Trofimovich (2010) study was the beginning to a series of investigations (Kennedy, 2012; Kennedy & Blanchet, 2014; Kennedy et al., 2014) in which foreign language learners' awareness about L2 prosodic features was analyzed as either *quantitative* (language as a set of items to be memorized) or as *qualitative* (language as a means to communicate). Although the authors did not directly compare the two types of awareness in terms of profoundness, the idea is present that different types of phonological awareness exist.

Following the dominant view in language awareness research and in some of the L2 phonological awareness studies, we also propose that L2 phonological awareness is better viewed as a continuum rather than a dichotomy, ranging from lower-level superficial awareness to more profound understanding of the L2 phonological system. Viewing L2 phonological awareness like a continuum seems especially adequate when we think of how language learners differ in their L2 phonological awareness: some are only able to perceive an acoustic difference between two phones whereas others are able to critically compare them with L1 phones or even verbalize some distributional rules. It was also previously discussed, that the development of L2 phonological awareness about a given feature does not necessarily mean that all of its aspects are noticed. For example, many EFL learners are able to discern between /i/ and /ɪ/ but initially only notice the length distinction between the two, perhaps never coming to notice the more relevant spectral distinction. Thus, as there are degrees of L2 pronunciation, there are likely to be degrees of L2 phonological awareness.

Although empirically justified, viewing L2 phonological awareness like this leads to the earlier discussed problems of distinguishing between the different levels of awareness, and between no-awareness and low-awareness (cf. *Ch.2.1.*). This is especially true if we consider L2 phonological awareness to be based on mainly proceduralized knowledge. In the lack of empirical evidence on how the boundaries between the degrees could be reliably set, we propose that until such research comes to exist, researchers state which level(s) is their object of study and how the levels are operationalized and defined in their research.

We also propose that L2 phonological awareness is domain-specific so that it consists of knowledge at the segmental, suprasegmental and phonotactic domains of the L2.[17] Although the implicit understanding in the field exists that L2 phonological awareness can be measured at different domains (as evident by studies focusing on subphonemic, phonemic and suprasegmental features), to the best of my knowledge no researcher other than Alves (2009) has suggested the existence of domains. He divided L2 phonological awareness into syllabic-, rime-, phonemic- and subphonemic awareness. With the exclusion of subphonemic awareness, the rest follow the traditional view on L1 phonological awareness as seen in the previous chapter. Alves' definition of L2 phonological awareness entails, apart from the ability to reflect on the L2 phonological structure, also the ability to manipulate it, and when L2 phonological awareness is defined like this, it seems justifiable to employ the same levels as in L1 phonological awareness research. However, we follow the position that defining phonological awareness as the ability to manipulate and segment speech is not cognitively and contextually relevant in

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[17] Phonotactics could be viewed to form part of the suprasegmentals as well, as they extend over more than one segment, but since the principles behind phonotactic knowledge and the size of the unit (syllables vs. words, phrases and utterances) are different to prosodic features *per se*, they will be treated as different domains. *Prosody* and s*uprasegmentals* will be treated as synonyms.

L2 adult speech acquisition (Mora et al., 2014). For this reason, the classification proposed here follows the rather traditional view of language as segments, combinations of segments and combination of phrases.

Segmental awareness according to this view corresponds to L2 phonological awareness at the segmental domain including knowledge about contrastive units (phonemes) as well as non-contrastive units (allophones). It can be manifested through accurate perception and production of L2 phones and allophones, as well as through sensitivity to their distributional patterns. It is also evident in the language user's ability to spot a difference between the L1 and L2 phonologies, as the Flege and Hammond (1982) and Mora et al. (2014) studies showed.[18] In the same line, L2 segmental awareness is also evident in the language user's ability to identify a foreign or incorrect pronunciation of a segment in own or others' speech. Segmental awareness can of course, also be manifested explicitly, through the ability to verbalize information about the L2 at the segmental level, but the aforementioned limitations on the presence of such explicit knowledge in phonetically naïve language learners have to be kept in mind.

Phonotactic awareness can be defined as L2 phonological knowledge at the phonotactic domain. As such, it includes knowledge about the L2 syllable structure and the permissible and impermissible sound combinations as well as knowledge about their distribution. Phonotactic awareness can be manifested in the accurate perception and production of L2 syllabic structures (syllables, onsets and rimes), for example those involving consonant clusters, as well as in sensitivity to phonotactic violations. As with segmental awareness, some aspects of phonotactic awareness may be stored as declarative

[18] It should be stated that L2 phonological awareness also indirectly includes L1 phonological awareness as, only by being aware of the L1 phonology, can differences and comparisons between the two be made.

knowledge in some individuals, but the majority of it is likely to be based on proceduralized, non-verbalizable knowledge.

Finally, ***prosodic awareness*** entails knowledge about the L2 at the suprasegmental domain. Awareness about lexical stress, phrasal stress, intonation, rhythm and tones belong to this domain. L2 prosodic awareness can be witnessed in the accurate perception and production of L2 prosodic features, such as the ability to perceive and interpret differences in the colocation of phrasal stress, for example. L2 prosodic awareness would also be evident in the language learner’s ability to identify incorrect L2 prosodic patterns, either own or others’. As with the two other domains, some L2 learners may show explicit L2 prosodic awareness to varying degrees, but most of the knowledge underlying L2 prosodic awareness is likely to be proceduralized.

Following the earlier discussion about the nature of L2 phonological awareness, in the present study, ***L2 phonological awareness*** **is understood as knowledge about the target language phonological system at the segmental, prosodic and phonotactic domains, most of which is not available for conscious reflection or verbalization.** Consequently, we extend van Lier’s (1998) view about language awareness for L2 phonological awareness:

> Language awareness comprises both these levels of linguistic knowledge [epilinguistic and metalinguistic], which relate to each other in intricate and dynamic ways…if metalinguistic knowledge is the tip of a solid language awareness iceberg, it will play a substantial role in language learning. However if it is a tip without such an iceberg underneath, it will be insignificant and will melt away without leaving a trace. (p.135,137)

L2 phonological awareness consists mostly of proceduralized nonverbalizable knowledge, which forms the solid base of this imaginary iceberg. This type of knowledge is encountered in all L2 learners to varying extents. The tip of the iceberg is made of explicit, verbalizable, L2 phonological awareness, and it is not necessarily present in all language learners: some features may be organized as declarative facts in the L2 learner's mind, but extensive knowledge of such type is likely to be encountered only in individuals who have undergone explicit phonetics and phonology training. The size of the base of the iceberg as well as the height of the top will vary from individual to individual: speakers possess varying degrees of phonological awareness based on proceduralized and declarative knowledge in their L1 and L2. This perception of L2 phonological awareness is depicted in Figure 4.1.

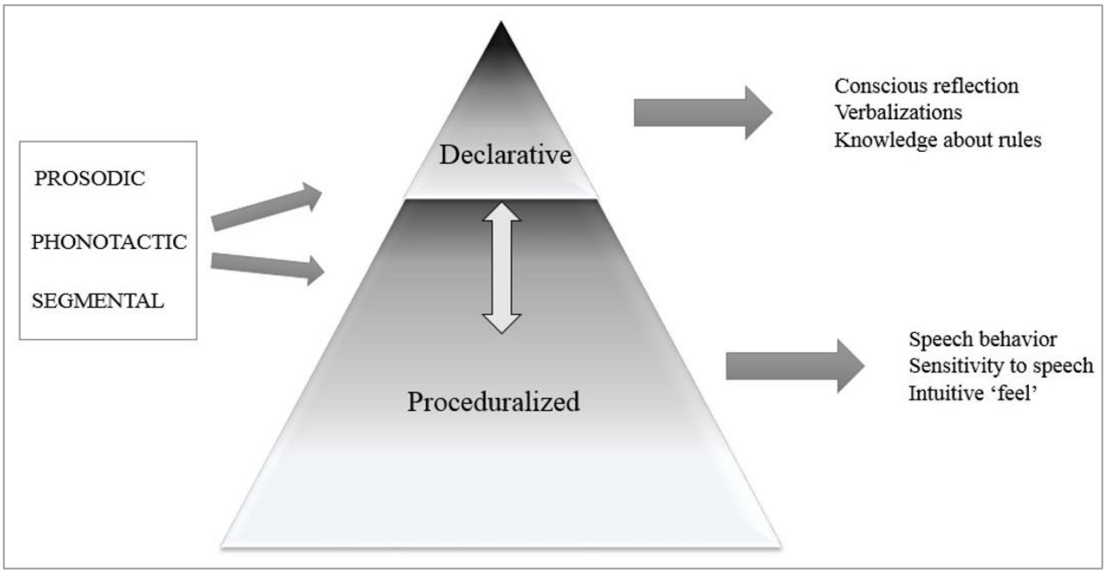

Figure 4.1. L2 Phonological awareness

Let us take a moment to consider what we know about the relation between L2 phonological awareness and other variables.

4.1.3. Potential factors affecting the development of L2 phonological awareness

Individuals have been shown to differ in their amount of language awareness and Schmidt (2010, and elsewhere) put forward the common observation that individuals vary in their ability to notice: some notice more and others notice less. This is also expected to be true for L2 phonological awareness: individuals will vary in the amount (quantity) and depth (quality) of their L2 phonological awareness. As the research in L2 phonological awareness is still in its infancy, we can only hypothesize on the possible reasons to these individual differences.

As L2 phonological awareness, by definition, is language-specific, it is expected to develop through L2 experience and use. Piske (2008) states that "the sensitivity to and awareness of both native and non-native speech sounds develop on the basis of the linguistic environment or input an individual is exposed to" (p.159). From this it follows that language learners who use the L2 more and have been in contact with it longer will show higher degrees of L2 phonological awareness than those who have less L2 experience. This scenario is still to be empirically proven, although some studies have addressed the issue.

Two studies have examined the effect of language experience on the degree of L2 phonological awareness. Shoemaker (2014) found a relation between the proceduralized aspects of L2 phonological awareness at the segmental level (allophonic variation) and the participants' language learning experience: 3rd year English majors performed better than 1st year English majors, suggesting that the amount of language exposure had an effect on the development of L2 phonological awareness. Venkatagiri and Levis (2007) investigated explicit L2 phonological awareness through similar manipulations tests as employed in L1 phonological awareness research. No relation was found between the participants' L2 phonological awareness and the number of years of L2 study or number of months living in the L2 country. Thus, the relationship between language experience and L2 phonological awareness requires further research.

Examining the same language learners, Kennedy and Trofimovich (2010) and Kennedy (2012) found no clear relation between the amount of L2 use and explicit L2 phonological awareness. Kennedy and Trofimovich (2010) employed self-reported measures of L2 use in the four skills out of which only the amount of L2 listening was found to be related to explicit (qualitative) L2 phonological awareness. This on the one hand suggests, that the amount of L2 use is beneficial for L2 phonological awareness, but on the other hand it raises questions as to why the other measures of L2 use were not found to be related to L2 phonological awareness. In re-examining the participants of this study, Kennedy (2012) looked into the participants' reported daily use of English in different social situations as registered through a language activity log. No relation was found between this more fine-grained measure of L2 use and explicit L2 phonological awareness. The findings from these studies indicate that more research is required to determine the relationship between L2 phonological awareness and language use.

Related to the issue of language experience and use is the role of L2 vocabulary knowledge and general L2 proficiency. As phonology is transmitted through words, it could be expected that learners with higher L2 vocabulary would have developed higher degrees of L2 phonological awareness than learners with poorer L2 vocabulary knowledge. The relation between L2 vocabulary knowledge and L2 phonological awareness has not been studied to the date.

Whether some individual differences, such as working memory, phonological short-term memory, attention control, non-verbal intelligence and aptitude, are related to L2 phonological awareness is not known. Venkatagiri and Levis (2007) are to the best of my knowledge the only researchers who included a measure for one of these, phonological short term memory. Phonological short-term memory was examined with a nonword repetition task and a picture-nonword association task, and these were found to be related to some of the L2 phonological awareness tasks (involving manipulation of L2 phones) but not to others. As studies examining these factors in relation to language awareness have also reached inconclusive results, not much can be hypothesized of their relation to L2 phonological awareness. It is clear that the field of individual differences and L2 phonological awareness offers much to research.

One could also ask whether L2 phonological awareness is related to language awareness in general or to L1 phonological awareness as measured in L1 literacy acquisition. No studies have been carried to the date to investigate this. It seems more plausible to imagine a relationship between language awareness (more specifically, grammatical awareness) and L2 phonological awareness than between L1 phonological awareness and L2 phonological awareness. Although the domains are different, language awareness and L2 phonological awareness operate with the same mechanisms of conscious noticing and attention on L2 input.

On the other hand, L1 phonological awareness, understood as the ability to manipulate sounds, may not be related to L2 phonological awareness. First, because they tap into very different skills, and the former is strongly related to exposure to written language whereas the latter is not. Second, because as was discussed in the previous chapter, the spontaneous ability to manipulate L1 sounds seems to decline after a certain degree of literacy has been attained, and thus is no longer relevant in the adult L2 learner population. However, implicit L1 phonological awareness, namely, the sensitivity to L1 phonology, may be found to be related to L2 phonological awareness. It could be that individuals who are more sensitive to their L1 phonology are also more sensitive to their L2 phonology. This is a matter for further studies.

L2 phonological awareness could also be found to be related to the learning environment and to the learner’s languages in question. Since phonological awareness is language specific, some differences might be observed depending on the language-pairing. For example, it might be easier to acquire L2 phonological awareness for an L2 which is (psycho)typologically more related to the L1. The opposite could also happen, it might be more difficult to develop L2 phonological awareness for a language which is perceived to be similar to the L1. Future research should look into this matter. It would also be interesting to see how knowledge about more than one foreign language shapes L2 phonological awareness.

As with the earlier factors discussed, due to the severe lack of research, no studies comparing L2 phonological awareness in immersion vs. instructed contexts exist. L2 phonological awareness might develop differently in the two contexts, the immersion setting offering usually more input and enabling higher amount of L2 use, and the instructed setting teaching a more analytical approach to the language, which even if not related to pronunciation, might still lead to cognitive changes which would not be observed in the absence of instruction.

A final consideration about L2 phonological awareness is whether it is a stable, unchanging trait or whether it can be increased. As discussed earlier, L2 phonological awareness is likely to be related to language experience and use. Thus, increasing L2 phonological awareness as a function of language experience and use should be possible, although not empirically proved yet. On the other hand, studies examining the role of explicit instruction on L2 pronunciation provide indirect evidence that increasing L2 phonological awareness with explicit phonetics/phonology instruction may be possible.

The general idea behind explicit phonetics/phonology instruction, independently of whether it is carried out in a language lab (perceptual training) or in a classroom setting (pronunciation instruction), is that it increases learners' awareness by making the target items more easily noticeable. This increased awareness is expected to be reflected in improved L2 perception and/or production. In this sense, although these studies do not directly measure L2 phonological awareness, they do employ consciousness-raising activities. Consequently, if L2 speech performance is found to have increased as a result of the treatment, L2 phonological awareness can be inferred to have increased as well.

A large amount of studies about perceptual training indicate that perceptual training can improve language learners' L2 perception and production at the segmental and suprasegmental domains (e.g., Aliaga-García & Mora, 2009; Bradlow, Akahane-Yamada, Pisoni, & Tohkura, 1999; Cebrian & Carlet 2014; Iverson, Hazan, & Bannister, 2005; Lively, Pisoni, Yamada, Tohkura, & Yamada, 1994; Rato, 2013; Wang, Spence, Jongman, & Sereno, 1999). This suggests that a very explicit and usually relatively short-term training can increase L2 phonological awareness.

Similar findings on the improvement of L2 perception and production have been observed in L2 pronunciation instruction studies at the segmental (Alves & Magro, 2011; Cenoz & García Lecumberri, 1999; Couper, 2011; Silveira, 2004; Saito, 2013a, 2013b, 2015) and suprasegmental domains (Kennedy & Blanchet, 2014; Kennedy et al., 2014; Ramírez Verdugo, 2006; Saito & Wu, 2014).

These research areas offer indirect evidence for the increasing of L2 phonological awareness through explicit instruction. Nevertheless, the aim of these studies has not been to examine L2 phonological awareness *per se*, which is why a certain caution needs to be employed when interpreting the results.

So far we have discussed the nature of L2 phonological awareness, basing the discussion on empirical evidence whenever possible, but also hypothesizing on the possible outcomes as very few studies about L2 phonological awareness exist. In the next section we will discuss the relationship between L2 phonological awareness and L2 pronunciation.

4.2. Phonological awareness and pronunciation in L2

One of the main research aims of the present study is to determine whether a relation can be observed between the degree of L2 phonological awareness and L2 pronunciation. Findings from previous studies suggest that this might be the case, although no study to the date has examined the relationship between the proceduralized, non-verbalizable aspects of L2 phonological awareness and L2 pronunciation.

An indication suggesting that a relation between the two might exist is that several studies in the field of language awareness have found a positive relation between language awareness and the language learner's general language proficiency (Bergsleithner & Borges Mota, 2013; Calderón, 2013; Renou, 2001; Roehr, 2008). Bergsleithner and Borges Mota (2013) examined the relation between the accuracy of the oral production and noticing of the target structures, and found a strong positive relation between the two. Calderón (2013) found that the participants with higher L2 proficiency also showed higher degree of language awareness about the target structure (past perfect subjunctive). Renou (2001) and Roehr (2008) looked whether metalinguistic knowledge and general language proficiency (written) were related in advanced L2 learners. Both studies found strong positive correlations between the two.

A strong reason to believe that L2 pronunciation should be related to L2 phonological awareness is the reasoning behind pronunciation instruction practices and research. As was already discussed in the chapter, a large body of research suggests that the employment of consciousness-raising activities is beneficial for the development of L2 production of specific target features (Alves & Magro, 2011; Couper, 2011; Ramírez Verdugo, 2006; Saito, 2013a, 2013b, 2015) as well as L2 pronunciation as whole (Kennedy et al., 2014; Saito, 2012; Wrembel, 2005). By extension, we could thus assume that an increase in L2 pronunciation would also imply an increase in L2 phonological awareness, although it should be yet again noted that none of the aforementioned studies included a direct measure for L2 phonological awareness.

Finally, evidence from studies investigating L2 phonological awareness in the absence of specific phonetic instruction suggests that L2 phonological awareness may be related to accuracy of L2 speech production. Two studies employing implicit measures of L2 phonological awareness have found it to be positively related to accuracy in the production of a target feature. Mora et al. (2014) found a positive relation between participants' accurate production of L2 VOT and their ability to mimic L2 accented L1. Baker and Trofimovich (2006) found a strong relation between self-perception (noticing the gap) and accurate production of L2 vowels.

Findings from studies examining the explicit aspects of L2 phonological awareness also provide evidence that L2 phonological awareness may be related to L2 pronunciation. Kennedy and Trofimovich (2010) and Kennedy et al. (2014) found a relation between the depth of explicit L2 phonological awareness (qualitative) and L2 pronunciation. Venkatagiri and Levis (2007) found a relation between participants' ability to manipulate segments accurately and L2 comprehensibility.

Consequently, strong indications exist that a relationship between L2 phonological awareness and L2 pronunciation is possible. Should such relation be found, it would parallel the one found for language awareness and general L2 proficiency. Although some L2 phonological awareness studies have addressed the issue, the findings have concentrated on the explicit manifestations of L2 phonological awareness. The two studies focusing on the more implicit side only measured the accurate production of the target features, not L2 pronunciation as a whole. Determining whether such a relationship exists seems highly important because if L2 phonological awareness is found to be related to L2 pronunciation, it would be the first step in determining the causality of the relation. Namely, whether in fact L2 phonological awareness is the reason behind more native-like or improved L2 pronunciation or whether the relation is reciprocal: L2 phonological awareness increases L2 pronunciation. In other words, learners with more accurate L2 pronunciation might engage more in noticing as the attained proficiency enables the relocation of attention to less salient features. Independently of the direction of the relation, if a positive relation between the two was to be found, this could have interesting theoretical and practical implications.

We have discussed the findings from many studies carried out on L2 phonological awareness, but we have not discussed the type of instruments they have employed. This is the topic for the next section.

4.3. Accessing L2 phonological awareness

The objective of this final section is to discuss methodological issues involving L2 phonological awareness. We will begin by taking a look at the type of instruments previous studies have employed and then we will discuss some factors that need to be taken into account in order to obtain reliable measures of L2 phonological awareness.

Table 4.1 presents an overview of the instruments used in previous studies on L2 phonological awareness. A quick look at Table 4.1 shows that measures relying on the participant's oral production were employed in all but three of the studies (Baker & Trofimovich, 2006; Ramírez Verdugo, 2006; Shoemaker, 2014). Most of the studies have also defined L2 phonological awareness as mostly or solely as consisting of explicit knowledge. Let us discuss the main task types and what possible problems they suppose if the target is to obtain a comprehensive account of L2 phonological awareness.

Study	Definition of phonological awareness	Measure of L2 phonological awareness			
		Implicit		Explicit	
		Perception	Production	Reporting	Other
Flege & Hammond (1982)	implicit	-	Delayed mimicry	-	-
Zuengler (1988)	implicit	-	Delayed mimicry	Stimulated recall & delayed recall	-
Mora et al. (2014)	implicit	-	Delayed mimicry	-	-
Shoemaker (2014)	implicit	Forced-choice ID	-	-	-
Baker & Trofimovich (2006)	implicit	self-perception	-	-	-
Wrembel (2011)	mainly explicit	-	self-repairs	Stimulated recall	-
Wrembel (2013)	mainly explicit	-	self-repairs	Stimulated recall	-
Wrembel (2015)	mainly explicit	-	self-repairs	Stimulated recall	-
Venkatagiri & Levis (2007)	explicit	-	nonword reading	-	13 Phoneme manipulation tasks
Ramírez Verdugo (2006)	explicit	-	-	-	Visual and auditory pitch analysis and comparison
Kennedy & Trofimovich (2010) & Kennedy (2012)	explicit	-	-	Journal entries	-
Kennedy & Blanchet (2014) & Kennedy et al. (2014)	explicit	-	-	Journal entries	-
Moore (1997)	explicit	-	-	Journal entries	-

Table 4.1. Previous studies about L2 phonological awareness.

In the explicit domain, the favored method to measure L2 phonological awareness has been to rely on the participants' ability to tell (either orally or through writing) what is it that they are aware of. Verbal protocols were employed by Wrembel (2013, 2015) to examine her participants' awareness of L3 phonology acquisition and their own pronunciation. In order to avoid memory constraints affecting the participants' recalling, she employed stimulated verbal recalls in which the participants were played back their own pronunciation (passage reading) in small bits and asked to comment on it immediately afterwards. The comments about the L3 phonology followed a clear pattern: most comments were made at the lowest level (*noticing*), then at the level of *understanding* of rules and only a small amount of the comments involved the highest level of TL phonological awareness, *metacognition*. These findings offer support to the earlier discussed gradient nature of L2 phonological awareness.

Asking language learners to keep a language learning journal is a traditional method to examine language awareness (Schmidt & Frota, 1986). In a series of studies, Kennedy and colleagues (Kennedy, 2012; Kennedy & Blanchet, 2014; Kennedy et al., 2014; Kennedy & Trofimovich, 2010) examined the development of language learners' awareness about the suprasegmental features of the L2 over a 4-month pronunciation instruction course focusing on prosody. Learners were asked to note their thoughts about their learning process and what they were learning in and out of the class. The general results of these studies showed a positive relation between the type of language awareness (qualitative/quantitative) and performance in the post-test.

These measures based on reporting have been successfully employed in the context of explicit L2 phonological awareness. However, by definition, measures based on verbalization are not suitable for measuring proceduralized knowledge. Thus, if the aim is to obtain a comprehensive view of the language learner's L2 phonological awareness, other measures should be favored or used on the side of these instruments.

The explicit aspect of L2 phonological awareness was also examined by Venkatagiri and Levis (2007). A large battery of tests measuring the participants' (L2 adult ESL learners) ability to blend, delete, segment, count, rhyme and alliterate L2 sounds was used. In other words, the same tasks that previously (and successfully) have been employed with children in their L1 in relation to literacy development. Employing these tasks in adult L2 users does not seem cognitively adequate. First, adults are not required to employ these skills anymore once literacy has been reached, thus it makes little theoretical sense to take these skills in adults as a reflection of their phonological awareness. Second, these tasks have been developed to test children. The cognitive processing in children and adults can hardly be compared, which is why appropriate tasks for each age group should be employed.

The studies examining the implicit or proceduralized aspects of L2 phonological awareness have also mainly employed measures involving production. The delayed mimicry paradigm, already discussed earlier in the chapter, was employed in three studies (Flege & Hammond, 1982; Mora et al., 2014, Zuengler, 1988). In general, the results from these studies are encouraging for employing mimicry as a measure of L2 phonological awareness. However, the problem with this instrument, if used in isolation, is that it puts large demands on the participants' articulation abilities. In other words, deficits in articulation may be confused for deficits in L2 phonological awareness. The same problem is encountered with the *nonword reading task* employed in Venkatagiri and Levis (2007).

The studies by Wrembel (2011, 2013, 2015) discussed earlier also included a measure for the proceduralized aspect of TL phonological awareness. The participants were asked to correct their own pronunciation mistakes which they were able to notice (self-repair). The results showed varying levels of self-repair and varying degrees in the successfulness of the repairs. This measure seems better able to capture language learner's proceduralized aspects of L2 phonological awareness by tapping into the phenomenon of *noticing the gap*. However, as the results showed, participants were not very successful in repairing their faulty pronunciations, indicating that this measure is also confounded with articulatory issues. *Noticing the gap* was also investigated by Baker and Trofimovich (2006), but only at the level of perception. As this measure did not require the participants to explicitly verbalize their knowledge or to manifest it through pronouncing the L2, it is deemed more suitable than the measures discussed earlier. Another study examining L2 phonological awareness through perception only is Shoemaker (2014). Forced choice identification task in which participants were presented with potentially ambiguous L2 phrases was used. The results showed that the task was able to measure L2 phonological awareness about allophonic variation reliably.

As can be seen from the review above, only a few studies have employed instruments based on perception. This is unfortunate as by definition, proceduralized L2 phonological awareness cannot be measured through verbalization, and studies relying on L2 production as a measure of L2 phonological awareness risk confounding articulation problems with gaps in awareness. For this reason, we propose, agreeing with Robinson (2003) that when the aim is to obtain a comprehensive understanding of the learner's L2 phonological awareness, tasks relying on more implicit measures, such as perception, preference ratings, error spotting, rather than production, should be employed. In examining the explicit aspects of L2 phonological awareness, verbalization tasks and production tasks can offer interesting additional data.

Another issue to take into account when measuring L2 phonological awareness is the creation of domain-specific tasks. L2 phonological awareness comprises knowledge about the phonological system as a whole, and it seems very unlikely that one task would be able to capture awareness about the prosodic, phonotactic and segmental domains simultaneously (Mora et al., 2014). For this reason, it seems appropriate to create a battery of domain-specific tasks which focus on a given domain of L2 phonological awareness.

A crucial aspect in creating domain-specific tasks is that they are representative of the domain as whole. Whereas examining language learners' awareness about a given feature in the L2 (e.g., VOT) is necessary and relevant, it does not necessarily reveal much about the overall L2 phonological awareness. For this reason, it is important to test features within each domain that are representative of the domain and can be expected to reflect knowledge about the given domain reliably.

With this aim, it is necessary to conduct a careful analysis of the learner's languages and to determine in which areas they differ. Testing L1 Catalan learners about L2 Italian vowels, for example, would not make much sense as the vowel inventories of the languages are very similar. L2 phonological awareness can only be reliably observed in areas which differ between the L1 and the L2. Otherwise, the risk is to confound the findings with the speaker's L1 phonological awareness or general language aptitude.

Perhaps most importantly, it is crucial to take into account the specific characteristics of the language learners who are to be tested. The tests should be designed to take into account how adult L2 learners differ cognitively, linguistically and behaviorally from children and from monolingual adults. Consequently, tasks employed with children or with monolingual adults are unlikely to be suitable for adult L2 learners. Adults and children differ in their working memory capacity, phonological short-term capacity, analytical thinking, learning strategies, non-verbal intelligence and completeness of phonological representations.

Finally, it is necessary to carry out testing with the instruments so that their reliability can be established. This can be done by piloting the tasks with the population of interest, to observe problems arising from the testing and to carry out reliability statistics to evaluate the internal consistency of the measures.

In sum, in this section instruments employed in previous L2 phonological awareness research were discussed from the point of view of their adequacy of measuring the construct of L2 phonological awareness as defined in the present study. We saw that very few studies employed instruments suitable to examine L2 phonological awareness based on proceduralized knowledge. The section was concluded with some suggestions about what should be taken into account when developing instruments for L2 phonological awareness.

<u>*Chapter summary:*</u>

In this chapter we have discussed in depth L2 phonological awareness by tying together research on cognition (Ch.1), language awareness (Ch.2), L1 phonological awareness (Ch.3) and previous studies on L2 phonological awareness. Based on extensive evidence on L2 speech processing, it was argued that contrary to the dominant view, L2 phonological awareness is likely to consist of mainly proceduralized knowledge. The weak interface position was adopted. Consequently, it was suggested that L2 phonological awareness is developed through initial conscious noticing, and then through subsequent processing the underlying memory representations became proceduralized. Pinpointing the exact moment of noticing of L2 phonology is a complicated task and it was suggested that noticing leads to subtle gradual changes in the interphonology so that L2 phonological awareness can be inaccurate and incomplete, as often occurs. It was seen that the inherently unconscious nature of speech is not remedied by external factors. The primacy of meaning over form leaves little room for the noticing of L2 phonology to occur. Most importantly, FL classrooms do not encourage the development of L2 phonological awareness.

L2 phonological awareness based on proceduralized knowledge is applied effortlessly and automatically, and it is evident in L2 speech perception, production and fluency behavior. L2 phonological awareness based on declarative knowledge develops, to a large extent, only for individuals who have undergone explicit pronunciation *instruction. L2 phonological awareness is often incomplete due to the fact that L2 learners simply do not notice all the relevant aspects in the L2 phonology.*

Next, the idea of L2 phonological awareness of a continuum was developed. It was suggested that following previous research, viewing L2 phonological awareness as a continuum is more appropriate than viewing it as a dichotomy. L2 phonological awareness was also suggested to be domain-specific and to be evident in the segmental, suprasegmental and phonotactic domains.

These postulations led to the definition of L2 phonological awareness as "knowledge about the target language phonological system at the segmental, prosodic and phonotactic domains, most of which is not available for conscious reflection or verbalization". A metaphor of an iceberg with proceduralized knowledge as the base and declarative knowledge as the tip was borrowed from van Lier's (1998) views for language awareness.

The final sections of the chapter discussed some potential factors affecting the development of L2 phonological awareness, the possible relationship between L2 phonological awareness and L2 pronunciation, and instruments used in previous research. Suggestions were made on task development and on interesting research areas. Overall, it was seen that research about L2 phonological awareness has been extremely scarce, and that the existing research has been heterogeneous in terms of terminology, instruments and findings. It is evident that more research about L2 phonological awareness is required.

5. The phonologies of General American and Brazilian Portuguese compared

This final chapter of *Part I* presents a description of General American and Brazilian Portuguese in the three phonological awareness subdomains which were investigated in the present research: segmental, phonotactic and prosodic. Within each section, the discussion centers on those crosslinguistic differences which were targeted in the three phonological awareness tasks.

Section 5.1 presents the differences in the segmental inventories between General American and Brazilian Portuguese, and lays out the areas of English segmental phonology which have been shown to be difficult for L1 Brazilian EFL learners.

Section 5.2 centers on the phonotactic domain. It examines the differences between General American and Brazilian Portuguese consonant clusters, and ends with a description of the typical problems L1 BP speakers face in the acquisition of General American consonant clusters.

In Section 5.3 the differences in prosody between General American and Brazilian Portuguese are discussed. More specifically, the assignment of nuclear stress in both languages, and the problems L1 BP EFL learners have with the acquisition of English nuclear stress are addressed. Finally, the chapter ends with the presentation of the research design of the present study.

5.1. General American and Brazilian Portuguese segmental inventories

The present section describes and compares the General American and Brazilian Portuguese vowel and consonant inventories. The comparisons are concluded with a discussion of the problematic areas for Brazilian EFL learners.

Let us begin by defining the two languages in question. ***General American (GA)*** is understood as an American variety with the following characteristics: it does not present marked eastern or southern characteristics, it is widely spread through media and it is the variety taught to foreigners (Wells, 1982, p.470).

Brazilian Portuguese (BP) refers to the standard variety which is taught to foreigners and shared by the educated speakers in Brazil. Brazilian Portuguese presents some consolidated regional allophonic variation, which will be discussed whenever pertinent. However, not all the variation in Brazilian Portuguese can be attributed to geography as observed by Azevedo (2004):

> Some of the most salient contrasts within Brazilian Portuguese are not regional but social. There is considerable divergence between the vernacular speech of the majority of the population, the speech of the educated minority, and the normative language codified in prescriptive grammars. (p.211)

It should be noted that the two language varieties discussed here, General American and Brazilian Portuguese, are rather theoretical concepts. As such, they are useful for describing and generalizing phonological behavior, however, language user’s phonological realizations are dynamic and they are likely to have individual, regional and social traces that these concepts do not account for.

5.1.1. General American vowels and consonants

In the following sections, some aspects of General American vowels and consonants are discussed. For a detailed account on the realization of English phonemes in general, see for example, Cruttenden (2008), Roach (2009) or Wells (1982, *Vol.I*).

The first part of this section is devoted to providing an overview of the General American vowels. General American has 12 monophthongs; /i, ɪ, e, ɛ, æ, ʌ, ə, ɑ, ɔ, o, u, ʊ/ (Figure 5.1), all of which can occur in a stressed position with the exception of /ə/ that appears only in unstressed syllables.[19] Additionally three diphthongs exist: /aɪ, aʊ, ɔɪ/.[20]

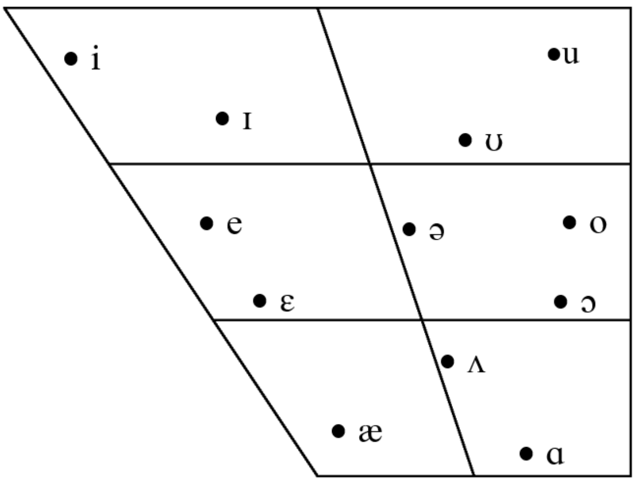

Figure 5.1. General American vowels. Adapted from Yavas (2011, p.79)

One of the characteristic features affecting the whole General American vowel system is that the temporal differences between the lax and the tense vowels are less salient than in Standard Southern British English (SSBE), and the main determinant of

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[19] Whereas some authors include [ɚ] as a phoneme, following Yavas (2011), here it is seen as a variant of /ə/.

[20] The /e/ and /o/ are usually diphthongized to some extent, and because of this, some authors count them as diphthongs (/eɪ, oʊ/). Likewise, /i/ and /u/ can be slightly diphthongized and could be presented as /ij/ and /uw/.

vowel duration is the following phonetic environment. Consequently, vowel quality is the main factor distinguishing pairs such as *seat- sit* /sit/ - /sɪt/.

The largest differences between the GA and SSBE vowel inventories can be found in the back vowel area, which is less crowded in General American. GA does not have the SSBE phoneme /ɒ/, which is realized as either /ɔ/ or /ɑ/. Another phenomenon affecting the General American back vowels is the LOT-THOUGHT merger: the assimilation of /ɔ/ and /ɑ/ into /ɑ/, so that *taught* is realized as [tɑt].

Vowels preceding an /ɹ/ are *r-colored* in General American. Additionally, many of the vowel contrasts are neutralized when followed by a tautosyllabic /ɹ/. The high front vowels /i/ and /ɪ/ are realized as [ɪɹ] such as *fear* [fɪɹ].[21] The mid and low front vowels, /e/, /ɛ/ and /æ/ are realized as [ɛɹ], resulting in a three-way homophony between *merry*, *marry* and *Mary*: [ˈmɛ.ɹi]. The rounded back vowels, /ɔ/ and /o/, are neutralized as [ɔɹ], and the high back vowels /u/ and /ʊ/ become [ʊɹ] as in *poor* [pʊɹ]. These three realizations substitute the SSBE centring diphthongs /iə, eə, ʊə/. Finally, /ʌ/ and [ɝ] are realized as [ɝ] as in *current* [ˈkɝ.ᵊnt].

Having discussed the main characteristics of General American vowels, its consonantal inventory is described next. General American has 24 consonant phonemes (Table 5.1). Some characteristic realizations of the GA consonants that systematically differ from SSBE are detailed next.

General American is a rhotic variety, that is to say, the orthographic <r> is retained in pronunciation before consonants and word finally, contrary to SSBE. The GA /ɹ/ has two allophones: it is realized as a post-alveolar approximant [ɹ] pre-vocalically, and post-

[21] Whereas Wells (1982, p.485) follows this analysis, Yavas (2011, p.81) argues in favor of in-between realization for the high front and back vowels: /ir, ur/.

vocalically it is often described as vocoid, giving retroflex characteristics to the preceding vowel without being fully articulated (Wells, 1982, p. 490).

MANNER	**PLACE**							
	Bilabial	**Labio-dental**	**Dental**	**Alveolar**	**Post-alveolar**	**Palatal**	**Velar**	**Glottal**
Plosive	p b			t d			k g	
Fricative		f v	θ ð	s z	ʃ ʒ			h
Affricate					tʃ dʒ			
Nasal	m			n			ŋ	
Approximant				l	ɹ			
Glide	w					j	w	

Table 5.1. General American consonants. When sounds appear in pairs, the left one is voiceless and the right one voiced.

The lateral approximant /l/ is darker in GA than in SSBE. It is heavily velarized in pre-consonantal and final position, and somewhat velarized before stressed vowels (Giegerich, 1992, p.211; Wells, 1982, p.490). The difference between the two varieties is clear in words such *barely* as [ˈbɛ˞.ɫi] in GA but as [ˈbeə.li] in SSBE.

In the present section the vocalic and consonantal inventories of General American have been discussed. Attention was given especially on those aspects in which differences to SSBE are encountered.

5.1.2. Brazilian Portuguese vowels and consonants

The present section provides an overview of the vocalic and consonantal inventories of Brazilian Portuguese. For a general account on the Brazilian Portuguese segmental inventories, see Cristófaro Silva (2002) and Cristófaro Silva and Yehia (2009).

Brazilian Portuguese has 12 monophthongs: seven oral vowels /i, e, ɛ, a, ɔ, o, u/ and five nasal vowels /ĩ, ẽ, ã, õ, ũ/ as seen in Figure 5.2. Additionally [ɐ] occurs as an allophone of /a/ in word final unstressed syllables in most varieties.

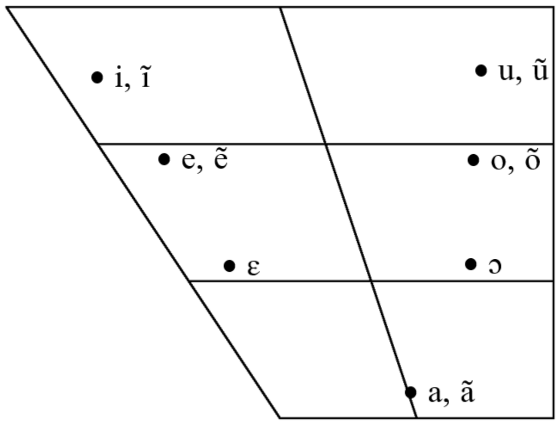

Figure 5.2. Brazilian Portuguese vowels.

The distribution of the Brazilian Portuguese vowels is governed by tonicity. All the monophthongs can occur in stressed syllables and their realization is homogeneous across the country. In unstressed position, the vowel inventory is reduced and subjected to minor regional allophonic variation.

Unlike English, in which all the diphthongs are falling, the Brazilian Portuguese diphthongs can be either falling or rising. There are 16 falling diphthongs (/aɪ, eɪ, ɛɪ, oɪ, ɔɪ, uɪ, aʊ, eʊ, ɛʊ, oʊ, iʊ, ãɪ, õɪ, ũɪ, ẽɪ, ãʊ/) and four rising diphthongs (/ɪɐ, ɪe, ɪʊ, ɪo/). Like other Romance languages, Brazilian Portuguese does not use duration contrastively. When the General American and the Brazilian Portuguese vowel inventories are contrasted, we can observe that Brazilian Portuguese lacks some of the vowels General American has, namely the two closed lax vowels, /ɪ/ and /ʊ/,[22] the central vowels /ə/, [ɝ] and /ʌ/, and the low open vowels /æ/ and /ɑ/. Additionally, the Brazilian Portuguese /ɛ/

[22] In some dialects, these occur as allophones for /i/ and /u/ in unstressed position (Cristófaro Silva, 2002)

and /ɔ/ are always monophthongs whereas in General American they may be realized as diphthongs as was seen in the previous section. Overall, it can be seen that Brazilian Portuguese employs fewer vowels than General American, especially in final post-tonic position in which only three vowels (/i, a, u/) can occur. [23]

Brazilian Portuguese has 19 consonants (Table 5.2). The following paragraphs elaborate on some of the characteristic features of the Brazilian Portuguese consonants, mentioning regional variation when pertinent. Unless otherwise stated, the realization of the consonants is unvarying across the country.

MANNER	**PLACE**					
	Bilabial	**Labio-dental**	**Dental or alveolar**	**Post-alveolar**	**Palatal**	**Velar**
Plosive	p b		t d			k ɡ
Fricative		f v	s z	ʃ ʒ		/R̄/*
Nasal	m		n		ɲ	
Tap or a flap			ɾ			
Approximant			l		ʎ	

Table 5.2. Brazilian Portuguese consonants. When sounds appear in pairs, the left one is voiceless and the right one voiced.* See discussion for the BP rhotics below.

The consonants which in English are realized as alveolar, namely: /t, d, s, z, n, l/, show geographical variation in Brazilian Portuguese and can be realized either as alveolar or dental (Cristófaro Silva, 2002). According to the author, /t/ and /d/ are palatalized when followed by an [i] in the southeast of Brazil (including the widely-spread accents of Rio de Janeiro and São Paulo) so that for example, *tia* ‘aunt’ and *dia* ‘day’ are realized as [tʃiɐ] and [dʒiɐ] in the Southeast and as [tɪɐ] and [dɪɐ] in the rest of the country, although palatalization can also occur. Thus, whereas the affricates are phonemes in General

[23] The most frequent realizations of these vowels in final post-tonic position are [i,.ɐ, ʊ] (Cristófaro Silva, 2002).

American, they are regional allophones in Brazilian Portuguese. The voiceless plosives, /p, t, k/, have a zero VOT in Brazilian Portuguese: they are never aspirated contrary to English /p, t, k/.

The nasals /m/ and /n/, and the lateral /l/ have a limited distribution and cannot occur syllable finally. In syllable initial position, the realization of /m/ and /n/ is similar to English. When <m> or <n> occur syllable finally, they indicate nasalization of the preceding vowel and no consonant is released: *mim* 'me' [mĩ], *banco* 'bank' [ˈbã.ku]. The lateral liquid /l/ only appears syllable initially and it is realized as a 'clear l'. In the syllable final context, the orthographic <l> is produced as a semivowel [w] so that *mal* 'evil' and *mau* 'bad' are homophones: [maw] .[24]

The sibilants, /s/, /z/, /ʃ/ and /ʒ/, contrast word-initially and intervocalically, but syllable-finally the contrast is neutralized and the realization is either [s, z] or [ʃ, ʒ] depending on the language variety and the following voicing context. So that, for example *pistas*, 'clues' is pronounced as [ˈpis.tɐs] in some regions and as [ˈpiʃ.tɐʃ] in others.

To conclude with the description of Brazilian Portuguese consonants, let us consider the case of rhotics. There is a considerable variation in the realization of rhotics in Brazilian Portuguese. Phonologically, two cases of 'r' exist: the 'weak r' and the 'strong R'. They contrast only intervocalically: *caro*/*carro* 'expensive'/ 'car' [ˈka.ɾu]/ [ˈka.xu]). In all the other contexts, with the important exception of syllable and word finally, they occur in complementary distribution. In syllable and word final position, the contrast between the 'weak r' and the 'strong R' is neutralized giving rise to, what in the Brazilian phonological tradition has been called as, the archiphoneme /R/ (Cristófaro

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[24] The realization can also be [l] or [ɫ] in some interior regions in the south of Brazil. However, the use of this variant is very limited in nature and conditioned by socioeconomic and age factors (Collischonn & Quednau, 2008).

Silva, 2002, p.159).[25] The phonetic realization of the 'weak r' is [ɾ] across all the Brazilian varieties, and it is somewhat similar to the General American intervocalic tap. The realization of the 'strong R' (and thus the archiphoneme /R/) however varies considerably, and can be one of the following: [x, ɣ, r, ɾ, ɹ, h, ɦ]. The realization of /R/ as the English retroflex [ɹ] is limited to the rural areas of São Paulo and Minas Gerais and is thus not very frequent, contrary to [x, h, ɾ] which are heard in the largest metropolises (Azevedo, 2004, p.224; Callou & Leite, 2009, p.76). It is of interest to note that although part of the variation can be attributed to geography, different realizations can coexist within the same region and even within the same speaker (Monguilhott, 2007).

In the present section, an overview of Brazilian Portuguese vocalic and consonantal inventories was provided. Special attention was paid on those aspects in which differences to General American are encountered. Additionally, regional variation was discussed in those occasions in which it could have an effect on L2 English speech learning.

5.1.3. Acquisition of General American vowels and consonants by L1 BP speakers

So far, the segmental inventories of General American and Brazilian Portuguese have been described. In this section, we will examine the areas in which L1 BP EFL learners are likely to encounter difficulties. We will begin by discussing the problems L1 BP speakers present in the acquisition of General American vowels.

[25] The concept of 'archiphoneme' is widely used in Brazilian linguistics to refer to the variants of /s/ and /r/ in contexts in which the opposition between phonemes is neutralized and regional variants can be used interchangeably. Some authors also include a nasal archiphoneme /N/ and define the nasal vowels as oral vowel + /N/ (Cristófaro Silva, 2002, p.165)

The high vowels /i/-/ɪ/ and /u/-/ʊ/ are frequently assimilated into Brazilian Portuguese /i/ and /u/ respectively. Thus, accurately perceiving and producing pairs such as *feet-fit* or *pool-pull* is challenging for L1 BP EFL learners, although perception (Rauber, 2006a) has been shown to be more accurate than production (Baptista, 2006; Gonçalves, 2014).

The low front vowel /æ/ does not occur in Brazilian Portuguese; perceptually the closest BP vowel is /ɛ/. Consequently, L1 BP speakers tend to produce the English /æ/ with quality closer to the Brazilian Portuguese /ɛ/ (Baptista, 2006; Rauber, 2006a), realizing *sad* and *said* as homophones.

The central vowel /ʌ/ also causes problems, because stressed central vowels do not occur in Brazilian Portuguese. Previous research has shown that /ʌ/ is in fact perceived as a new vowel (Baptista, 2006) and thus, according to Flege (1995), its production over time should become more accurate than the production of vowels that are mapped as similar to the L1 (the case of aforementioned /i/-/ɪ/ and /u/-/ʊ/). However, until the new category is established, /ʌ/ is frequently realized as an interlanguage [ɜ] (Baptista, 2006), or due to graphemic transfer as [u] or [o].

Although the schwa-like [ɐ] occurs in Brazilian Portuguese, the English /ə/ is problematic for Brazilian EFL learners, especially when occurring in pre-tonic syllables.[26] This is because in Brazilian Portuguese, vowels maintain their quality in unstressed syllables (with the exception of final post-tonic vowels), whereas in English any vowel can become a schwa in an unstressed syllable.

One final complication arises for L1 BP EFL learners, namely, that of orthography. The sound-letter correspondence is highly transparent in Portuguese and

[26] Some authors in fact represent it with [ə] and describe it acoustically almost identical to SSBE [ə] (Marusso & Cristófaro Silva, 2007)

Brazilian EFL learners often assume that the same occurs in English, so that <a, e, i, o, u> = [a, e, i, o, u] (Zimmer, Silveira, & Alves, 2009, p. 10).

Moving to the consonants, several English consonants pose problems for L1 BP speakers. Let us first consider the consonants that do not exist in Brazilian Portuguese, namely /θ, ð, h, ɹ, ŋ/.

The interdental /θ/ and /ð/ are highly problematic for L1 BP speakers. Previous research shows that although the voiceless interdental fricative is uncategorized in Brazilian Portuguese and discriminated well from /t/, /f/ and /s/ (Reis, 2010), its production is less target-like. So that /θ/ is frequently realized as [t], or as [f] or [s] (*thing* [fiŋ], [siŋ] or [tiŋ]) (Reis, 2006). The perception and production of /ð/ appears to be less accurate than of /θ/, and Brazilian EFL learners primarily realize it as [d] (*them* [dem]) (Reis, 2006).

As mentioned earlier, [h] and [ɹ] can appear as regional variants of /R/ in Brazilian Portuguese, but when <h> appears in orthography, it is realized as ∅ (*hora* ‘hour’ [ˈo.ɾɐ]). As the General American retroflex [ɹ] is in very limited use in Brazilian Portuguese, its accurate realization is challenging, and the <r> is frequently substituted by one of the Brazilian Portuguese allophones, so that *rat* sounds like *hat*. In perception, L1 BP EFL learners have been shown to be able to acoustically discern /h/ from /ɹ/ in initial position, however in word-recognition only advanced speakers were able to do so (Osborne, 2014).

The accurate pronunciation of the velar nasal /ŋ/ is difficult for L1 BP speakers and non-target-like production persist even at advanced proficiency levels (Zimmer, 2004). It is frequently realized as [nk] or [ng], likely due to orthography (Cabañero & Alves, 2008), although some speakers pronounce it as [n]. It is also not rare to find an epenthetic [i] inserted in the end (cf. *Ch.5.2.3*). Possible Brazilian pronunciations for *sing* thus are [sink], [sing], [sin] and [ˈsin.gi].

As nasals [m, n] and the lateral [l] do not appear syllable finally in Brazilian Portuguese, the pronunciation of syllable and word final [m, n, l] can cause problems for Brazilian EFL learners. A word final nasal in Brazilian Portuguese marks nasalization of the preceding vowel and EFL learners have been shown to transfer this nasalization pattern into English, especially in the initial stages of acquisition (Monahan, 2001; Zimmer, 2004) so that *ham* becomes [hã]. The same occurs with syllable final <n> (Kluge & Baptista, 2008; Silveira, 2012) so that *sin* can be realized as [sĩ].[27] Similarly, the syllable and word final <-l>, <-ll> or <-le> often become vocoid when spoken by Brazilian learners of English, even at intermediate and advanced stages (Silveira, 2012; Zimmer, 2004), so that *feel* is realized as [fiw]. [28]

Other pronunciation errors that have an orthographic origin occur in the English words with the spelling <te, ti, de, di>, <j-> and <-ge>. In the first group, the problem occurs because some Brazilian speakers use [tʃ] and [dʒ] as allophones for [t] and [d] in this context as was seen earlier, so that *tin* can be pronounced as *chin* ([tʃin]) and *dig* as *jig* ([dʒig]). Word initial <j-> is pronounced as [ʒ] in Brazilian Portuguese, so that *joy* might become [ʒɔɪ]. <ch> in Brazilian Portuguese corresponds to [ʃ] and not to [tʃ], so that *rich* might be pronounced as [ɹɪʃ]. Finally, words ending in <-ge> are pronounced with [ʒ] in BP, but with [dʒ] in English, consequently, *page* can be pronounced as [peɪʒ].

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[27] Although in GA vowels can become nasalized when followed by a nasal consonant, the nasal consonant is always fully released, except in African American Vernacular English in which it can be deleted (Yavas, 2011, p.68).

[28] As the [l] is velarized in GA, it can in some occasions become vocalized if the tongue loses contact with the alveolar region (Wells, 1982, p.258). The same can occur in African American Vernacular English (Yavas, 2011, p.70). However, these are exceptional realizations and not systematic as in BP.

We will end this section with a discussion of the problems that the English obstruents can pose for L1 BP speakers. As the Brazilian Portuguese voiceless stops [p, t, k] are perceptually similar to the English [pʰ, tʰ, kʰ], they are frequently realized without aspiration (Alves & Magro, 2011; Zimmer, 2004). Additionally, as seen in the earlier section, dental production may occur in [t] and [d], further contributing to a perceived foreign accent. Brazilian Portuguese does not allow voiced obstruents in word final positions (Zimmer et al., 2009, p. 37), and thus, Brazilians have been traditionally described to realize the English word final [-b, -d, -g, -z, -dʒ] as their voiceless counterparts [-p, -t, -k, -s, -tʃ].[29] Native English speakers may devoice final obstruents and realize them as ([b̥, d̥, g̊, z̥, d̥ʒ]), but they are not confused with their voiceless counterparts due to the length of the preceding vowel, which is longer before voiced sounds than before voiceless sounds (cf. the [æ] in *bad* and *bat*), and due to the lenis pronunciation of the voiced sounds in comparison to the voiceless sounds.[30] The length of the preceding vowel and the lenis realization are especially important for the accurate identification in the case of final plosives /b, d, g/ which might not have an audible release, thus making voicing an irrelevant feature.

<u>*Section summary:*</u>

This section has provided an overview of the phonologies of General American and Brazilian Portuguese in the segmental domain. It was seen that Brazilian Portuguese has fewer oral vowels than General American and that the occurrence of Brazilian

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[29] A recent study by Zimmer & Alves (2012) challenges this view in relation to the plosives and argues that the final [b, d, g] are realized as devoiced, but with an extra-long closure, which contributes to their perception as [p, t, k]

[30] The voiced sounds are produced with less muscular force than voiceless sounds, which are denoted *fortis*.

Portuguese vowels is governed by tonicity. Additionally, it was shown that the word final position puts limitations to the BP consonants and that considerable regional variation in the realization of the consonants exists, especially in the case of the sibilants and the rhotics, a phenomenon which may have an effect on L2 English perception and production. The section ended with a description of the problem areas previous research has identified for L1 BP perception and production of L2 English. It was seen that in many of the problem areas, perception has been found to be more accurate than production.

5.2. General American and Brazilian Portuguese phonotactics

The present section provides a comparison of General American and Brazilian Portuguese phonotactics in terms of consonant clusters, which were chosen as the target structure to measure L2 phonological awareness in the phonotactic domain. First, General American consonant cluster inventory is presented. Next, the clusters occurring in Brazilian Portuguese are presented and contrasted with the General American consonant clusters. Finally, previous research with L1 BP EFL learners in relation to the problem areas in the acquisition of L2 English consonant clusters is reviewed.

Consonant clusters were chosen as the target structure to measure L2 phonological awareness in the phonotactic domain due to a prior piloting. Seven native English speakers and 46 L1 Spanish-Catalan EFL learners were tested at the University of Barcelona (UB) for the saliency of different phonotactic violations. The participants rated 70 English nonwords for their word-likeness on a scale from one to seven (1= not a possible English word, 7= definitely a possible English word). The stimuli were presented aurally as spoken by an L1 AmE speaker. Half of the nonwords followed English phonotactic rules (legal nonwords), whereas half presented phonotactic violations (illegal nonwords). The stimuli were prepared taken into account the phonotactic restrictions discussed in Szigetvári (2009) and Sethi and Dhamija (1999). Table 5.3 on the following page presents some of the areas which were examined.

The piloting results showed that the ratings given to the legal and illegal nonwords in all areas except consonant clusters did not differ significantly or did so only marginally. For example, the mean ratings given for *Group 2,* was 4.56 for the legal nonwords and 3.36 for the illegal nonwords in the case of the L1 English speakers, and 4.95 and 4.19 in the case of the L1 Spanish/Catalan speakers. Whereas the ratings given for initial consonant clusters were 6.02 for the legal and 1.85 for the illegal for the L1 English speakers and 5.24 and 3.17 for the L1 Spanish/Catalan speakers. That is to say, the nonwords with impossible consonant clusters were rated low for English word-likeness, whereas the nonwords with possible consonant clusters were rated high for English word-likeness.

Group	Phonotactic rule	Examples of legal nonwords	Examples of illegal nonwords
1	Non-coronal consonant clusters can be preceded by lax vowels only	pɪft dɛmps	pift dimps
2	/aʊ/ can be followed by coronal consonants only	taʊl kaʊt	taʊp kaʊk
3	/ɔɪ/ can be followed by alveolar consonants only	bɔɪt tɔɪn	bɔɪp tɔɪk
4	/h/ can only occur syllable initially	hɔɪl	tæh
5	In initial consonant clusters beginning with /s/, the following plosive needs to be voiceless	sput	sbɛt
6	In final consonant clusters with three consonants, the last one needs to be /s/	bɛmpts	bɛmptk

Table 5.3. Examples from the initial piloting on English phonotactics.

The overall results showed that even the native speakers of English did not seem to be aware of all of the phonotactic violations and did not show a clear preference for the legal nonwords over the illegal, which would be expected. However, a different scenario was presented with consonant clusters, for which clear preference was seen for the legal combinations. Consequently, consonant clusters were selected as the target area to test phonological awareness at the phonotactic domain.

5.2.1. General American phonotactic constraints on consonant clusters

This section discusses phonotactic restrictions posed for consonant clusters in English, more specifically in General American.[31] Phonotactic constraints are governed by the position of the sound within the syllable: different combinations can occur syllable initially (on the syllable onset) than syllable finally (syllable coda). The structure of the English syllable is the following:

- C^1 C^2 C^3 **V** C^1 C^2 C^3 C^4

Only the vowel (V) is an obligatory constituent of an English syllable. Additionally, up to three consonants (C) can occur in the syllable onset and up to four consonants can occur in the syllable coda. We will begin by discussing the restrictions for syllable initial consonant clusters.

In the case of a single consonant onset, any of the English consonants can occupy the position with the exception of /ŋ/. Moreover, the presence of /ʒ/ is limited to a small set of French loanwords. The possible double (CC) and triple (CCC) onset clusters are seen on Table 5.4 as summarized from Cruttenden (2008, p.254-259) and Yavas (2011, p. 139-146). In the case of CC clusters, two combinations are possible: either /s/ + C, or obstruent + approximant. /s/ and /ʃ/ occur in complementary distribution so that /ʃ/ occurs before /ɹ/ and /s/ elsewhere (Yavas, 2011, p.141). In the case of CCC clusters, the first consonant is obligatorily /s/, the second is a voiceless stop and the third is either a glide (/j, w/) or an approximant (/l, ɹ/).

[31] The phonotactic rules discussed in here do not necessarily apply for all varieties of English. E.g., yod dropping causes that GA is more restrictive with what consonants can occur before /j/.

Group	N° of Cs	Onset clusters in GA	Example
1	CC	C[1] = /s/ C[2] = /p, t, k, l, w, m, n/	*speak* /spik/, *steak* /stek/, *sweep* /swip/ *smell* /smɛl/, *snake* /snek/
2		C[1] = / p, b, t, d, k, g, f, θ/ C[2] = /l, r, w/ */pw, bw, tl, fw, dl, θl/	*prey* /pre/, *quick* /kwɪk/, *threat* /θrɛt/
3		C[1] = /ʃ / C[2] = /ɹ/	*shriek* /ʃɹik/
4		C[1] = /m, b, p, v, f, k, h/ C[2] = /j/	*view* /vju,/ *few* /fju/, *cue* /kju/
5	CCC	C[1] = /s/ C[2] = /p, t, k/ C[3] = /l, r, j, w/ * /spw, stl, stw, stj/	*split* /splɪt/, *stream* /strim/, *skew* /skju/

Table 5.4. Onset clusters in General American.

In syllable final position, up to four consonants can occur. Any single consonant can occupy syllable final position in English with the exception of /h/, /j/ or /w/. The possible coda consonant clusters are seen in Table 5.5 on the following page, summarized from Cruttenden (2008, p.254-259) and Yavas (2011, p. 139-146).

In the case of a CC cluster in coda position, the following combinations are possible, with the restrictions seen in Table 5.5: plosive + plosive (*Group 1*), plosive + fricative (*2*), fricative + fricative (*3*), fricative + plosive (*4*), nasal + a homo-organic consonant (*5*), lateral liquid + plosive/fricative/nasal (*6*). In the case of three consonants in the coda position (groups *7-11* in Table 5.5), the last consonant is obligatorily /s/, /z/, /t/, /d/ or /θ/ and the –CCC words frequently have a morphophonemic marker of tense, person or possessive. Four-consonant clusters are only possible in morphophonemic endings, and as seen in groups *12* and *13* in Table 5.5, they are highly infrequent. It is interesting to note that in CCC and CCCC coda clusters, the obstruents always agree in the voicing (Yavas, 2011, p.145).

Group	N° of Cs	Coda clusters in GA	Example
1	CC	**plosive + plosive** /pt, /bd, gd/	*kept* /kɛpt/, *bribed* /braɪbd/, *begged* /bɛgd/
2	CC	**plosive + fricative** /ps, pf, pθ, ts, ks, kz, bz, dz, gz, tθ ~ dθ/ (/pz/*/tz/*/gs/*)	*hips* /hɪps/, *oomph* /umpf/, *depth* /dɛpθ/, *bits* /bɪts/, *kicks* /kɪks/, *slicks* /slɪkz/ *cabs* /kæbz/, *deeds* / didz/, *bags* /bægz, *breath* /brɛtθ/ ~ /brɛdθ/ *coupé* /kopz/, *coyote* /ˈkaɪ.otz/, *hags* / hægs/
3	CC	**fricative + fricative** /f, fz, θs, vz, ðz/ (/fθ/*)	*roofs* /rufs/, *grief* /gɹifz/, *math* /mæθs/, *wives* /waɪvz/, *baths* /bæðz/ *fifth* /fɪfθ/
4	CC	**fricative + plosive** /sp, st, sk, ft, ʃt, zd, vd, ðd/	*gasp* /gæsp/, *best* /bɛst/, *disk* /dɪsk/, *lift* /lɪft/, *mashed* /mæʃt/, *used* /juzd/ *moved* /muvd/, *teethed* /tiðd/
5	CC	**nasal + homo-organic C** /mp, nt, nd, ns, nθ, nz, ŋk/ */mb, nð, ŋg,/	*camp* /kæmp/, *count* /kaʊnt/, *find* /faɪnd/, *once* /wʌns/, *tenth* /tɛnθ/ *jeans* /dʒinz/, *bank* /bæŋk/
6	CC	**C¹ = /l/** **+ plosive** /p, t, k, b, d/ **+ fricative/ affricate** /s, f, θ, ʃ, z, v, tʃ, dʒ/ **+ nasal :** /m, n/	*help* /hɛlp/, *guilt* /gɪlt/, *silk* /sɪlk/, *bulb* /bʌlb/, *cold* /kold/ *false* /fɔls/, *self* /sɛlf/, *health* /hɛlθ/ , *Welsh* /welʃ/, *feels* /filz/, *shelve* /ʃɛlv/ *belch* /bɛltʃ/, *bulge* /bʌldʒ/ *realm* /rilm/, *kiln* /kɪln/
7	CCC	**C³ = /s/** C¹ C² = /pt, ft, st, lt, kt, nt, mp, sp, lp, sk, lk, ŋk, mf, lf, nθ, /tθ/ (/pθ/*, /fθ/*)	*adopts* /aˈdɑpts/, *lifts* /lɪfts/, *ghosts* /gosts/, *belts* /bɛlts/, *facts* /fækts/ *ants* /ænts/, *lamps* /læmps/, *grasps* /græsps/, *helps* /hɛlps/, *asks* /æsks/ *sulks* /sʌlks/, *drinks* /drɪŋks/, *nymphs* /nɪmpfs/, *gulfs* /gʌlfs/, *months* /mʌntθs/, *eights* /etθs/ *depths* /dɛpθs/, *fifths* /fɪfθs/
8	CCC	**C³ = /z/** C¹ C² = /lb, nd, ld, lm, ln, lv/	*bulbs* /bʌlbz/, *finds* /faɪnds/, *holds* /holdz/, *films* /fɪlmz/, *kilns* /kɪlnz/, *wolves* /wʊlvz/
9	CCC	**C³ = /t/** C¹ C² = /ps, ds, ns, ls, ks, mp, sp, lp, sk, lk, ŋk, ntʃ, ltʃ/	*lapsed* /læpst/, *midst* /mɪdst/, *danced* /dænst/, *whilst* /waɪlst/, *next* /nɛkst/ *jumped* /dʒʌmpt/, *gasped* /gæspt/, *helped* /hɛlpt/, *asked* /æskt/, *milked* /mɪlkt/ *thanked* /θæŋkt/, *punched* /pʌntʃt/, *belched* /bɛltʃt/
10	CCC	**C³ = /d/** C¹ C² = /ndʒ, ldʒ, lm, nz, lv	*changed* /tʃendʒd/, *bulged* /bʌldʒd/, *calmed* /kɑlmd/, *cleansed* /klɛnzd/ *solved* /sɑlvd/
11	CCC	**C³ = /θ/** C¹ C² = (/ks/*, /ŋk/*, /lf/*)	*sixth* /sɪksθ/, *length* /leŋkθ/, *twelfth* /twelfθ/
12	CCCC	**C⁴ = /s/** C¹C²C³ = /mpt/ (/lpt/*, /kst/*, /lkt/*, /lfθ/*, /ksθ/*)	*prompts* /prɑmpts/ *sculpts* /skʌlpts/, *texts* /teksts/, *mulcts* /mʌlkts/, *twelfths* /twelfθs/, *sixths* /sɪksθs/
13	CCCC	**C⁴ = /t/** C¹C²C³ = (/mps/*, /lts/*)	*glimpsed* /glɪmpst/, *waltzed* /wɔltst/

Table 5.5. Coda clusters in General American. Asterisk (*) indicates that the cluster is only found in one word.

5.2.2. Brazilian Portuguese phonotactic constraints on consonant clusters

Brazilian Portuguese is more restrictive than English with consonant clusters. The present section will present the permissible consonant clusters in Brazilian Portuguese. First, the onset clusters are discussed. The preferred syllable structure in Brazilian Portuguese is CV, although the following is also possible:

- C C **V** C

As in English, the only obligatory element of the syllable is the vowel. In onset position, up to two consonants can occur and in the coda position only one. In word initial position, any consonant with the exception of /ɲ/, /ʎ/ and ‘the weak r’ can occur.[32] The permissible CC-clusters are seen in Table 5.6, as summarized from Cristófaro Silva (2002, p.156) and Azevedo (2004, p.50)

Onset clusters in BP			**Example**
1	CC	C^1= /p, t, k, b, d, g, f/ (/v/) C^2 = /l, ɾ/ * /tl/, /dl/	*pluma* ‘feather’ /ˈplu.mɐ/ *prato* ‘plate’ /ˈpra.tu/, *trato* ‘deal’ /ˈtɾa.tu/ *claro* ‘bright’ /ˈkla.ɾu/, *cruz* ‘cross’ /kɾuS/ *bloco* ‘block’ /ˈblɔ.ku/ *braço* ‘arm’ /ˈbɾa.su/ *drama* ‘drama’ /ˈdɾã.mɐ/, *globo* ‘globe’ /ˈglo.bu/ *grão* ‘grain’ /gɾãu/, *flor* ‘flower’ /floR/ *fraco* ‘weak’ /ˈfɾa.ku/

Table 5.6. Onset clusters in Brazilian Portuguese.

As can be seen in Table 5.6 above, the first member of the cluster needs to be a plosive or /f/. The voiced fricative /v/ only occurs in loanwords (*Vladimir* /ˈvla.di.miR/).

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[32] /ɲ/ and /ʎ/ occur in two loanwords, *nhoque* ‘*gnocchi’ (*a type of pasta) [ˈɲɔ.ki] and *lhama* ‘*llama’ (*a South American mammal) [ˈʎã.mɐ], respectively. (Cristófaro Silva, 2002, p. 155)

The second member in the cluster needs to be either /l/ or the ‘weak r’. In writing, clusters such as <pn> and <ps> as in *pneu* ‘tire’ and *psiquiatra* ‘psychiatrist’ are seen, but an epenthetic [i] is inserted so that the preferred CV syllable structure can be maintained: [ˈpi.neʊ], [pi.si.kiˈa.trɐ] (Azevedo, 2004, p.48). Triple consonant clusters are not allowed in Brazilian Portuguese.

Brazilian Portuguese is very restrictive with consonants occurring word finally. No clusters are allowed, and only the allophonic variants of /s/ and /ɾ/ can occupy the coda position. The orthographic <m> and <n> are also possible, but as was seen before, the syllable final nasals are omitted in the vast majority of the dialects. Likewise, syllable final <l> is vocalized in the majority of the varieties of Brazilian Portuguese (cf. *Ch.5.1.2*). Loanwords ending orthographically in other consonants, usually receive an epenthetic [i] (Azevedo, 2004, p.49), so that ‘club’ becomes *clube* /ˈklu.bi/, ‘picnic’ *piquenique* /ˈpi.ki ˈni.ki/ and ‘stress’ *estresse* /isˈtrɛ.si/. In other words, only one of the sibilant variants of the /s/ ([s, z, ʃ, ʒ]) or one of the rhotic variants of /ɾ/ ([x, ɣ, r, ɾ, ɹ, h, ɦ]) is permitted in word final position. In non-final coda position, that is to say, in the middle of the word, two consonants, which obligatorily are /s/ + /ɾ/, can occur in a small number of cases, such as in *perspectiva* ‘perspective’ [peɾs.pek.ˈti.vɐ] (Cristófaro Silva, 2002, p. 164).

Having discussed the phonotactic restrictions imposed for consonant clusters in General American and Brazilian Portuguese, the following section proceeds to examine the difficulties L1 BP speakers have shown when acquiring English clusters.

5.2.3. Acquisition of General American consonant clusters by L1 BP speakers

The research on the acquisition of English consonant clusters by L1 BP EFL learners has focused mainly on onset clusters (Cardoso & Liakin, 2009; Cornelian Júnior, 2003; Rauber, 2006b; Rebello & Baptista, 2006; Silveira, 2002). These studies report that the preferred strategy of the L1 BP EFL learners in dealing with onset clusters that are illegal in Brazilian Portuguese, is the insertion of a prothetic vowel [i] in front of the cluster, so that *study* is produced as [is.tʌ.di].

In perception, studies have revealed that the discrimination of CC from iCC sequences is challenging for L1 BP learners of English (Cardoso, John, & French, 2009; Silveira, 2002). In other words, L1 BP EFL learners often perceive an illusory prothetic vowel in consonant clusters that are not permitted in Brazilian Portuguese. This goes in line with several studies carried out by Dupoux and colleagues (e.g., Dupoux, Kakehi, Hirose, Pallier, & Mehler, 1999; Dupoux, Pallier, Kakehi, & Mehler, 2001; Dupoux, Parlato, Frota, Hirose, & Peperkamp, 2011), which show that language users perceive illusory phones in illegal sound combinations in order to conform the input into the L1 phonotactics.

Research on the acquisition of English consonants in coda position by L1 BP learners has been scarce. To the best of my knowledge, only one study involving the acquisition of coda clusters by Brazilian EFL learners exists. Major (1994, 1996) identified four strategies used by his test subjects (four L1 BP speakers) on producing two-member coda clusters in English. The employed strategies were: insertion of an epenthetic [i] to break up the cluster, phone substitution, cluster simplification and word final obstruent devoicing. The use of vowel epenthesis has also been reported in studies carried out with single consonants in coda position (Baptista & Silva Filho, 2006; Cardoso, 2005; Koerich, 2006; Silveira, 2004) and with the nativization of English loanwords into Brazilian Portuguese (cf. *Ch.5.2.2*, p.142) (Freitas & Neiva, 2006; Munhoz Xavier, 2013). This, together with the use of vowel prothesis in onset position and Major's results, suggests that vowel epenthesis is employed in the context of final consonant clusters. Additionally, as reported by Major and by research carried out with other languages (Abrahamsson, 2003; Hansen, 2001, 2004) cluster simplification (omitting one of the cluster members) could also be employed in this position, especially in the clusters with more than two members.

Section summary:

The present section reviewed the General American and Brazilian Portuguese consonant cluster inventories. It was seen that General American is more permissible with consonant clusters in both, onset and coda, positions than Brazilian Portuguese. In reviewing studies about the acquisition of English consonant clusters by L1 BP speakers, it was seen that most of the research has focused around the sC onset clusters. It was also seen that L1 BP speakers tend to perceive an illusory vowel in clusters which would be illegal in Portuguese. L1 BP speakers then often transfer this faulty perception into production by inserting an epenthetic [ɪ] to break up the cluster. Other strategies reported to be employed by the L1 BP speakers are cluster simplification and phone substitution.

5.3. General American and Brazilian Portuguese prosody

This section presents a cross-linguistic comparison of prosody in General American and Brazilian Portuguese in terms of nuclear stress assignment, which was chosen as the target structure to measure L2 phonological awareness in the prosodic domain. First tonicity as a general speech phenomenon is discussed, after which cross-linguistic comparisons between General American and Brazilian Portuguese are presented in depth. Finally, likely problem areas arising from cross-linguistic comparisons are presented.

We will begin by briefly discussing the functioning of tonicity from the point of view of information organization in order to lay out the necessary theoretical framework for the remaining of the section. In everyday communication situations, speakers face the decision of how to divide or 'chunk' the information they want to express. The organization of speech into chunks (tonality) is governed by the speaker's decision on how to present information. Consider the following examples from Wells (2006, p.7):

- We don't know who she is.
- We | don't know who she is.
- We don't | know who she is.
- We | don't know | who she is.

In the above examples, and in the course of the section, '|' stands for intonation breaks which divide intonation phrases. The examples illustrate how the same speech material can be divided in different ways depending on the speaker's intended meaning. Thus, ***intonation phrase*** is defined as a unit of information which has a single intonation pattern.

Within each intonation phrase, the speakers choose the information that they consider the most important for the listener to focus on. This information is highlighted by the placement of nuclear stress. ***Nuclear stress*** (*sentence stress, nucleus, pitch accent)* is the syllable that bears the nuclear tone within the intonation phrase (Wells, 2006, p. 93). Assignment of the nuclear stress is called ***tonicity.*** For the present study, tonicity was chosen as the target area within prosody due to the problems it presents for L2 users.

Nuclear stress is the most prominent stress within the intonation phrase. Its high prominence is accomplished by an extra-heavy stress and a change in pitch movement. Jones, 1960 (as cited in Mott, 2011, p.183) defines ***stress*** as the degree of force with which a syllable is uttered. Stress is assigned by at least one of the following correlates: higher pitch, longer duration and/or stronger intensity in comparison to the surrounding syllables. Nuclear stress is generally placed on the last stressed syllable of the intonation phrase. The problem for the L2 user lies in learning the cases in which this does not occur, as the assignment of nuclear stress is language specific and related to the information status of the constituents within the intonation phrase. Negative transfer from the L1 easily leads to misunderstandings and to non-target-like language use.

The information structure of the constituents in the intonation phrase plays an important role in the assignment of nuclear stress. The speaker decides which information is to be presented as the most noteworthy and which information will be left to the background. In doing so, the speaker decides on the focus domain of the sentence. ***Focus domain*** is the part of the intonation phrase the speaker wants to bring into the listener's attention, either because the information is unknown to the listener or because it is especially significant. Therefore, the focus domain can be either *broad* or *narrow*. An utterance is understood as having a ***broad focus*** when the speaker wishes to bring all the information in the sentence into the listener's attention. Broad focus sentences can be thought to occur in 'all-new' or 'out-of-the-blue contexts' and they have been described to have a neutral stress pattern (Cruttenden, 1997, p.70). ***Narrow focus***, on the contrary, highlights one part of the message and only part of the utterance is brought into focus. Narrow focus can be further divided into two subclasses: contrastive and informative. ***Contrastive focus*** implies a contrast or emphasis of some kind, whereas ***informative focus*** simply presents information about the focused constituent. Consider the following examples of broad and narrow focus domains. Square brackets are used to indicate the focus domain and the constituent bearing the nuclear stress is underlined.

1. What happened?

- [My purse was stolen.] (broad focus)

2. Whose purse was stolen?

- [My] purse was stolen. (narrow focus: contrastive)

3. Who is she?

- She's [my friend]. (narrow focus: informative)

Example 1 presents broad focus: all the information in the answer is new to the listener. *Example 2* has a narrow focus; the speaker is making a contrast between her purse and someone else's. *Example 3* also presents a narrow focus, but the aim is to provide information about the subject and no contrast is implied: the focus is thus informative. As can be seen from the above examples, the nuclear stress always occurs within the focus domain. The speakers select the information they wish to focalize or highlight, (the focus domain), and then within the focus domain, they choose the item that they consider the most important for the message. This word will have the nuclear stress.

When deciding on the focus domain and nuclear stress placement, the speaker needs to consider what information is known to the listener and what is new. ***New information*** coincides with the focus domain, as this is by default the information that requires highlighting. It is information the speaker assumes to be unknown to the listener and wishes the listener to pay attention to. ***Given information*** is information the speaker assumes the listener to already know. It may have come up earlier in the conversation (*4*) or it may be inferred from the context (*5*) or it can form part of the background knowledge shared by the interlocutors (*6*).

4. Laura reads a lot.

- *She*'s [so smart].

5. The phone's ringing.

- [I'll answer] *it*.

6. Do you read the Guardian?

- [I don't like] *newspapers*.

Given information thus does not need to be brought into focus, as it is assumed to be in the consciousness of the listener in some way (Cruttenden, 1997, p.81).

Although learning to convey contrastive focus is important for language learners, the mechanisms used to convey it are similar across languages. Consequently, the aim of the present study is the assignment of nuclear stress in broad focus and, to a smaller degree, in informative narrow focus sentences, as it is here where interesting cross-linguistic differences are found. The following sections will lay out the assignment of nuclear stress in broad focus context in General American and Brazilian Portuguese. Before beginning with the language-specific descriptions, it is worth highlighting that nuclear stress assignment is not always a clear-cut matter. This is because the focus domain, and consequently the placement of the nuclear stress, is speaker- and context dependent. On the one hand, the focus domain is selected by the speaker based on the information that he considers noteworthy to the listener. This information might not coincide with what the listener considers noteworthy. On the other hand, the concepts of *focus*, *given* and *new information* can only be studied within a context. The same utterance can have several interpretations and information structure analyses depending on the context it appears in. Even in out-of-the-blue contexts, the speakers tend to supply the missing background information. Thus, nuclear stress assignment is never context neutral (Zubizarreta & Vergnaud, 2005).

5.3.1. Tonicity in General American

In the discussion of the assignment of nuclear stress in General American, the theory put forward by Zubizarreta and Nava (Nava, 2008; Nava & Zubizarreta, 2010; Zubizarreta, 1998; Zubizarreta & Nava, 2011) is followed. More specifically, it is assumed that the assignment of the nuclear stress in General American is governed by two principles: *Germanic Nuclear Stress Rule* and *Anaphoric Deaccenting Rule*. We will begin by discussing the *Germanic Nuclear Stress Rule*.

As mentioned in the previous section, nuclear stress is assigned on the last stressed syllable within the intonation phrase, which generally speaking means that the nuclear stress is located on the rightmost constituent of the intonation phrase (Wells, 2006, p.95). However, English, as other Germanic languages, allows nuclear movement so that the nuclear stress does not obligatorily appear on the last constituent in the intonation phrase. Consider the following examples:

7. Mr. Jones bought a <u>house</u>.

8. Mr. <u>Jones</u> died.

9. Mr. Jones suddenly <u>died</u>.

10. Mr. Jones is <u>crying</u>. / Mr. <u>Jones</u> is crying.

Example 7 above shows a transitive construction (SVO) in which the nuclear stress falls, as expected, on the constituent bearing the last lexical stress. Whereas the nuclear stress readily falls on the last constituent in transitive sentences, intransitive sentences present a different case, evident in the remaining three examples, which present a non-final, or flexible, nuclear stress.[33]

The work carried out by Zubizarreta and Nava (Nava, 2008; Nava & Zubizarreta, 2008, 2010; Zubizarreta & Nava, 2011; Zubizarreta & Vergnaud, 2005) suggest that non-final nuclear stress occurs because Germanic languages are sensitive to predicate-argument relations (*Examples 7, 8* and *10* above) and to the order of the sentence constituents (*Example 9* above). Accordingly, the nuclear stress falls on the rightmost constituent in utterances ending in a constituent other than a verb, (Zubizarreta & Vergnaud, 2005). In phrases ending in a verb (i.e., intransitive constructions), the nuclear stress is variable and depends on the predicate structure, and on the speaker's perception of the events, namely on whether the speaker views the information as thetic or categorical.

In a ***thetic*** interpretation, the speaker simply states the event without providing a comment on it. In a ***categorical*** interpretation, the speaker states the event and provides a comment (Zubizarreta & Nava, 2011). In English, SV thetic constructions have the nuclear stress on the subject, whereas the SV categorical constructions have the nuclear stress on the verb. Previous research (Nava & Zubizarreta, 2010; Zubizarreta & Nava, 2011) indicates that native English speakers view unaccusative constructions as thetic, whereas unergative constructions can be viewed either as thetic or categorical, depending

[33] Intransitive sentences, (i.e., those that do not take a direct object) are divided into unaccusative and unergative constructions. Unaccusative verbs take a subject that is not actively responsible by the action denoted by the verb (i.e., the subject has the semantic role of a patient). Unaccusative verbs describe either a change of state (*break*, *explode*, *melt*) or location (*arrive*, *disappear*, *fall*). Unergative verbs, on the other hand, take a subject who is an agent, an active initiator or experiencer of the event (*laugh*, *work*, *cry*).

on the noteworthiness of the event described: unexpected events favor a categorical interpretation. This is illustrated in the following examples:

11. A glass broke. (thetic)

12. The baby's laughing. / The baby's laughing. (categorical/thetic)

13. The lion was laughing. (categorical)

Example 11 presents the expected nuclear stress pattern for unaccusative constructions: the nuclear stress falls on the subject as the speaker simply states what happened. *Example 12* shows the two alternative nuclear stress patterns for unergative constructions. The choice depends on the speaker's perception of the event: whether the speaker is simply declaring the event or stating the event and providing a comment on it. The final example (*13*) illustrates the likely nuclear stress pattern for unergative sentences with an unexpected event. In these cases, the speaker is more likely to interpret the sentence as categorical, and to provide a comment on it instead of just simply stating the facts.

In addition to the thetic/categorical distinction, the presence of a modifier moves the nuclear stress to a final position in unaccusative sentences (e.g., Zubizarreta & Vergnaud, 2005). This is illustrated in *Examples 8* and *9*, repeated here as *14* and *15* for convenience:

14. Mr. Jones died.

15. Mr. Jones suddenly died.

In *Example 14,* the nuclear stress is on the subject as is expected for unaccusative sentences. When an adverb is added (*15*), the nuclear stress moves to the verb. According to Zubizarreta and Nava (2011), this occurs because Germanic languages can denote argument-modifier distinctions via prosody and give primacy to arguments. Compare the interpretation of the two examples above with the following one:

16. Mr. Jones died.

In *Example 16*, an implicit contrast is presented: Mr. Jones DIED, he did not DISAPPEAR or FALL, for example. Thus, the presence of a nuclear stress in a final position in SV unaccusative sentences in English automatically calls for a narrow focus interpretation.

To put it briefly, the *Germanic Nuclear Stress Rule* is flexible and sensitive to the relations between the sentence constituents. Nuclear stress is assigned differently in transitive and intransitive sentences. In English transitive sentences, the nuclear stress falls on the rightmost constituent in broad focus interpretation. The occurrence of the nuclear stress on a non-final position would call for a narrow focus interpretation (either contrastive or informative). In intransitive constructions, on the other hand, the nuclear stress is more flexible and its placement is dependent on the subject-predicate relations. The nuclear stress falls on the subject in the case of unaccusatives, and on the subject or the verb in the case of unergatives, depending on the speaker's perception of the information presented. The presence of an adverb in an intransitive sentence moves the nuclear stress obligatorily to the rightmost constituent. It is worth highlighting that the above discussion applies in broad focus, all-new, context and that in narrow focus interpretation, the nuclear stress can appear on other constituents.

Having discussed the *Germanic Nuclear Stress* algorithm, we will now move on to discuss the other rule affecting nuclear stress assignment in English. Namely, deaccenting, or what Nava and Zubizarreta (2010, and elsewhere) term as the *Anaphoric Deaccenting Rule*. Anaphoric deaccenting refers to the fact that English, and other

Germanic languages, allow function words and previously mentioned information to be deaccented. This has an important effect on the assignment of the nuclear stress.

Two types of constructions are typically deaccented in English: functional categories and given information. English deaccents function words (pronouns, prepositions, copulas and auxiliary verbs), or to put it in more theoretical terms, functional categories may be interpreted as metrically invisible in English (Nava & Zubizarreta, 2010). This is reflected in prosody in that English function words are normally unstressed and show vowel reduction. In terms of nuclear stress assignment, function words cannot receive a nuclear stress in English in broad focus context.[34] Consequently, if an intonation phrase ends in a function word, the nuclear stress moves to a non-final position:

17. Lisa received a <u>gift</u> from them.

18. Who are you <u>talking</u> about?

19. I was just <u>walking</u> by.

The other case of deaccenting in English is discourse-based. As was discussed earlier, assignment of nuclear stress is frequently affected by the information status of the constituents within the intonation phrase. Intonation phrases are units of information and not all the constituents present the same degree of conversational importance. In English, the general rule is that *given information* is deaccented and *new information* is accented, as this is the information the speaker desires to bring to the listener's attention (Wells, 2006, p.109). Therefore, if an intonation phrase ends in given information, the nuclear stress shifts to the left as the given information is deaccented (Nava & Zubizarreta, 2010):

20. Who is that tall girl?

- <u>Kate</u> is that tall girl.

[34] In a narrow focus interpretation, function words can receive the nuclear stress: *He looked <u>up</u>, not <u>down</u>*.

21. Do you have *Pride and Prejudice*?

- I don't have much time to read.

22. Could you do the laundry?

- I hate washing clothes.

Example 20 above shows how the nuclear stress moves from the final position to the subject, as the rest of the phrase is given information and does not need to be brought into focus. The following example illustrates how the speaker and the interlocutor share common knowledge. The interlocutor knows that *Pride and Prejudice* is a book, which is why she is not bringing *to read* into focus, but instead highlights the new information (she does not have time to read books). The final example shows how synonyms are also considered as old information (Wells, 2006, p.111). As *doing the laundry* and *washing clothes* mean the same, the interlocutor removes importance from them, and instead highlights the new information, which expresses his attitude towards such chores. Also empty words that have very little meaning, such as *thing* or *people*, are deaccented in broad focus interpretation (Wells, 2006, p.150)

To summarize, the assignment of nuclear stress in General American is governed by two principles: the *Germanic Nuclear Stress Rule* and the *Anaphoric Deaccenting Rule*. The default position for the nuclear stress is on the last constituent bearing a lexical stress. The *Germanic Nuclear Stress Rule* states an exception for this rule in the case of intransitive constructions, in which the nuclear stress moves to a non-final position. English also allows previously mentioned information and functional categories to be deaccented. Consequently, in cases in which an intonation phrase ends in deaccented information, the nuclear stress likewise moves to a non-final position. It can thus be stated that the assignment of nuclear stress is flexible in General American, respecting the argument relations and discourse and pragmatic-related decisions. In other words, English uses prosody to convey meanings that in other languages are expressed syntactically as we will see in the following section.

5.3.2. Tonicity in Brazilian Portuguese

Whereas research on Romance tonicity, in general, is rather extensive, research on Brazilian Portuguese tonicity, specifically, has been scarce. The present section is divided into two parts. The first part discusses the nuclear stress assignment in Romance languages and Portuguese (both, European and Brazilian) with the aim of providing a general overview of Romance tonicity, which is used as a guide to extrapolate aspects of Brazilian Portuguese nuclear stress assignment. As the research carried out to the present day on Brazilian Portuguese tonicity is rather limited, it was deemed beneficial to carry out a small-scale data collection whose results would complement the existing research. To that end, the second part of the section presents the results of a sentence reading task carried out by the researcher with 10 Brazilian Portuguese speakers.

5.3.2.1. Tonicity in Romance

Nuclear stress assignment in Romance languages, especially Spanish, has been widely studied. In this section, first the general principles governing nuclear stress assignment in most of the Romance languages, including European Portuguese, are presented. Although European Portuguese and Brazilian Portuguese are dialects of the same language, they differ greatly in their phonetic realizations as well as in their syntax: European Portuguese nuclear stress movement follows the general rules presented for Romance languages, whereas Brazilian Portuguese follows some of these generic rules but it also presents some crucial differences which make it stand aside from the other

Romance languages. Due to the general lack of studies about Brazilian Portuguese nuclear stress assignment, we will begin the discussion from the context of Romance languages in general and will dedicate the last part of the section to contrast these generalities to some particularities of Brazilian Portuguese.

The *Romance Nuclear Stress Rule* is more rigid than the *Germanic Nuclear Stress Rule*. It assigns the nuclear stress on the rightmost constituent within the intonation phrase without exceptions in broad focus context (Nava, 2008; Nava & Zubizarreta, 2008; Zubizarreta & Vergnaud, 2005). If the nuclear stress appears on a non-final position, the interpretation is by default contrastive. As the unmarked information structure presents the given information first and the new information in the last place, the Romance nuclear stress most often than not coincides with the new information, as in English. Consider the following examples from Spanish: [35]

23. ¿Qué pasó? (‘What happened?’)

- [Me robaron el <u>bolso</u>.] (‘My bag was stolen.’)

24. ¿Quién es María? (‘Who’s María?’)

- María es [mi <u>amiga</u>]. (‘María’s my friend.’).

25. * [<u>Carmen</u> me dio un regalo]. (‘Carmen gave me a gift’).

As can be seen from the above examples, the nuclear stress aligns with the intonation phrase boundary. Narrow informative focus with nuclear stress movement, allowed in English, is not allowed in many Romance languages as illustrated by *Example 25*. The interpretation for *25* is obligatorily that of a contrast (CARMEN gave me a gift, not MARÍA). Bringing constituents into focus, which in English would be obtained through nuclear

[35] All the examples from Spanish correspond to Castilian Spanish as some research reports that dialectal variation in the use of nuclear stress might exist (Gabriel, 2010 as cited in Zubizarreta, in press)

movement, in Romance languages is mainly obtained through syntactic devices, so that the focused constituent will be aligned with the intonation boundary (Zubizarreta & Nava, 2011). In other words, whereas English uses prosodic devices to assign focus, Spanish, European Portuguese, and many other Romance languages, use syntactic devices and alternative lexical choices. Let us consider the following examples for European Portuguese from Cruz-Ferreira (1998) which illustrate the possible options:

26. Eu prefiro que ela <u>venha</u>. ('I prefer her to <u>come</u>.')

27. Eu prefiro que venha <u>ela</u>. ('I prefer <u>her</u> to come.')

28. Eu <u>prefiro</u> | que ela <u>venha</u>. ('I <u>prefer</u> her to come.')

Examples 26 and *27* show how the word order can be changed in order to place the focused constituent on the last position of the intonation phrase. The last example shows an alternative way to rearrange the information so that the intonation phrase is divided into two, each of which has a nuclear stress on the last constituent.

Syntax is also employed to operationalize the thetic/categorical distinction in Romance languages, which, as we saw in the previous section, is conveyed in English through nuclear stress movement. The means of conveying the distinction vary from one Romance language to another. French, for example, presents the existential 'il y a'-construction, whereas Spanish and Italian resort to changes in word order (Zubizarreta & Nava, 2011). In Spanish, unaccusatives, which tend to receive a thetic interpretation as was seen earlier, frequently follow the VS word order, whereas unergatives, which are more frequently perceived as categorical, follow the SV word order (Zubizarreta & Nava, 2011):

29. Llegaron los <u>invitados</u>. ('The <u>guests</u> arrived.')

30. Sr. Jones está <u>llorando</u>. ('Mr. Jones is crying.')

Example 29 shows an unaccusative structure with the preferred VS word order. *Example 30* illustrates the typical SV word order of unergative construction. It can again be appreciated that the nuclear stress remains in the final position, contrary to the English nuclear movement. Consequently, in most of the Romance languages, the semantic distinction between thetic and categorical interpretation is obtained through syntax.

Contrary to English, anaphoric deaccenting is not allowed in Romances languages such as Spanish, Catalan, Italian (Zubizarreta & Nava, 2011) or European Portuguese (Cruz-Ferreira, 2004), which means that functional categories and given information cannot be deaccented. To put in another way, functional categories are always metrically visible in Romance, whereas they can be invisible in Germanic (Nava & Zubizarreta, 2010). As a consequence, a sentence ending in a function word will still have the nuclear stress on the rightmost constituent, namely, on the function word. Consider an example from European Portuguese (Cruz-Ferreira, 1998) (*31*) and Spanish (*32*):

31. Eu prefiro que venha ela. ('I prefer her to come.')

32. Deberías preguntar a alguien. ('You should ask someone'.)

Like functional categories, deaccenting given information is not allowed in most of the Romance languages (see Cruz-Ferreira, 2004 for European Portuguese; Domínguez, 2002 for Catalan; Nava & Zubizarreta, 2010 for Spanish and Italian). Hence, even if the utterance ends in given information, the nuclear stress cannot be moved and stays fixed on the last lexical item, contrary to English. This contrast between Romance and Germanic languages is especially relevant for the later discussion about Brazilian Portuguese, which is why it will be discussed here in depth. Let us consider the following examples from Spanish presenting repeated and inferable information:

33. ¿Has leído *Cien años de soledad*? ('Have you read *One Hundred Years of Solitude*?')

- [No me gustan los libros]. ('I don't like books.')

34. ¿Qué es ese ruido? ('What's that noise?')

- [El teléfono está sonando]. ('The telephone's ringing.')

35. ¿Conoces a algún mexicano? ('Do you know any Mexicans?')

- [Estoy casada con un mexicano.] ('I'm married to a Mexican.')

36. ¿Qué vas a preparar para la cena? ('What will you cook for dinner?')

- *Voy a preparar [una sopa] para la cena. ('I'll cook a soup for the dinner.')

The first three examples present a broad focus answer ending in given information. The nuclear stress appears on the final position in all the cases, whereas in English it would be moved to the left from the deaccented information. *Example 36* presents a narrow focus answer repeating the wording of the question. The nuclear stress would appear on the final position as the *Romance Nuclear Stress Rule* determines, but it would fall outside the focus domain, violating the focus/prosody principle (Zubizarreta & Vergnaud, 2005).[36] To avoid this awkward structure, speakers resort to changes in word order for the purpose of moving the new information into the focus domain:

37. Voy a preparar para la cena [una sopa].

We have seen in the course of the present section how nuclear stress placement differs between Romance and Germanic languages. Whereas in Germanic, the nuclear

[36] "The focus constituent must contain the intonational nucleus of the intonational phrase, where the intonational nucleus is identified as the syllable that bears main phrasal prominence" (Zubizarreta & Vergnaud, 2005 p.4)

stress is flexible and can be moved in order to convey semantic and pragmatic decisions, in Romance the nuclear stress is fixed on the last lexical item. The semantic and pragmatic decisions are obtained through syntax, which is made possible by the relatively free word order present in many Romance languages.

We will now turn to the target language of our study, Brazilian Portuguese. In general terms, Brazilian Portuguese tonicity parallels the one discussed for Romance languages in the preceding paragraphs. However, Brazilian Portuguese presents some particular characteristics which have an effect on how prosodic prominence is conveyed, which is why the earlier description of Romance nuclear stress assignment was necessary.

As in the other Romance languages discussed, the nuclear stress in Brazilian Portuguese is assigned on the last lexical item of the intonation phrase (Frota et al., in press; Moraes, 1998, 2007; Tenani, 2002). In other words, the nuclear stress is fixed in Brazilian Portuguese in broad focus context. In a narrow focus interpretation, when only a part of the message is brought into focus, languages can use different strategies to focalize information, as we have seen in the course of the section. Some languages use prosodic devices, such as changes in tone, nuclear stress placement and tonality. Other languages use syntactic devices, such as changes in word order and cleft and pseudo-cleft structures. More often than not, a language can use both types of devices but prefers one over the other. As we have seen, General American uses mainly prosodic devices in order to focalize constituents, whereas many Romance languages such as Spanish and European Portuguese use mainly syntactic devices. Brazilian Portuguese appears to use a combination of both strategies.

As was seen before, Spanish and European Portuguese have a relatively free word order which is employed to move the focused constituent to the right edge of the intonation phrase so that it naturally coincides with the intonation boundary and occupies the default position for new information. The word order in Brazilian Portuguese, however, is not flexible. The unmarked word order in Brazilian Portuguese is SVO. Apart from that, only SV is possible, contrary to European Portuguese which allows six different word orders (Fernandes, 2007). VS is only used in unaccusative and passive constructions (Kato, 2000). Additionally, OSV can be used in a marked context. Consider the following examples from Fernandes (2007, p.71):

38. A Joana comeu a sopa. (SVO) ('Joana ate the soup.')

39. A sopa, a Joana comeu. (OSV) ('The soup, Joana ate [it].')

Example 38 shows the unmarked SVO word order with nuclear stress on the last lexical item. The latter example shows a marked construction in which the object is topicalized. In relation to intransitive sentences, the unaccusative sentences follow either the SV or VS order, whereas the unergative sentences obligatorily are SV in unmarked context (Fernandes, 2007, p.69):

40. Uma janela quebrou/ Quebrou uma janela. (SV/VS) ('A window broke.')

41. O cachorro está latindo. (SV) ('A dog's barking.')

42. * Está latindo o cachorro. (VS) ('A dog's barking.')

The results from Fernandes (2007) indicate that although the VS order is possible in the case of the unaccusatives, the Brazilian Portuguese speakers prefer the SV order (in 82% of the cases). In the case of unergatives the preference is even higher (95.4%). This indicates that the default SV word order is preferred in intransitive sentences, even when the subject is brought into focus in which case it will receive a focal stress. Whether the thetic/categorical distinction is reflected through these word order changes, as discussed earlier for Spanish, remains to be studied.

Seeing that the Brazilian Portuguese word order is rather restricted, the word order changes used to focalize constituents in Spanish and European Portuguese are not grammatically possible in Brazilian Portuguese. In other words, Brazilian Portuguese cannot resort to changes in word order with the aim of bringing constituents into focus. Instead, other prosodic and syntactic devices are used. Let us consider the following examples as an answer to the question 'What do you want?':

43. Eu quero [o livro]. ('I want the book.')

44. [O livro] |, eu quero. ('The book is what I want.')

45. O que eu quero é [o livro]. ('What I want is the book.')

The above examples all show a narrow focus answer with the nuclear stress in the final position of the intonation phrase. The first example shows the preferred (unmarked) strategy in which the given information is placed on its default place where it naturally coincides with the nuclear stress. If placing the focused constituent on the last place is not possible, the speaker can resort to two syntactic devices. *Example 44* shows how topicalization can be used to bring constituents into focus. When a constituent is ***topicalized***, it is moved to the left of the utterance and presented in a separate intonation phrase, in which it will thus receive its own nuclear stress. The final example illustrates focalization through a cleft structure. Cleft structures are by definition marked, so although the focused constituent appears on the last position as in *Example 43*, it receives more salience in the cleft construction. Should the nuclear stress be placed on a non-final position, the interpretation would by default be contrastive:

46. Eu quero o livro. ('I WANT the book.')

So far we have seen how the Brazilian Portuguese word order is rather restricted, and focalizing constituents through syntax is not as widely employed as in Spanish or European Portuguese. Therefore, Brazilian Portuguese will need to resort to prosody when the focalized construction would be banned by the syntax. However, as discussed earlier, the nuclear stress is obliged to remain on the rightmost constituent, so nuclear movement, as employed by English, is not an option.

Prosodically, Brazilian Portuguese speakers can resort to at least two strategies in order to focalize constituents.[37] The first is chunking the speech material into several intonation phrases, as European Portuguese (cf. *Ex. 28*). This way the nuclear stress will remain on the final position, but a constituent can be brought into focus without resorting to syntax:

47. O que você gostaria de beber? (‘What would you like to drink?’)

- Eu aceito um pouco do <u>vinho</u> | que você <u>comprou</u>. (‘I’ll have some of the <u>wine</u> you bought.’)

The other prosodic device to focalize constituents is what differentiates Brazilian Portuguese from other Romance languages as well as from English. Brazilian Portuguese allows a disassociation of a focal stress and a nuclear stress (Moraes, 2007), contrary to English in which the nuclear stress always appears on the focused constituent. If the focused constituent is not the last one in the intonation phrase, namely, the one where the principal prosodic prominence (the nuclear stress) would naturally fall, Brazilian

[37] In European Portuguese changes in the nuclear tone can be used to convey meanings which in English would be obtained through nuclear movement. For example, *Eu não fui ao médico por estar <u>do\ente</u>* and *Eu não fui ao médico por estar <u>do^ente</u>* both translate literally into ‘I didn’t go to the doctor’s because I was ill’, but in the first example with a falling tone the conveyed meaning is ‘I didn’t go to the doctor’s because I was so ill’ whereas the rise-fall in the second sentence conveys the meaning of ‘ I went to the doctor’s but not because I was ill’(Cruz-Ferreira, 2004, p.16). Most likely this applies to Brazilian Portuguese, but the author is not aware of any studies discussing this.

Portuguese speakers have the option of placing a ***focal stress*** on it. Acoustically, when a focal stress is present, it is the most prominent stress in the intonation phrase (Fernandes Svartman, 2008). Although the main prosodic prominence falls on the focused constituent in these cases, the nuclear stress still remains on the last lexical element, as indicated by the final H+L* nuclear tone (F. Fernandes, personal communication, October 29th, 2014). Consequently, the intonation phrase will then have a flexible focal stress and a fixed nuclear stress (Moraes, 2007), contrary to English which will only show a nuclear stress.

In the following paragraphs, a rudimentary description of the assignment of focal stress in Brazilian Portuguese is provided.[38] This is because tonicity is a rather recent field of interest in Brazilian Portuguese, and because until recently, impressionistic descriptions and case studies dominated the field. Even currently, many studies suffer from methodological limitations such as small sample sizes. Additionally, the majority of the studies have been conducted with the South and Southeastern varieties.

The placement of a focal stress on focalized subjects has been well established in Brazilian Portuguese (Fernandes, 2007; Truckenbrodt, Sandalo, & Abaurre, 2008). The results from Fernandes (2007) indicate that Brazilian Portuguese speakers can place a focal stress on the subject when the subject is required to be brought into focus and situated in non-final position. Contrary to European Portuguese, Brazilian Portuguese thus treats the two subclasses of narrow focus, contrastive and informative, in the same way by placing the main prosodic prominence on the focused element. Fernandes (2007) recorded the responses of three L1 BP speakers' on broad and narrow focus questions with the aim of determining the preferred subject focalization strategies. Her results revealed that the Brazilian Portuguese speakers placed a focal stress on the subject as the

[38] I would like to thank Dr. Flaviane Fernandes for answering my numerous questions about the topic. All errors of course remain mine.

first option and resorted to cleft structures as the second option. Consider the following example from her study (focal stress in bold):

48. Quem comeu o bolo? ('Who ate the cake?')

- O bolo [**a Maria]** comeu. (OSV) ('Maria ate the cake. ')

-*O bolo comeu [a Maria]. (OVS) ('The cake, Maria ate it.')

As Brazilian Portuguese does not allow the OVS structure, contrary to European Portuguese, it resorts to the placement of a focal stress. The results from Truckenbrodt et al. (2008) follow the same line with Fernandes. They obtained narrow focus readings from six L1 BP speakers from the state of São Paulo. The contexts were both informative and contrastive narrow focus. Four out of six speakers showed a focal stress on the focalized subject. The remaining two speakers did not show any pre-nuclear prominence patterns. In the four speakers who realized a focal stress, no clear tonal pattern was found to go with it. The authors conclude that the informants who did not place any focal stresses might not have paid attention to the elicitation context, or that alternatively, *not* marking focus prosodically might be an available option for some Brazilian Portuguese speakers.

Many questions remain about the nature of focal stress in Brazilian Portuguese. First, its presence is only possible in informative narrow focus context. However, its realization has been stated to be similar to that of a contrastive stress (Fernandes Svartman, 2008). Whether the phonetic properties of the focal stress are different to a contrastive stress remains unknown. Second, it is also possible that the speakers may place a phonetic boundary after the focalized constituent (Frota et al., in press), which would divide the intonation phrase into two and align the focused constituent with the intonation boundary, where it would naturally receive a nuclear stress. However, more data is needed to examine this. Third, whereas the presence of a focal stress on subjects has been explored in Brazilian Portuguese, to the best of my knowledge, no studies exist on whether other sentence constituents (e.g., objects or complements) can be brought into focus in the same way through a focal stress. Finally, it would seem that focal stress is only operative in narrow focus interpretation, however, some preliminary research (footnote 15 in Zubizarreta & Nava, 2011) suggests that Brazilian Portuguese might allow deaccenting of given information like English, contrary to Spanish and European Portuguese. As no studies on the matter exist and deaccented structures were one of the target structures of the present study, it was deemed necessary to carry out a small- scale data collection to further explore the matter.

5.3.2.2. Brazilian Portuguese sentence production experiment

The present section discusses the results of a small-scale study which was designed to contribute to the existing pool of information about Brazilian Portuguese tonicity, so that comparisons with General American could be more reliably established. Ten Brazilian Portuguese speakers were recorded reading a set of 20 question-answer pairs and the assignment of nuclear stress, focal stress and tonality were analyzed.

A subset (25%) of the test sentences of the task measuring the prosodic domain, *the Low-pass Filtered Intonation Identification Task* (cf. *Ch.8.3.1.*), were selected as the targets. The test sentences consisted of question-answer pairs in which the question provided the context and the answer was the target which was recorded. The answers consisted of unaccusative and deaccented sentences as well as control transitive sentences. Sentences from all the tested structures were included, but as the main aim was to determine whether deaccenting of given information can take place in Brazilian Portuguese, the majority of the sentences belonged to this category. The sentences were translated into Portuguese by two native speakers. The test sentences can be seen in Table 5.7

Trial n° *	Sub type	CONTEXT	TARGET		Focus domain
		Question	BP translated answer	Original English answer	
Unaccusative					
101	Change of location	Que aconteceu antes da festa? (‘What happened before the party?’)	[Muitos convidados chegaram.]	[Many guests arrived.]	B
003		Por que as crianças estão chateadas? (‘Why are the kids upset?’)	[O gato delas desapareceu.]	[Their cat disappeared.]	B
010	Change of state	Que foi esse barulho? (‘What was that noise?’)	[Uma janela quebrou.]	[A window broke.]	B
123		E depois, que aconteceu? (‘And then what happened?’)	[O jogo começou.]	[The game started.]	B
Deaccented					
146	Relative clause	O que você gostaria de beber? (‘What would you like to drink?’)	Eu aceito [um pouco do vinho que você comprou.]	I’ll have [some of the wine you bought.]	N
148		O que é isso? (‘What´s that?’)	É [o livro que o João escreveu.]	That’s [the book John wrote.]	N
152		Que vocês vão fazer hoje à noite? (‘What are you doing tonight?’)	[Temos muitos deveres de casa para fazer.]	[We have a lot of homework to do.]	B
027	Functional category	Por que você não atendeu às ligações dele? (‘Why didn’t you answer his calls?’)	[Estou muito chateado com ele.]	[I’m very annoyed with him.]	B
130		Que eu deveria fazer? (‘What should I do?’)	Você deveria [falar com o seu chefe sobre isso].	You should [talk to your boss about it].	N
032		O que é isso? (‘What’s that?’)	É [uma encomenda para você].	It’s [a delivery for you].	N
134		Onde é o hotel? (‘Where’s the hotel?’)	[Deveríamos perguntar para alguém.]	[We should ask someone.]	B
155	Given information	Você comprou cenouras? (‘Did you buy carrots?’)	[Eu também comprei outras verduras.]	[I also bought some other vegetables.]	B
136		Você conhece algum mexicano? (‘Do you know any Mexicans?’)	[Eu sou casada com um mexicano.]	[I’m married to a Mexican.]	B
144		Você poderia preparar o jantar? (‘Could you prepare dinner?’)	[Eu odeio cozinhar.]	[I hate cooking.]	B
039		Por que você comprou aquele quadro velho? (‘Why did you buy that old painting?’)	[Porque eu coleciono quadros.]	[Because I collect paintings.]	B
138		Você viu os meus óculos? (‘Have you seen my glasses?’)	[O Tom] está com os seus óculos.	[Tom] has your glasses.	N
042		Que barulho é esse? (‘What’s that noise?’)	[O cachorro está latindo.]	[The dog’s barking.]	B
Control items					
204	Transi-tive	Quem é essa? (‘Who’s that?’)	Ela é [a minha tia].	She’s [my aunt].	N
206		O que aconteceu? (‘What happened?’)	[Eu perdi minhas chaves.]	[I lost my keys.]	B
Contrasive		Ela gosta de pássaros? (‘Does she like birds?’)	Ela [adora] pássaros.	She [loves] birds.	N

Table 5.7. **Test sentences for the Brazilian Portuguese sentence production experiment**.
*Trial number indicates the original number of the trial in the *Lowpass-filtered Intonation Identification Task.* The nuclear stress is underlined and the focus domain is indicated with square brackets: B= broad, N= narrow

The informants were six L1 BP EFL learners who participated in the main data collection (*p10, p22, p46, p47 p55* and *p62*), one L1 BP EFL learner (m) who did not participate in the main data collection, and three monolingual Brazilians (1f, 2m) who did not use English actively. The six participants who participated in the main data collection were randomly selected and they were chosen to take part as it was deemed interesting to see what kind of prominence patterns they would contribute to the sentences in their L1 in comparison to their performance with the same sentences in English in *the Low-pass Filtered Intonation Identification Task*. No interference from the L2 task was expected to occur as the English *Low-pass Filtered Intonation Task* and the Portuguese sentence recording were carried out with one year apart. Brazilians who did not actively use English were also included in the study in order to examine whether speakers who have little or no knowledge of English and who do not use it actively would produce the same prominence patterns as the EFL learners.

The informants were recorded individually at UFSC and at the researcher's home.[39] The researcher read aloud the question and the informants read aloud the answer from a sheet of paper or a computer screen. All the interaction with the informants was carried out in Portuguese in order to encourage monolingual processing (Grosjean, 1989).

The productions were visually and auditorily inspected for the location of nuclear stress, focal stress and chunking. In Brazilian Portuguese neutral statements, nuclear stress can be identified as the last stressed syllable bearing the nuclear tone H+L* (Fernandes, 2007; Tenani, 2002). Consequently, nuclear stress was located from the pitch contour as being the last stressed syllable showing a falling pitch movement (Figure 5.3).

[39] One of the informants received the sentences via email and recorded them herself due to traveling.

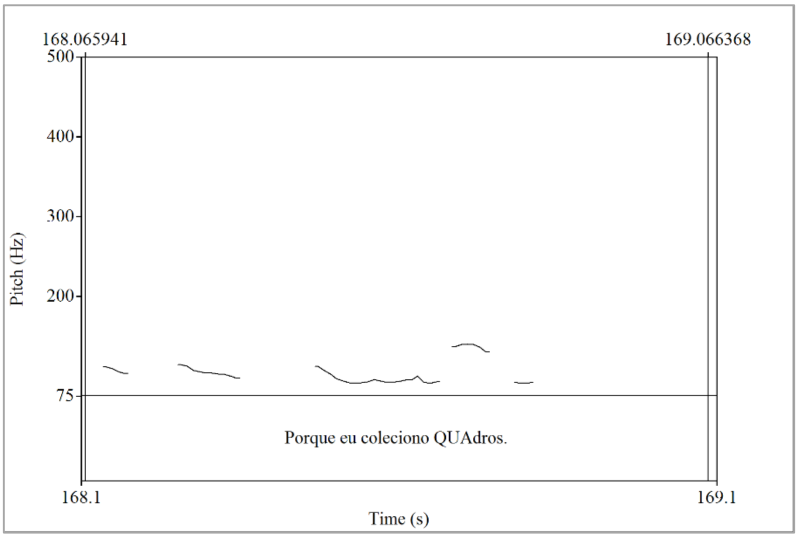

Figure 5.3. Pitch contour of *Porque eu coleciono quadros* ('Because I <u>collect</u> paintings'). The pitch contour indicates the nuclear stress on the rightmost constituent.

As in most of the cases, the nuclear stress fell on the very last syllable of the intonation phrase, pitch movement was difficult to perceive visually. In these cases the pitch contour appeared rather flat, occasionally showing a fall in the last syllable (Figure 5.4). In these cases, the sentences were auditorily examined and the syllable with the highest pitch and greatest loudness was assigned as having the nuclear stress.

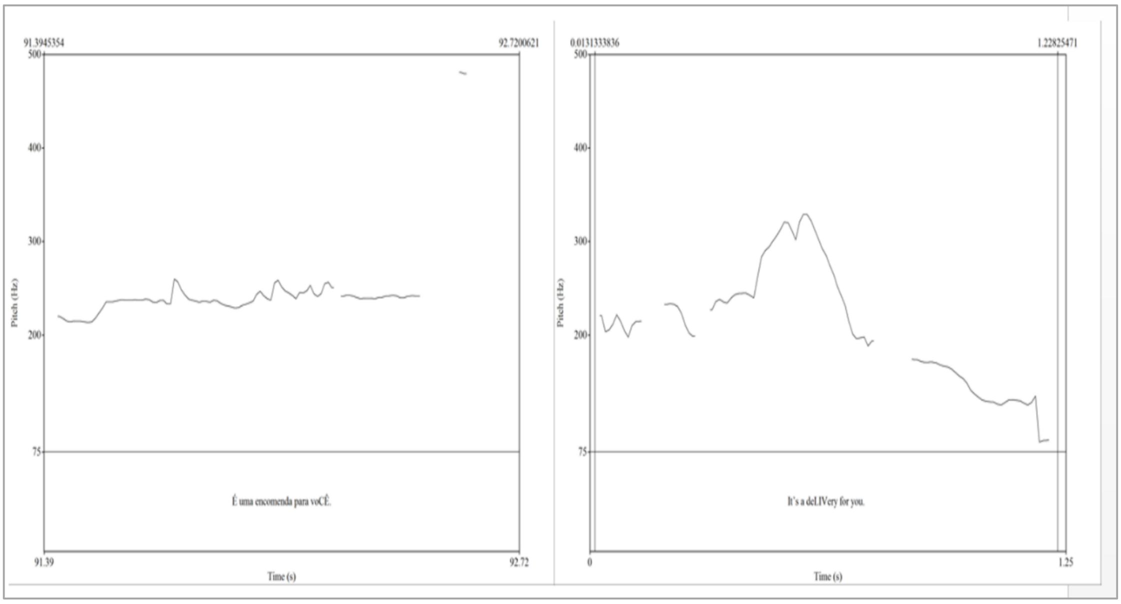

Figure 5.4. Pitch contour of the Portuguese and English versions of 'It's a delivery for you' as pronounced by native speakers.

Focal stress was identified once the nuclear stresses had been assigned. The utterances were visually and auditorily examined for the presence of any prominent syllables before the nuclear stress. Focal stresses were thus defined as a syllable with the highest pitch and the greatest loudness appearing before the nuclear stress (Figure 5.5).

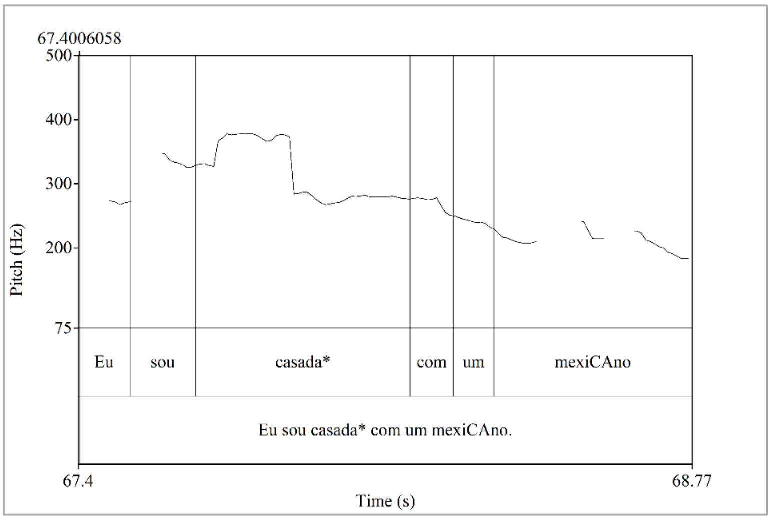

Figure 5.5. **Pitch contour of *Eu sou casada com um mexi<u>ca</u>no* ('I'm <u>married</u> to a Mexican').** Focal stress (*) on 'casada' and a nuclear stress on 'mexiCAno'.

Finally, the spectrograms were inspected for any visible and audible pauses in order to determine whether the informants resorted to chunking of the intonation phrases. The results of the analyses are discussed next.

The placement of nuclear stress was homogenous across the utterances and the speakers. In all of the 197 instances (10 speakers x 20 utterances[40]), except one, the nuclear stress was assigned on the rightmost lexical item in the intonation phrase as identified by a falling H+L* tone.[41] In the one instance with a differing NS placement, the nuclear movement began on the last content word instead of the last lexical item (*Você deveria falar com o seu <u>chefe</u> sobre isso* ['You should talk to your <u>boss</u> about it']). The

[40] Due to technical problems, three sentences from one participant were not recorded.
[41] In the case of one informant, the nuclear stress was identified as the final rising tone on the last stressed syllable as his intonation was rising in all the statements.

control items (transitive and contrastive structures) showed the same nuclear stress placement in English and Portuguese, as expected. As nuclear stress and focal stress can be disassociated in Brazilian Portuguese, the placement of focal stress was examined next.

In 37 sentences out of 197 (18.7%), a focal stress was identified through a visible peak in F0. Let us first discuss the instances in which the pre-nuclear prominence corresponded to emphasis rather than bringing constituents into focus. Following Truckenbrodt et al. (2008), the emphatic stresses were defined as those which had a larger pitch range than the neutral statements and the statements with a focal stress. In 10 out of the 37 cases (27%), an emphatic stress was placed on the word *muito* 'a lot'. Most likely, the Brazilian Portuguese speakers decided to emphasize this word due to its quantifying nature, instead of giving the sentence a neutral reading. All the sentences with *muito* had a broad focus, and this type of emphasis was not called for by the context. Another word attracting an emphatic stress was *odeio* 'hate' in *Eu o**dei**o cozinhar* 'I hate cooking' (As a response to 'Could you prepare dinner?'). Two were the informants who produced *odeio* with an extra heavy stress appropriate to a narrow focus reading (such as 'Do you like cooking?'). As the context in both of the cases did not call for an emphatic reading, which, most likely then, was due to the quantifying and emotional nature of the words, these emphatic realizations will not be discussed here further.

The remaining 25 pre-nuclear stresses could be identified as proper focal stresses. They occurred in the lexical items that in English receive the nuclear stress. Table 5.8 on the following page presents an overview of the results, which are discussed more in detail in the following paragraphs.

Sentence Type	**N° tokens**	**NS assignment on the rightmost constituent**	**Focal stress**	**Chunking**
Control transitive (*n*=2)	19	100	0	0
Unaccusative (*n*=4)	39	100	0	0
Deaccented				
Functional (*n*=4)	40	97.50	7.50	0
Given (*n*=6)	60	100	26.60	8.30
Relative (*n*=3**)**	29	100	3.40	13.70
Contrastive (*n*=1)	10	100	50.00	10.00
Total	197	99.50	12.60	5.30

Table 5.8. Results of the Brazilian Portuguese sentence production experiment. Percentage of occurrence. NS=Nuclear stress

All the focal stresses occurred in the deaccented sentences and none was found in the unaccusative or transitive categories. Let us examine the placement of focal stress within each subgroup of the deaccented category.

In the deaccented sentences ending in function words, three cases of focal stress were found. The remaining 37 sentences ending in functional categories did not present focal stresses. The cases with a focal stress occurred in the following sentences. One participant placed a focal stress (indicated in bold) on *chateado* 'upset' in the broad focus sentence *Estou muito chate***a***do com ele* 'I'm very annoyed with him' (as an answer to the question 'Why didn't you answer his calls?'). Two participants placed a focal stress on *chefe* 'boss' in the narrow focus sentence *Você deveria falar com seu* ***che****fe sobre isso* 'You should talk to your boss about it' (as a response to 'What should I do?'). As only 7.5% of the deaccented sentences ending in functional categories were produced with a focal stress, we could conclude that this subcategory did not particularly attract focal stresses.

Only one focal stress was found in the group of the deaccented sentences ending in relative clauses. One informant placed a focal accent on *vinho* 'wine' in *Eu aceito um* *pouco do **vi**nho que você comprou* 'I'll have some of the wine you bought' (as a response to 'What would you like to drink?'). The remaining 28 sentences were produced without focal stresses. Thus, as with the deaccented sentences ending in functional categories, the deaccented subgroup ending in relative clauses did not particularly attract focal stresses either.

The group presenting the highest number of focal stresses was that of the deaccented sentences ending in given information. Sixteen of these sentences (26.6%) were produced with a focal stress. The sentence presenting the highest number of focal stresses (6/10 informants) was *O **Tom** está com seus óculos* 'Tom has your glasses' ('Have you seen my glasses?'). This sentence differs from the others in that it presents a narrow focus with a topicalized subject whereas all the other sentences have a broad focus. As discussed earlier, the placement of a focal stress in narrow focus sentences with topicalized subjects has been attested to be frequent in Brazilian Portuguese (Fernandes, 2007). If this sentence is considered a case apart and only the sentences with broad focus are examined, then 16.6% of the broad focus deaccented sentences ending in given information carried a focal stress. Three broad focus sentences were identified to especially attract a focal stress in Brazilian Portuguese. These were: *Eu sou ca**sa**da com um mexicano* 'I'm married to a Mexican' ('Do you know any Mexicans?') (5/10 informants), *Eu também comprei **ou**tras verduras* 'I also bought other vegetables' ('Did you buy carrots?') (3/10 informants) and *Porque eu cole**cio**no quadros* 'Because I collect paintings' ('Why did you buy that old painting?') (2/10 informants). These three sentences repeat the information which is considered given, either directly or through a hypernym (carrots- vegetables). Consequently, it seems that explicitly mentioned given information is more prone to attract a focal stress in Brazilian Portuguese than the other structures which were tested.

Finally, the chunking of the sentences was examined. This is an alternative strategy to highlighting constituents by restructuring the information through the division of the sentence into several intonation phrases, each of which ends in a nuclear stress. This was the strategy employed in 10 sentences (5.3%). All of the cases of tonality occurred within the *deaccented relative* and *deaccented given* groups, except one which occurred in the contrastive sentence.

Four cases of tonality occurred in the group involving relative clauses. One of the informants divided the sentence *Eu aceito um pouco do vinho que você com<u>prou</u>* 'I'll have some of the <u>wine</u> you bought' ('What would you like to drink?') into two, placing a nuclear stress at the end of each: *eu aceito um pouco do <u>vi</u>nho | que você com<u>prou</u>.* Another one placed a boundary after *aceito*. Two participants divided the sentence *É o livro que o João escre<u>veu</u>* 'That's the <u>book</u> John wrote' (As a response to 'What's that?') into two. In the first case, the informant placed a boundary after João, thus giving a nuclear accent to *João* and *escreveu.* The other informant divided the sentence by placing a boundary after *livro* 'book', so that both *livro* and *escreveu* received a nuclear accent. In two of the four cases presented in here, the Brazilian informants divided the sentence so that that the first nuclear stress would coincide with the nuclear stress in the English equivalent.

The cases of chunking in the deaccented sentences presenting given information involved the same sentences in which many of the other informants placed a focal stress. Namely, one informant divided the sentence *Eu também comprei outras verduras* 'I also bought other vegetables' ('Did you buy carrots?') into two by placing a boundary after *outras*. This additional nuclear stress coincides with the corresponding English constituent ('other') receiving a nuclear stress. One informant divided the sentence 'I'm <u>ma</u>rried to a Mexican' as *Eu sou ca<u>sa</u>da | com um mexi<u>ca</u>no*, so that the first nuclear stress coincided with the English equivalent ‘married’ and the second fell on the repeated information. Finally the sentence with the topicalized subject ‘Tom has your glasses’, *O Tom está com seus óculos,* showed two informants diving the sentence into two after *Tom* and one informant dividing the sentence after *está*. Consequently, all the participants, except two, brought the subject, *Tom*, into focus either by marking it with a focal stress or by diving the intonation phrase after it and consequently giving it a nuclear accent. This hints that sentences with a topicalized subject behave differently from broad focus sentences. Dividing a sentence into several intonation phrases is frequently due to hesitation phenomena or to the length of the sentence, but it is worth noticing that in total, eight out of the nine cases of chunking, the division of the sentence was such that the first nuclear stress would coincide with the constituent receiving the nuclear stress in English.

The preceding paragraphs presented the results of a Brazilian Portuguese sentence recording, which was carried out with the aim of obtaining additional information on the functioning of nuclear and focal stress in Brazilian Portuguese. The results suggest that Brazilian Portuguese allows a disassociation between a nuclear and a focal stress, as suggested by previous research. Although the nuclear stress obligatorily occurs on the rightmost constituent of the intonation phrase, pre-nuclear prominence can be obtained through the placement of a focal stress if the speaker wishes to highlight one piece of information. An alternative way to reorganize the prominence pattern of the sentence could be seen in a small set of the test sentences in which the informants divided the utterance into two intonation phrases. Curiously, in the majority of the cases involving a focal stress, this coincided with the constituent that in English receives the nuclear stress. Likewise, the majority of the cases involving tonality, the new structure was organized so, that the first nuclear stress would coincide with the constituent bearing the nuclear stress in English. These phenomena were attested in both EFL learners and in monolingual Brazilian Portuguese speakers.

The Brazilian Portuguese production data presented here must be interpreted with caution due to the small sample size and the fact that most of the informants were fluent in English. That being said, the obtained results suggest that although the rigid nuclear stress rule operating in Brazilian Portuguese does not allow nuclear movement, and deaccenting is consequently disallowed, other prosodic devices, such as the placement of focal stress and chunking, can be available for the Brazilian Portuguese speakers in order to bring elements into the listener's focus.

As some sentences seemed to attract more focal stresses and chunking, and these, generally said, coincided with the English nuclear stressed constituents, the speakers might be employing some underlying rules which might be shared by the two languages. However, the data at hand is insufficient to make suppositions of the nature of such rules. Clearly, more research needs to be carried out about tonicity in Brazilian Portuguese. It would be especially interesting to examine how the cases of coinciding General American nuclear stress and the Brazilian Portuguese focal stress are perceived and processed by Brazilian EFL learners. At the present moment, not enough data exists to formulate hypotheses on this matter and such hypotheses are beyond the scope of this study.

This section has examined tonicity in Brazilian Portuguese. We have seen that, in comparison to English, the Brazilian Portuguese nuclear stress is rigid and it obligatorily appears on the last constituent of the intonation phrase in broad focus context. In contrastive narrow focus context, the nuclear stress will move onto the contrasted constituent, as in English, but in narrow focus informative context, the nuclear stress will remain on the final position. It was seen that the Brazilian Portuguese word order is inflexible, and that prominence to constituents appearing in non-final position can be obtained either through chunking or through the placement of a focal stress. There is currently not enough data available to see clear patterns for the focal stress placement, but two structures attracting a focal stress were identified based on previous research. On the one hand, we saw that topicalized subjects have been shown to attract a focal stress (Fernandes, 2007; Truckenbrodt et al., 2008). On the other hand, the results of the sentence recording presented in the preceding paragraphs, indicate that sentences ending in previously mentioned information (given) can attract a focal stress. Additionally, the results of the small-scale study show that the placement of focal stress frequently coincides with the nuclear stress in the corresponding English sentences. Following this, it would seem that although Brazilian Portuguese does not allow deaccenting of functional categories or given information in the same way as English (i.e., post-nuclear deaccenting), some sort of deaccenting strategy is available for at least some Brazilian Portuguese speakers through the placement of focal stress and consequently the relocation of the main prosodic prominence to the left.

5.3.3. Acquisition of General American tonicity by L1 BP speakers

This section will discuss the problems L1 Brazilian Portuguese EFL learners are likely to have when acquiring General American tonicity. As, to the best of my knowledge, no previous research with Brazilians exists on the topic, studies conducted with L1 Spanish speakers as well as predictions made based on the differences between the tonicity systems of English and Portuguese are discussed.

Romance speakers face two difficulties when acquiring English tonicity due to the prosodic differences between Romance and Germanic languages. Namely, the restructuring of the *Romance Nuclear Stress Rule* to the *Germanic Nuclear Stress Rule* and the acquisition of the *Lexical Anaphora Deaccenting Rule* (Nava & Zubizarreta, 2008, 2010).

As we have seen in the previous sections, a clear difference exists between English and Brazilian Portuguese in the assignment of nuclear stress. Whereas the default position in both languages is on the last lexical constituent, English allows nuclear movement also in broad focus context, whereas Brazilian Portuguese does not. In order to place the nuclear stress correctly in English, the Brazilian Portuguese speakers must then restructure their *Romance Nuclear Stress Rule*. Nava (2008) studied L1 English speakers and L1 Spanish EFL learners on the placement of nuclear stress in unaccusative structures. Her results showed that L1 English speakers place the nuclear stress on the subject (SV), whereas the L1 Spanish EFL learners showed a preference for the nuclear stress on the verb, as in their L1 (SV). Similar results were found in Nava and Zubizarreta (2008) in which the L1 English speakers produced the nuclear stress on the subject in 97.5% of the unaccusative sentences. The L1 Spanish EFL learners however showed target-like nuclear stress placement in the same structures in only 13% of the cases. This would indicate that moving from the rigid nuclear stress assignment of Spanish into the more flexible nuclear stress assignment of English is difficult. As Brazilian Portuguese shares the same *Romance Nuclear Stress Rule* as Spanish, we would expect L1 Brazilian Portuguese EFL learners to show difficulties in the acquisition of the *Germanic Nuclear Stress Rule*.

Another task the Brazilian EFL learners face is the acquisition of the *Lexical Anaphora Deaccenting Rule*. As we saw earlier, Romance languages such as Spanish, Italian and European Portuguese do not allow nuclear movement due to deaccenting of function words and given information. Speakers of these languages must then acquire the

Lexical Anaphora Deaccenting Rule and learn what type of information is deaccented in English (Nava & Zubizarreta, 2008, 2010). Nava (2008) discovered that L1 Spanish EFL learners did not show deaccenting in English, and instead transferred the utterance-final nuclear stress to the L2. On the same line are the results of Nava and Zubizarreta (2008) in which the L1 English speakers consistently deaccented previously mentioned lexical nouns, whereas the L1 Spanish EFL learners only showed deaccenting in 23% of the cases. The L1 Spanish EFL learners deaccented more function words than given information. It would thus appear that earlier mentioned (either implicitly or explicitly) information is deaccented in English is more difficult to learn than learning to deaccent final functional categories.

As discussed earlier, Brazilian Portuguese does not necessarily behave like Spanish with respect to deaccenting. Whereas the nuclear stress cannot be moved, the existence of a focal stress does indicate that some sort of deaccenting can be operative in Brazilian Portuguese. As discussed earlier, if the focal stress is present, it will bear the main prosodic prominence in the intonation phrase. Consequently, although the nuclear stress remains on the last constituent, it has lost its role as the syllable bearing the main prosodic prominence within the intonation phrase. In other words, it is possible that the focal stress is used in Brazilian Portuguese to deaccent given information. To the present day, there is no information that Brazilian Portuguese would allow deaccenting of function words. We could thus hypothesize that like the L1 Spanish speakers, the Brazilian Portuguese EFL learners will show difficulties in understanding that utterances ending in function words are deaccented in English. Utterances ending in given information might not present such a big problem if the placement of focal stress is in fact a strategy available in all the contexts presenting given information. However, more research is needed to determine whether Brazilians can benefit from this aspect of their L1 when acquiring English tonicity.

<u>*Section summary:*</u>

The present section laid out the functioning of nuclear stress in General American and in Brazilian Portuguese. It was seen that whereas the assignment of GA nuclear stress is flexible, as determined by Germanic Nuclear Stress Rule and Anaphoric Deaccenting Rule, the assignment of BP nuclear stress is more restricted. However, the phenomenon of focal stress was attested for Brazilian Portuguese. It was seen that although the nuclear stress in broad focus context obligatorily appears in the last sentence constituent, a focal stress can appear on a non-final constituent bearing the main prominence of the utterance and frequently coinciding with the GA nuclear stress placement.

5.4. Design of the present study

In this final section of *Part I*, the research design of the present study is summarized. The target level of awareness, target phonological domains and instruments are shortly reviewed as well as the main research aims.

The focus of the present dissertation is on the lower level of awareness, *noticing* in Schmidt's terms. This lower level awareness is targeted especially in its non-verbalizable manifestations. For this reason, instruments which primarily tap into proceduralized rather than declarative knowledge are employed. Nevertheless, it is necessary to keep in mind that separating the two knowledge types in behavior is artificial and learners are likely to resort to which ever type of knowledge they have available in order to solve the task at hand (R. Ellis, 2005, 2009).

Different degrees of awareness can be observed in language learners, and as discussed earlier (cf. *Ch.4.1.2*), it is necessary to set the upper and lower limits to what is understood with ‘lower level awareness’ in the present study. The upper limit in this study was not set because it would coincide with the distinction between proceduralized and declarative knowledge. The aim of the present study was to capture the most representative type of L2 phonological awareness present in EFL learners, which was deemed to be manifested through proceduralized knowledge, but manifestations of declarative knowledge were not disregarded as they also form part of L2 phonological awareness. However, the amount of such manifestations is necessarily limited because the tasks the participants performed did not tap into declarative manifestations of L2 phonological awareness.

Setting the lower limit was deemed more relevant, as it separates a low-level phonological awareness from simple unconscious registration. This issue was solved in the present study by focusing only on the participants’ existing knowledge representations rather than on their acquisition. In other words, the participants were not tested on whether they noticed given features (as in most of the language awareness research) in which case in the lack of verbal report, the researcher might be unsure whether conscious noticing or unconscious registration occurred (cf. eye-tracking in *Ch.2.2.*, for example). This is not a problem when learners’ existing cognitive representations are tested. We assume that in order for that knowledge to exist and to be manifested in accurate task behavior, that knowledge has been consciously noticed in some prior point in the learner’s L2 learning trajectory.

The research design of the dissertation is seen in Figure 5.6 and will be elaborated in the following paragraphs.

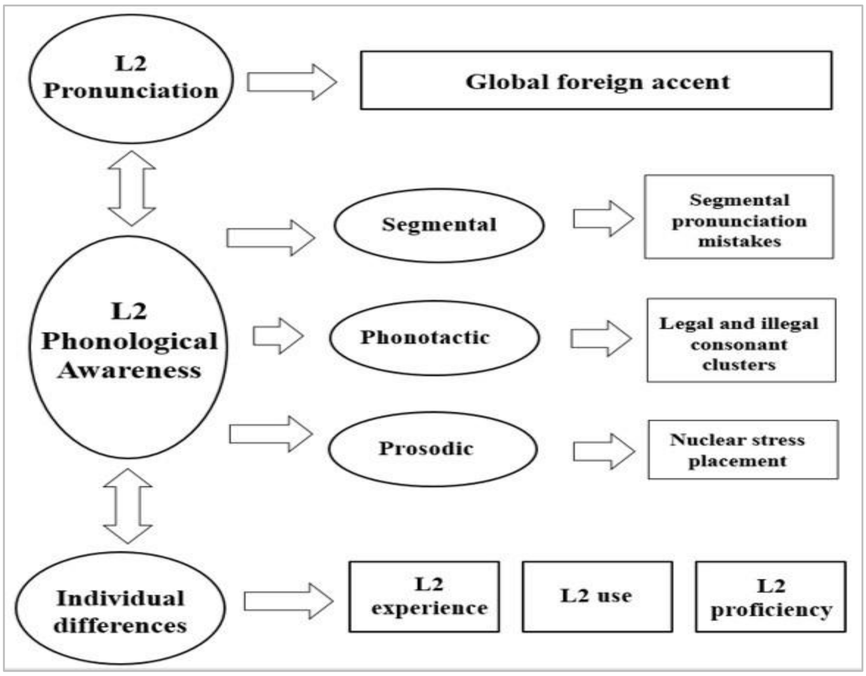

Figure 5.6. Research design

Let us begin from the center of the figure where L2 phonological awareness is seen to consist of the segmental, phonotactic and suprasegmental subdomains. Following the discussion in the present chapter, L2 phonological awareness was tested in these three subdomains. For each subdomain, a target area was selected. The segmental domain task targeted segmental pronunciation mistakes present in vowels and consonants deemed difficult for L1 BP EFL learners. The phonotactic domain focused on English legal and illegal consonant clusters, and the prosodic domain centred on nuclear stress placement. The tasks were perception-based and language-specific (L1 BP → L2 GA), and they tapped mostly into proceduralized knowledge.

Two main aims for the study were established: to examine the effect of individual differences in L2 phonological awareness and to examine the relationship between L2 phonological awareness and L2 pronunciation. L2 experience, L2 use and L2 proficiency (as measured by L2 vocabulary size), among others were investigated in relation to L2 phonological awareness. The data on these variables was gathered with a questionnaire. In order to examine the relationship between L2 phonological awareness and L2 pronunciation, the L2 learners' global foreign accent was assessed by native AmE judges.

Chapter summary:

The aim of this chapter was to present the target areas around which the three phonological awareness tasks were created. General American and Brazilian Portuguese segmental, phonotactic and prosodic inventories were presented and contrasted with this aim in mind. The chapter ended with a description of the research design of the dissertation, which will be fully developed in Part II.

PART II

THE STUDY

After establishing the theoretical background to the study in *Part I*, this second part of the dissertation presents the methodology and the instruments employed. It consists of five chapters.

We will begin by presenting the research questions and the objectives of the study in *Chapter 6*. *Chapter 7* then introduces the two participant groups employed in the study. *Chapter 8* is dedicated to the materials and divided into several subsections. We will begin by discussing the creation of the task measuring the segmental domain of L2 phonological awareness in *Section 8.1*. The following section focuses on the task used to measure phonotactic awareness and *Section 8.3* presents the task for the prosodic awareness domain. Once the L2 phonological awareness tasks have been discussed, *Section 8.4* introduces the instrument to measure the language learners' L2 pronunciation. *Section 8.5* and *8.6* present instruments used to measure independent variables which might be related to the development of L2 phonological awareness.

After the presentation of the instruments, *Chapter 9* outlines the data collection procedure employed in the study. Finally, the findings are discussed in *Chapter 10*, which is divided into several subsections following the organization of the research questions.

6. Objectives and research questions

The aim of the current chapter is to present the research objectives of this dissertation and to formulate the specific research questions used to address them. We will begin by discussing the objectives.

6.1. Objectives

The present dissertation has four main objectives arising from the current state of affairs of L2 phonological awareness research laid out in the preceding chapters. These are:

1. To research adult L1 Brazilian Portuguese EFL learners' L2 phonological awareness in the segmental, phonotactic and prosodic subdomains
2. To further expand our understanding of the nature of L2 phonological awareness
3. To examine the relationship between L2 phonological awareness and L2 pronunciation
4. To create language-specific instruments to measure non-verbalizable L2 phonological awareness in the segmental, phonotactic and prosodic domains reliably

The first aim of the study arises from the lack of studies on L2 phonological awareness and more specifically, from the scarcity of existing data on the acquisition of English phonology by L1 BP speakers. Brazilian Portuguese–English interphonology has not been widely studied, the majority of the studies focusing on L1-Spanish, L1-Chinese, L1-Korean and L1-French EFL learners. L2 phonological awareness, more specifically, has been examined in various language combinations, but very few studies exist about the phonological awareness of L2 Brazilian Portuguese EFL learners, and these studies have focused on the development of L2 phonological awareness as a result of explicit instruction (Alves & Magro, 2011; Silveira, 2004) rather than on L2 phonological awareness in the absence of specific instruction.

Brazil, with its more than 200 million inhabitants, has been called an emerging power and it is undeniably attracting a growing global interest. Foreign companies expand to Brazil and Brazilians enter the global markets, increasing the interaction between Brazilians and English speakers, whether they are native or non-native. As a consequence, the role of English as a foreign language in Brazil is rapidly growing. Owing to this, it is important to add to the existing pool of data on Brazilian Portuguese-English interphonology, and to extend L2 phonological awareness studies to Brazilian Portuguese EFL learners.

The second aim of the study is to add to the current knowledge on the nature of L2 phonological awareness. As was seen in *Chapter 4,* very little is known about L2 phonological awareness in adult foreign language users. As phonological awareness can potentially be beneficial for L2 speech acquisition (cf. *Ch.4.2*), understanding its nature better is imperative.

The third aim of the study focuses specifically on the relationship between L2 phonological awareness and L2 pronunciation. Knowing whether phonological awareness and L2 pronunciation are related can benefit L2 speech researchers and language instructors to a large extent: Should higher L2 phonological awareness be related to more target-like L2 pronunciation, enhancing L2 phonological awareness could be added to the language teaching curriculum.

The final aim of the dissertation is to create reliable instruments to measure L2 phonological awareness in adult language learners. As was seen in *Chapter 4* (cf. *Ch.4.3.*), instruments to examine L2 phonological awareness need to meet a certain set of requirements. Three language- specific (BP -> English) tasks were created and tested for the present study. They are hoped to aid researchers to develop L2 phonological awareness instruments for future studies.

With the first three aims in mind, the following section will present the research questions.

6.2. Research questions

Five research questions (RQ) were formulated in order to address the nature of phonological awareness:

- **RQ 1:** Is there a difference in phonological awareness between native speakers and foreign language learners?

- **RQ 2:** To what extent are the segmental, phonotactic and suprasegmental domains of L2 phonological awareness related to one another?

- **RQ 3:** Do participants who report having received L2 phonetics and phonology instruction show a different degree of L2 phonological awareness than participants who report to be phonetically naïve?

- **RQ 4:** Is phonological self-awareness (metacognition) related to L2 phonological awareness?

- **RQ 5:** How much of the variation in L2 phonological awareness can be explained by individual variables such as: language experience, language use, and L2 vocabulary size?

One research question was formulated in order to address the nature of the relationship between L2 phonological awareness and L2 pronunciation:

- **RQ 6:** To what extent is L2 phonological awareness related to L2 pronunciation accuracy?

Chapter summary:

This chapter has discussed the aims and the main research questions of the present study. Six research questions were posed, divided into two main areas: the nature of L2 phonological awareness and the relationship between L2 phonological awareness and L2 pronunciation.

7. Participants

In this chapter, the participants of the study are presented. It is organized into two sections, one for each participant group. *Section 7.1* focuses on the L1 Brazilian Portuguese (L1 BP) participants, and details first how they were selected before proceeding to the description of their demographic characteristics. *Section 7.2* explains the procedures used to contact the L1 American English (L1 AmE) participants and is followed by a description of the L1 AmE participants' demographic and language background data.

7.1. L1 Brazilian Portuguese participants

The 71 L1 BP participants were selected among the students of the Federal University of Santa Catarina (UFSC) in Florianópolis, Brazil. English teaching at UFSC is centered on the undergraduate and graduate English Language and Literature programs, and on the undergraduate Executive Secretary program. Additionally, English language classes are offered to the academic community through the extracurricular language program (*Extra*). The vocabulary used in the testing materials required an intermediate/ upper-intermediate knowledge of English, which is why learners from lower proficiency levels were not targeted. Consequently, EFL learners from upper-intermediate to near-native levels were approached as potential participants.

Teachers at the two final years (3rd and 4th) of the English undergraduate program, at the English graduate program, and at the upper-intermediate and advanced *Extra* courses were contacted. Out of these, 20 teachers (one from the undergraduate 3rd year, two from the undergraduate 4th year, eight from the graduate program, four from the upper-intermediate *Extra* program and five from the advanced *Extra* program) agreed to collaborate and the 20 classrooms were visited in order to approach the students.

In order to test only monolingual L1 BP EFL learners without diagnosed hearing problems, a pre-selection process was carried out through an online questionnaire (cf. *Ch.8.6.1*). Seventy-one L1 BP speakers passed the pre-selection process and agreed to participate in the research by signing a consent form prior to data collection. In the remaining of the section, the characteristics of the L1 BP participants as a group are discussed in detail. Data from individual participants can be seen in Appendix A.

First, demographic data of the L1 BP participants is presented. This can be seen summarized in Table 7.1.

Age	Sex		Hand dominance		Region of birth		Occupation	
M= 26.01	67.60%	Female	94.40 %	Right	80.30%	South	90.10%	Student
SD= 7.63	32.40%	Male	5.60%	Left	15.50%	Southeast	4.20%	EFL teacher
					2.80%	Central-West	5.60%	Other
					1.40%	Northeast		

Table 7.1. Demographic data of the L1 BP participants. *M*= Mean, *SD*= Standard deviation

Of the 71 L1 BP participants, 48 were female and 23 were male. Their mean age was 26.01 years (range: 17-55). Four participants were left-handed and none of the 71 L1 BP participants reported to have a hearing problem. In relation to geographical distribution, 80 percent of the participants were born in the South of Brazil and most of these in the state of Santa Catarina (59%), followed by Rio Grande do Sul (12%) and Paraná (8%). Southeast was the birth region for 15 percent of the participants, namely, 9 percent in the state of São Paulo and 5 percent in the state of Minas Gerais. Two participants were born in the Central-West, one in Distrito Federal and the other in the state of Mato Grosso do Sul. One participant was born in the Northeast of Brazil, in the state of Maranhão.

In terms of the current place of residence, 91 percent of the participants resided in the city of Florianópolis and the rest lived in the Florianópolis metropolitan area. It was established that the L1 BP participants should come from a monolingual family and this indeed was the case: all of the 71 L1 BP participants had received a solely monolingual upbringing and all of their parents had been born and raised in Brazil.

In terms of occupation, 90 percent of the L1 BP participants were full-time students. More specifically, half (49%) of the students were studying English (at the BA, MA & PhD levels),[42] 23 percent were majoring in the field of Applied Sciences, 8 percent in the field of Natural Sciences, 4 percent in both, Social Sciences and Humanities (excluding English Language, Literature and Translation Studies) and 2 percent were majoring in Formal Sciences. Out of the participants who were not full-time students (*n*=7), three were EFL teachers and four were employed in other fields (civil engineering, project management, social work and mathematics).

As explained earlier in the chapter, the L1 BP participants were contacted through the English Language and Literature program and through the *Extra* classes. Consequently, 45 percent of the participants came from the English Language and Literature program and 47 percent came from the *Extra* program. Five participants did not fall into either of these groups. They had formerly taken part in the *Extra* program and learned about the research from other participants.

Taking a closer look at the English Language and Literature students, the majority of them, 32 percent, were undergraduate English majors (14% 3rd year and 18% 4th year)

[42] Some of the English language and Literature majors also worked part-time as EFL instructors.

and the remaining 12 percent were English graduate students (8% MA, 4% PhD). Most of the *Extra* students came from the advanced level (22%), whereas 16 percent were completing the upper-intermediate level and 8 percent were taking a specialized preparation course for TOEFL.[43]

Having discussed the demographic characteristics of the L1 BP participants, the remaining of the section focuses on describing their linguistic experience in detail. Characteristics of the L1 BP participants relating to English language and linguistics are summarized in Table 7.2.

AOL English	Dialect familiarity		Target pronunciation variety		Nº of foreign languages	
M= 9.31	88.70%	American	88.70 %	American	43.70%	1 FL
SD= 2.75	8.50%	British	7.00%	British	38.00%	2 FL
	1.40%	Australian	1.40%	Australian	18.30%	3 or more FL
	1.40%	Other	1.40%	Irish		

Table 7.2. Linguistic data of the L1 BP participants. AOL = Age of Onset of Learning, FL = Foreign language

The mean Age of Onset of Learning (AOL) English was 9.31 (range: 2-18). Ten of the participants (14%) had begun to study English at preschool, whereas the rest of the participants had first been exposed to English through obligatory education. Portuguese was the sole home language for near all (97%) of L1 BP participants. There were two participants who reported to speak English in addition to Portuguese at home: one did so with an L1 BP sibling in order to practice and the other was married to a native speaker of English.

Owing to the fact that American English is the predominant English variety present in Brazil, being the variety which is taught at school and having the largest

[43] TOEFL, *Test in English as a Foreign Language*, is an English proficiency test especially designed for students who want to study in an English-speaking country, as such we would expect the EXTRA students in this preparatory class to range from upper-intermediate to advanced levels.

salience through media, it is not surprising that it was the variety the L1 BP participants reported to be the most familiar with. Six participants (8%) reported British English to be the most familiar variety, whereas one said so of Australian English.[44] When asked which variety of English the participants used as a model for their own pronunciation, 88 percent said the American variety to be their aim, 7 percent aimed at the British variety, whereas Australian and Irish Englishes were the targets of one participant each. One participant reported not to know what her pronunciation model was.

In relation to phonetic training, 88 percent of the participants had never attended a specialized course in English Phonetics and Phonology. The eight participants (11%) who had received English Phonetics and Phonology instruction were all English Language and Literature students and had attended the same optional one semester course focusing on English segmental phonetics. None of them had received phonetics and phonology instruction in the semester prior to the data collection: the average time from the English Phonetics and Phonology course was 2.63 years (range: 1-6).

Finally, considering the L1 BP participants' knowledge in languages other than English, only 11 percent reported to be fluent in another foreign language in addition to English, whereas 80 percent of the participants considered themselves fluent in English. All participants but one reported English to be their strongest foreign language (L2) .[45] Nearly half (43%) of the L1 BP participants did not know any other foreign language apart from English. Among the participants who spoke a third language, the most frequent L3s were other Romance languages: Spanish (22%), French (12%) and Italian (10%). Thirteen participants reported knowledge of an L4, the most frequent were Spanish and Italian (four participants each) and German (three participants).

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[44] One participant reported to be the most familiar with *other* dialect of English, but there is no data on what this other dialect was.

[45] The participant reported Spanish as her L2 and English as the L3

Having discussed the L1 BP participants of the study, the next section will center on the native English participants.

7.2. L1 American English participants

For the purpose of comparing phonological awareness between language learners and native speakers of the language, a group of native speakers of English was tested. Given the fact that the L1 BP participants were the most familiar with American English, an effort was made to match the L1 English participants' dialect to the one familiar to the EFL learners.

Due to methodological limitations, testing fully monolingual L1 AmE speakers living in an entirely monolingual environment was not possible. The L1 AmE participants of the study were either visiting or living in Florianópolis at the time of the data collection. Minimal experience in foreign languages and linguistics, as well as a short length of stay in Brazil were established as preferable participant characteristics so that the potential effect of knowledge about other languages could be minimized. With this aim, student exchange organizations and the international relations offices of the three main universities in Florianópolis (UFSC, UDESC and UNISUL) were contacted. Additionally, local language schools offering Portuguese classes for foreigners and the teachers administering such courses at UFSC were approached. The initial contact with the teachers and the administrative personnel was carried out via email in Portuguese and it included the presentation of the researcher as well as the research project, and the request for collaboration through forwarding a 'Call for participation in research' flyer to the L1 AmE speakers within the reach. With the aim of reaching more potential L1 AmE participants visiting or living in Florianópolis, social media was used to diffuse the flyer. In total, 19 L1 AmE speakers agreed to take part in the data collection and signed a consent form before their participation. In order to maximize the participation of L1 AmE speakers, the L1 AmE participants did not take part in a pre-selection process, contrary to the L1 BP participants. Although allowing a larger sample of L1 AmE participants, this method suffers from the serious drawback that linguistic background and other individual characteristics could not be controlled for prior to data collection.

The rest of the section discusses in detail the demographic and linguistic characteristics of the L1 AmE participants as a group. Data from individual participants can be found in Appendix B. The demographic data is summarized in Table 7.3.

Age	Sex		Hand dominance		Region of birth		Occupation	
M= 24.10	63.20%	Female	89.50%	Right	31.60%	West	73.70%	Student
SD= 6.68	36.80%	Male	10.50%	Left	26.30%	South	15.80%	EFL teacher
					26.30%	Midwest	10.50%	Other
					15.80%	Northeast		

Table 7.3. Demographic data of the L1 AmE participants.

The mean age of the L1 AmE participants was 24.10 (range: 18-44). Twelve of the L1 AmE participants were female and seven male. Two of the participants were left-handed. All but one participant reported not having been diagnosed with auditory problems.[46]

The geographical origin of the L1 AmE participants was diverse. The most frequent state of birth was California (four participants), followed by North Carolina and Massachusetts (two participants each). Fifteen of the L1 AmE participants resided around the US: six in California, two in Massachusetts, and one in each; Washington, Ohio, New

[46] The participant in question reported a hearing loss of 40% in the left ear due to an occupational injury. As the participants were freely allowed to select the volume level at the tasks, this participant was included in the data collection with reservations.

Jersey, Maryland, Arkansas, Florida and Alabama. The remaining four participants resided in Florianópolis at the time of the data collection.

Before discussing the general characteristics of the L1 AmE participants in more detail, it is necessary to examine the characteristics of the four participants who were residing in Florianópolis. *Np01* had lived in Brazil for 1.5 years and taught EFL for a year. *Np02* had lived two years in Brazil, was married to a Brazilian and had taught EFL for less than a year. *Np13* had been living in Brazil and teaching English for three months. Finally, *np17* had lived in Brazil for 10 years and was married to a Brazilian. Additionally, *np17* was completing his PhD in Translation Studies and worked as a Portuguese-English translator, which together with his long length of residence (LOR) made his Portuguese experience outstanding. The four L1 AmE participants residing in Florianópolis, although being in contact with teaching and linguistics, had never received instruction in either EFL teaching or in English Phonetics and Phonology.

Moving to the L1 AmE participants' linguistic upbringing, the parents of 16 of the L1 AmE participants had been born in the US, whereas in four cases one or both of the parents had been born abroad. Participant *np11* was the only one whose both parents had been born outside the US, namely in Mexico, and she had received a bilingual Spanish-English upbringing from birth. The father of *np03* had been raised in the Netherlands but always addressed his son in English. The mother of *np12* had been raised in Belgium and used French and English to communicate with her daughter. Thirteen of the L1 AmE participants spoke only English at home, whereas three spoke both, English and Portuguese,[47] *np11* used Spanish in addition to English and *np12* spoke French in addition to English. Finally *np18* used Italian in addition to English when communicating

[47] These three were *np01*, *np02* and *np17*, all residing in Florianópolis.

with her grandmother. The data from these participants was included in the study with caution due to their linguistic background (cf. introduction to *Ch.10*).

As with the L1 BP participants, the majority (73%) of the L1 AmE participants were full-time students.[48] Three were EFL teachers, as mentioned previously, and two participants worked in other fields (science teaching and paramedics). The most frequent study fields were Applied and Social Sciences (both 31%), followed by Humanities (10%).

Having described the demographic characteristics of the L1 AmE participants, the remaining of the chapter focuses on describing their linguistic experience, which is summarized in Table 7.4.

AOL Portuguese	**L2**		**L3**		**Nº of foreign languages**	
M= 22.95	52.50%	Portuguese	42.10%	Portuguese	26.30%	1 FL
SD= 5.36	26.31%	Spanish	15.80%	Spanish	47.40%	2 FL
	15.00%	French	10.50%	Italian	26.30%	3 FL
	5.26%	Italian	5.30%	French		

Table 7.4. Linguistic data of the L1 AmE participants.
AOL Portuguese= Age of Onset of Learning Portuguese. FL= Foreign language

All the L1 AmE participants had started to study Portuguese as adults. The mean AOL of Portuguese was 22.95 years (range: 18-34). The length of stay in Brazil was predominantly short: around half (52%) had lived less than three months in Brazil, and around one-third (31%) had lived less than six months in Brazil at the time of the data collection. In other words, 84 percent of the L1 AmE participants had stayed less than half a year in Brazil. More than half of the participants (57%) had studied Portuguese for less than six months, three participants had studied Portuguese between six to twelve

[48] Two participants, *np11* and *np17*, were part-time students and worked in health care and translation, respectively

months, and three had studied Portuguese between one to two years. One participant had never studied Portuguese in an academic setting, and one had received Portuguese instruction between two to four years.

In relation to phonetic training, nearly none (89%) of the L1 AmE participants had received instruction in phonetics and phonology. The two who had undergone phonetic training had not done so in English: *np07* had participated in short pronunciation training courses in several Western and East Asian languages and *np16* had attended a two-month course in French phonetics and phonology.

Looking at the foreign language experience of the L1 AmE participants, ten of the L1 AmE participants said Portuguese to be their strongest foreign language (L2), Spanish was the second most frequent L2 (five participants) followed by French (three participants). One participant informed Italian to be her strongest foreign language. The vast majority of the L1 AmE participants (73%) spoke more than one foreign language. All the additional languages were Romance languages. Only 16 percent of the L1 AmE participants considered themselves fluent in Portuguese, whereas 28 percent considered themselves fluent in a foreign language other than Portuguese.

On the whole, considering the L1 AmE participants' short length of stay in Brazil, in addition to the small amount of Portuguese instruction, and the fact that only one-sixth considered themselves fluent in Portuguese, whereas nearly double the amount considered themselves fluent in another foreign language than in Portuguese, we can conclude that following the current global linguistic reality, the majority of the L1 AmE participants were foreign language users instead of full monolinguals. However, the foreign language experience with Portuguese, and as a consequence with Portuguese phonology and phonetics, was limited, and because of this, their knowledge about Brazilian Portuguese is not expected to have an effect on their task performance.

<u>*Chapter summary:*</u>

The two sections of this chapter began by detailing the procedures used to select participants for the study. Then, a full demographic and linguistic description of the two groups of participants was provided. It was seen that in total 71 L1 BP speakers and 19 L1 AmE speakers participated in the data collection. The following chapter presents the tasks which the participants completed.

8. Materials

In this chapter, the materials used in the study are discussed. The chapter is divided into six sections, one for each instrument. First, the phonological awareness tasks are presented in the following order: segmental awareness, phonotactic awareness and finally prosodic awareness. *Section 8.4* introduces the task used to evaluate the L2 pronunciation of the L1 BP participants. Finally, the instruments used to collect data on individual variables are presented: *Section 8.5* describes the instruments measuring vocabulary size whereas *Section 8.6* discusses the questionnaires used in the study.

8.1. Segmental awareness

Segmental awareness is understood as one of the three components of phonological awareness. It refers to the knowledge the speaker has of the target phonological system at the segmental level, namely, knowledge about individual speech sounds be they contrastive or non-contrastive (cf. *Ch.4.1.2,* p.104).

The section on segmental awareness is divided into three parts and organized in the following way. *Section 8.1.1* describes the target structures and the stimuli, in *Section 8.1.2* the creation of the *Phonological Judgment Task* is discussed, and the final section, *8.1.3*, presents the analyses carried out with the segmental awareness data.

8.1.1. Stimuli

The current section provides a description of the stimuli used in the *Phonological Judgment Task*. In this task, the participants listened to General American phones produced by L1 BP and L1 AmE speakers and were asked to decide whether the pronunciation of the segment was correct or not.

The stimuli for the *Phonological Judgment Task* were selected based on the problems Brazilian EFL learners have demonstrated to have when acquiring English vowels and consonants (cf. *Ch.5.1.3.*). Consequently, the following potential problem areas were chosen: vowels ([i-ɪ, u-ʊ, ɑ, æ, ʌ, ɝ]), consonants ([θ, ð, ɹ, h, ŋ]), nasalization, final devoicing ([-b, -d, -g, -z, -dʒ]), VOT ([p-, t-, k-]) and orthographic transfer (<ch>, <j->, <-ge>, <-l(l)>) .[49]

In order to obtain the target phone productions, a list of potential stimuli words was created with the help of the sound search function of the CD-ROM of *Cambridge English Pronouncing Dictionary* (Jones, Roach, Hartman, & Setter, 2006). The following criteria were established for the selection of the stimuli environment (word in which the phone appeared):

1. Each stimulus word would have at least two of the target sounds in order to maximize the number of potential pronunciation mistakes

2. All the words would be monosyllabic in order to control for the word-stress and memory constraints

[49] Nasalization affects both, the nasalization of the vowel and the elision of the following nasal consonant. In the present study it was included under consonants, but it alternatively could had been analyzed as a phenomenon affecting the vowel.

3. All of the words should be familiar to the participants since in order to know the correct pronunciation of the word, a mental representation of it has to exist

4. No cognate words between English and Portuguese were permitted.[50]

This procedure yielded 45 potential words (Appendix C). In order to fulfill the requirement *3* above, word frequency measures were calculated with the help of *WebCelex*, an online database for Dutch, English and German lexicons (Max Planck Institute for Psycholinguistics, 2001). The chosen frequency measure was ***COBUILD frequency/ million words***. This measure shows on a logarithmic scale how often the word occurs in English, as represented by the University of Birmingham 1991 COBUILD corpus containing approximately 18 million words. The word frequency measures are presented in Appendix D. *Gym* was removed from the stimuli list due to its low frequency. The mean frequency of the remaining words was 369 (range: 8 [*ham]* - 4734 [*this]*).

Recording lists were created with two repetitions of each target word in a randomized order. The target words were embedded into carrier sentences ("____. I say ____ again."). As the aim was to obtain productions *with* pronunciation deviations, intermediate English learners were approached as the speakers. Seven English majors on their second year at UFSC agreed to participate as well as two other beginner English students. In total, there were nine L1 BP speakers. Five of the speakers were female and four were male. The mean age of the speakers was 26.89 (range: 17-56) and they had studied English on average for 3.25 years (range: 2 months-12 years). Eight of them had been born in the South of Brazil and one in the Northeast. They used English on average

[50] After data collection it was brought into my knowledge that *jeans* is in fact a cognate in Brazilian Portuguese; *calça jeans* [kaw.sɐ dʒĩs]. The item was kept in the task, but responses to it were checked with scrutiny.

11% of the time (range: 0-25). Seven of the participants said that English was their strongest foreign language, whereas French and Spanish were the strongest foreign languages to two of the participants. All the speakers reported to be the most familiar with the North American variety of English. As a compensation for their participation, the speakers received a chocolate bar and a participation certificate which could be converted into course credits. The recordings were carried out individually at Fonapli (the phonetics laboratory of the Faculty of Language and Communication at UFSC) with a Sony PCM-M10 recorder with sampling frequency set to 44100 Hz/16-bit.

In order to include stimuli without pronunciation deviations (corresponding to the 'correct'-answers), two native speakers of American English were recorded. The first of the L1 AmE speakers (*NS1*) was a 44-year-old female from California who lived in Florianópolis at the time of the data collection. She had lived in Brazil for three years prior to the data collection, and Portuguese was her only foreign language. She was working as an EFL teacher and received a monetary compensation of R$190 (62€) from the two recording sessions together. The second L1 AmE speaker (*NS2*) was a 35-year-old female also born and raised in California. She lived in Barcelona during the data collection and Spanish was her only foreign language. She had no knowledge of Portuguese and she had never been to Brazil. She also worked as an EFL teacher.

The *NS1* recordings were carried out at LINSE (the signal-processing laboratory at the Engineering Department of UFSC) in a soundproof booth with M audio project mix 10 and sampling frequency set to 44100 Hz/16-bit. The *NS2* recordings were carried out by another researcher at the phonetics laboratory at the UB, also in a soundproof booth. All of the L1 BP recordings followed the same structure. First, the participant signed a consent form and filled in a language background questionnaire. They were then given the recording lists and allowed to look through them. After this, they read aloud the recording lists at their own pace, being able to take a break or repeat if necessary.

In order to obtain the final set of stimuli, the L1 BP word productions were inspected auditorily and visually in Praat (Boersma & Weenik, 2013) for the presence of pronunciation deviations. In the case of the *devoiced* targets, presence of final devoicing was confirmed by visually inspecting the waveform for the absence of glottal pulses during the duration of the final segments (Figure 8.1).

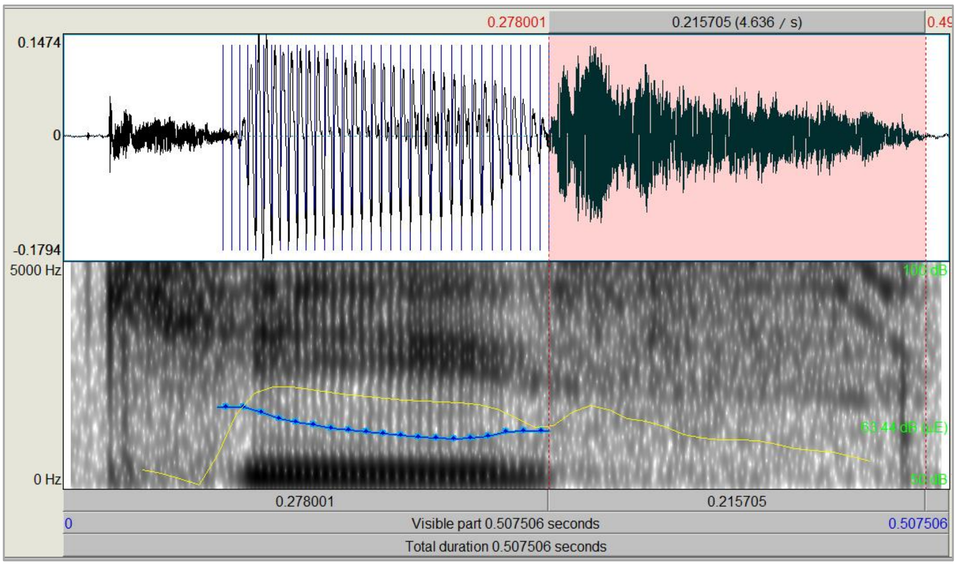

Figure 8.1. Waveform and spectrogram of *keys* [kis]. The devoiced consonant indicated with highlighting.

For the *VOT* targets, the short-lag VOT was confirmed by measuring the duration of the VOT from the release burst of the plosive to the beginning of the presence of glottal pulses (Figure 8.2). Only tokens with VOT below 40 ms were selected. For the *orthographic transfer*, production of <j-> as [tʃ] was confirmed through the lack of glottal pulses in the waveform. Production of [-dʒ] as [ʒ] was confirmed by the absence of the obstruent.

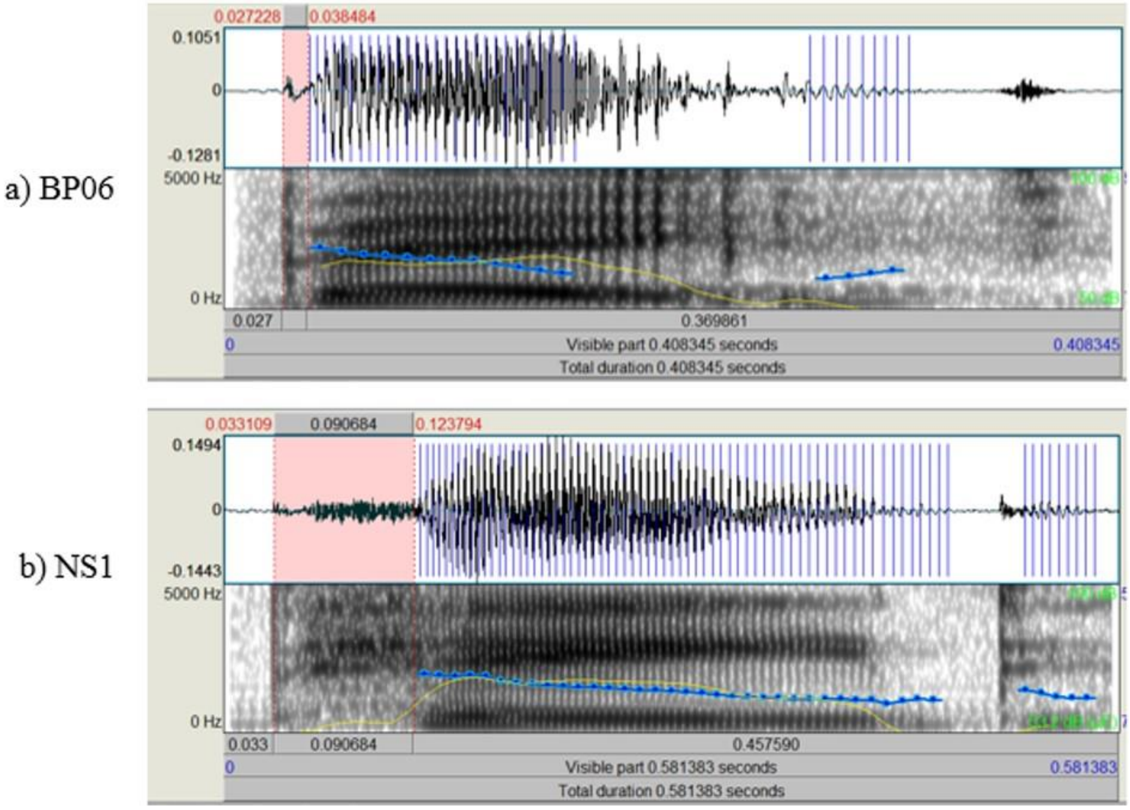

Figure 8.2. *Paid* pronounced by L1 BP (a) and L1 AmE (b) speakers. VOT highlighted for both speakers 11 ms and 90 ms, respectively.

The vowels and the consonants which did not render naturally to visual inspection (*n*=35) were confirmed auditorily to present pronunciation deviations in the following manner. First, the researcher carefully listened to each item and transcribed the pronunciation deviation. Then the items were combined to a single sound file and presented to another phonetician who was asked to listen to the targets and provide a phonetic transcription. The other phonetician agreed with the pronunciation deviations in 77.14% of the cases. The cases in which no agreement was found (*n*=7) were submitted to a third phonetician who was also asked to perform the same task. Agreement on the presence of pronunciation deviation and their nature after this last step was 97.14%.

None of the L1 BP speakers made mistakes with /h/ (i.e., omitting it) or <ch> (i.e., producing *church* as [ʃɝʃ]) and thus these target areas were left out. The final set of stimuli was selected from the words with pronunciation deviations in the following way. If there was only one instance of a deviation, that was chosen. In the case of several deviations, the ones were chosen that presented auditorily the harshest non-target-like pronunciation and those that had the best sound quality. A balance between female and male voices was tried to maintain. The final set of stimuli was unbalanced in regards the pronunciation deviation areas, because the L1 BP speakers did not realize all the pronunciation deviations to the same extent, so that there were for example, more mistakes involving /i-ɪ/ (*n*=8) than involving the production of /ɹ/ (*n*=1).

Once the stimuli spoken by the L1 BP speakers were selected, a selection was made with the L1 AmE speaker stimuli. In order to keep the task at a reasonable length, it was estimated that it would be enough to have $^1/_3$ of the trials pronounced by native speakers of English.[51] Each of the target pronunciation deviation areas received a native pronunciation as well, respecting the internal balance between the areas, so that more native speaker trials would be presented for /i-ɪ/ than for /ɹ/, for example. The target phones were extracted from the words as specified in the following paragraph.

After the target word stimuli had been selected, they were processed for presentation. First, the target deviant phone was isolated from the word, together with a neighboring sound at the zero crossings using Praat. The neighboring sound was included because consonants in isolation are not auditorily very salient and thus they were to be presented as either VC or CV. The same VC or CV presentation was adopted for vowels

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[51] Additionally, the L1 BP listeners were not expected to notice all the pronunciation deviations in the L1 BP speaker trials, so that they would likely identify a proportion of the L1 BP speaker trials as spoken by native speakers of English.

so that the presentation would be uniform throughout the task. After the extraction, the stimuli were preprocessed in Audacity by normalizing all the speech samples to the same peak amplitude level and by removing any low-frequency noise.[52]

The final set of stimuli for the *Phonological Judgment Task* can be seen in Table 8.1 on the following page.

[52] Audacity is available for free download at http://audacity.sourceforge.net

Target area	Word	Target phone	Realization	Speaker	Target area	Word	Target phone	Realization	Speaker	Target area	Word	Target phone	Realization	Speaker	Target area	Word	Target phone	Realization	Speaker
	Practice trials (*n*=4)										**First trials (*n*=3)**								
	dream	[im]	[im]	*NS2*	V	ran	[æ]	[æ]	*NS1*		car	[ɹ]	[ɣ]	*BP08*		church	[ɝ]	[ɜ]	*BP04*
	young	[ŋ]	[nk]	*BP01*	V	stood	[ʊ]	[u]	*BP08*		kill	[kʰ]	[kʰ]	*NS1*					
Test trials (*n*=98)																			
Vowel	cheese	[i]	[i]	*NS1*	**Consonant**	this	[ð]	[ð]	*NS1*	**Devoicing**	job	[b]	[b]	*NS1*	**VOT**	cook	[kʰ]	[kʰ]	*NS1*
	seen	[i]	[i]	*NS1*		this	[ð]	[d]	*BP02*		job	[b]	[p]	*BP06*		king	[kʰ]	[kʰ]	*NS2*
	feel	[i]	[i]	*NS1*		this	[ð]	[d]	*BP04*		paid	[d]	[d]	*NS1*		king	[kʰ]	[k]	*BP08*
	cheese	[i]	[ĭ]	*BP07*		thing	[θ]	[θ]	*NS1*		stayed	[d]	[d]	*NS2*		paid	[pʰ]	[pʰ]	*NS1*
	seen	[i]	[ĭ]	*BP04*		thing	[θ]	[tʰ]	*BP02*		paid	[d]	[t]	*BP06*		paid	[pʰ]	[p]	*BP06*
	feel	[i]	[ĭ]	*BP02*		third	[θ]	[tʰ]	*BP02*		stayed	[d]	[t]	*BP09*		page	[pʰ]	[p]	*BP04*
	feel	[i]	[ɪ]	*BP04*		third	[θ]	[s]	*BP04*		sad	[d]	[tʰ]	*BP01*		page	[pʰ]	[p]	*BP05*
	wheel	[i]	[ɪ]	*BP04*		teeth	[θ]	[θ]	*NS2*		third	[d]	[t]	*BP02*		pigs	[pʰ]	[p]	*BP04*
	keys	[i]	[ĭ]	*BP07*		teeth	[θ]	[f]	*BP05*		third	[d]	[t]	*BP04*		pigs	[pʰ]	[p]	*BP09*
	jeans	[i]	[ɪ]	*BP04*		month	[θ]	[f]	*BP01*		bag	[g]	[g]	*NS1*		pool	[pʰ]	[p]	*BP06*
	jeans	[i]	[ĭ]	*BP07*		month	[θ]	[t]	*BP08*		bag	[g]	[k]	*BP05*		purse	[pʰ]	[p]	*BP05*
	hill	[ɪ]	[ɪ]	*NS1*		rare	[ɹ]	[ɹ]	*NS2*		keys	[z]	[z]	*NS1*		teeth	[tʰ]	[tʰ]	*NS2*
	rich	[ɪ]	[ɪ]	*NS1*		rare	[ɹ]	[ɣ]	*BP08*		toes	[z]	[z]	*NS1*		tongue	[tʰ]	[tʰ]	*NS1*
	hill	[ɪ]	[ɪ̆]	*BP07*		king	[ŋ]	[ŋ]	*NS1*		jeans	[z]	[z̥]	*NS1*		tell	[tʰ]	[tʰ]	*NS1*
	rich	[ɪ]	[i]	*BP07*		strong	[ŋ]	[ŋ]	*NS2*		cheese	[z]	[z]	*NS1*		toes	[tʰ]	[tʰ]	*NS1*
	pool	[u]	[ŭ]	*BP04*		tongue	[ŋ]	[ŋ]	*NS1*		keys	[z]	[s]	*BP07*		teeth	[tʰ]	[t]	*BP05*
	pool	[u]	[ʊ]	*BP06*		king	[ŋ]	[nk]	*BP08*		toes	[z]	[s]	*BP04*		tell	[tʰ]	[t]	*BP01*
	cook	[ʊ]	[ʊ]	*NS2*		strong	[ŋ]	[nk]	*BP06*		jeans	[z]	[s]	*BP07*		toes	[tʰ]	[t]	*BP04*
	cook	[ʊ]	[u]	*BP09*		tongue	[ŋ]	[nk]	*BP07*		cheese	[z]	[s]	*BP07*	**Orthographic transfer**	job	[dʒ]	[dʒ]	*NS1*
	sad	[æ]	[æ]	*NS1*		thing	[ŋ]	[nk]	*BP02*		pigs	[z]	[s]	*BP04*		job	[dʒ-]	[tʃ][53]	*BP09*
	sad	[æ]	[ɛ]	*BP07*		thing	[ŋ]	[n]	*BP09*		this	[z]	[s]	*BP04*		jeans	[dʒ-]	[tʃ][1]	*BP07*
	month	[ʌ]	[ʌ]	*NS1*		ham	[æm]	[æm]	*NS1*		purse	[z]	[s]	*BP06*		page	[-dʒ]	[ʒ]	*BP05*
	month	[ʌ]	[o]	*BP01*		ham	[æm]	[aw]	*BP05*		page	[dʒ]	[tʃ]	*BP04*		hill	[ɫ]	[ɫ]	*NS1*
	month	[ʌ]	[õ]	*BP08*												hill	[ɫ]	[iw]	*BP08*
	job	[ɑ]	[a]	*BP06*												feel	[ɫ]	[iw]	*BP02*
	purse	[ɝ]	[ɜ]	*BP05*												wheel	[ɫ]	[iw]	*BP01*

Table 8.1. Stimuli for the *Phonological Judgment Task*. The *word* column shows the word from which the stimulus was extracted. Underlining indicates the portion of the audio file that was presented for the listeners. The *speaker* column shows the identification number of the speaker, *NS* stands for Native English speaker and *BP* for L1 Brazilian Portuguese speaker.

53 Although the two speakers did not realize <j-> as [ʒ] following BP sound-letter correspondence, these trials were kept because of the non-target-like pronunciation.

30 words were used as test items and additional nine words appeared in the practice trials. Each test word appeared at least twice in one of the two following ways. A word could appear twice by the same speaker but with different target sounds, for example, *page* could appear with focusing on VOT in one trial and focusing on <-ge> on another trial. Alternatively, the word could appear twice with the same target area but spoken by two different speakers, e.g., VOT in *page* pronounced by a native and a non-native speaker. Each word appeared during the test phase 3.6 times on average (range: 2-5). On average there were seven words (range: 4-14) produced by each of the L1 BP speakers.[54] In case of the L1 AmE speakers, 25 out of the 33 native speaker stimuli came from *NS1* due to clearer enunciation.

The stimuli present a drawback which could have been avoided by using synthesized speech or alternatively having a larger sample of speakers. Due to the nature of the words (C)CVC and the small number of speakers, in some cases (9 pairs) the presentation of the stimuli overlapped in the following way: the same speaker provided two trials both of which shared the vowel but differed in the consonants. For example, *BP01* pronounced *month* as [mont] and [mo] was used in a trial targeting the native-likeness of the vowel and [ont] in a trial targeting the native-likeness of the final interdental fricative. Additionally, in two cases, the same stimulus was used to test two different targets areas: *BP07* pronounced *keys* as [kĭs] and [is] was used on two occasions. First to determine the native-likeness of the vowel and then to determine the native-likeness of the final consonant. Although the overlapping of the audio in these ways is not ideal, this should not have affected the listeners who were instructed very clearly on which sound they should base their answer on. Furthermore, it was deemed that obtaining

[54] Data from BP03 had to be disregarded due to poor sound quality.

real speech from a population analogous to the listeners would be more beneficial than using synthesized speech.

8.1.2. Phonological Judgment Task

This section presents the structure of the *Phonological Judgment Task*. To the best of my knowledge, this type of instrument has not been previously used to measure L2 phonological awareness. The idea for the *Phonological Judgment Task* arose from research carried out within language awareness using grammaticality judgments tasks (e.g., Ammar et al., 2010; Rebuschat & Williams, 2012; Renou, 2001). In a grammaticality judgment task, the participant is presented with target language sentences and asked to decide whether they are grammatical or ungrammatical (cf. *Ch.2.3*, p.55). In some cases, the participant is then asked to provide the correct answer. The objective was to transfer this task structure for phonetics and phonology, and to create a task in which phones would be judged for their accuracy, that is to say, native-likeness. In order to do so, the specific nature of segmental awareness and the requirements it posits to the instrument needed to be taken into account. These features are discussed next.

Several pronunciation-specific features make the creation of a task like this challenging. The first problem arises with the visual presentation of the stimuli. If segments are heard without context, it is extremely hard for the listener to judge their native-likeness. For example, the [æ] in *cat* and in *bad* are different, and thus in order to judge the native-likeness of [æ], the listener needs to know from which of the words the vowel comes from. Hence, it is necessary to present the stimuli visually. However, phonetically naïve participants are unfamiliar with phonetic transcription and their awareness of what constitutes a phone can be deficient. Consequently, the visual form of the stimulus needs to be presented orthographically, and the target area or the answering options need to be letters and not phonetic symbols, so that for example, <th> would stand for /θ/ in *thing*.

Another problem in dealing with individual phones is that they are inherently very short, often produced fast and they are not usually encountered in isolation. This on the one hand, posits problems for the listener, who has to make a decision based on a very short auditory stimulus. On the other hand, the researcher faces a trade-off between presenting the phone, rather artificially, in isolation but giving it the maximum salience, or presenting it in a real context together with other phones, but with the risk of losing its prominence.

Finally, motoric limitations have to be taken into account when measuring segmental awareness (cf. *Ch.4.1.1.1.*, p.90; *Ch.4.3*, p.118). It is possible to know that a specific sound is not pronounced in a native-like manner (low-level awareness), and even in the case of exposure to explicit teaching, to be able to give an explanation to why this is so (high-level awareness). Yet the language user might be unable to pronounce the sound correctly, as is the case for many EFL learners with /θ/ and /ɹ/. Consequently, the participants should not be asked to orally correct the incorrect trials.

After having examined some of the pronunciation-specific features which have to be acknowledged when testing L2 phonological awareness at the segmental level, the creation of the *Phonological Judgment Task* is now discussed.

Two previous versions of the *Phonological Judgment Task* were created and piloted before deciding for the final version used in the data collection. The first version of the task was piloted in 2012 with seven native English speakers and 46 L1 Spanish-Catalan EFL learners at UB. The participants listened to words isolated from an English utterance, and indicated the most salient pronunciation error they heard (if any). Additionally, they had to mark how many other pronunciation errors they could hear. The stimuli were chosen from the *Speech Accent Archive* (Weinberger, 2014) and came from 13 L2 English speakers (10=L1 Spanish, 3=L1 Portuguese), and from two native English speakers, who were recorded at the UB by the researcher. The results indicated that a large number of the pronunciation deviations went unnoticed, and that the native English speakers did not agree on the most salient mistakes. This initial piloting showed on the one hand, that the task had to be simplified because the pronunciation deviations were not salient enough when presented in this way. On the other hand, it was seen that the stimuli should be improved, and that words in isolation should be used instead of words from an utterance. Additionally, speech rate should be controlled for since many of the words were spoken very fast, which increased the difficulty of the task. In the second version of the task, the same stimuli were used as in the final version of the task. The task structure was simplified so that the listeners heard a stimulus word and had to mark on an answer sheet all the pronunciation mistakes they were able to identify (Figure 8.3) instead of ranking them as in the first version. The pronunciation deviations were presented within the target words and not as CV/VC segments as in the final version. Relistening was allowed.

The second version of the task was piloted in Florianópolis in 2013 with 10 L1 BP EFL learners and five native English speakers. The L1 BP EFL learners were upper-intermediate *Extra* students at UFSC and did not differ in terms of demographic and linguistic characteristics from the participants used in the final data collection (cf. Appendix E for the characteristics of the piloting participants).

Listen carefully to the word. Are all the sounds pronounced correctly in English?

If not, please circle **ALL** the sounds that were NOT native-like. If all the sounds in the word were native-like in your opinion, circle "native-like".

	Circle all the pronunciation mistakes you could hear					Or select "native-like"
17	P	AI	D			native-like
18	P	I	G	S		native-like
19	P	OO	L			native-like

Figure 8.3. Part of the answer sheet of *Phonological Judgment Task* v.2

The second piloting showed that many of the pronunciation deviations still remained unnoticed due to the task structure. It appeared that when the deviations were presented within the word, it was difficult for the listeners to identify them. This could be because the listeners were paying attention to the meaning and not to the form (VanPatten, 1996, cf. *Ch.4.1.1.3,* p.99). Additionally, very few of the participants used the relistening option. Consequently, for the final version of the task, it was decided that the listeners' attention should be directed as closely as possible to the pronunciation deviations. This was implemented by deciding to present the stimuli in isolation as CV/VC and by repeating each stimulus twice. Moreover, the task structure was further simplified to a forced choice paradigm. The final version of the task was piloted in Florianópolis in 2013 with five L1 BP upper-intermediate EFL learners from *Extra* and with one L1 AmE speaker. The results showed that more pronunciation deviations were noticed than in the previous versions. Additionally, a Cronbach's Alpha value of .87 indicated that the task was reliable.

In the following paragraphs, the structure of the final version of the *Phonological Judgment Task* is presented in more detail.

All the phonological awareness tasks, including the *Phonological Judgment Task* were created and administered with DmDx display presentation software (Forster & Forster, 2012).

The task consisted of three parts: segmentation practice, practice trials and test trials. Since piloting of the task showed that language users are not used to think in terms of individual sounds, and rather think in terms of letters, syllables or words, it was deemed necessary to make sure that the participants understood what was meant with a *sound*. This was achieved by four segmentation practice trials. In these trials, after hearing a monosyllabic English word spoken by a native speaker of English, the participants had to answer how many sounds this word had (Figure 8.4). The answer was given by pressing one of the number keys in the keyboard. After providing the answer, feedback was given on the accuracy of the response, focusing especially on separating sounds from letters (Figure 8.5).

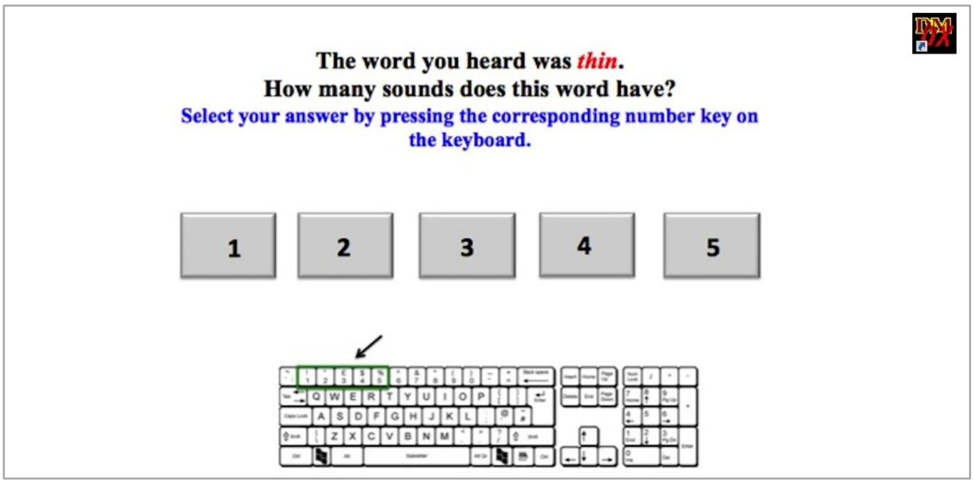

Figure 8.4. Screenshot from a segmentation practice trial.

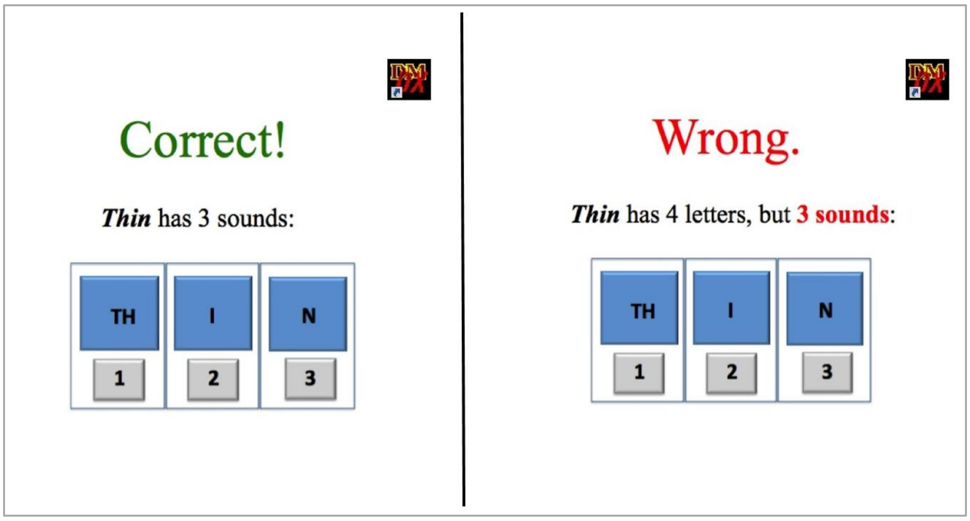

Figure 8.5. Screenshots from the negative and positive feedback to the segmentation practice trial.

The segmentation practice trials were followed by instructions on how to complete the task. Each of the trials was as follows. First, the participants saw a test word in which the target segment was underlined. They were told to read the word and focus on the underlined part. Next, they would hear the underlined part together with the neighboring segment (CV/VC) twice at a comfortable volume and they were asked whether the sound was native-like in English or not.[55] Figures 8.6 and 8.7 show screenshots of the task. Participants received instructions that they were to make their decision based on the underlined part only, although they would hear a bit more of the word for the sake of making the task easier. The trials could be relistened as many times necessary, but the response could not be changed. Response (‘yes’/’no’) was given by pressing the corresponding Control key on the keyboard.[56] If no answer was given within 20 seconds, the next trial was automatically presented.

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[55] The stimulus was presented twice in order to make the task easier and to encourage more noticing, as the segments were very short. Additionally, this meant that each participant relistened each stimuli at least once.
[56] A right-handed and a left-handed versions of the task were created in order to have the same presentation in all of the phonological awareness tasks (cf. *Ch.8.2.2*, p.255)

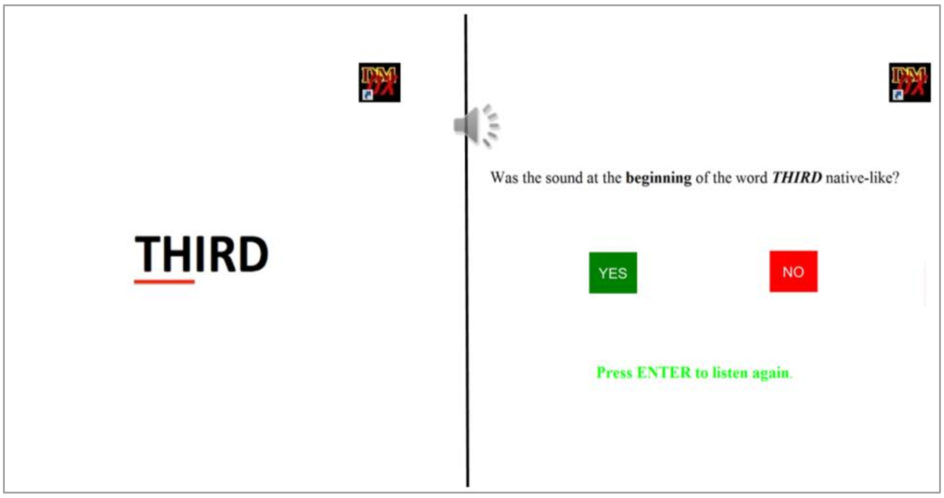

Figure 8.6. Screenshots from trial 'third_th_bp02'. The loudspeaker stands for the presentation of the auditory stimuli.

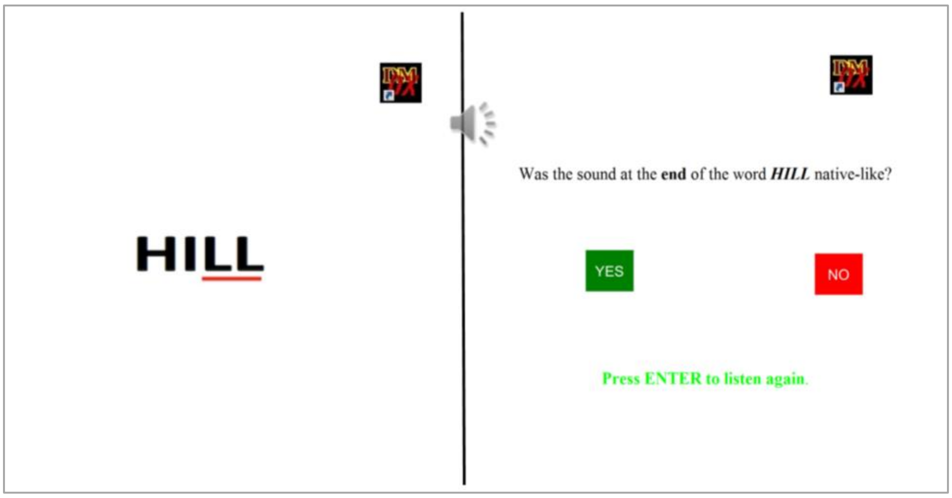

Figure 8.7. Screenshots from trial 'hill_ll_ns1'. The loudspeaker stands for the presentation of the auditory stimuli.

There were four practice trials which presented segments by L1 AmE and L1 BP speakers. The practice trials did not provide feedback. After the practice block, the participants were instructed to ask for clarifications if they had doubts.[57] The first three trials after the practice block were left out of the analyses. The test block consisted of 98 randomized trials, 65 spoken by L1 BP speakers, each of them with a pronunciation

[57] At this point also the volume level was adjusted if the participant considered it inadequate, as once the DmDx experiment is started, the volume level cannot be changed.

deviation, and 33 spoken by L1 AmE speakers. After 46 trials, the participant could take a break.

The Phonological Judgment Task was carried out individually in a quiet room at Faculty of Language and Communication (Centro de Comunicação e Expressão) at UFSC with a laptop computer and Roland RH-5 monitor headphones. The participants received oral and written instructions on how to complete the task. First, the researcher described the task and made sure that the participant understood what was meant with 'native-like', as piloting had showed that this term was not necessarily familiar to all participants. Then the participant read the instructions on the screen in a self-paced manner, being able to ask for clarifications at any point. When the instructions were understood, the participant began the task.

8.1.3. Analyses

The data from the *Phonological Judgment Task* comes in the form of mistake identification accuracy and secondarily, in the number of replays. The output from DmDx results files shows the reaction time to each trial preceded by a positive or a negative (+/ -) sign indicating whether the given response was correct or not. Reaction time data was not relevant for this task and it was thus disregarded. The responses were coded as "1" (for correct) or "0" (for incorrect). In order to obtain the mean mistake identification accuracy percentages used for the analyses, the responses of the individual trials were added and the sum was divided by the total number of trials and the result was multiplied by 100.

As the task allowed relistening, a relistening rate was also computed for each participant, as well as for all the non-native speaker trials and all native speaker trials in order to determine whether some participants relistened significantly more than others, and whether non-native speaker trials and native speaker trials were relistened to a different degree. Relistening rates were calculated as a mean percentage (amount of relistening averaged across the trials per each condition).

Mean mistake identification accuracy was computed separately for each participant in the following conditions: segmentation practice trials, practice trials, all non-native speaker trials (*n*=65), all native speaker trials (*n*=32), all trials combined (*n*=97), trials involving mistakes of phonological nature and trials involving mistakes of allophonic nature.[58] Additionally, a mean mistake identification accuracy was calculated for each of the test categories: *consonant*, *vowel*, *final devoicing*, *orthographic transfer* and *VOT*. The means were computed separately for non-native speaker trials and native speaker trials in order to make comparisons between non-native speaker trials and native speaker trials possible. Subcategories within each category (i.e., /i/ and /ɪ/ among others for the vowels) were not computed due to the uneven, and frequently small subcategory size.

Finally, a ***Segmental Awareness Score*** was computed in order to make comparisons to other tasks and to individual variables possible. This score was required to capture the main knowledge behind the *Phonological Judgment Task* and because of this, the mean mistake identification accuracy for the non-native speaker trials was selected as the *Segmental Awareness Score*. The ability to identify pronunciation deviations in non-native speech is seen as a reflection of phonological awareness at the segmental level, whereas the ability to accept native pronunciations as correct (mean

[58] Mistakes of phonological nature= *vowel*, *consonant* and *orthographic transfer* trials. Mistakes of allophonic nature= mean mistake identification accuracy from *final devoicing* and *VOT* trials.

identification accuracy for native speaker trials) may also be a reflection of phonological awareness but it can also result from positive evidence from the input. Identifying pronunciation deviations on the other hand requires perceiving and comparing the deviation with the listener's awareness of the L2 segmental phonology and rejecting it if no match is found.

Section summary:

In this section, an overview of the task to measure phonological awareness in the segmental domain was provided. The section began by presenting the stimuli used in the task, chosen based on the problems L1 BP EFL learners have been shown to present with the acquisition of English vowels and consonants. Next, a description of the Phonological Judgment Task was provided. The final section laid out the analyses carried out with the data. The following section moves to another area of phonological awareness and presents the task used to measure it at the phonotactic domain.

8.2. Phonotactic awareness

Phonotactic awareness refers to the knowledge the language user has of the permissible sound combinations and sequences in the target language. Together with segmental and prosodic awareness, it is understood as a component phonological awareness (cf. *Ch.4.1.2,* p.104).

The aim of this section is to present the instrument used to measure L2 phonological awareness in the phonotactic domain, namely the *Lexical Decision Task*. We will begin by discussing the preparation of the stimuli. *Section 8.2.2* covers the creation of the *Lexical Decision Task*. Finally the analyses carried out with the *Lexical Decision Task* data are presented in *Section 8.2.3*.

8.2.1. Stimuli

The present section describes the stimuli which were used in the task measuring the participants' phonological awareness in the phonotactic domain, namely the *Lexical Decision Task*. In this task, the participants listened to English words and nonwords and decided whether the presented stimulus was a real word or not in English. Response times to the nonword stimuli were measured and taken as an indication of the participants' phonotactic awareness.

The stimuli consisted of English words and nonwords (Figure 8.8). The nonwords were further divided into legal and illegal groups in order to examine participants' phonotactic awareness. ***Legal nonwords*** are those that present sound combinations which are permissible in the target language phonotactics. ***Illegal nonwords*** are those that violate the phonotactic principles and present impossible sound combinations. Within each group (*word, legal nonword* and *illegal nonword*) two types of items were created: test items and distractor items. The test items had an initial consonant cluster whereas the distractor items did not. Consequently, the structure of the test items was (C)CCVC and the structure of the distractor items was CVC.

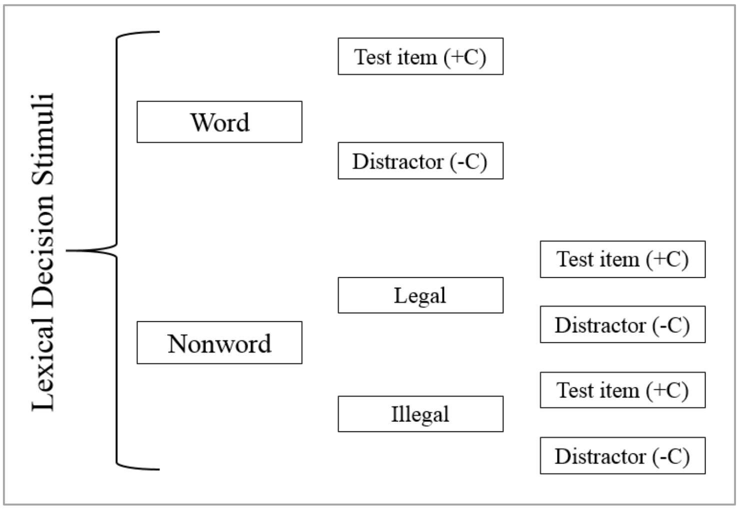

Figure 8.8. Overview of the *Lexical Decision Task* stimuli.

Consonant clusters were selected as the target structure due to previous piloting indicating that this was the area in which native and non-native speakers demonstrated most phonotactic sensitivity (cf. introduction to *Ch.5.2*). Further delimitation on the clusters was made due to previous research with lexical decision tasks. Previous research employing lexical decision tasks with consonant clusters has shown that lexical decision is already made when processing the onset (e.g., Praamstra, Meyer, & Levelt, 1994; Trapman & Kager, 2009). In other words, listeners' lexical decisions are faster when the illegal and legal clusters appear word-initially than when they appear word-finally. Consequently, in the present study, only initial consonant clusters were tested.

Before presenting the stimuli, some phenomena affecting lexical processing are discussed with the aim of providing an overview of factors that need to be taken into account when preparing stimuli for a speeded task requiring lexical access.

In a lexical decision task, participants access their mental lexicons in order to decide whether the presented stimulus is a word or a non-existing word. When doing so, processes of activation and inhibition are present when phones and lexical items compete for selection. Three characteristics affecting this pattern of activation and inhibition have been identified: word frequency, phonological neighborhood density and phonotactic probability.

Let us begin by discussing the effects word frequency has on spoken word recognition. ***Word frequency***, or the frequency of occurrence of words in the lexicon, has been shown to have a facilitative effect on word processing. High frequency words are processed faster and more accurately than words with low frequency (Forster & Chambers, 1973; Goldinger, Luce, & Pisoni, 1989; Luce & Pisoni, 1998; Stone & Van Orden, 1993). Additionally, words that are familiar to the participants are processed faster than unfamiliar words (e.g., Connine & Mullennix, 1990). Word frequency, by definition, is a characteristic that is only applicable to words. The following two characteristics, phonological neighborhood density and phonotactic probability have been shown to have an impact on both word and nonword processing, which makes them particularly relevant for the present study.

Phonological neighborhood density and phonotactic probability, although affecting different processing levels, lexical and sublexical respectively, are not unrelated. Phonological neighborhood density frequently correlates with phonotactic probability, so that words made of frequent phones are usually phonetically similar to many other words (Vitevitch, Luce, Pisoni, & Auer, 1999). Therefore, phonological neighborhood density and phonotactic probability are usually tied together.

Phonological neighborhood density refers to the number of words that are phonetically similar to a given word (Vitevitch et al., 1999). Members of the same neighborhood are those that can be converted into another member of the neighborhood by exchanging, adding or deleting a phone (Luce & Pisoni 1998; Vitevitch & Luce, 1998). The effect of phonological neighborhood density on lexical access is hindering, for both words and nonwords. Items occurring in dense neighborhoods engage in more intense competition than items occurring in sparse neighborhoods. This results in slower processing, which is manifested in slower reaction times and lower accuracy for dense neighborhood words and nonwords in comparison to sparse neighborhood items (e.g., Goldinger et al., 1989; Hunter, 2013; Luce & Pisoni, 1998; Ziegler, Muneaux, & Grainger, 2003).

Whereas phonological neighborhood density has an effect at the lexical level, phonotactic probability operates at the sublexical, phonetic, level. ***Phonotactic probability*** is defined as the relative frequency of segments and sequences of segments in a given position in a word (Vitevitch et al., 1999). The effect of phonotactic probability in spoken word recognition has been shown to be facilitative for both words and nonwords. To put in another way, words and nonwords made of frequent phones are processed faster and more accurately than words made of less frequent phones in tasks engaging the sublexical level, as is the case of word naming tasks or same-different auditory judgment tasks (Luce & Pisoni, 1998; Vitevitch & Luce, 1998, 1999).

Nonwords have been shown to behave in a special way in lexical decision tasks. Initially, nonwords should be processed at the sublexical level, as no lexical entries for them exist. Consequently, the prediction would be that nonwords made of high frequency phones would be processed faster (facilitatory effect of phonotactic probability) and that neighborhood density should not have a hindering effect on nonword processing as the access remains sublexical. However, faster response latencies have been found for words and nonwords which have *low* neighborhood density and *low* phonotactic probability

(Hunter, 2013; Vitevitch & Luce, 1999). This suggests that if the task type favors lexical access, also nonwords engage in lexical competition. This is further corroborated by recent studies with event-related potentials (Hunter, 2013) which show an increased neural activity or competition, for nonwords in a lexical decision task.

To summarize, word frequency, word familiarity, phonological neighborhood size and phonotactic frequency are characteristics that have an effect on the speed and accuracy of processing of words and nonwords, which is why they have to be taken into account when creating stimuli for a lexical decision task. Word frequency and familiarity usually correlate, and their effect on word processing is facilitative. Phonological neighborhood size and phonotactic frequency are likewise related. Phonological neighborhood size has been shown to have a hindering effect on word and nonword processing, and recent research suggests that the effect of phonotactic probability is also hindering in tasks favoring lexical access. Furthermore, some recent studies suggests that individual differences, such as attention control (Janse & Newman, 2013) and language disorders, such as aphasia (Sadat, Martin, Costa, & Alario, 2014), may have an effect on the degree of the inhibitory effect of neighborhood density and that this effect could even become facilitatory.

The effect of task demands and individual differences on these phenomena is beyond the scope of the present research. However, as these characteristics affect task behavior in tasks involving lexical access, they need to be taken into account when creating word and nonword stimuli. The *Lexical Decision Task* in the present study was not used to study lexical access. Instead, it was used as a vehicle to examine phonotactic awareness through the reaction latencies to the nonword stimuli. Because of this, rigorous matching of words and nonwords for their frequency, density and probabilistic characteristics was not the main aim of the study. However, within each group (*word*, *legal nonword* and *illegal nonword*) care was taken to control for these phenomena in order to ensure that the found results would be due to participants' phonotactic awareness and not to the frequency and probabilistic characteristics of the stimuli.

Having discussed the relevant phenomena previous research has identified as having an impact on lexical access, we will move to the presentation of the stimuli. The next section describes the criteria used to create and select the nonword stimuli.

8.2.1.1. Nonwords

The creation of the nonword stimuli began by contrasting the onset consonant clusters of English and Portuguese in order to form the legal nonwords (cf. *Ch.5.2*). The legal clusters were selected among those that are permissible in General American but illegal in Brazilian Portuguese. There are 16 such clusters in GA: /sp, st, sk, sl, sm, sn, θɹ, ʃɹ, sw, mj, bj, pj, vj, fj, kj, hj/. As semivowels are acoustically vowel-like, C+/j/ and C+/w/ could be erroneously perceived as a consonant + vowel, e.g., *sweet* as [suˈwit] and a possible nonword *swik* as [suˈwik]. This would convert the CC for a CV onset, which is permissible in Brazilian Portuguese. In order to avoid this, the clusters having a semivowel as a second member were not included.

With the aim of confirming that the remaining eight clusters had a high frequency of occurrence in English, biphone positional probability was calculated with the help of Phonotactic Probability Calculator (Vitevitch & Luce, 2004). ***Phonotactic Probability Calculator*** is an online calculator which calculates different phonotactic probability measures for American English words and nonwords.[59] ***Biphone positional probability***

[59] The Phonotactic Probability Calculator employs Klattese, a computer-readable phonemic transcription. Consequently, in all the calculations performed with the help of this calculator, the stimuli were previously transcribed into Klattese.

provides the frequency of occurrence of the cluster in initial position in English. As the clusters with nasal consonant as the second member are perceptually very similar, only the cluster with the higher phonotactic probability, /sm/, was included (/sn/ .0015). Consequently, the legal two-member clusters used in the study (biphone positional probabilities between brackets) are: /st/ (.0177), /sp/ (.0091), /sk/ (.0078), /sl/ (.0041), /θɹ/ (.0018), /sm/ (.0017) and /ʃɹ/ (.0010).

Since Brazilian Portuguese does not allow three-member clusters, the eight General American CCC onset clusters were all potentially good targets. A further selection was made based on the sum of biphone positional probabilities. ***Sum of biphone positional probabilities*** is the sum of all the segment-to-segment co-occurrence probabilities of the target item. That is to say, it provides the overall frequency of the CCC cluster. In order to create as word-like legal nonwords as possible, the four most frequent three-member clusters were chosen. These were: /stɹ/ (.236), /spɹ/ (.0118), /spl/ (.0107) and /skɹ/ (.0099).

Once the legal clusters were selected, the phonotactic rules of General American were purposely violated in order to create the illegal clusters. Let us first discuss the creation of the illegal two-member clusters. The /s/ + voiceless plosive rule (cf. *Ch.5.2.1*, Table 5.4, *Group 1*) was violated by combining /s/ with voiced plosives, resulting in */sb, sd, sg/. These clusters additionally violate the sonority sequencing principle (Selkirk, 1984), which states that the sonority level of a syllable rises towards the nucleus, so that the second cluster member should be more sonorant than the first.[60] In these three clusters, the sonority level falls since voiceless fricatives are more sonorant than voiced stops (Yavas, 2011, p.136).

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[60] Note that the clusters with /s/ as the first member violate the sonority principle and are considered to have a special status in several languages (Yavas, 2011, p.142)

Accidental gaps were located from the obstruent + approximant group (cf. *Ch.5.2.1*, Table 5.4, *Group 2*), in which alveolar stops cannot cluster with /l/ (Yavas, 2011, p.140). This rule was exploited by creating */dl/ and */tl/ clusters. Another violation was created for the clusters whose first member is an obstruent. In these cases, the second member needs to be an approximant (cf. *Ch.5.2.1,* Table 5.4, *Group 2* and *4).* This rule was violated by combining an obstruent with a fricative, creating */bz/. Finally, the distribution rule of /s/ and /ʃ/ (cf. *Ch.5.2.1*) was violated so that /ʃ/ would appear before /ɹ/ forming */ʃɹ/.

The same procedure was adopted for the illegal three-member clusters. The legal /spl, spɹ, skɹ/ clusters were converted into voiced clusters */zbl, zbɹ, zgɹ/, violating the rule that the first member of a three-consonant cluster is necessarily /s/ (cf. *Ch.5.2.1*, Table 5.4, *Group 5*). Another violation was made again with the alveolar stop + /l/ sequence by creating */stl/. The non-occurrence of the two-member illegal clusters in General American English was confirmed by entering them into the Phonotactic Probability Calculator. As expected, the biphone positional probability of the illegal CC clusters was zero: they do not occur in General American.[61]

The procedure described above yielded in total 11 legal and 11 illegal English onset clusters. All of the clusters were illegal in Brazilian Portuguese. Table 8.2 presents the legal and illegal clusters used in the study.

[61] No similar measure, i.e, measuring the co-occurrence probability of three phones, exists for three-member illegal clusters, however two L1 AmE speakers confirmed that none of the *CCC clusters could occur in General American.

Legal	**CC-**	/sp/	/st/	/sk/	/sl/	/sm/	/ʃɹ/	/θɹ/
	CCC-	/spl/	/spɹ/	/skɹ/	/stɹ/			
Illegal	**CC-**	/sb/	/sd/	/sg/	/dl/	/tl/	/bz/	/sɹ/
	CCC-	/zbl/	/zbɹ/	/zgɹ/	/stl/			

Table 8.2. Legal and illegal clusters for nonwords.

Once the onset target clusters were selected, the syllable rimes were created in order to form the nonwords. The following criteria were established:

1. The stimuli should be monosyllabic in order to minimize memory constraints, markedness and prosodic effects due to words stress.
2. The rime of the stimuli should be as neutral as possible.
3. Phonological neighborhood size and phoneme probabilities of the stimuli should be controlled for.

It was deemed important to keep the non-target part of the stimuli (i.e., the rime) as neutral as possible, so that it could be established that the reaction obtained for the stimuli would be due to the cluster and not due to the rime. With this aim, phoneme positional probability was calculated for the General American vowels and consonants in rime position with the help of Phonotactic Probability Calculator. ***Phoneme positional probability*** tells how frequent a given sound is in the given position. The vowels with the highest phoneme positional probabilities in CCVC are /ɪ/ (.0350), /æ/ (.0283), /ɛ/ (.0256), /ɑ/ (.0204) and /i/ (.0188), and these were the vowels selected to occupy the nucleus of the nonwords. The coda consonants with the highest phoneme positional probabilities are /t/ (.0894), /s/ (.0501), /n/ (.0467), /k/ (.0422), /d/ (.0403), /p/ (.0362), and /l/ (.0355). Consequently, these consonants were combined together with the vowels to form the rime of the nonwords. Following this, a preliminary stimuli list was created. The stimulus items were created by combining each of the target consonant clusters with the high-probability vowels and high-probability coda consonants.

In the following step, the preliminary stimuli list was submitted to lexical analysis in order to exclude any existing words. The nonword status of the items was confirmed with the sound search function of the CD-ROM of *Cambridge English Pronouncing Dictionary* (Jones et al., 2006). The transcriptions of the preliminary stimulus items were entered into the CD-ROM and all the items that had a lexical entry were removed.[62] This yielded 251 preliminary nonwords.

The nonword stimuli set was further delimited for two reasons. First, the number of trials in the *Lexical Decision Task* needed to be kept reasonable in order to avoid fatigue in the participants.[63] Second, the phonological neighborhood size and phonotactic probability measures needed to be taken into account for further data analyses. In order to do so, the preliminary set of nonword stimuli was submitted to phonological neighborhood density and phonotactic frequency calculations. The following criteria were defined:

1. Illegal nonwords should have a low phonological neighborhood density and a low phonotactic probability.
2. Legal nonwords should have a higher phonological neighborhood density and a higher phonotactic probability than the illegal nonwords.

Phonological neighborhood density measure was obtained with the help of The Irvine Phonotactic Online Dictionary (IPhOD) (Vaden, Halpin, & Hickok, 2009). ***IPhOD*** is an online dictionary which contains phonological neighborhood density and

[62] Including proper names
[63] Initially a large set of nonwords was created because in the initial piloting two tasks with different stimuli were tested (cf. *Ch.8.3.2*)

phonotactic probability measures for American English words and pseudowords.[64] With the aim of obtaining the phonological neighborhood density measure, all the potential stimuli were transcribed into CMUPD glyphs and entered into the IPhOD online calculator.[65]

The phonotactic probability measures chosen were the sum of biphone positional probabilities and the sum of phoneme positional probabilities. As defined earlier, the sum of biphone positional probabilities is the sum of all the segment-to-segment co-occurrence probabilities of the target item. ***Sum of phoneme positional probabilities*** is the sum of the position-specific probabilities of each segment within the item. It gives an overview of the item's phonotactic probability (Vitevitch & Luce, 2004). In order to obtain the calculations, the preliminary set of stimuli was transcribed into Klattese and entered into the Phonotactic Probability Calculator. The preliminary list of stimuli together with their phonological neighborhood density and phonotactic probability measures can be seen in Appendix F.

In order to determine that the legal and the illegal nonwords differed from each other in terms of neighborhood density and phonotactic probability, independent-samples t-tests were conducted (Appendix G). The results confirmed that the legal and illegal nonwords differed significantly in the three measures. Since the preliminary set of stimuli fulfilled the set phonological neighborhood density and phonotactic probability requirements, a selection was made within each consonant cluster group for the final stimuli respecting two criteria with the aim of introducing variety and avoiding bias. First, in order to obtain stimuli which correspond to the natural variation in phonological

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[64] The phonotactic probability measures in IPhOD are not positionally-constrained, which is why it was not used for phonotactic probability calculations as it is important to take into account the frequency of a target sound in a *given* position.

[65] CMUPD is a machine-readable phonetic transcription system used in the Carnegie Mellon University Pronouncing Dictionary

neighborhood density and phonotactic frequencies within the set limits, roughly the same number of items were chosen above and below the mean values within each target consonant cluster group. Simultaneously, a balance between the rime vowels and consonants within the selected items was maintained with the purpose of offering phonetic variability. This procedure yielded 54 legal and 54 illegal nonword stimuli, which are presented in Table 8.3 together with their neighborhood density and phonotactic frequency characteristics.

Legal (*n*= 54)	**Phonological neighborhood density**	**Sum of phoneme positional probabilities**	**Sum of biphone positional probabilities**	**Illegal (*n*= 54)**	**Phonological neighborhood density**	**Sum of phoneme positional probabilities**	**Sum of biphone positional probabilities**
CC				**CC**			
/sp-/				*/sb-/			
spɑp	10	.1794	.0124	sbɑp	5	.1673	.0021
spæk	17	.1933	.0133	sbæk	7	.1813	.0036
spæs	10	.2012	.0124	sbæs	2	.1891	.0027
spɪd	15	.1981	.0121	sbɪd	4	.1860	.0013
/st-/				*/sd-/			
stæp	18	.1942	.0213	sdæp	3	.1753	.0015
stit	17	.2379	.0195	sdit	4	.2190	.0025
stɛl	21	.1908	.0211	sdɛl	8	.1719	.0020
stɪn	18	.2115	.0229	sdɪn	4	.1926	.0040
stɪp	18	.2010	.0220	sdɪp	5	.1820	.0032
/sk-/				*/sg-/			
skæs	7	.2082	.0111	sgɑp	4	.1642	.0020
skik	11	.1909	.0091	sgæl	2	.1714	.0011
skɛs	8	.2055	.0106	sgik	5	.1687	.0012
skɛt	13	.2448	.0092	sgit	4	.2158	.0012
skɪk	13	.2071	.0122	sgɛn[66]	3	.1799	.0056
skɪs	12	.2149	.0123	sgɪl	6	.1782	.0022
/sl-/				*/dl-/			
slæd	20	.2156	.0120	dlæs	5	.1749	.0097
slæs	18	.2254	.0137	dlik	4	.1576	.0039
slɛn	6	.2194	.0136	dlɛs	4	.1722	.0064
slɛs	7	.2227	.0105	dlɛt	3	.2115	.0050
slɪn	13	.2289	.0119	dlɪd	4	.1718	.0054
/sm-/				dlɪs	4	.1816	.0080
smɑp	7	.1782	.0040	*/tl-/			

smæl[66]	7	.1855	.0036	tlæd	5	.1577	.0079
smik	10	.1827	.0034	tlæs	6	.1675	.0097
smin	6	.1872	.0031	tlɛn	3	.1615	.0095
smit	9	.2298	.0033	tlɛs	5	.1648	.0064
smɪl	13	.1922	.0047	*/bz-/			
/ʃɹ-/				bzæp	1	.1168	.0012
ʃɹæn	7	.1760	.0186	bzik	2	.1134	.0014
ʃɹis	7	.1699	.0098	bzɛk	2	.1202	.0032
ʃɹit	7	.2092	.0102	bzɛn	3	.1247	.0054
ʃɹɪk	11	.1782	.0177	bzɪs	2	.1375	.0036
/θɹ-/				*/sɹ-/			
θɹæp	5	.1625	.0135	sɹæn	9	.2687	.0176
θɹik	7	.1591	.0110	sɹis	7	.2626	.0088
θɹɛk	7	.1659	.0125	sɹit	9	.3019	.0092
θɹɛn	6	.1704	.0147	sɹɪk	11	.2709	.0167
θɹɪs	7	.1832	.0186	**CCC**			
CCC				*/zbl-/			
/spl-/				zblæn	1	.1766	.0063
splæn	5	.2885	.0163	zblit	0	.2073	.0076
split	5	.3192	.0175	zblɪk	0	.1711	.0154
splɪk	3	.2830	.0253	zblɪs	1	.1882	.0097
splɪs	5	.3000	.0197	*/zbɹ-/			
/spɹ-/				zbɹæd	1	.1391	.0028
spɹæd	3	.2510	.0141	zbɹin	0	.2077	.0097
spɹik	4	.2822	.0196	zbɹɛt	1	.1954	.0047
spɹin	6	.3195	.0210	zbɹɪk	2	.1758	.0134
spɹɛt	4	.3073	.0160	zbɹɪl	1	.1830	.0072
spɹɪl	4	.2948	.0185	*/zgɹ-/			
/skɹ-/				zgɹɑp	0	.1231	.0026
skɹɑp	5	.2451	.0116	zgɹæk	0	.1409	.0042
skɹæk	4	.2629	.0132	zgɹæl	0	.1480	.0053
skɹæl	4	.2700	.0143	zgɹis	1	.1843	.0086
skɹis	4	.3063	.0176	zgɹɪd	1	.1678	.0065
skɹɪd	7	.2898	.0155	*/stl-/			
/stɹ-/				stlɑk	1	.2586	.0207
stɹɑk	8	.2633	.0262	stlæk	3	.2580	.0214
stɹæk	8	.2628	.0270	stlæt	3	.2997	.0211
stɹæt	9	.3045	.0267	stlɛd	2	.2629	.0210
stɹɛd	11	.2676	.0260	stlɛn	0	.3051	.0270
stɹɪd	8	.2897	.0292	stlɪd	1	.2850	.0255
MEAN	**9.16 (4.9)**	**.2283 (.046)**	**.0149(.006)**	**MEAN**	**3.22**	**.1899**	**.0082**

Table 8.3. Nonword stimuli for the *Lexical Decision Task*.

[66] These items were excluded after the piloting phase (cf. *Ch.8.2.2.*, p.254)

The mean neighborhood density was 9.16 for the legal nonwords and 3.22 for the illegal nonwords. In other words, there were on average 3.22 similar sounding words in the English lexicon for each illegal nonword and 9.16 for each legal nonword. In comparison to the Vitevitch and Luce nonwords (1998, 1999), the nonwords in the present study had a very low neighborhood density. This is beneficial for their processing, as lexical access will be faster due to lesser lexical competition. Comparison of the phonotactic probabilities to previous studies is difficult due to differing measures, but the difference in the probabilities between the legal and the illegal nonwords in the present study was significant, as indicated by the already discussed independent samples t-tests carried out for the whole set of stimuli. As the non-target part of the stimuli (the rime) was controlled for and consisted of high-probability phones, it is safe to say that the difference in the probabilities was due to the target consonant clusters.

This section has discussed the creation of the nonword stimuli for the *Lexical Decision Task*. Legal and illegal nonwords were created by carefully selecting the onset consonant clusters and rime phones by first comparing the General American and Brazilian Portuguese phonotactics and then by calculating phonotactic probabilities of the items. The result is a set of highly controlled monosyllabic English nonwords differing in the legality of the onset consonant cluster. Continuing with the description of the stimuli, the following section will detail how the word stimuli were created.

8.2.1.2. Words

The word stimuli were created to resemble the legal nonwords as closely as possible so that the lexical decision would solely be based on lexicality instead of structural properties (e.g., monosyllabic vs. disyllabic items). Consequently, all the word stimuli were monosyllabic (C)CCVC words. The onset consonant clusters selected for the word stimuli were the same as the ones used to create the legal nonwords, namely: /sp, st, sk, sm, ʃɹ, spl, spɹ, stɹ, skɹ/.[67] A preliminary examination of a dictionary suggested that these clusters would not yield enough word items. Hence, additional clusters were selected. The additional clusters were selected from the obstruent + approximant group (cf. *Ch.5.2.1*, Table 5.4, *Group 2*), and were /tɹ, bɹ, fl, pl, fɹ/.[68] These clusters were chosen for their high frequency in English (/tɹ/ .0124, /bɹ/ .0075, /fl/ .0063, /pl/ .0060, /fɹ/ .0056). Additionally, it was established that:

1. The word stimuli should be known by upper-intermediate EFL learners, and consequently familiar to the participants of the study.
2. The words should not differ from the legal nonwords in terms of phonological neighborhood density or phonotactic probability.

Suitable monosyllabic words were searched by using the sound search function of the *Cambridge English Pronouncing Dictionary* CD-ROM. Words that could be unknown to the L1 BP participants were not included (e.g., *scoot, trait, smack* etc.). This procedure yielded 82 possible word stimuli. This number was further delimited into 77 because piloting of the experiment indicated that many intermediate/ upper-intermediate level L1 BP EFL learners were not familiar with five of the word items (*shriek, shrill, spam, sprout* and *steep*). Combined COBUILD frequency/million words was calculated with the help of WebCelex (Max Planck Institute for Psycholinguistics, 2001) in order to confirm that the rate of occurrence of the word stimulus items was high. The mean

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[67] /θɹ, sl/ which were used for legal nonwords, were not included for the words

[68] As was seen in *Ch.5.2.2*, these clusters are permissible in Brazilian Portuguese. This however is impertinent as the permissibility of the phonotactics of the *word* items were not under study.

frequency of the 77 word stimuli was 124 (range: 2 [*brag*] - 910 [*still*]). Although the frequency of occurrence of some of the word stimuli was low, piloting suggested nevertheless that the words were familiar even for language users with a lower proficiency than the participants in the present study. None of the words used in the *Lexical Decision Task* were cognates in Brazilian Portuguese as this has been found to affect lexical access (e.g., Dijkstra, van Jaarsveld, & Ten Brinke, 1998)

Phonological neighborhood density was calculated using IPhOD, following the same procedure as for the nonwords. Phonotactic frequency measures, namely, phoneme positional frequency and sum of biphone frequencies, were calculated with Phonotactic Probability Calculator in the same manner as for the nonwords (cf. *Ch.8.2.1.1*, p.231). The final *word* stimuli with their frequency and phonotactic characteristics can be seen in Table 8.4 on the following page.

The mean neighborhood density of the word stimuli was 13.77, which was not much higher than for the legal nonwords (9.16), but lower than for the word stimuli in Vitevitch and Luce (1999). In their study, words defined as having high neighborhood density had a mean density of 56, whereas the words defined as low-density had a mean density of 40. As seen earlier (cf. *Ch.8.2.1,* p.224) words belonging to sparse phonological neighborhoods, as the words in the present study, result in processing benefits (higher accuracy and faster response latency). The mean phonotactic probabilities of the word items were likewise comparable to the legal nonwords: sum of phoneme positional probability .2283 (legal nonwords) vs. .2062 (words); sum of biphone positional probability .0149 (legal nonwords) vs. .0157 (words). We could thus conclude that the matching of the word stimuli to the legal nonwords in terms of phonological neighborhood density and phonotactic probability was as successful as possible after having taken into account the main requirements of the word items.

Target	COBUILD	Phonological nd	Sum of phoneme pp	Sum of biphone pp	Target	COBUILD	Phonological nd	Sum of phoneme pp	Sum of biphone pp
brag	2	14	.1844	.0192	**small**	600	19	.2011	.0112
brain	75	24	.2036	.0146	**smell**	97	8	.1776	.0037
brave	24	12	.1715	.0137	**smile**	244	12	.1828	.0043
bread	93*	21	.2083	.0166	**smoke**	92	8	.1692	.0026
break	270*	19	.1991	.0138	**smooth**	45	11	.1825	.0041
breathe	44	8	.1627	.0155	**space**	138	5	.1378	.0020
brick	43	24	.2198	.0242	**spare**	45	11	.1872	.0106
bride	12	21	.1948	.0141	**speak**	371	17	.1912	.0141
brief	53	10	.1773	.0160	**speed**	97	15	.1839	.0112
bright	85	17	.2439	.0145	**spell**	37	17	.1819	.0116
bring	512	24	.1832	.0228	**spill**	19	17	.1839	.0126
flag	29	13	.1332	.0147	**spit**	18	18	.1934	.0132
flake	11	14	.1478	.0100	**split**	45	18	.2472	.0136
flame	27	15	.1351	.0096	**spoil**	30	5	.3247	.0185
flat	133	22	.2089	.0154	**sprain**	2	9	.1595	.0097
flight	70	20	.1926	.0099	**spread**	107	8	.2907	.0160
float	44	16	.1992	.0107	**spring**	104	4	.2607	.0142
floor	177	12	.1387	.0080	**stage**	177	14	.2621	.0239
frame	46	13	.1817	.0115	**stain**	25	12	.1553	.0198
freeze	69*	19	.1687	.0144	**stair**	133*	23	.1908	.0213
fresh	71	8	.1725	.0138	**state**	373	16	.1981	.0226
frog	9	7	.1719	.0133	**steak**	31*	22	.2335	.0210
place	741	15	.1935	.0097	**steam**	29	22	.1863	.0205
plan	303	12	.2041	.0203	**step**	160	15	.1781	.0194
plane	117*	18	.1902	.0105	**still**	910	13	.1915	.0204
plate	56	17	.2328	.0103	**straight**	126*	23	.2003	.0217
plot	32	14	.2388	.0096	**strain**	55	12	.3020	.0283
plug	16	10	.1542	.0099	**strap**	15	13	.2977	.0278
scar	16	13	.1930	.0109	**stream**	59	9	.2444	.0263
school	514	13	.1801	.0087	**street**	321	10	.2796	.0318
score	53	16	.1773	.0084	**stress**	57	9	.3308	.0316
scratch	31	4	.2312	.0119	**strong**	212	8	.2896	.0293
scream	59	8	.2796	.0181	**trade**	196	6	.2320	.0254
screen	42	5	.3265	.0191	**treat**	105	5	.2378	.0250
scrub	16	5	.2329	.0111	**trick**	32	20	.1904	.0187
skill	81	11	.1668	.0101	**trim**	14	15	.2440	.0216
skin	105	18	.2004	.0109	**truth**	134	18	.2131	.0292
skip	10	18	.2116	.0121	**MEAN**	**124**	**13.77**	**.2062**	**.0157**

Table 8.4. Word stimuli for the *Lexical Decision Task*. COBUILD= Combined COBUILD lemma frequency/million words for lemmas, Phonological nd= Phonological neighborhood densitiy,Sum of phoneme pp= sum of phoneme positional probabilities, sum of biphone pp= sum of biphone positional probabilities.*****As the stimuli were presented only aurally, the Combined COBUILD lemma frequency/million words was counted to include the frequency of the homophones. For example, the frequency for *break* was calculated as *break* (259) + *brake* (11) =270. The word items with homophones are indicated with an asterisk

In this section, it was seen that rigorous matching of syllable structure and target clusters was adopted in the creation of the word stimuli in order to parallel the form of the legal nonwords. Additionally, the characteristics of neighborhood density and phonotactic probabilities were calculated, and it was seen that they did not differ greatly from the legal nonwords. As a result, a set of word stimuli was obtained which closely matched the structure of the legal nonwords ([C]CCVC), but differed in the critical dimension, namely, lexicality. Having discussed the creation of the target trials, the following section presents the distractor stimuli.

8.2.1.3. Distractors

In order to improve the reliability of the *Lexical Decision Task*, a set of distractor items without consonant clusters was created. This was deemed necessary because if all the items in the task had consonant clusters, the real purpose of the task might become obvious for the participants. It should be noted that the participants thought they were doing a simple lexical decision task, whereas in reality they were tested for phonological awareness through their knowledge about permissible English consonant clusters. The distractor items were divided into two, nonword distractors and word distractors. All the distractor items were monosyllabic and had CVC structure.

Part of the nonword distractor items were chosen among the nonwords used in a previous piloting experiment of a word-likeness rating task (cf. *Ch.5.2.1*). Nonwords that obtained the highest word-likeness ratings were chosen. Additional nonwords were created by combining high frequency English consonants with vowels that were not used in the nonword stimuli. This was done in order to obtain more phonetic variability to the stimuli. As a result, 20 CVC nonword distractors were obtained (Table 8.5).

Target	Phonological neighborhood density	Sum of phoneme positional probabilities	Sum of biphone positional probabilities
bɔɪt	18	.1207	.0004
tʃʊm	4	.0805	.0022
fum	19	.1181	.0024
gaʊd	16	.0736	.0006
dʒid	24	.0835	.0033
gɝ	9	.0506	.0004
gʌŋ	23	.0769	.0043
haɪf	21	.0933	.0043
lutʃ	18	.0642	.0020
naʊp	5	.0706	.0003
nɝ	6	.0485	.0004
nʊg	3	.0520	.0007
pait	34	.1846	.0051
saɪp	25	.2026	.0067
teŋ	12	.0855	.0012
tes	25	.1525	.0043
tɛŋ	18	.1291	.0066
θɛp	7	.0731	.0018
vɛk	16	.1488	.0106
wem	25	.0989	.0030
zɑt	16	.1291	.0028
MEAN	**16.38**	**.1072**	**.0031**

Table 8.5. Nonword distractor stimuli for the *Lexical Decision Task*.

Although the distractor items were not controlled for neighborhood density and phonotactic probability measures as they were not the target test items in the task, the means are reported here for comparison. The mean neighborhood density of the distractor nonwords (16.38) was higher than that of the test item nonwords (9.16). The phonotactic probabilities on the other hand were lower (.1072 vs. .2283 and .0031 vs. .0149).

The word distractor items were selected among the word stimuli used in Vitevitch and Luce (1999). In their study, one set of word stimuli was composed of words with low neighborhood density and low phonotactic probability, and another set was composed of words with high neighborhood density and high phonotactic probability. For the purpose of the present study, varying phonotactic probabilities were wanted in order to obtain more variation to the stimuli. Words with CVC structure that should be familiar to upper-intermediate EFL learners were selected among their stimuli. In total, 41 word distractor items were chosen, half with low neighborhood density and low phonotactic probability, and half with high neighborhood density and high phonotactic probability. Their frequency and probability characteristics are presented in Table 8.6 on the following page.

The mean frequency and probability values are provided for the word distractor stimuli for reference. The mean word frequency of the distractor words was 369.39, which was notably higher than that of the word items (124). The mean neighborhood density of the distractor words was 31.46, which again was higher in comparison to the word items (13.77). On the contrary, the mean phonotactic probabilities were lower than for the word items (.1557 vs. .2062 for phoneme positional and .0070 vs. .0157 for biphone positional). That is to say, the distractor items, both nonwords and words, had higher neighborhood densities but lower phonotactic probabilities than the test items.

Target	Combined COBUILD frequency/ million words for lemmas	Phonological neighborhood density	Sum of phoneme positional probabilities	Sum of biphone positional probabilities
back	1282	47	.1841	.0112
bag	82	37	.1291	.0028
boat	77	37	.1665	.0065
book	450	28	.1486	.0087
cake	36	36	.1754	.0040
case	496	33	.2007	.0051
cat	67	45	.2381	.0181
coat	68*	40	.2080	.0106
come	1960	37	.1813	.0094
date	88	29	.1149	.0022
dead	183	37	.1627	.0108
dog	119	23	.1470	.0046
down	1231	28	.1576	.0049
fan	23	41	.2221	.0179
feed	151	28	.1303	.0029
hair	207*	33	.1907	.0116
head	559	39	.1502	.0079
hill	119	42	.2093	.0130
hot	145	15	.1163	.0042
house	620	7	.1659	.0063
knife	46	11	.1279	.0019
leg	176	24	.0778	.0027
light	406	39	.1249	.0056
long	1026	18	.1344	.0070
luck	45	38	.0742	.0028
mouth	149	13	.1063	.0025
night	477*	27	.0742	.0014
page	98	21	.1241	.0049
path	61	21	.1712	.0097
pick	191	42	.2341	.0134
ran	514	48	.2256	.0194
red	164	43	.1610	.0122
road	310*	41	.1244	.0033
size	156*	35	.1568	.0042
suit	101*	33	.1905	.0050
sun	359*	42	.2377	.0116
time	1977*	28	.1374	.0041
walk	363	34	.1282	.0032
wall	215	31	.1343	.0042
wash	100	22	.1545	.0067
wife	248	17	.0885	.0010
MEAN	**369.39**	**31.46**	**.1557**	**.0070**

**Table 8.6. Word distractor stimuli for the *Lexical Decision Task*. ***As the stimuli were presented only aurally, the Combined COBUILD lemma frequency/million words was counted to include the frequency of the homophones. For example, the frequency for *coat* was calculated as *coat* (67) + *cote* (1) = 68. The word distractor items with homophones are indicated with an asterisk.

This section has discussed the creation of distractor items to the *Lexical Decision Task*. A set of distractor nonwords and words without consonant clusters was created in order to ensure that the participants would not know the real purpose of the task. The distractor items also served the additional function of providing more phonetic and probabilistic variation to the task by being made out of a larger selection of phones. So far, the creation of the stimuli has been discussed. Before presenting the *Lexical Decision Task*, the preparation of the stimuli is detailed.

8.2.1.4. Stimuli preparation

Recording lists were created with all the nonword, word and distractor stimuli presented orthographically. A female native speaker of American English (*NS1 Ch.8.1.1*. p.204) was recorded on two occasions. The informant was instructed to read each target item in a clear, but normal speaking speed with a non-rising tone. She was asked not to hyperarticulate or to produce unnaturally slow speech, but also not to speak too fast so that all the consonants would be audible and released. The lists included two randomized repetitions of each item organized into blocks (words, distractors, legal nonwords and illegal nonwords). The items were embedded into carrier sentences (“I say ____ again.”), although the use of the sentences was abandoned during the recording session, since the informant found it easier to read the items in isolation. The recording session began with the recording of the word stimuli as it was thought to be the easiest for the informant to pronounce.

Pronunciation of the nonwords may pose problems, which is why a short training session on the sound-letter correspondences in the nonword stimuli was given before the recording session. This focused mainly on the vowels (for example, "<ee> is pronounced as /i/ in *seem* and <u> is pronounced as /ʌ/ in *sun")*. The informant could also confirm the pronunciation and repeat the items during the recording session if wanted. Once the sound-letter correspondence was learnt, the legal nonwords did not cause any pronunciation problems as all the items were made of combinations which are possible in English.

This was not the case with the illegal nonwords. As the illegal nonwords had consonant clusters which do not occur in English, an L1 AmE speaker could have difficulties in pronouncing the clusters correctly. With the aim of facilitating correct pronunciation, two versions of the illegal nonword stimuli were created: monosyllabic and disyllabic. For instance, /dlip/ was represented as <dleep> and also as <deleep>. In the disyllabic items, the word stress was indicated by underlining and the informant was instructed to pronounce the preceding vowel as an /ə/. Schwa was chosen due to its articulatory neutrality, and because it naturally occurs in unstressed syllables in English. Because of the neutral lip position during schwa production, this extra vowel could be later easily removed from the stimuli without leaving remarkable articulatory traces. Previous research (Dupoux et al., 1999) employing rounded back vowels has expressed concerns that their removal from the speech unit, although carefully executed, might leave articulatory traces in the remaining stimuli and contribute to the perception of a vowel in the middle of the consonants.

The recording was carried out in a soundproof booth at LINSE, at UFSC. Recording was done with M audio project mix 10 and a professional microphone with sampling frequency set to 44100Hz/16-bit. The recording lists were read at the pace set by the informant, allowing breaks whenever necessary. Pronunciation mistakes were marked in the researcher’s list and the items with incorrect pronunciation were repeated at the end of each block. After the first recording session, the stimuli were auditorily and visually inspected in Praat (Boersma & Weenik, 2013) for their correctness. Items with incorrect pronunciation were marked, and a new recording list with the incorrectly pronounced items was created. A second recording session was scheduled in which the informant read the missing stimuli.

The final stimuli were auditorily and visually analyzed in Praat for their correctness, specifically, that the pronunciation of each vowel, coda consonant and most importantly the onset consonant cluster corresponded to the targets. Each stimulus item was chosen among the repetitions by selecting the token that had the clearest pronunciation. Voicing (e.g., /z/ vs. /s/, /b/ vs. /p/) was confirmed by visually inspecting the waveform for the presence (or absence) of glottal pulses during the duration of the segment. Full release of plosives was confirmed by inspecting the waveform for the presence of an outburst. Tokens without fully released plosives were rejected. Vowels were auditorily confirmed to correspond to the targets.

The illegal disyllabic nonwords were treated by removing the epenthetic schwa at zero crossings in order to obtain the target monosyllable (Figure 8.9). The initial zero crossing was established after the burst and the final zero crossing as the point in which no vowel formants could be seen (Dupoux et al., 1999; Dupoux et al., 2011). As a result, the illegal consonant clusters presented no auditory or visual traces of a vowel.

a) /bəˈzik/

b) /bzik/

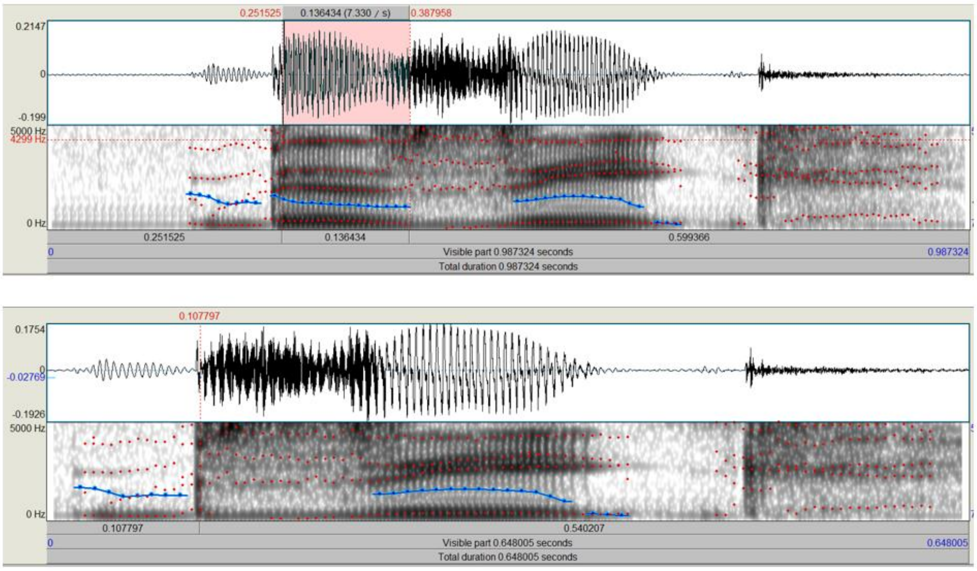

Figure 8.9. Waveforms and spectrograms of */bzik/ as original disyllabic (a) and as the final stimulus (b). The removed vowel is indicated with highlighting in a) and the limit between the two resulting consonants as a vertical red dotted line in b).

a) [tʰəˈlɛs]

b) [stek]

c) [tlɛs]

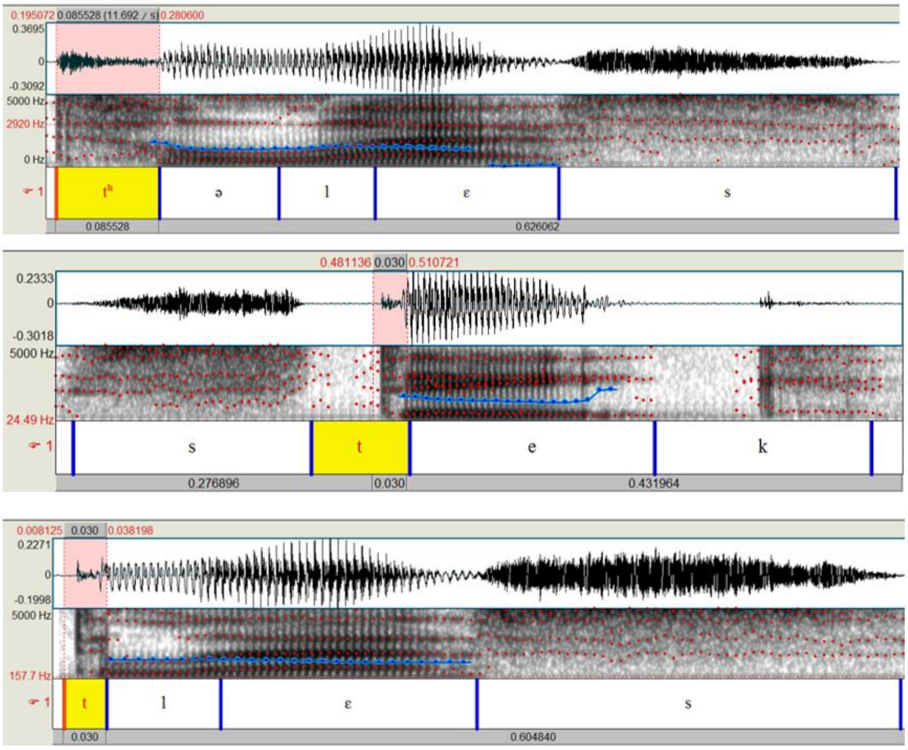

Figure 8.10. Example of splicing: */tlɛs/. Original disyllabic item with aspirated /t/ highlighted (a), source stimulus for unaspirated /t/ with target selected (b) and final stimulus with unaspirated /t/ and removed epenthetic vowel (c).

Splicing was used with the */tl/ clusters. With the presence of the epenthetic schwa, the initial plosives received aspiration. For instance, /tlɛs/ was represented as <teles> and the informant’s pronunciation was [t^{h}əˈlɛs]. When the vowel was removed, the resulting item, [t^{h}lɛs] had aspiration and sounded unnatural, as aspiration does not occur in English when the plosive is followed by another consonant. In order to remove this discrepancy, the /t/ was spliced at zero crossings from other stimulus (*steak*) in which it did not present aspiration, and combined with the remaining CVC target (Figure 8.10 on the previous page).

The final set of stimuli was preprocessed for presentation in Audacity. First, the stimuli were normalized to the same peak level (maximum amplitude 1.0dB). Next, any low-frequency noise that could be present was removed with Audacity’s noise removal option which reduces noise by 24dB, does frequency smoothing at 150 Hz and adds a decay time to 0.15 s.

The final set of stimuli for the *Lexical Decision Task* organized by trials can be seen in Table 8.7.

Stimulus type	Legal		Illegal		Distractor		Word	Distractor
Practice (*n*= 6)	sprik slin	sprɪk slɪn	dlid stlen	dlɪd stlɛn			shred	luck
First trials (*n*= 4)	skik	skɪk	zbrik	zbɹɪk	pait	pait	strive	

Test trials (*N*= 235)

Nonword (*n*= 120)										**Word (*n*= 115)**				
Legal (*n*= 50)				**Illegal (*n*= 50)**				**Distractor (*n*= 20)**		**Word (*n*= 75)**			**Distractor (*n*= 40)**	
CC		**CCC**		**CC**		**CCC**				**CC**		**CCC**		
spaap	spɑp	splan	splæn	sbaap	sbɑp	zblan	zblæn	boit	bɔɪt	brag	score	scratch	back	knife
spak	spæk	spleet	split	sbak	sbæk	zbleet	zblit	chum	tʃʊm	brain	spit	scream	bag	leg
spas	spæs	splik	splɪk	sbas	sbæs	zblik	zblɪk	foom	fum	brave	skill	screen	boat	light
spid	spɪd	splis	splɪs	sbid	sbɪd	zblis	zblɪs	gaud	gaʊd	bread	skin	scrub	book	long
stap	stæp	sprad	spɹæd	sdap	sdæp	zbrad	zbɹæd	geed	dʒid	break	skip	split	cake	mouth
steet	stit	spreen	spɹin	sdeet	sdit	zbreen	zbɹin	ger	gɝ	breathe	small	sprain	case	night
stel	stɛl	spret	spɹɛt	sdel	sdɛl	zbret	zbɹɛt	gung	gʌŋ	brick	smell	spread	cat	page
stin	stɪn	spril	spɹɪl	sdin	sdɪn	zbril	zbɹɪl	haif	haɪf	bride	smile	spring	coat	path
stip	stɪp	straak	stɹɑk	sdip	sdɪp	stlaak	stlɑk	looch	lutʃ	brief	smoke	straight	come	pick
smaap	smɑp	strak	stɹæk	sgaap	sgɑp	stlak	stlæk	naup	naʊp	bright	smooth	strain	date	ran
smin	smin	strat	stɹæt	sgal	sgæl	stlat	stlæt	ner	nɝ	bring	space	strap	dead	red
smeek	smik	stred	stɹɛd	sgeek	sgik	stled	stlɛd	nug	nʊg	flag	spare	stream	dog	road
smeet	smit	strid	stɹɪd	sgeet	sgit	stlid	stlɪd	saip	saɪp	flake	speak	street	down	size
smil	smɪl	skraap	skɹɑp	sgil	sgɪl	zgraap	zgɹɑp	teing	teŋ	flame	speed	stress	fan	suit
shran	ʃɹæn	skrak	skɹæk	sran	sɹæn	zgrak	zgɹæk	teis	tes	flat	spell	strong	feed	sun
shrees	ʃɹis	skral	skɹæl	srees	sɹis	zgral	zgɹæl	teng	tɛŋ	flight	spill		hair	time
shreet	ʃɹit	skrees	skɹis	sreet	sɹit	zgrees	zgɹis	thep	θɛp	float	spoil		head	walk
shrik	ʃɹɪk	skrid	skɹɪd	srik	sɹɪk	zgrid	zgɹɪd	vek	vɛk	floor	stage		hill	wall
skas	skæs			dlas	dlæs			weim	wem	frame	stain		hot	wash
skeek	skik			dleek	dlik			zaat	zɑt	freeze	stair		house	wife
skes	skɛs			dles	dlɛs					fresh	state			
sket	skɛt			dlet	dlɛt					frog	steak			
skis	skɪs			dlis	dlɪs					place	steam			
thrap	θɹæp			bzap	bzæp					plan	step			
threek	θɹik			bzeek	bzik					plane	still			
threk	θɹɛk			bzek	bzɛk					plate	trade			
thren	θɹɛn			bzen	bzɛn					plot	treat			
thris	θɹɪs			bzis	bzɪs					plug	trick			
slad	slæd			tlad	tlæd					scar	trim			
slas	slæs			tlas	tlæs					school	truth			
slen	slɛn			tlen	tlɛn									
sles	slɛs			tles	tlɛs									

Table 8.7. Stimuli for the *Lexical Decision Task*. Nonword stimuli: orthographic form on the left and phonetic transcription on the right. CC=two-member clusters, CCC= three-member clusters

8.2.2. Lexical Decision Task

The present section presents the creation and the structure of the *Lexical Decision Task*. Before discussing the task, let us begin by discussing why lexical decision was chosen over other task types. Lexical decision is an experiment used widely in psycholinguistic research. Participants are asked to classify stimuli either as words or as nonwords and their speed (reaction time) and accuracy (error rate) are examined. Lexical decision tasks have been used, among other things, to measure phonotactic frequency and phonological neighborhood effects (e.g., Vitevitch & Luce, 1998), orthographic effects (e.g., Pexman, Lupker, & Jared, 2001), phonological processing (e.g., Praamstra et al., 1994), semantic processing (Hino, Lupker, & Pexman, 2002; Holcomb & Neville, 1990), syntactic priming (e.g., Wright & Garrett, 1984) and bilingual lexical processing (Lemhöfer & Radach, 2009; Pallier, Colomé, & Sebastián-Gallés, 2001). Stimuli can be presented either visually or aurally, and in immediate or delayed response conditions. Main analyses are in form of response latencies and response accuracy, but other measures such as event-related potentials (Hunter, 2013; Praamstra et al., 1994) have also been employed.

Apart from lexical decision, other possible tasks to study phonotactic awareness are *wordspotting* (e.g., Weber & Cutler, 2006), *word-likeness judgments* (Altenberg, 2005; Trapman & Kager, 2009), *nonword repetition* (e.g., Kovács & Racsmány, 2008) and *gating tasks* (e.g., Hallé, Segui, Frauenfelder, & Meunier, 1998).

In a *wordspotting task*, participants listen to nonsense speech with the attempt to identify an embedded real word. This type of task draws the listener's attention to the adjacent context and requires very well controlled stimuli, so that the natural acoustic variation of the target items does not affect their identification (Weber & Cutler, 2006).

A lexical decision task draws the listener's attention in a more direct way to the acoustic properties of the target item and in this case, the target onset cluster, which is beneficial for the identification.

In a *word-likeness judgment task*, the listeners rate nonwords for their word-likeness. This type of task is useful in examining grades of phonotactic knowledge and it has been successfully used in previous research. However, as a previous piloting task showed (cf. *Ch.5.2.*), this gradient knowledge might not always be manifested clearly. Furthermore, for linguistically-naïve participants, it can be difficult to rate non-existing words for their word-likeness as these concepts are rather abstract and not present in every day speech situations.

Nonword repetition tasks require the participant to name an aurally or visually presented nonword. Accuracy of the response is taken to reflect phonotactic awareness. Nonword repetition tasks are suitable instruments with native speakers. In contrast, with non-native speakers, interesting data could be lost due to motoric limitations (cf. *Ch. 4.1.1.1 & Ch.4.3*).

Gating tasks present the listener with incremental bits of speech, which the listener tries to identify. Response accuracy is analyzed for each 'gate' (bit). Previous studies have revealed listeners to manifest a perceptual bias to interpret illegal clusters as conforming to the phonotactic patterns of the L1 in gating tasks (Hallé et al., 1998). Although this perceptual illusion seems to be present in language users in a wide variety of tasks (Dupoux et al., 1999), lexical decision tasks seem to be able to capture phonotactic knowledge in spite of perceptual illusions (e.g., Trapman & Kager, 2009). This might be because lexical decision tasks require fast responses and the listener's focus is on lexicality, rather than acoustic differences.

From what was seen above, it would seem that lexical decision tasks are well suited to test phonotactic awareness. They are perception-based, and thus are not subject to non-native speakers' possible motoric limitations evident in production-based tasks. They are able to capture the listener's instinctive phonotactic knowledge through reaction time measurements before any re-mapping procedures due to L1 phonotactic expectations have time to emerge. Additionally, they do not focus the listener's attention to phonotactics, but to lexicality, and they do not require the participant to verbalize any distributional rules, meaning that non-verbalizable phonological awareness can be readily tested.

Previous research has shown that lexical decision tasks can be used to measure phonotactic awareness successfully through reaction times measurements. Rejection of illegal nonwords has been shown to be faster than that of legal nonwords (Mikhaylova, 2009; Trapman & Kager, 2009; Stone & Van Orden, 1993). This occurs because lexical search for nonwords presenting an illegal onset is blocked very fast as the onset combination is immediately judged as impossible (Trapman & Kager, 2009). Lexical search for legal nonwords, on the other hand, takes longer because as legal nonwords conform to the phonotactic patterns of the target language, search goes on until it can be effectively concluded when no match is found. To put another way, response latencies in a lexical decision task using legal and illegal nonwords indicate the language user's awareness of the permissible and impermissible sound combinations in the target language: if no awareness of the phonotactics exists, differences in reaction times would not occur.

When comparing the response latencies between words and nonwords in a lexical decision task, it has been found that responses to *words* are faster (Forster & Chambers, 1973; Hudson & Bergman, 1985; Hunter, 2013; Mikhaylova, 2009; Vitevitch & Luce, 1999). That is, finding the lexical match for a word is faster than searching the mental lexicon for an illegal nonword which is nevertheless rejected fast, or processing a legal nonword which resembles a word but does not have a lexical representation and thus needs to be rejected after the search. Consequently, the following pattern of response times is expected in the present lexical decision task:

- word < illegal nonword < legal nonword

From previous studies, it is rather clear that this pattern should be expected in native speakers. In non-native speakers with varying degrees of phonotactic knowledge, the response pattern might not be as clear. Trapman and Kager (2009) studied the awareness on permissible consonant clusters in monolingual Dutch speakers, bilingual Russian/Dutch speakers and bilingual Spanish/Dutch speakers in an auditory lexical decision task. Their results revealed that native speakers possess phonotactic knowledge about consonant clusters through response accuracy and response latencies. More interestingly, the results also indicated that L2 users possess similar phonotactic knowledge, and that this knowledge increases with language proficiency. That is to say, more proficient L2 speakers showed more native-like response behavior than less proficient L2 speakers. This finding goes in line with the hypothesis made in *Chapter 4* that phonological awareness increases as a result of language experience (cf. *Ch.4.1.3*). Similar findings have been found in orthographically presented lexical decision tasks with Russian/ English (Mikhaylova, 2009) and German/English bilinguals (Holmes, 1996). Namely, L2 speakers possess L2 phonotactic knowledge which is manifested through reaction times, and this knowledge differs from monolingual native speakers by being more deficient (longer reaction times and less accurate responses).

Two tasks to measure phonological awareness at the phonotactic domain were piloted before the actual data collection with the aim of choosing the task that would best capture participants' phonotactic awareness. One of the tasks was the *Lexical Decision Task* which was chosen as the final data collection instrument. The second piloting task was named *Nonword Illegality Decision* and it was created in order to contrast the fast decision making of the lexical decision task (online processing) with a task which is self-paced (offline processing) in order to see whether different patterns would emerge in the data (cf. discussion about timed and untimed GJTs in *Ch.2.3,* p.55).

In the *Nonword Illegality Decision Task*, the participants were aurally presented with three nonwords and were asked to decide whether all of them were made up of possible sound combinations in English, and if not, to identify the item that presented impossible combinations.

Score	**Change trials (target)** Example: /ʃɹæt/-/stæt/-/sdæt/		**No-change trials (control)** Example: /skɛn/-/θɹɛn/-/spɛn/	
	Description	**Response**	**Description**	**Response**
0	correctly identifying the illegal nonword	/sdæt/	correctly identifying all nonwords as legal	"all possible"
1	falsely identifying all the nonwords as legal	"all possible"	-	-
2	failing to identify the illegal nonword and falsely identifying a legal nonword as illegal	/ʃræt/	falsely identifying a legal nonword as illegal	/spɛn/

Table 8.8. ***Nonword Illegality Decision Task*** **scoring.**

The task was divided into two blocks. In the first part, the stimuli consisted of legal and illegal nonwords with consonant clusters on the onset ([C]CVC). In the second part, the consonant clusters were on the coda of the nonword (CVCC[C]). The non-target part of the stimulus was kept constant, so that the three nonwords occurring in the same trial differed only in the consonant cluster. The position of the illegal nonword was rotated.

Error scores in change trials (one of the nonwords illegal) and in no-change trials (three nonwords legal) were calculated (Table 8.8) for initial and final consonant clusters.

The *Nonword Illegality Decision Task* was piloted with five L1 English speakers and 14 L1 BP upper-intermediate EFL learners (Appendix E). The results showed that the L2 users performed slightly, although not significantly, better, and that the overall error score in all conditions was 50-60%, indicating that the task was too difficult. Qualitative feedback from the L1 English participants revealed that this was due to the failure to hear differences between the trial items. L2 users encountered the same problem, but also reported not to know which of the items presented impossible clusters. These results provide support to the perceptual deafness effect reported by previous research with native speakers (Dupoux et al., 1999, 2001, 2011; Hallé, Chéreau, & Segui, 2000; Hallé et al., 1998). The results also suggest that a self-paced task was not adequate for the purposes of the present study, most likely because when provided with time to think about the answers, the participants were accessing their declarative knowledge about English phonotactics, which is likely to be incomplete and inaccurate, as declarative knowledge frequently is (cf. *Ch.1.2.1*, p.16). Therefore, a lexical decision task was deemed more suitable. One the one hand, it examines phonotactic awareness in a more implicit way as the participants are not aware of being tested about L2 phonotactics. On the second hand, the inclusion of a time-pressure favors access to proceduralized knowledge, rather than declarative.

The *Lexical Decision Task* used in the study was piloted with five L1 English speakers and 14 L1 BP upper-intermediate EFL learners (Appendix E). Reaction times were analyzed and submitted to a mixed ANOVA with *StimulusType* (legal/illegal/word) and *L1* (English/BP) as independent factors. Reaction time data showed a significant effect of *StimulusType* ($F[2,17]= 12.72$, $p<.001$, $\eta^2 = .60$). The effect of *L1* was not significant (*p*=.075), and there was no L1*StimulusType interaction (*p*=.250). Bonferroni adjusted posthoc comparisons showed that the differences between the three stimulus types were all significant. Reaction to words was the fastest and to legal nonwords the slowest in both L1 AmE and L1 BP speakers. The L2 users responded slower in all stimuli conditions in comparison to the L1 AmE speakers. These piloting results agree with the predictions made earlier and confirm that lexical decision task can be used to measure phonotactic awareness in L1 and L2. The task's reliability was likewise manifested with Cronbach's Alpha values of .91 on the accuracy of response data.

Piloting of the *Lexical Decision Task* led to some small improvements which were implemented for the final version of the task. Five of the word items were removed because the majority (8/14) of the L1 BP EFL learners failed to recognize them as words. These items were: *steep, sprout, spam, shrill* and *shriek.* Two of the nonwords (/sgɛn/ and /smæl/) were removed because the majority of the L1 AmE and L1 BP speakers identified them as words.

The Lexical Decision Task was created and administered with DMDX software (Forster & Forster, 2012). The task consisted of two parts: practice trials (*n*=6) and test trials (*n*=235). The participant was instructed to decide whether the presented sound sequence was a word or not in English by pressing the corresponding answer key (Figure 8.11). In order to keep the real purpose of the task unknown, instructions were given to focus on lexicality, and no mentioning of consonant clusters or "weird sounding" items were made. Answers were to be made as fast as possible without sacrificing accuracy. Additionally, in order to capture more precise reaction time measurements, the participants were instructed to keep their index fingers on top of the answer keys during the task. Following Trapman and Kager (2009), since the 'no' answers (nonwords) were the target of the study, the response key for ‘no’ answers was located under the participant’s dominant hand. This meant that there was a right-handed and a left-handed version of the task, differing only in the assignment of the response keys.

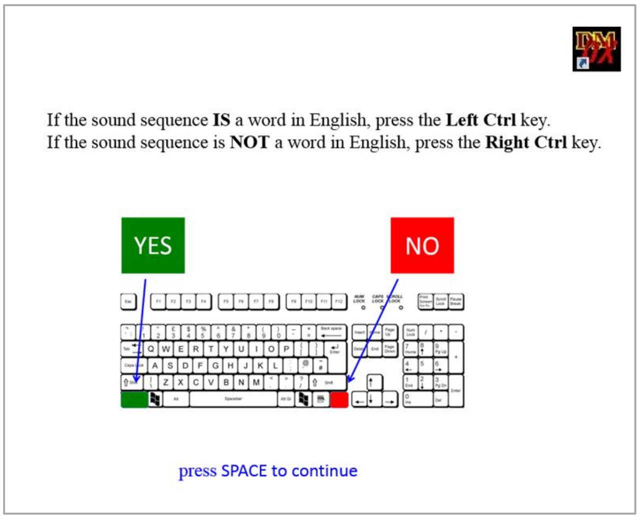

Figure 8.11. Screenshot from the *Lexical Decision Task* instructions.

The practice items provided feedback on speed (“Good speed!” or “TOO SLOW!”) without reference to accuracy in order to guide the participants to answer as fast as possible. The test block consisted of 50 legal nonword trials, 50 illegal nonword trials, 75 word trials, 20 nonword distractor trials and 40 word distractor trials presented aurally in a randomized order (Figure 8.12). It was possible to take a short break halfway through the test.

The participant had 2500 ms to decide on the answer before the next trial was presented. The adequate duration of ‘the time out’ is crucial in a lexical decision task. A too short ‘time out’ leads to large amounts of missed data, but giving the participant too much time to decide on the answer could affect the answer pattern as responses would not be as automatized as with a short ‘time out’. The ‘time out’ in the present experiment is comparable to previous research involving phonotactics and lexical decision (Stone &

Van Orden, 1993: 2500 ms; Trapman & Kager, 2009: 2400 ms). Additionally, piloting of the task showed the inter-stimulus interval (ISI) to be adequate as the L1 AmE speakers missed only three items as a group, and the L1 BP speakers missed only 23 items in total.

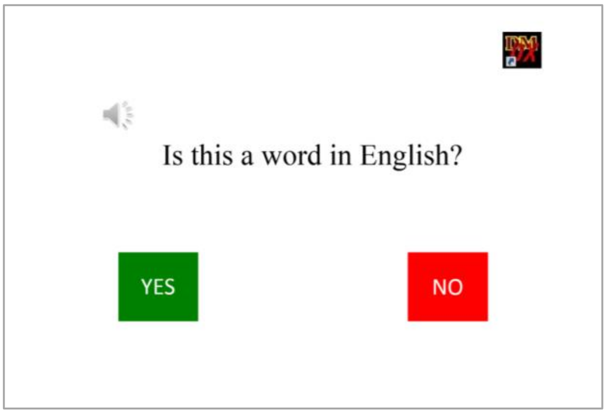

Figure 8.12. **Screenshot from trial** ***stel*****.** The loudspeaker stands for the presentation of the auditory stimulus.

The *Lexical Decision Task* was carried out individually in a quiet room at the Faculty of Language and Communication at UFSC with a laptop computer and headphones. The participants received oral and written instructions on how to complete the task. Hand dominance was determined with a questionnaire prior to the task (cf. *Ch.8.6.1*). First, the researcher described the task, after which the participant read the instructions on the screen in a self-paced manner, being able to ask for clarifications at any point. When the instructions were understood, the participant began the task.

8.2.3. Analyses

The data from the *Lexical Decision Task* comes in the form of response times (RT) and response accuracy. In the task, the reaction times were measured from the onset of the stimulus. For the data analysis, corrected reaction times were calculated in order to obtain more precise response latency measures, following previous research (Luce & Pisoni, 1998; Trapman & Kager, 2009). The corrected reaction times were calculated by subtracting the stimulus duration from the total reaction time. Following previous research (Forster & Chambers, 1973; Hunter, 2013; Luce & Pisoni, 1998; Vitevitch & Luce, 1998, 1999) only the items with correct answers were included in the analyses with reaction times.

Reaction time data is prone to be affected by spurious responses. For example, the participant might get momentarily distracted, which would lead to longer response latencies. On the other hand, the participant might anticipate the stimulus or make a fast guess before actually hearing and processing the trial. In order to avoid spurious responses to have an effect on genuine reaction times to the phenomenon under study, researchers frequently either eliminate part of the extreme values, or replace them with the mean values. However, questions have been raised on the appropriateness of such procedures as they can introduce asymmetric biases into statistics (Ulrich & Miller, 1994) and weaken the power of the statistical tests (Ratcliff, 1993). This is because the researcher cannot know for sure which values are spurious and which are genuine. Thus, excluding or transforming a portion of the extreme data points frequently also affects the overlapping genuine data points.

In the present study, setting a lower cutoff was studied. A study conducted by Luce in 1986 (as cited in Whelan, 2008) demonstrated that 100 ms is the minimum time for a genuine reaction, as this is the time needed for stimulus perception and the corresponding motoric responses. Therefore, in the present study, all the responses below 100 ms were examined for their accuracy (n=635, 3.6%). [69]As all the answers below 100

[69] It is necessary to remember that these were *corrected* reaction times from which the stimulus duration had been subtracted. As a consequence, the original reaction times were well over the 100 ms mark discussed for genuine reaction times.

ms showed a correct response, the use of a lower cutoff was disregarded in order to preserve valid, albeit fast, data. Therefore, no screening was performed on the data. This is to say, extreme values on the upper edge were not eliminated or replaced, as the ‘time out’ was rather short (2500 ms) and fast reaction times were preserved. Furthermore, as piloting of the task found statistical differences in spite of the possible spurious data points, keeping the extreme data points was considered more beneficial than eliminating or transforming them with the risk of losing genuine data and power of the statistical tests.

Mean response times for each participant were calculated for the three conditions: *legal nonword, illegal nonword* and *word.*[70] Means were also calculated separately for the two-member cluster items and the three-member cluster items in order to examine whether the number of consonants had an effect on the processing speed.

Although the main data from the *Lexical Decision Task* comes in the form of reaction times, the accuracy of the responses can also provide interesting insights. With the aim of examining the response accuracy, mean response accuracy scores were calculated for each participant for each of the three conditions, and for the two- and three-member clusters separately and together.[71] Finally, stimulus characteristics (biphone positional probability sum, phoneme positional probability sum neighborhood size and lemma frequency) were entered into the data set in order to examine their effect on the responses.

[70] Sum of the corrected reaction times given to all correct answers for each condition divided by the number of included trials.
[71] The data was coded as “0” for incorrect answers and as “1” for correct answers after which a sum was calculated by adding the items for each condition, dividing the sum by the number of items and multiplying it by 100 in order to obtain a percentage of correct answers.

Finally, in order to obtain a single score representing the participant's phonotactic awareness behind the task, a ***Phonotactic Awareness Score*** was computed. This was done using the following formula:

- 1- (RT illegal/ RT legal)*100.

The resulting number represents the difference (in %) between the reaction time of the illegal nonwords and the legal nonwords. The larger the difference, the more accurately the participant is distinguishing between the illegal and legal nonwords. In other words, the larger the distance, the more awareness the participant is showing of the English onset consonant clusters. If the distance in the reaction times is negative or very small, the participant is not discerning between the legal and illegal nonwords and is thus not showing phonotactic awareness of English consonant clusters.

Section summary:

The aim of this section was to discuss the instrument used to measure L2 phonological awareness in the phonotactic domain in depth. First the creation of the stimuli used to examine the participants' phonotactic awareness in English was discussed. (C)CCVC legal and illegal nonwords and word stimuli were created by comparing the GA and BP consonant cluster inventories, and by taking into account frequency and probabilistic phenomena, which were duly examined. The section then turned to examine the task used to measure phonological awareness at the phonotactic domain. Possible ways of accessing phonotactic awareness were compared, and aural lexical decision was chosen as the most appropriate instrument. Some specific aspects of lexical decision tasks were then examined. Finally, the data analyses for the Lexical Decision Task were discussed.

8.3. Prosodic awareness

The present section describes the task used to access the last of the phonological awareness components: prosodic awareness. Prosodic awareness is defined as the mainly proceduralized knowledge the language user has of the target language in the suprasegmental domain (cf. *Ch. 4.1.2*, p.105). *Prosody*, *suprasegmentals* and *intonation* are seen here as synonyms and will be used interchangeably over the course of the section to refer to speech phenomena extending over stretches of speech longer than a segment.[72] Suprasegmentals thus cover purely linguistic phenomena of stress, pitch and rhythm, but also fluency phenomena such as speech rate, pausing and hesitation behavior.[73] The prosodic awareness task in the present research focuses on sentence stress and is called *Low-pass Filtered Intonation Identification Task*.

The section begins by discussing the selection and creation of the stimuli. Then, the *Low-pass Filtered Intonation Identification Task* is presented. The last section presents the data analyses for the *Low-pass Filtered Intonation Identification Task.*

8.3.1. Stimuli

In the present section the stimuli selected to measure the participants' phonological awareness in the prosodic domain is discussed. The selected task presented

[72] *Intonation* is understood in the broader sense of the term, rather than intonation proper, referring only to variations in fundamental frequency over continuous speech.
Phonotactics is not viewed as part of prosody because the size of the unit is different (syllable vs. words and utterances) and because the principles behind phonotactics are of very different nature than those behind prosody.
[73] In the course of the section, *stress*, rather than *accent*, is used to refer to the most prominent syllable within the word and within the intonation phrase. In the first case, we will refer to *word stress*, in the latter to *nuclear stress* or *sentence stress*.

question-answer pairs in which the participants were asked to judge whether the intonation in the answer was adequate to the context laid out by the question.

Two types of trials were created, those that were appropriate in General American, but incorrect if transposed into Brazilian Portuguese ('yes' trials) and those which were incorrect in English but appropriate if transposed into Brazilian Portuguese ('no' trials). Additionally, control trials, which were correct in both languages, were included in the form of transitive sentences. Table 8.9 shows the general design of the trials:

Nº of trials (n=77)	Type	Appropriate in AmE	Appropriate in BP	Main Analysis
8	Practice	✓✗	✓✗	✗
17	Unaccusative	✓	✗	✓
12	Unaccusative	✗	✓	
20	Deaccented	✓	✗	
23	Deaccented	✗	✓	
5	Control transitive	✓	✓	✗

Table 8.9. Overview of the *Low-pass Filtered Intonation Identification Task* stimuli.

8.3.1.1. Answer targets

Due to the differences between the two languages, the rules presented earlier in *Chapter 5.3, Germanic Nuclear Stress Rule* and *Anaphoric Deaccenting Rule* were taken as the target structures. We will begin by discussing the creation of the unaccusative answers.

As discussed earlier, unaccusative verbs in English show nuclear movement to the subject, whereas in Brazilian Portuguese the nuclear stress stays on the verb (Cf. *Ch.5.3.3*). In order to create the unaccusative target answers, first a selection was made on English unaccusative verbs. Verbs which would be familiar to intermediate EFL learners and which could be used to form natural utterances were selected. Next, the sentences were created around the verbs by taking into account memory constraints, vocabulary familiarity and naturalness of the sentence. All the unaccusative target answers had broad information focus. In order to create the cross-language design of the task, two sentences were created to parallel the same structure, one following English intonation rules and the other one violating them, but following Brazilian Portuguese tonicity rules (nuclear stress indicated by underlining):

49. What happened next?

- The new professor arrived ('yes' trial)

50. What happened before the party?

- Many guests arrived. ('no' trial)

Structures targeting anaphoric deaccenting were included in order to determine whether such structures would pose a problem for Brazilian EFL learners. Should Brazilian Portuguese function in line with other Romance languages, anaphoric deaccenting should pose a problem. Acquisition of the *Lexical Anaphoric Deaccenting Rule* has been shown to be easier than the restructuring of the *Nuclear Stress Rule* (Nava & Zubizarreta, 2008, 2010). We could thus expect to see differences due to the participants' English proficiency.

The creation of the deaccented sentences began by selecting the target structures. These were of three types: utterances ending in given information, in relative clauses and in function words. Most of the deaccented trials had broad information focus (75%). The trials with narrow focus corresponded to narrow informative focus and occurred mainly in the utterances ending in relative clauses. As with the unaccusative sentences, memory constraints, vocabulary familiarity and naturalness of the sentences were taken into account when creating the deaccented sentences. The 'yes'-'no' trial design was obtained by creating parallel sentences half of which followed the English tonicity rules and half of which broke them but followed the Brazilian Portuguese tonicity rules:

51. What's the matter?

- I want to see you. ('yes' trial)

52. What's the matter?

- I can't hear you. ('no' trial)

Finally, a set of control transitive sentences were created in order to confirm that the behavior of the L1 AmE and L1 BP participants would be the same. Unmarked transitive sentences were chosen as the control structure as in these the nuclear stress falls on the last constituent in both languages and consequently these should not pose a problem for the L1 BP participants. Again, the sentences were created not to be too long or to present unknown vocabulary. All the transitive answers but one had broad focus:

53. What did you do yesterday?

- I saw a film. ('yes' trial)

8.3.1.2. Question prompts

Once the answer targets had been created, the questions to elicit them were formed. The questions were designed to provide the context for the answer, so that after hearing the question, which always presented an unmarked context, the listener would be able to decide whether the tonicity in the answer was appropriate or not to appear in unmarked context in English. With this aim, the questions were designed to be generic and to elicit an answer with only one possible tonicity pattern. See the following example illustrating a question prompt with the corresponding answer and two alternative tonicity patterns which would not be possible answers to the question:

54. Why is she sad?

- Their <u>friendship</u> ended.

- *Their friendship <u>ended</u>. ('What happened to their friendship?')

- *<u>Their</u> friendship ended. ('Whose friendship ended?')

8.3.1.3. Stimuli preparation

A list of the question prompts was created with three randomized repetitions for each question. A female native speaker of American English (*NS2*, *Ch.8.1.1*, p. 204) was recorded in a soundproof booth at the phonetics laboratory at UB with a Shure SM58 cardioid microphone and Marantz PDM660 solid-state digital recorder at a sampling frequency set to 44100 Hz/16-bit. The informant was instructed to read the question prompts in a normal conversational speed as if asking a real question without knowing the answer. The informant was instructed to speak in clear but natural way without exaggerating or sounding extremely polite or expressive. A selection was made from the repetitions for the questions which sounded the most natural and had the clearest pronunciation.

Once the question prompts were recorded, another female native speaker of American English (*NS1*, *Ch.8.1.1*, p.204) recorded the target answers at LINSE at UFSC in a soundproof booth with M audio project mix 10 and sampling frequency set to 44100 Hz/16-bit. In order to make sure that the informant in fact produced the expected prominence patterns in the answers, she provided the answers by listening to the previously recorded question prompts. A concatenated Praat sound file presenting two repetitions of each question prompt was created. The questions were randomly inserted into the sound file separated by 4-second pauses. The informant received a list of the question-answer pairs and was instructed to listen to the question and then during the pause read the answer as if genuinely answering the question. She was also instructed to use falling intonation as common for statements and not to provide contrastive or very expressive answers. This elicitation approach of using the questions of the actual experiment ensured that a native speaker of English would in fact produce the answers as expected.

As half of the trials were to present an incorrect English tonicity pattern, another set of question prompts were required to elicit them correctly. With this aim, questions eliciting contrastive narrow focus answers were created and they were recorded by the researcher. These questions were inserted into a concatenated Praat sound file and the elicitation method for the answers was the same as that described above. Consider the example questions and answers for the 'yes' and 'no' trials:

55. Q: And then what happened?

A: - The film started. ('yes' trial)

56. Q: Did the game finish?

A: - No. The game started. ('no' trial)

Several repetitions were recorded and the most natural sounding one with clearer pronunciation and matching speed to the questions were selected. The answers were extracted from the sound file at zero crossings, and together with the question prompts they were treated for presentation.[74] First the answers were low-pass filtered at 450Hz and smoothed at 20Hz in Praat. Next, Audacity was used to clean all the stimuli from any low frequency noise and to adjust the amplitude level of the questions and the answers to match, as after low-pass filtering the answers, the volume of the questions was loud in comparison to the answers. This was achieved by normalizing the questions to the same peak level and by reducing their amplitude level by 10db. The final set of stimuli consisted of 85 question-answer pairs in which the question presented normal sound quality and the answer was low-pass filtered so that the answers sounded muffled, as if heard through a wall. The following Table 8.10 presents the question-answer trials for the *Low-pass Filtered Intonation Identification Task*.

[74] In the case of the 'no' answers, when the target sentence was preceded by negation, the negation always appeared separated with a pause and it was easily cut off before the extraction of the target.

Practice trials (*N*=8)

Practice with feedback (*n*=5)				First trials (*n*=3)			
Trial nº	CONTEXT: Question	**TARGET: Answer**	FD	Trial nº	CONTEXT: Question	**TARGET: Answer**	FD
501	What happened next?	The new professor arrived.	B	507	What's that?	It's a message for you.	N
502	What happened in the meeting?	She brought a cake.	B	508	What happened at the dinner?	The guests vanished.	B
503	What happened at the exam?	He brought his books with him.	B	510	Who's that?	She's a new friend I made.	N
504	Have you seen my keys?	Mary has your keys.	N				
505	What are you doing tonight?	I have a class to attend.	B				

TEST TRIALS (*N*=77)

Transitive (*n*=5)

Trial nº	CONTEXT: Question	**TARGET: Answer**	FD	Trial nº	CONTEXT: Question	**TARGET: Answer**	FD
201	What did you do yesterday?	I saw a film.	B	206	What happened?	I lost my keys.	B
203	What are you doing tonight?	I have to finish the essay.	B	207	What would you like to eat?	I'll have some rice.	B
204	Who's that?	She's my aunt.	N				

Unaccusative (*n*=39)

'yes' trials (*n*=17)				'no' trials (*n*=12)			
Trial nº	CONTEXT: Question	**TARGET: Answer**	FD	Trial nº	CONTEXT: Question	**TARGET: Answer**	FD
001	And then what happened?	New evidence emerged.	B	101	What happened before the party?	Many guests arrived.	B
002	What happened?	The flight departed.	B	103	What happened next?	The train departed.	B
003	Why are the kids upset?	Their cat disappeared.	B	104	Why are you sad?	My wallet disappeared.	B
007	Why is she sad?	Her pet died.	B	108	Why is the road wet?	The snow melted.	B
008	Why are the kids upset?	Their chocolate melted.	B	110	What was that noise?	A glass broke.	B
009	What happened next?	The lake froze.	B	115	Why is your boss upset?	The taxes increased.	B
010	What was that noise?	A window broke.	B	116	What happened last week?	The temperature rose.	B
011	What's going on?	The ship's sinking.	B	118	What caused the accident?	The motor failed.	B
012	What happened next?	The ceiling collapsed.	B	119	What's the matter with her?	Her arm hurts.	B
014	What's that smell?	The cake burned.	B	121	What happened at the court?	The lawyers settled.	B
015	Why are you happy?	My salary increased.	B	123	And then what happened?	The game started.	B
016	What happened in the meeting?	Some problems arose.	B	125	Why is she crying?	Their relationship ended.	B
018	What had caused the accident?	The brakes had failed.	B				
019	What's the matter?	My leg hurts.	B				
021	And then what happened?	The film started	B				
022	What's the matter?	My classes began.	B				

024	Why is she sad?	Their friendship ended.	B				
Deaccented (*n*=43)							
'yes' trials (*n*=20)				**'no' trials (*n*=22)**			
Trial nº	CONTEXT: Question	**TARGET: Answer**	FD	Trial nº	CONTEXT: Question	**TARGET: Answer**	FD
026	What's the matter?	I want to see you.	B	126	What's the matter?	I can't hear you.	B
027	Why didn't you answer his calls?	I'm very annoyed with him.	B	127	Why didn't Tina answer his calls?	She's very irritated with him.	B
028	And then what happened?	I received an email from her.	B	128	And then what happened?	Mark got a gift from her.	B
029	What should I do?	You should talk to your boss about it.	N	130	What's the matter with your shirt?	There's a hole in it.	B
030	What's the matter with your dress?	There's a stain on it.	B	132	Did you hear what happened at the interview?	I didn't ask her about it.	B
032	What's that?	It's a delivery for you.	N	133	Did you hear what happened at the party?	No one told me.	B
033	Have you seen today's paper?	No, give it to me.	B	134	Where's the hotel?	We should ask someone.	B
037	What are you having for dinner?	We're having chicken for dinner.	N	135	What are you having for lunch?	I'm having a sandwich for lunch.	N
038	Do you know any Canadians?	My friend's Canadian.	B	136	Do you know any Mexicans?	I'm married to a Mexican.	B
039	Why did you buy that old painting?	Because I collect paintings.	B	137	Why are you reading again?	Because I enjoy reading.	B
041	Do you have a computer?	I have to buy one.	B	138	Have you seen my glasses?	Tim has your glasses.	N
042	What's that noise?	The dog's barking.	B	139	Have you seen my keys?	I haven't seen them.	N
043	Does she like birds?	She loves birds.	B	141	What's that noise?	The telephone's ringing.	B
044	Will you travel by plane?	I'm scared of flying.	B	143	Will you go by foot?	I'm tired of walking.	B
045	Could you do the laundry?	I hate washing clothes.	B	144	Could you prepare dinner?	I hate cooking.	B
047	What would you like to eat?	I'll have some of the cake you made.	N	146	What would you like to drink?	I'll have some of the wine you bought.	N
049	What's that?	That's the film Laura rented.	N	148	What's that?	That's the book John wrote.	N
050	What's that on the stove?	That's the dinner I was making.	N	149	What's that on the plate?	That's the salad I was eating.	N
055	Do you want some chocolate?	I also want some other sweets.	B	150	Who's that?	She's the girl Tom dated.	N
056	What happened before the party?	The telephone rang.	B	152	What are you doing tonight?	We have a lot of homework to do.	B
				155	Did you buy carrots?	I also bought some other vegetables.	B
				120	What's that noise?	The doorbell's ringing.	B

Table 8.10. Stimuli for the *Low-pass Filtered Intonation Identification Task*. Underlining indicates the location of the nuclear stress. FD=Focus domain: B= Broad focus domain, N= Narrow focus domain.

8.3.2. Low-pass Filtered Intonation Identification Task

The current section presents the *Low-pass Filtered Intonation Identification Task* which was used to measure the participants' awareness of General American nuclear stress assignment. Before presenting the structure of the task, let us first discuss the motivation behind selecting this task type.

The *Low-pass Filtered Intonation Identification Task* is a forced-choice ('yes'/'no') task which presents mini-dialogues consisting of a question (context) and an answer (target). After hearing the dialogue, the listener is asked to decide whether the intonation in the answer is adequate in that given context. As with the other phonological awareness domains, a task focusing on perception was selected so that motoric ability and other elements which play a role in production would not interfere with the measure (cf. *Ch.4.3*, p.118).

Forced-choice format was selected partly because it is cognitively more demanding than discrimination between two or more alternatives, for example, since the participants cannot compare the stimuli to other stimuli but only to the knowledge they have of the General American tonicity (Vanclancker-Sidtis, 2003). Employing more cognitively demanding tasks has the effect of increasing task demands and thus approximating the task closer to real-world communication (Robinson, 2003).

In order to draw the participants' attention into intonation without getting distracted with the segmental information, the targets, (the answers), were low-pass filtered. Low-pass filtering removes the speech signal above a given frequency (in this case 450Hz) so that most of the segmental information disappears while the suprasegmental information is maintained. The resulting speech sounds muffled, as if spoken from another room. The intonation of the utterance remains perfectly accessible, but no individual words can be distinguished.

Low-pass filtering was selected for several reasons. Low-pass filtering has been used successfully in previous research investigating the role of prosody over other factors, such as: foreign accent judgments (Trofimovich & Baker, 2006), foreign accent recognition (Jilka, 2000) and dialect identification (van Bezooijen & Gooskens, 1999). Additionally, it has been used successfully to examine implicit L1 phonological awareness in children in which a similar task design, in which the child is asked to match a low-pass filtered utterance to a normally-produced utterance, has been employed (cf. *Ch. 3.4*, p.83).

This body of research indicates that low-pass filtering renders well for tasks requiring the listeners to retrieve prosodic information about the speech signal. This is so, perhaps because using low-pass filtered stimuli encourages the listener to consciously pay attention to the prosody, which in non-treated speech may be left aside over meaning and segmental information (VanPatten, 1996, cf. *Ch.4.1.1.3.*, p.99). Finally, using low-pass filtering should make the task cognitively more demanding so that a more fine-grained analysis of the participants' prosodic awareness is possible.

Whether a given intonation pattern is acceptable or not is context-dependent as we have seen earlier (cf. *Ch.5.3*, p.148), which is why it was necessary to provide the listeners with a context. This was accomplished in the form of the mini-dialogue question. First the participants heard the question, after which they were shown the answer orthographically. After reading the answer, the same answer was heard as a low-pass filtered version. As discussed earlier, the questions were chosen to present a very specific context (cf. *Ch.8.3.1.2*), and because of this only one adequate intonation pattern was possible for the answer.

The orthographic presentation of the answer before its acoustic presentation was necessary as the low-pass filtering made the identification of individual words impossible and the listeners would not have been able to retrieve the meaning of the utterance. Using tasks requiring orthographic presentation of speech can be problematic with L2 users. First, knowledge of the sound-letter correspondence can affect participants' performance, especially in tasks focusing on segmental information. However the presence of orthography in a task involving prosody should not pose problems. The only orthographic cues relevant for this kind of task are punctuation marks because they give cues on whether the utterance should be interpreted as a statement, question or exclamation, apart from signaling pauses in the utterance (intonation phrase boundaries). However, all the stimuli consisted of neutral statements and of only one intonation phrase, which eliminates the presence of this type of orthographic cues.

Another problem emerging with the use of written material with language learners is that differences in reading fluency may be mistakenly taken to reflect differences in proficiency. One way to decrease the effect of reading fluency differences is to provide the participants with enough time to read the text. However, in the present task it was impossible to present the target visually for an unlimited time because the participants had to be able to retain in mind the question (the context). In the present task, the timing of the orthographic and acoustic presentation of the target was done so that the participants would have a good amount of time (2500 ms) to read the answer to themselves before hearing it. Previous piloting of the task suggested this time to be adequate, both for reading and for retaining the context in mind.

The written presentation of the target before the acoustic presentation was intended to encourage the processing of not only the meaning of the sentence but also the intonation, as readers provide intonation into text while silently reading it. The idea behind this task structure was that viewing the orthographic representation of an utterance would trigger the need to retrieve its prosodic representation from the language learner's long-term memory, which would then be compared to the low-pass filtered speech signal in order to decide whether there is a match or not. Should the learners consider that the acoustic presentation corresponds to their mental representation, a 'yes' response is given. In the contrary case, a 'no' response is expected.

Two versions of the intonation identification task were piloted with L1 AmE and L1 BP upper-intermediate EFL learners (Appendix E): the low-pass filtered version and a normal version. Five L1 AmE speakers and ten L1 BP EFL learners took the normal untreated version of the task and one L1 AmE speaker and five L1 BP EFL learners took the low-pass filtered version. In both versions of the task, the EFL learners reported to understand all the questions and the answers, as well as to have enough time to read the answer before its aural presentation. The low-pass filtered version task was perceived as more difficult and the participants reported to be guessing more than the participants who took the normal version of the task.[75] However, a Mann-Whitney U-test identified only one test area (deaccented 'no' trials) whose answers differed significantly between the two versions (Appendix H). This indicates that although the participants felt that the low-pass filtered version of the task was more difficult, in fact their performance was not poorer than in the normal version of the task. In other words, although the low-pass filtering clearly increased the level of perceived difficulty, it did not hinder task performance. Consequently, the low-pass filtered version of the task was selected.

The piloting revealed that the native English speakers did not agree on the adequacy of the intonation in some of the trials. Nine trials were removed for the actual

[75]Subjective difficulty of the task was examined with answer to the statement *It was easy to pick up the right answer* on a 5-point scale (1=strongly disagree, 5= strongly agree). Normal version of the task received the mean rating of 3.5 whereas the low-pass filtered version was rated as 2.4.

data collection (six unaccusative, two deaccented and one transitive) because over 40% of the L1 AmE speaker answers were incorrect. Three of the trials involved negation and the L1 AmE speakers were probably expecting the stress to fall on the negating element. The remaining six trials involved an emotive or unexpected element in the question (‘Why are you smiling?’ - ‘He gave me flowers.’) or in the answer (e.g., ‘What happened?’ - ‘The factory exploded.’). Most likely the native speakers were expecting to hear a more expressive intonation and judged the intonation in the answer to be incorrect, not because of the nuclear stress assignment but because of the more compressed F0 scale than expected. No other changes were made from the piloting to the data collection and Cronbach’s Alpha showed that the reliability of the low-pass filtered version of the task was very high (.91).

As the other phonological awareness tasks, the *Low-pass Filtered Intonation Identification Task* was created and administered with DmDx. The task consisted of two parts: a practice block with feedback and the test block with 77 randomized trials. Before the practice block, the participant received written instructions which apart from explaining the task structure, focused on drawing the participant’s attention to intonation. As many of the participants were linguistically naïve and might not have known for sure what was meant with ‘intonation’, they were given the following definition: “Intonation is the melody of speech. Each language has its own intonation” followed by some examples. Additionally, attention was drawn to the fact that intonation is context-specific and that they should decide whether the intonation in the answer was appropriate or not in the context provided by the question. Finally, the participants were warned that the answers would sound weird as if spoken from another room, but that they should do their best to focus on the melody of the answer and make their decision based only on intonation as all the sentences were grammatically correct in English.

The five practice trials provided immediate feedback (Figure 8.13). After the practice trials, the participants received instructions to ask any remaining questions about the task structure.

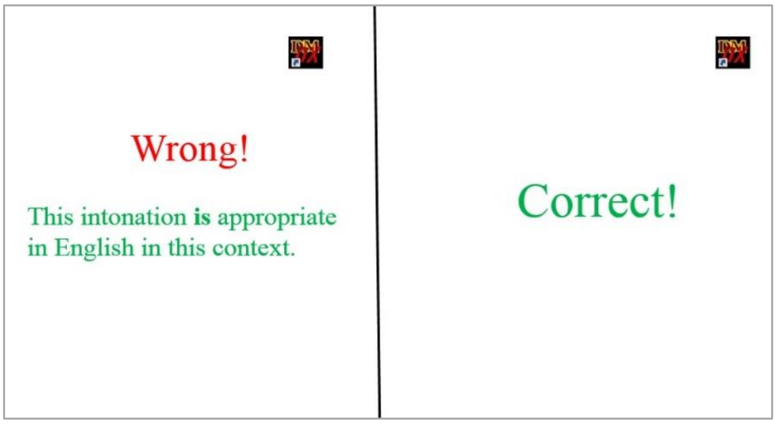

Figure 8.13. Screenshots from the negative and positive feedback on the practice trials of the *Low-pass Filtered Intonation Identification Task*.

The test block consisted of 77 randomized trials. The structure of each trial can be seen in Figure 8.14. First an image of a loudspeaker was seen on the screen for 300 ms. The loudspeaker was expected to draw the participant's focus to the following audio file. Next, the question of the trial was heard. Following the question, the answer was orthographically shown at the middle of the screen where it remained for 2500 ms. Next an image of a loudspeaker was shown again to signal that the answer was about to be presented aurally. The orthographically presented answer was heard as a low-pass filtered audio file and immediately after that, the participant was asked to decide whether the intonation in the answer was appropriate to the context or not. The answer was provided with the control keys on the computer keyboard. If no answer was provided within 10 seconds, the next trial was automatically presented.

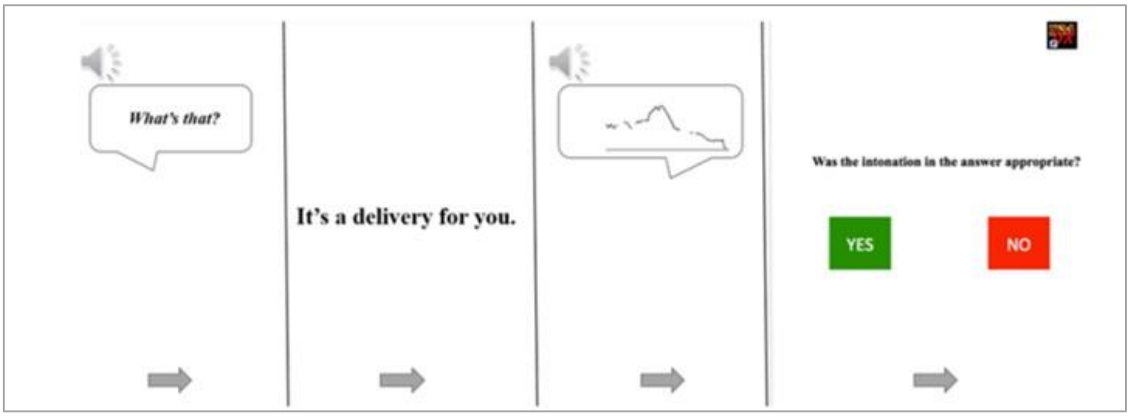

Figure 8.14. Illustration of the *Low-pass Filtered Intonation Identification Task* trial structure.
The grey loudspeaker stands for the presentation of the auditory stimulus.

The *Low-pass Filtered Intonation Identification Task* was carried out individually in a quiet room at the Faculty of Language and Communication at UFSC. The participants received both oral and written instructions on how to complete the task and were encouraged to ask for clarification at any point. According to the participant's hand dominance, a right handed or a left handed version of the task, differing only in the assignment of the response keys, was appointed in order to parallel the structure of the *Lexical Decision Task* (cf. *Ch.8.2.2*, p.255). The task was presented on a laptop computer and the trials were heard through professional Roland Rh-5 headphones. An option to take a small pause at the half way of the task was given. Once the task instructions were clear, the participant began the task.

8.3.3. Analyses

The data from the *Low-pass Filtered Intonation Identification Task* comes in the form of accuracy of response. Correct responses were coded as "1" and incorrect responses as "0". A mean response accuracy percentage was computed for each participant and for all the examined areas.[76]

In order to examine the acquisition of the *Germanic Nuclear Stress Rule* and the *Anaphoric Deaccenting Rule,* a separate mean response accuracy score was computed for the unaccusative and the deaccented sentences, in the two conditions 'yes' and 'no' separately. Additionally, within the deaccented group, a mean response accuracy score was calculated for each subgroup: functional categories, relative clauses and given information, in order to establish whether BP EFL learners showed differences in the acquisition of these structures. Likewise, the focus domain of the target was taken into account and mean response accuracies for the broad focus trials and the narrow focus trials in the two conditions (yes/no) were computed. Finally, the mean response accuracy in the control transitive trials was calculated in order to establish that the L1 AmE and L1 BP speakers responded to them in a similar way. Additionally mean response accuracy was computed to all the 'no' trials, all the 'yes' trials, all the unaccusative trials together ('yes'+ 'no'), all deaccented trials together ('yes'+ 'no') and to all test trials together.

In order to compare the performance in the prosodic domain to the other two phonological awareness domains and to individual variables, a ***Prosodic Awareness Score*** was computed. *Prosodic Awareness Score* was taken to be the percentage of correct responses in the 'no' trials. This score reflects the ability to differentiate appropriate tonicity patterns from inappropriate patterns, which reflects the underlying suprasegmental knowledge the L2 user has acquired. Being able to reject the trials which were incorrect in English, but correct if transposed into Brazilian Portuguese, reflects that the language user has acquired phonological awareness of the tonicity system of General

[76] Sum of all the individual answers to the category divided by the number of individual items and multiplied by 100.

American. Being able to accept the trials which were correct in English but incorrect if transposed into the L1 (% of correct responses in 'yes' trials) is also a manifestation of some sort of awareness on the General American tonicity system, but it might also in part be a result of positive evidence from the input, whereas in the case of the 'no' trials, whose tonicity patterns are not attested in the input, the underlying tonicity system needs to have been acquired.

Section summary:

This section has presented the instrument used to measure the last of the phonological awareness components, namely, prosodic awareness. First, the creation of the stimuli was discussed based on the problem areas earlier identified for L1 BP EFL learners in the acquisition of English prosody. Next, the structure of the Low-pass filtered Intonation Identification Task was presented. The section ended with the presentation of the data analyses.

With this section, the description of the three phonological awareness tasks is completed. The following section describes the creation of the task which was used to assess the L1 BP EFL learners' L2 pronunciation.

8.4. L2 Pronunciation

After having discussed the tasks used to access phonological awareness, the current section presents the tasks used to elicit and evaluate the participants' pronunciation in the L2. The section consists of two parts. In the first part, the task used to elicit L2 users' foreign language pronunciation is presented. *Section 8.4.2* introduces the task used to evaluate these productions.

Before beginning with the task descriptions, it is necessary to define what is meant with 'L2 pronunciation'. ***L2 Pronunciation*** is understood as the phonological competence of the L2 user, reflected in the approximation to native-like pronunciation. In order to evaluate L2 pronunciation, or the degree of foreign accent, two steps are necessary. As the first step, a speech sample, which is taken to be representative of the L2 pronunciation, is obtained from the informant. The second step then proceeds to evaluate the speech sample either subjectively or objectively. In the present study, speech samples were obtained through a *Delayed Sentence Repetition Task* and the chosen evaluation method was a *Foreign Accent Rating Task*.

8.4.1. Elicitation: Delayed Sentence Repetition Task

We will begin this section by shortly reviewing the alternative ways of eliciting speech from L2 users. We will then proceed to present the target stimuli and the structure of the chosen elicitation method.

Several tasks have been used to elicit speech from language learners. A widely used method is to ask the language learner to read aloud text (e.g., Bongaerts, van

Summeren, Planken, & Schils, 1997; Flege & Fletcher, 1992; Major & Baptista, 2007; Munro & Derwing, 2001). The length of the text can vary from individual words and sentences to whole paragraphs. With this method, all the informants provide the same speech sample which means that precise comparisons can be readily made. Additionally, reading aloud is usually used to obtain longer stretches of speech, which makes it especially suitable when global foreign accent is studied. Nevertheless, the reading aloud method presents some drawbacks. In the first place, the read speech sample is affected by the informants' reading proficiency and reading habits (Piske, MacKay, & Flege, 2001). A good reader will sound more fluent and a poor reader is easily perceived as having a poor L2 pronunciation. Also, many informants are not used to reading aloud and as a consequence, the elicited speech sample frequently does not sound natural. Additionally, by employing a reading task, the speech sample may contain pronunciation errors due to wrongly learnt sound-letter correspondence (Schmid & Hopp, 2014).

A way of eliminating the downsides of the reading aloud method is to elicit spontaneous speech by either providing a topic for discussion or by interviewing the informant (e.g., Abrahamsson & Hyltenstam, 2009; Bongaerts et al., 1997). The production obtained from spontaneous speech elicitation is very natural and does not suffer from the problems of written text. However, this method is also not without problems. By allowing the informant to speak spontaneously, the informant also chooses the content freely. This is reflected in that the speech samples are difficult to judge as all the samples are different and may not present the same phonological content. Additionally, the speakers can purposely avoid phones and structures they consider difficult with the aim of trying to sound more proficient. On the other hand, grammatical mistakes, hesitations and pauses, frequently present in spontaneous speech, are likely to affect the evaluation of the speech sample negatively.

A form of eliciting spontaneous speech in a more controlled way is to ask the informant to describe a picture, to narrate a story or to describe a seen movie (e.g., de Jong, Steinel, Florijn, Schoonen, & Hulstijn, 2012; Hopp & Schmid, 2013; Munro & Derwing, 1995; Muñoz & Llanes, 2014). By presenting all the informants with the same material, the speech samples are likely to be more unified and easily comparable than in the free speech method. The material can be selected to favor the target phones and structures. The informants can also be given some preparation time, which is likely to improve the performance and reduce hesitation phenomena. However, many of the downsides of the free speech method are not avoided with this method. Namely, the presence of grammatical mistakes, avoidance of structures and the effect of speech rate and overall fluency (Piske et al., 2001).

Delayed Sentence Repetition Task (e.g., Flege, Munro, & MacKay, 1995; Flege et al., 2006; MacKay, Flege, & Imai, 2006; Piske et al., 2001; Trofimovich & Baker, 2006) is an elicitation method which eliminates the effect of reading and orthography, but produces highly controlled, usually fluent, speech. In this task, the informant is presented with words or sentences, usually spoken by a native speaker of the target language, and asked to repeat them after a pause or a distractor item (hence, 'delayed'). In order to avoid direct imitation, the targets are usually embedded in a mini-dialogue (for example, question-answer) so that direct imitation is not possible as the target is followed by a distractor (Flege et al., 1995). Delayed sentence paradigm permits a rigorous selection of the stimuli as the words or sentences can be constructed around the phenomena under study. As all the informants produce the same items, comparisons between oral proficiency are relatively easily made. Production data from a delayed sentence repetition task is usually not subject to speech disfluencies as the informants can use the native speaker tempo as the model. Thus, the raters can base their judgment on the target dimension, degree of foreign accent, rather than on confounding disfluency phenomena. Reading skills or the effect of sound-letter correspondence are neutralized as the targets are usually only presented aurally. The method is nevertheless without shortcomings. The samples elicited in this way are rather limited in length, namely individual words or sentences. Due to memory constraints, elicitation of longer stretches of speech is not possible. As the samples are rather short, they may not give a comprehensive picture of the informant's L2 pronunciation. This can be avoided up to a certain point, by eliciting several utterances, and by selecting items which present a wide variety of phones and structures, so as to offer the most representative speech sample as possible. The time from the native model target to the repetition of the target needs to be highly controlled for. Too short of an interval is likely to lead to direct imitation, and consequently to an atypically accurate production. Whereas, a too long of an interval makes it hard to retain the target in mind, leading to missing data.

A Delayed Sentence Repetition paradigm was chosen as the elicitation method for the present study due to its numerous benefits. By using complete utterances in which a set of target phones and diphones appear, the three domains, the segmental, the phonotactic and the prosodic, are catered for. As the production is the same from all the informants, their subsequent ranking through a *Foreign Accent Rating Task* is expected to be highly reliable. The elicited speech samples were intended to be representative of each participant's L2 pronunciation. With this aim, the best possible or the poorest possible productions were not targeted.[77] Instead, natural production occurring in daily communicative situations in the EFL classroom and with native and non-native speakers was intended to be captured.

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[77] It has been suggested that formal elicitation methods such as reading aloud may elicit untypically native-like speech samples (Abrahamsson & Hyltenstam, 2009).

The creation of the sentences to be elicited began by comparing the General American and Brazilian Portuguese segmental and phonotactic inventories and then by pinpointing the specific English phones with which the L1 BP EFL learners were likely to have difficulties (cf. *Ch.5.1.3*, *Ch.5.2.3*). A set of words in which these target phones and biphones appeared were created. In doing so, familiarity of the vocabulary was taken into account so that all the words would be known for intermediate EFL learners. Following this, sentences were constructed around the target words. The sentences were intended to include speech sounds which would be difficult for L1 BP English learners but also phones which should not present large difficulties, so that the production would not be too much affected by the challenging sounds. The length of the sentences was kept between 6 and 12 syllables in order to avoid memory constraints. In total, five sentences were created and piloted with 46 L1 Spanish-Catalan EFL learners at the University of Barcelona in 2012. The sentences were the following:

1. Strong Steve killed a huge snake.

2. Their new job taught them many things.

3. She started to work at the school canteen.

4. A fair judge gives another chance.

5. The magazines were delivered by Valerie.

The piloting indicated that the sentences did not present lexical problems. However, by the amount of hesitation phenomena and missing data, two of the sentences (*3* and *5*) were judged to be too long. From the remaining three sentences, the two which presented the largest amount of challenging phones for L1 BP EFL learners were selected. These are presented in the following Table 8.11.

Sentence		Transcription	Likely segmental problems	Likely phonotactic problems	Likely prosodic problems
S1	**Strong Steve killed a huge snake.**	ˈstɹɑŋ ˈstiv ˈkʰɪɫd ə ˈhjudʒ ˈsnek	▪ Consonants (/ɹ/, /h/,/ŋ/, /j/) ▪ Vowels (/i-ɪ/, /u-ʊ/) ▪ Aspiration ▪ Final devoicing ▪ Orthographic transfer (/dʒ->ʒ/)	▪ Consonant clusters	▪ Unstressed function word ▪ Rhythm
S2	**Their new job taught them many things.**	ðɛɹ ˈnu ˈdʒɑb ˈtʰɑt ðə(m) ˈmɛni ˈθɪŋz	▪ Consonants (/ð/, /θ/, /ɹ/, ŋ/) ▪ Vowels (/i-ɪ/, /u-ʊ/) ▪ Aspiration ▪ Final devoicing ▪ Nasalization ▪ Orthographic transfer (/dʒ->ʒ/)		▪ Unstressed function words ▪ Rhythm ▪ Tonicity

Table 8.11. ***Delayed Sentence Repetition Task*** **target sentences.**

In order to create the mini-dialogue structure for the *Delayed Sentence Repetition Task*, the target answers were paired with questions. The questions were created to reinforce the answer by repeating part of it so as to aid their memorization.

The target answers were recorded at the UB phonetics lab in a sound proof booth with a female native speaker of American English (*NS2*, *Ch.8.1.1*, p.204). The recording equipment employed was a Shure SM58 unidirectional microphone and a Marantz PDM660 solid-state digital recorder with sampling frequency set to 44100 Hz/16-bit. The informant was presented with a list of the original five sentences repeated three times in a randomized order. She was asked to read them at her normal conversational speed. The most natural sounding repetitions with the clearest pronunciation were selected.

The question prompts were recorded at UFSC in a quiet room with a male native speaker of Brazilian Portuguese who had an advanced level of English (*p04*, Appendix E). The recording equipment was a Shure SM58 unidirectional microphone and a Sony PCM-M10 recorder with sampling frequency set to 44100 Hz/16-bit. A male speaker was selected to record the questions in order to avoid confusion with the female voice providing the target answers. The fact that he was not a native speaker of English was not expected to present problems as he was not the model to be imitated, but just the voice providing the distractor question.[78] He was presented with a list in which five questions were randomly repeated three times and asked to read the questions in a natural way at his normal reading speed. As with the female informant, the most natural sounding repetitions were selected.

The selected questions and answers were extracted from the sound files and preprocessed for presentation. Audacity was used to normalize the audio files to the same peak level and to remove any low-frequency noise which might have been present. Following this, the *Delayed Sentence Repetition Task* was created in Praat. The question and answer pairs together with silences were concatenated into one sound file in which each of the original five sentences appeared twice. The three disregarded sentences were kept as practice items and presented at the beginning of each round. The structure of each dialogue is shown in Table 8.12 on the following page.

The Delayed Sentence Repetition Task was carried out individually in a quiet room at the Faculty of Language and Communication at UFSC. The participant sat in front of a table in which the microphone was placed. As earlier, the recording was carried out with a Shure SM58 unidirectional microphone and a Sony PCM-M10 recorder with sampling frequency set to 44100Hz/16-bit. The computer screen in which the *Delayed Sentence Repetition Task* was playing was facing the researcher and away from the participant in order to avoid distractions. The participants did not see the orthographical presentation of the dialogues at any point. The delayed sentence repetition sound file was accompanied

[78] Unfortunately it was not possible to obtain a native English speaker to record the questions. Although, the L1 BP speaker was not providing the targets to imitate but the distractor questions, it is possible that if participants were able to identify him as a non-native speaker, they were put into 'bilingual mode', which could have affected their performance.

Type	Dialogue repetition 1				ISI^2	Dialogue repetition 2		
	IS	Question	ISI^1	**Answer**		Question	ISI	**Answer**
P	IS	What happened with the magazines?	ISI^1	The magazines were delivered by Valerie.	ISI^2	What happened with the magazines?		“_________.” 500ms
P		What does a fair judge do?		A fair judge gives another chance.		What does a fair judge do?		“_________.” 500ms
P		Where did she start to work?		She started to work at the school canteen.		Where did she start to work?		“_________.” 500ms
T		What did Strong Steve do?		Strong Steve killed a huge snake.		What did Strong Steve do?		“_________.” 500ms
T		Why do they like their new job?		Their new job taught them many things.		Why do they like their new job?		“_________.” 500ms

Table 8.12. Structure of the *Delayed Sentence Repetition Task* trials. P=practice, T=target, IS= initial silence (100 ms), ISI^1= inter-stimulus intervial (100 ms), ISI^2= inter-stimulus interval (150 ms).

by a text grid so that it was easier for the experimenter to follow the task and to take a note of any lexical deviations or missed data. The participant was instructed to repeat the answer after hearing the question for the second time. The dialogues were played through Roland RH-5 Monitor headphones at a comfortable volume selected by the participant. If the participant made a mistake or was unable to repeat the target answer, the dialogue was played again. If after two replays, the participant was still unable to repeat the target answer, the researcher read aloud the question and the answer. If the participants were still unable to repeat the target answer after this, they repeated the answer straight after the model without listening to the whole dialogue. This occurred in three instances.

Following the *Delayed Sentence Repetition Task*, the L2 learners’ productions of the two target sentences were extracted and preprocessed for presentation. First, the target sentences were isolated from the *Delayed Sentence Repetition Task* and extracted at zero crossings. The second repetition of the sentence was selected unless the first repetition of the sentence was more fluent. In some cases in which the participant was unable to produce the target sentence, more than two repetitions of the target sentences were needed and the last one of them (in which the sentence was pronounced grammatically and semantically correctly) was selected. In some cases, the extracted sentences presented pauses and hesitations. In order to avoid these disfluency phenomena having a negative effect on the perceived L2 pronunciation, pauses longer than 200 ms were eliminated by removing them from the speech sample at zero crossings. The part from which the pause was eliminated thus sounded more natural as the remaining pause was kept comparable to pauses occurring in the native speaker speech samples (approximately 90 ms). In total, 26% of the sentences needed to be treated in this way.

The isolated target sentences from the 71 L1 BP participants were preprocessed for presentation. First, all the low frequency noise was eliminated using Audacity's noise reduction script. This script reduces noise by 24dB and does frequency smoothing at 150Hz. Next, the sentences were normalized to the same peak level (maximum amplitude = -1.0dB) and DC offset was removed, again using Audacity.[79] In some cases, this meant increasing the amplitude which in few cases (*n*=6) resulted in more noise. These sentences were treated again for noise removal. The 142 items (71 participants x 2 sentences) were presented to L1 AmE judges in a *Foreign Accent Rating Task*.

8.4.2. Evaluation: Foreign Accent Rating Task

The evaluation of L2 pronunciation can be carried out either objectively or subjectively. The objective method consists of measuring different aspects of the

[79] DC offset is the mean amplitude displacement from zero which potentially can distort the sound

individual's speech, such as, VOT, vowel formants and duration. Suprasegmental features can be studied by examining the pitch contours, for example. The obtained measurements are then compared to native speaker productions in order to determine their (dis)similitude. However, not all aspects of speech render easily to measurements.

This problem can be avoided by presenting the obtained speech samples for other language users who will judge the native-likeness, or the degree of foreign accent, fluency and/or comprehensibility of the sample. Subjective judgments of language users obtained this way are highly uniform and language users agree to a large extent when judging L2 speech (Flege & Fletcher, 1992; Piske et al., 2001; Schmid & Hopp, 2014). Whereas the judges are usually native speakers of the target language, results from studies using other L2 speakers suggest that also L2 speakers are able to judge the pronunciation of other L2 speakers reliably (Major, 2007; Major & Baptista, 2007; Munro, Derwing, & Morton, 2006).

In the present study, the L2 users' speech samples, obtained as described in the previous section, were submitted to a panel of L1 AmE judges. The use of native judges instead of objective measurements was considered more relevant as the interest was in how native speakers perceive the pronunciation of the language users in question. Listener judgments are thought to reflect speech comprehension in typical native - non-native speaker interactions (Baker & Trofimovich, 2006). Moreover, foreign accent judgments offer a more global picture of the individual's L2 pronunciation as not everything can be measured, as stated earlier.

The task employed to obtain the L1 AmE judgments on the L2 users' pronunciation was *a Foreign Accent Rating Task,* widely used in previous research (e.g., Bongaerts et al., 1997; Flege, 1988; Flege & Fletcher, 1992; Flege et al., 2006; MacKay et al., 2006; Magen, 1998; Piske et al., 2001). In this task, the L1 AmE judges were presented with the speech samples and were asked to rate them for their degree of foreign accent on a 9-point scale.

The task was created and administered in Praat and consisted of three blocks: the practice block, the *Sentence 1* block and the *Sentence 2* block. In the practice block, the listener heard eight repetitions of the sentence 'She started to work at the school canteen' as pronounced by eight randomly selected L1 BP EFL learners. The aim of the practice block was to familiarize the listeners with the task structure and with the range of foreign accents.

The actual test block consisted of two parts in which all the repetitions of the *Sentence 1* ('Strong Steve killed a huge snake') were presented before the *Sentence 2* ('Their new job taught them many things'). The order of the two blocks was fixed whereas the order of the trials within the blocks was randomized. The task was self-paced and the listeners were allowed to take pauses at any point, in addition to the pre-determined pause separating the two test blocks. The sentences were rated on a nine-point Likert scale (1= no foreign accent, 9= a very strong foreign accent). A nine-point scale was deemed adequate to capture fine-grained differences among the participants' L2 pronunciation y (Southwood & Flege, 1999). The judges had the option to relisten each sentence once if required. Instructions were given to use the whole scale when rating the speech samples.

In order to increase task reliability, the two test sentences were read by five native English speakers and included in the task. Due to unavailability of L1 AmE speakers in Florianópolis at the time of the data collection, speakers of other varieties were included. Three were speakers of the General American variety, one was a speaker of Standard Canadian English and one, the only male, was a speaker of Standard Southern British English. Two of the native speakers were recorded personally by the researcher, whereas the remaining three recorded themselves and submitted the sentences electronically due to mobility issues. The electronically submitted samples were auditorily compared to the others and no difference in the sound quality was perceived. The samples were treated for presentation in the same way as the L1 BP samples.

The *Foreign Accent Rating Task* was carried out individually in a quiet room at the Faculty of Language and Communication at UFSC. The 19 L1 AmE judges (the L1 AmE participants presented in *Ch.7.2*) sat in front of a laptop computer wearing Roland RH-5 Monitor headphones. The structure of each trial was the following. The target sentence was heard at a comfortable, self-selected, volume through the headphones. Immediately after this, the rater saw the sentence written on the screen together with the rating scale (Figure 8.15) and was asked to judge the degree of foreign accent of the heard sample. The responses were given by clicking the corresponding boxes and numbers on the scale.

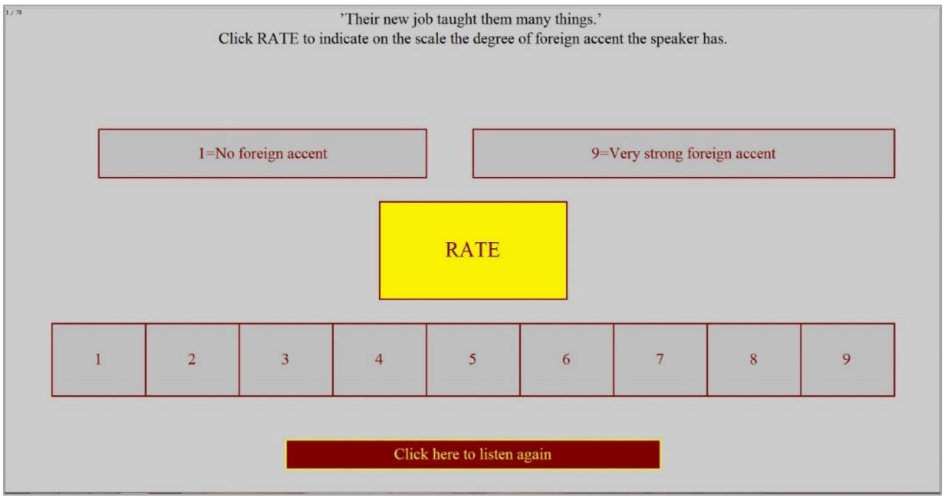

Figure 8.15. Screenshot from the *Foreign Accent Rating Task*.

The data from the task comes in the form of foreign accent ratings. Each L1 BP speaker (and the control L1 English speakers) received a foreign accentedness rating from each of the native judges for the two test sentences. In order to examine the comparability of the two test sentences, a mean from all the judges for each sentence was computed. A paired samples t-test was conducted for the mean ratings of *Sentence 1* ("job") and mean ratings of *Sentence 2* ("snake"). The test found a significant difference in the ratings so that ratings given to *Sentence 1* were significantly higher (more foreign accented) than those given to *Sentence 2* ($t[70]=3.65$, $p<.001$). Next, a Pearson correlation was carried out in order to determine whether the ratings given to each participant's two sentences were nevertheless related. A strong positive correlation between the two sentences was found ($r=.693$, $n=71$, $p<.001$). In other words, at the individual level, the participants who were rated as having a strong foreign accent in *Sentence 1* were also rated as having a strong foreign accent in *Sentence 2*. Thus, it was concluded that the two sentences could be combined for further analyses. Consequently, each L1 BP EFL learner obtained a ***Foreign Accent Score*** which was computed as the mean rating from the two sentences across the judges. The *Foreign Accent Scores* ranged from 2.29 to 8.18 ($M=5.73$, $SD=1.29$). Inter-rater reliability as measured by a Cronbach's Alpha was .96.

Section summary:

This section has presented the methodology of obtaining an L2 pronunciation measure from the L1 BP participants. The section began by presenting the chosen elicitation method used to elicit foreign accent samples in the form of two sentences containing challenging L2 phones. The second part of the section discussed how these speech samples were evaluated. The L2 speech samples from all the language learners were submitted to a panel of L1 AmE listeners who judged their degree of foreign accent on a nine- point scale. Finally, the creation of the Foreign Accent Score was discussed.

8.5. Vocabulary size

The tasks used to measure the L1 BP participants' vocabulary size are presented in this section. Vocabulary size was taken to be an indication of the language learners' overall L2 proficiency, and its possible effect on L2 phonological awareness was examined, following the suggestion made in *Chapter 4* about the need to examine factors which might be related to L2 phonological awareness (cf. *Ch.4.1.3*, p.108).

The reasoning behind using a vocabulary size measure as an indication of the individual's overall language proficiency is that vocabulary size is expected to increase as language proficiency increases (e.g., Milton, 2010). The relationship between vocabulary size and language proficiency is further testified by the fact that vocabulary size tests are frequently used as a quick language course placement test. More specifically, the vocabulary size measurements used in the present study have been used to place university students to appropriate course levels and to screen candidates for public examinations (Meara, 2005a). Logically, foreign language proficiency consists of several domains, such as grammatical, semantic, phonetic and pragmatic knowledge, and using only the individual's lexical knowledge is an oversimplification. However, for the aims of this study, vocabulary size was taken to be an adequate reflection of an individual's foreign language proficiency. First, the main focus of the study is on pronunciation, not on language proficiency, so that precise and time-consuming language proficiency testing procedures would have been unnecessary. Second, as the participants already took a battery of tests measuring phonological awareness, it was deemed necessary that the measure reflecting the general language proficiency would be quickly administered. This is the case with the two vocabulary measures selected.

8.5.1. X_lex and Y_lex

X_Lex (Meara, 2005b) and Y_Lex (Meara & Miralpeix, 2006) are two measures of vocabulary breadth: they estimate how many words the test taker knows in the test language.[80] 'Knowing' here means the ability to know the meaning of the word, without taking into account vocabulary depth: the different nuances of meaning and ability to actively use and combine the words (Milton, 2010). The X_Lex test is used to test the knowledge of the 5,000 most frequent words in the target language, whereas the Y_Lex test measures the knowledge of the 10,000 most frequent words, thus reflecting a more advanced vocabulary knowledge.

The X_Lex and Y_Lex tests are administered via a computer in a 'yes'-'no' format. The participants see a word on a computer screen and indicate by clicking the corresponding answer (a happy or a sad face) whether they know the meaning of the word or not (Figure 8.16). In order to increase reliability, the test includes nonwords. If the participants claim knowing one of these non-existing words, they will be penalized in the final score. The tests are self-paced and take around 4-8 minutes to complete, each.

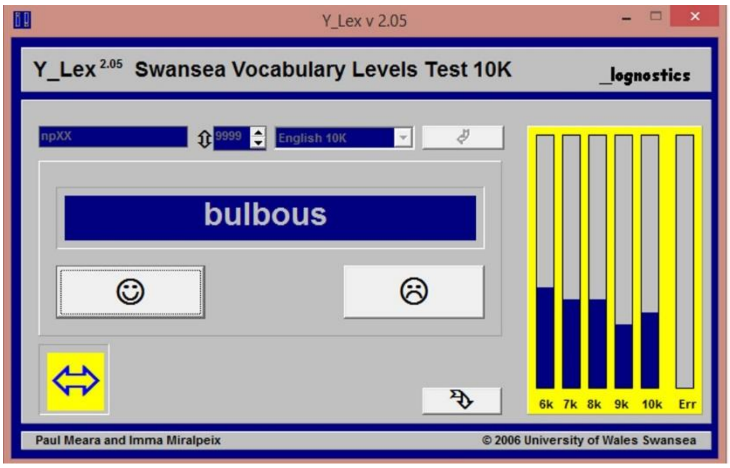

Figure 8.16. Screenshot from Y_Lex Advanced Vocabulary Size Test.

[80] Both tests are freely available for download at http://www.lognostics.co.uk/tools/

Participants were tested individually in a quiet room at the Faculty of Language and Communication at the Federal University of Santa Catarina. The X_Lex test was administered first, immediately followed by the Y_Lex test as the former presents easier vocabulary. In order to take the tests, the participant sat in front of a laptop computer where the tests were playing. Answers were provided by clicking the answer boxes with the mouse. The participants were instructed to click on the happy face only if they really knew the meaning of the word, and to click on the sad face if they were in doubt.

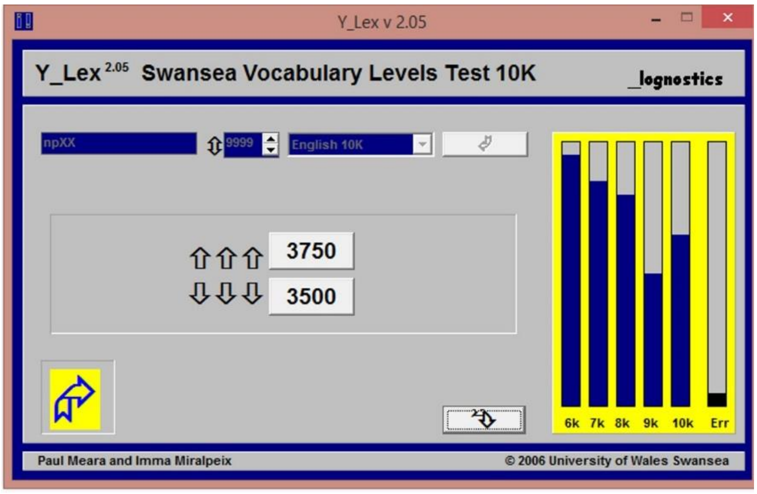

Figure 8.17. Screenshot from Y_Lex Advanced Vocabulary Size Test results screen. The 'raw' and 'corrected' scores are shown in the center and the knowledge of different frequency bands is illustrated on the right.

The X_Lex and Y_Lex tests provide the results in two formants: as feedback for the participant at the end of the task (Figure 8.17) and the proper results for the researcher in a separate text file. Two types of scores are obtained. The 'raw score' is an estimation of the individual's vocabulary size based on the 'yes' answers. The 'corrected score' is the most widely reported score as it takes into account the false alarm answers and adjusts the vocabulary score for guessing (Meara, 2005a). Additionally, the results provide an estimate of the participant's vocabulary knowledge according to each of the five frequency bands (representing each 1,000 words). Finally, the number of claimed ‘known’ imaginary words is shown. If this number is very high, the obtained vocabulary size measure is not reliable as the participant has either not understood the instructions or was not answering truthfully. In the present study, participants claiming to know five or more nonwords in either of the two tasks were excluded from any further analyses involving vocabulary size. 11 participants were excluded this way, leaving the number of participants with a vocabulary size estimate to 60. Each participant received a vocabulary size estimate (ranging from 0 to 5000) from each of the two tasks.

L2 Vocabulary Size Score was obtained by adding the corrected X_Lex score to the corrected Y_Lex score, thus the theoretical range of scores is 0-10,000 (words). The L1 BP participants’ range was 3750-8800. Mean L2 vocabulary size was 6672.50 (*SD*=1147.34).

Section summary:

The present section discussed the task used to measure the L1 BP speakers’ English vocabulary size. Vocabulary size measurements were obtained with the help of X_Lex and Y_Lex tests whose combined results provided the ‘L2 vocabulary Size Score’. This score was used in the analyses examining the effect of individual differences on L2 phonological awareness.

8.6. Questionnaires

The purpose of this section is to present the questionnaires used in the study to gather information about the participants' individual characteristics. Two questionnaires were created for the L1 BP participants, one targeting individual variables such as language experience and use, and another targeting attitudes, opinions and habits related to pronunciation. A separate questionnaire was elaborated for the L1 AmE participants. We will begin by reviewing the L1 BP participants' linguistic background questionnaire.

8.6.1. Linguistic background questionnaire

A large body of research exists on the effect of individual variables on the acquisition of a foreign language (for a review see Piske et al., 2001). Factors such as age of acquisition, amount of L2 experience, L2 use, L1 use and quality of the L2 input, among others, have been widely studied, and their relation to L2 acquisition established. A questionnaire was created, targeting these variables as precisely as possible in order to examine their relation to L2 phonological awareness.

The linguistic background questionnaire consisted of three parts (Appendix I). In the first part, demographic information and contact details were solicited. The second part consisted of questions related to language experience and the final part dealt with L1 and L2 language use. Taking a closer look at the first part of the questionnaire, two questions deserve to be observed in more detail. Participant's hand dominance (*Question 8*) was established in order to the correct assignment of the right-and left-handed versions of the phonological awareness tasks. Additionally, participants were asked if they had been diagnosed with any hearing problems in order to exclude participants who responded affirmatively (*Q9*).

The second part of the questionnaire was designed to obtain detailed information about the participant's language history. With this aim, questions about home language, parental place of birth and fluency in other languages were formulated. Several questions (*Q15*-*Q17*, *Q19*-*Q21*) targeted the participant's experience with English. Questions were made to establish the Age of Onset of Learning (AOL), number of years of English instruction in different contexts (pre-university, university and language schools) and time spent in English speaking countries. The quality of the input was assessed as well through questions about the amount of native speaker teachers in the attended classes (*Q18*) and the type of daily interactions with other L2 users (*Q27*). As the language variety used in the tests was General American, participant's familiarity with English dialects and preference for one over another was also assessed (*Q22* & *Q25*). Finally, in order to determine the level of explicit English phonetic instruction received, questions about attendance to phonetic classes and the different aspects of pronunciation which had been taught were asked (*Q23* & *Q24*).

The final part of the questionnaire targeted variables related to language use. Two measures were used. Participants were asked to evaluate the time spent speaking English and Portuguese at different contexts in hours in a typical day (*Q26*). They were also asked to think about the last 5 days, 5 weeks, 5 months and 5 years and estimate in percentage how much of the time they spoke in English, in Portuguese and in another language (*Q28*-*Q31*). These questions were expected to give a comprehensive portrait of the individual's typical language use over a relatively long period of time.

The questionnaire was created by using the online platform Google Docs.[81] Google Docs enables the creation of forms and questionnaires in several formats. The created questionnaire is uploaded to a Google server and the link to the questionnaire sent to the informants either via email or social media. The responses are gathered and stored in a separate file on the online server from where the researcher can download them into a spreadsheet.

The linguistic background questionnaire was filled online as a part of pre-selection process (cf. *Ch.7.1*, p.191). The participants received the link to their email address and accessed the questionnaire at a convenient time from home, university or another location.

The data obtained from the questionnaire was quantitative and was converted into categorical (sex, L1, L2 etc.), ordinal (self-estimated language proficiency, frequency of phonetics teaching etc.) and ratio (age, nº of years studied L2, nº of hours spoken a language etc.) scales.[82] The variables obtained for demographic data was discussed in detail in *Chapter 7*, and individual participants' demographic and linguistic characteristics can be seen in Appendix A. The calculation of the language experience and use variables which were employed in the further statistical analyses are discussed next.

The following variables were obtained to measure language experience: *AOL English*, *Academic English Experience*, *Native English Experience* and *English Experience Score*. ***AOL English*** (age in years) was obtained from the responses to Question 15. ***Academic English Experience*** (*Q16*) was computed as the sum of years spent in different learning environments. ***Native English Experience*** was computed as

[81] Freely available from http://www.google.com/forms/about/
[82] Qualitative questions were used only for clarifying purposes.

time spent in English speaking countries in months (*Q21*). Finally, ***English Experience Score*** was computed as the sum of *Academic English Experience* and *Native English Experience*: the higher the score, the more experience with English the participants had had.

Language use was measured through the following variables: *L1 Use Average, L2 Use Average, L1 Use Total Score, L2 Use Total Score, L2-L1 Use Ratio, L3 Daily Use*. ***L1 Use Average*** was the mean percentage of L1 use in the last five years (*Q28-31*). Cronbach's Alpha value of .86 indicated that the measure was reliable. ***L2 Use Average*** was the mean percentage of L2 use in the last five years (*Q28-31*) and had a Cronbach's Alpha value of .86. ***L1 Use Total Score*** was operationalized as the sum of L1 daily use at different contexts (*Q32*). As there were only four items, a mean inter-item correlation, instead of Cronbach's Alpha was calculated. The mean inter-item correlation was .41 and can be thus considered reliable. ***L2 Use Total Score*** was the sum of daily L2 use at different contexts (*Q26*) and had a mean inter-item correlation of .41. ***L2-L1 Use Ratio*** was computed as a ratio between *L2 Use Total Score* and *L1 Use Total Score*: the higher the ratio, the more L2 is used in comparison to the L1. ***L3 Daily Use*** was operationalized as the number of hours spoken in a foreign language other than English on a daily basis (*Q33*). Additionally, the quality of the received input was measured through the ***Quality of L2 Input Score*** which was calculated as the sum of the amount of interaction with native English speakers across different contexts; the higher the score, the more interaction with native English speakers in comparison to non-native English speakers (*Q27*).

Finally, experience with English phonetics and phonology teaching was measured through ***L2 Phonetics Experience Score***. This score was an overall measure of the participant's experience with English phonetics instruction and was computed as the sum of the answers to *Question 23*. To this sum 5 points were added if the participant reported to have attended a university level course in English phonetics and phonology (*Q24*). Cronbach's Alpha of this variable was .80. Descriptive statistics of the discussed variables can be seen in Table 8.13.[83]

Variable	Mean	*SD*	*Min.*	*Max.*
AOL English	9.28	2.78	2.00	18.00
Academic English Experience	17.65	3.04	10.00	29.00
Native English Experience	4.33	11.42	0.00	60.00
English Experience Score	21.98	12.04	12.00	77.00
L1 Use Average	77.02	14.89	15.00	95.00
L2 Use Average	21.73	14.49	5.00	85.00
L1 Use Total Score	14.55	3.87	7.00	20.00
L2 Use Total Score	6.48	1.91	4.00	14.00
L2-L1 Use Ratio	.50	.28	.20	2.00
Quality of L2 Input Score	16.17	12.99	4.00	59.00
L3 Daily Use	.10	.54	.00	4.43
L2 Phonetics Experience	18.32	4.54	7.00	30.00

Table 8.13. Descriptive statistics for language experience and use variables for L1 BP participants (*n*=69).

8.6.2. Phonological self-awareness questionnaire

The L1 BP participants filled in another questionnaire during and after the data collection session. This questionnaire was designed to address individual variation in relation to task behavior and self-perceived phonological awareness.[84]

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[83] The descriptives presented here and in the next section are based on those participants who were included in the final main analysis involving *Composite Phonological Awareness Score*. The number of participants in analyses involving subdomains of phonological awareness was higher. The total number of participants was 71 for L1 BP and 19 for L1 AmE.

[84] Questions targeting the participants' pronunciation motivation were also included with the aim of determining whether motivation was related to L2 phonological awareness, but the resulting score was not included in further analyses due to its low reliability (Cronbach's Alpha=.43); the questions did not measure the same underlying construct.

The first part of the questionnaire (cf. the following page) consisted of task related questions. The participant was asked to indicate the frequency with which he guessed, used intuition and used the knowledge of a rule when answering in the *Low-Pass Filtered Intonation Identification Task* (*Q1*) and in the *Phonological Judgment Task* (*Q2*). These questions were answered immediately after completing the corresponding task. The motivation for including questions like these was to gain an insight on the type of knowledge the participant used or claimed to use when performing the tests, more specifically, whether they were accessing proceduralized or declarative knowledge.

This subjective measurement was added following Rebuschat et al. (2013) suggestion to include confidence ratings and source attributions to determine what type of knowledge (explicit/implicit) language learners employ when performing a language awareness task. They argue that claiming knowledge of a rule is an indication that explicit knowledge was employed, whereas claiming the responses to be based on intuition suggests that proceduralized knowledge was employed (cf. *Ch.2.3,* p.56).

Claiming to have made frequent guesses when taking the tasks, could be an indication of the lack of knowledge of the underlying rules (or not understanding the task), but it could also be an indication of accessing proceduralized knowledge if the response accuracy is above chance-level. In the piloting of the *Low-pass Filtered Intonation Identification Task*, for example, the L1 BP participants reported to be guessing frequently. However, their accuracy rate was well above chance level (61% in all the trials combined).

NAME: ______________________________________

PART I: Task related questions

1. When answering, how often did you...? (TO BE FILLED AFTER THE PROSODIC AWARENESS TASK)

Write ✗ on the corresponding box.

	All the time	Often	Sometimes	Rarely	Never
Guess					
Use intuition					
Use knowledge of a rule					

2. When answering, how often did you...? (TO BE FILLED AFTER THE SEGMENTAL AWARENESS TASK)

Write ✗ on the corresponding box.

	All the time	Often	Sometimes	Rarely	Never
Guess					
Use intuition					
Use knowledge of a rule					

--------- **PART II: Phonological Awareness**

3. Give your opinion on the following statements. *Write ✗ on the corresponding box.*

	Strongly agree	Agree	Somewhat agree	Disagree	Strongly disagree
I can hear there are some English sounds I don't pronounce correctly although I try.					
I can hear my English intonation and rhythm are not correct although I try.					
I can hear I have a foreign accent when I speak in English.					

4. Give your opinion on the following statements. *Write ✗ on the corresponding box.*

	Strongly agree	Agree	Somewhat agree	Disagree	Strongly disagree
There are some specific English sounds that are difficult for Brazilians.					
There are some specific features in English intonation/rhythm that are difficult for Brazilians.					
Brazilians have a characteristic accent when they speak in English.					

5. How easy it is for you to....

Write ✗ *on the corresponding box.*

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
notice pronunciation mistakes in the production of *individual* sounds in other non-native speakers' speech?					
notice pronunciation mistakes in the *intonation and rhythm* in other non-native speakers' speech?					
tell where a *native* speaker of English comes from based on their English accent?					
tell whether a *non-native* speaker of English is Brazilian based on their English accent?					
tell where a *non-native* speaker of English (other than Brazilian) comes from based on their English accent?					

6. How easy it is for you to....

Write ✗ *on the corresponding box.*

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
notice whether *a sound combination* you hear is possible in English or not?					
notice whether the *intonation and rhythm* you hear in an English sentence are possible or not?					
notice whether an *individual sound* you hear is pronounced correctly in English or not?					

7. How easy it is for you to....

Write ✗ *on the corresponding box.*

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
explain why a sound combination you hear is possible or impossible in English?					
explain why the intonation and rhythm you hear are correct or incorrect in English?					
explain why an individual sound you hear isn't pronounced correctly in English?					

Figure 8.18. Phonological self-awareness questionnaire for the L1 BP speakers.

It could thus be that participants mistake the use of intuition for guessing on occasions, as they cannot base their answer on any learnt rules. Questions about source attributions were employed with the aim of seeing whether the participants would attribute most of their responses to intuition, supporting the researcher's beliefs that L2 phonological awareness is mainly proceduralized knowledge.

The variable obtained from these questions was termed ***Self-reported Task Behavior***. In order to obtain this variable, participants were divided into three groups for each strategy (guessing/intuition/knowledge of a rule) depending on their self-reported use of that strategy as reported in *Questions 1* and *2* (Figure 8.18): low use (answers coded as "never" and "rarely"), medium use ("answers coded as "sometimes") and high use (answers coded as "often" and "all the time").[85]

The second part of the questionnaire was built around self-perceived phonological awareness (cf. Figure 8.18). The participants were asked to provide their opinion on statements involving phonology. A set of questions targeted the participants' perception of their own pronunciation (*Q3*). Another set targeted the participants' awareness on the pronunciation of other L1 Brazilian EFL learners (*Q4*). *Question 5* inquired about awareness on the English pronunciation of EFL learners from other language backgrounds. It also inquired about the ability to distinguish different accents and dialects in the L2. The final questions (*Q6* & *Q7*) asked explicitly the participant's ability to *notice* and to *understand* aspects of the L2 pronunciation.

A ***Phonological Self-awareness Score*** was created by obtaining a sum from the answers to *Questions 5, 6* and *7*. This score tells overall how easy the participant finds different phonological awareness skills: the higher the sum, the easier the participant finds

[85] Descriptive statistics for the distribution of the L1 BP and L1 AmE participants for *Self-reported Task Behavior* are available in *Ch.10.4*, Table 10.13 (segmental domain) and Table 10.14 (prosodic domain)

phonological judgments. The mean *Phonological Self-awareness Score* for the L1 BP speakers was 34.55 (*SD*=4.63, *min*=23, *max*=43). Cronbach's Alpha value of .75 indicated that the score was reliable.

The questionnaire was created on Microsoft Word 2011 for Mac and printed out for the participants who filled it in at the end of the data collection session.

8.6.3. L1 AmE speaker questionnaire

The L1 AmE participants also completed a demographic/linguistic background questionnaire. In their case, as no pre-selection took place (cf. introduction to *Ch.7.2.*), only one questionnaire was created. The questionnaire was created with the Google Docs platform and filled online by the participants at the end of the data collection session.

The structure of the L1 AmE questionnaire paralleled the L1 BP questionnaire (cf. Appendix J). The first section gathered the same demographic information as the corresponding L1 BP section. The second part dealt with language experience, the third part with L1 and L2 use, and the final part focused on phonological self-awareness.

In the same manner as the L1 BP participants, the L1 AmE participants were inquired about attendance on phonetics classes (*Q17*), and also about teaching English for foreigners classes (*Q16*) as their explicit experience with linguistics was considered relevant. A set of questions focused around experience with Brazilian Portuguese (*Q18-20*) and with other languages (*Q14*, *Q15*, *Q27*). The L1 AmE participants were also asked to provide a self-estimate of their Portuguese proficiency (*Q21*). English and Portuguese language use were operationalized in the same manner as for the L1 BP participants:

hours/ day at different settings, as well as percentage of use between the last five days and five years (*Q22- Q26*).

The final section included those phonological self-awareness questions presented to the L1 BP participants which were also relevant for native English speakers. This section was included with the aim of enabling comparisons in self-perceived phonological awareness between native and non-native speakers. Answers to these questions were used to compute the *Phonological Self-awareness Score* in the same way as for the L1 BP speakers, explained in the earlier section.

The L1 AmE participants were also asked the same task behavior questions (use of guessing/intuition/rule) as the L1 BP participants after the segmental and prosodic subdomain tasks. The results were used to divide the L1 AmE participants in *Self-reported Task Behavior* groups in the same manner as previously reported for L1 BP speakers.

As the structure of the L1 AmE questionnaire paralleled the L1 BP questionnaires, the data obtained was treated in the same manner: the categorical, ordinal and ratio scales were converted into variables to be employed in further statistical analyses. The demographic and linguistic characteristics of the L1 AmE participants based on this data were presented in *Chapter 7.2,* and the individual demographic and linguistic data from each of the L1 AmE participants are available in Appendix B. The language use and experience variables which were employed in further statistical analyses are presented next.

The following language experience variables were obtained: *AOL Portuguese, Academic Portuguese Experience, Native Portuguese Experience* and *Portuguese Experience Score*. ***AOL Portuguese*** (age in years) was obtained from responses to *Question 18*. ***Academic Portuguese Experience*** was computed the amount of time of

Portuguese studied (*Q19*). ***Native Portuguese Experience*** was measured as the length of stay in Brazil (*Q20*). Finally, ***Portuguese Experience Score*** was computed as the sum of *Academic Portuguese Experience* and *Native Portuguese Experience*: the higher the score, the more experience with Brazilian Portuguese the L1 AmE participants had had. Language use was measured through *L1 Use Average*, *L2 Use Average* and *L3 Daily Use.* These variables were obtained as earlier explained in the section corresponding to the L1 BP speaker questionnaire.

Descriptive statistics of the discussed variables for the L1 AmE participants can be seen in Table 8.14.

Variable	**Mean**	***SD***	***Min.***	***Max.***
AOL Portuguese	23.36	5.93	18.00	34.00
Academic Portuguese Experience	1.42	2.65	0.00	10.00
Native Portuguese Experience	2.07	1.94	1.00	7.00
Portuguese Experience Score	4.71	2.26	2.00	9.00
L1 Use Average	75.75	8.68	57.50	87.5
L2 Use Average	17.32	7.93	5.00	35.00
L3 Daily Use	.57	1.01	0.00	3.00
Phonological self-awareness	45.36	16.40	39	53

Table 8.14. Descriptive statistics for language experience and use variables for L1 AmE participants (*n*=14).

<u>*Section and chapter summary:*</u>

This section has discussed the questionnaires which were used to elicit demographic, linguistic and attitudinal information from the participants with the aim of studying how these variables might affect their degree of phonological awareness.

We began the chapter by examining the instruments used to access each of the phonological awareness components: the segmental, the phonotactic and the prosodic.

We then proceeded to review the tasks used to elicit and evaluate the L1 BP participants' English pronunciation. Finally, we discussed the instruments used to measure variables which might be related to the participants' degree of phonological awareness. Section 8.5 was dedicated to the vocabulary size measures and the final section, 8.6, to the questionnaires which gathered data from the participants' L2 experience and use, self-awareness and pronunciation instruction experience, among others. The following chapter details the procedures used in the data collection.

9. Procedure

In the current chapter, the testing procedure carried out in the data collection sessions is discussed. We will go through the time frame of the data collection, the testing facilities and the equipment, as well as the order of the tasks and other testing procedures.

The data collection for the dissertation was carried out over the course of 2012 to 2014. In 2012, early versions of some of the tasks (segmental awareness [*Ch.8.1.2*] and phonotactic awareness, [*Ch.8.2.2*]) were piloted with L1 Spanish-Catalan learners of English. The participants were first year undergraduate students at the University of Barcelona taking a degree in English. This piloting population was used mainly due to the facility of access to them, as at the time they were taught by the researcher, but also because the relatively large participant population (*n*=46) allowed the testing of the tasks reliably. The tasks at this point were very rudimentary and not language-specific. The aim was to obtain preliminary information on what type of tasks could be used to access L2 phonological awareness, and what type of L2 phonological awareness (verbalizable/non-verbalizable) the language users possessed in general. Hence, the fact that the L1 of the participants was not Brazilian Portuguese was not a problem.

The piloting participants were tested in one session in a computer room at the UB. Each participant sat in front of a desktop computer wearing headphones. The session took 90 minutes and also other, unrelated, tasks were tested on the same occasion. The participants completed the first version of the phonotactic awareness task, followed by the first version of the segmental awareness task, X_lex, Y_lex and a language background questionnaire. As a compensation for their participation, they were rewarded with a course credit. This first piloting data collection was carried out in two sessions with the help of four other researchers.

The second piloting of the tasks was carried out in Florianópolis in 2013. The participants were L1 BP EFL learners and L1 English speakers (Appendix E). At this occasion, two tasks were tested for each of the phonological awareness domains, and the aim of the piloting was to determine which of the tasks would better serve the purposes of the study. The L1 BP participants were in their majority *Extra* students at the upper-intermediate level. The L1 English participants were exchange students and students of Portuguese as a foreign language at UFSC. Upper-intermediate language learners were chosen in order to determine that the vocabulary in the tasks would be suitable and would not cause any problems. The participants were tested individually in a quiet room at the Faculty of Language and Communication at UFSC. The tests were performed with an Acer Extensa laptop computer and Roland RH-5 monitor headphones. The participants first signed a consent form and filled in a questionnaire. The order of the tasks was the same for all the participants: *Lexical Decision*, *Illegality Decision* (cf. *Ch.8.2.2*), prosodic awareness (either normal or low-pass filtered version [cf. *Ch.8.3.2*]) and finally the *Phonological Judgment Task* (either *v.2* or *v.3*, [cf. *Ch.8.1.2*]).

Before discussing the procedures of the main data collection, it should be noted that a small- scale study was carried out after the actual data collection, in 2014, in order to examine Brazilian Portuguese tonicity (cf. *Ch.5.3.2.2*). On this occasion, ten L1 BP speakers were recorded at UFSC and at the researcher's home in order to obtain more information on Brazilian Portuguese tonicity. The recording equipment was the same as in the actual data collection, namely a Sony PCM-M10 recorder and a Shure SM58 cardioid microphone.

The main data collection took place between September and November 2013 at UFSC. As the forms of contacting the participants as well as their demographic characteristics have been detailed in *Chapter 7*, a brief overview here suffices. The L1 BP EFL learners who expressed interest to participate in the data collection were approached by email in which an overview of the research project was given (aim, duration of the tasks, type of tasks, compensation). In addition, the email included a link to the online questionnaire (cf. *Ch.8.6.1*), which the potential participants were asked to fill in as a part of the pre-selection procedure (cf. *Ch.7.1*). The answers of those language learners who filled in the questionnaire were examined for parental place of birth, fluency and use of other foreign languages than English, and time spent in English speaking countries. The EFL learners who passed the pre-selection process (practically all, with the exception of two multilinguals) were contacted and forwarded a link to the data collection schedule.

The data collection schedule was created with Doodle.[86] Doodle is an online tool used to schedule events. The event is created by indicating the available data collection days and hours and by sharing the calendar with the participants. The participants then select a suitable time for their participation by writing their name on the corresponding grid, which automatically updates the online calendar so that no double booking is possible. After the participant had selected a time for the participation, the researcher sent a confirmation email with the selected time and classroom details. A remainder email was sent two days before the set data collection session. In total, 71 L1 BP EFL learners participated in the data collection. The L1 AmE speakers did not fill an online

[86] Freely available at www.http://doodle.com

questionnaire prior to the data collection, but received directly a link to the corresponding Doodle schedule. In total 19 L1 AmE speakers took part in the data collection.

The data collection sessions followed the same order for all the participants, with the exception of a few rare cases in which the order of the tasks was changed due to excessive noise from the neighboring classroom, which might have worsen the quality of the recording of the *Delayed Sentence Repetition Task* speech sample. The session began with the researcher introducing herself and stating that the objective of the study was to examine how Brazilians learn English pronunciation. The structure of the participation session was also explained. The participants first signed a consent form in which they agreed to participate in the study (Appendix K). Next, the previously filled linguistic background questionnaire was checked, and any unclear information was clarified. Also the participant's hand dominance was confirmed at this point. The first task was the *Delayed Sentence Repetition Task* (cf. *Ch.8.4.1*). This oral proficiency task was administered relatively fast, taking approximately 5 minutes to complete.

After the L2 speech sample, the participants took the battery of the phonological awareness tasks. The first task was the *Lexical Decision Task*, which measured the participant's phonological awareness in the phonotactic domain (cf. *Ch.8.2.2*). It was done at the beginning of the data collection session as it measured reaction times. Leaving the task for later might have resulted in slower reaction times, as most likely the participant would have been more tired at the end of the session. Moreover, the *Lexical Decision Task* was rather short (around 12 minutes) and the participants considered it easy, which was expected to raise the self-confidence in relation to the whole data collection session.

The following task was the *Low-pass Filtered Intonation Identification Task* measuring phonological awareness in the prosodic domain (cf. *Ch.8.3.2*). The task took around 18 minutes to complete, and after finishing the task the participants were asked to answer the questions related to performance in the task (cf. *Ch.8.6.2*). At this point the participant was asked to take a small break, during which refreshments were offered. In addition to this marked break, participants were allowed to rest between the tasks at any point if needed, as the phonological awareness tasks were designed so that they could not be stopped once started, with the exception of one predetermined break half-way through each task.

Following the short break, the participants proceeded to the *Phonological Judgment Task*, which measured phonological awareness in the segmental domain (cf. *Ch.8.1.2*). The *Phonological Judgment Task* was taken after the *Low-pass Filtered Intonation Identification Task* as the former was thought to put a bit less strain on attentional resources as it allowed relistening of the trials. The task took around 15-20 minutes to complete, and following the task, the participants answered the questions related to their self-reported strategy use in the task (cf. *Ch.8.6.2*).

The last part of the data collection session focused on the individual variables. After the *Phonological Judgment Task*, the participants took the two vocabulary tests X_Lex and Y_Lex (cf. *Ch.8.5*). They were left in the end as they were very fast to administer, and they put less strain on attentional resources than the phonological awareness tasks. Finally the participants filled in the *Phonological self-awareness questionnaire* (cf. *Ch.8.6.2*) during which the researcher took a quick look at the participant's phonological awareness results. DmDx result files require some arranging and calculations before accurate results can be extracted, but they permit to see an overall tendency of the participant.[87]

[87] The results come in a text file showing the trials in the order they were presented followed by their reaction times and a + or a – sign depending on whether the answer was correct or not.

After the participants had filled in the questionnaire, the researcher provided overall feedback on the tasks. The overall purpose of each task was explained together with comments on how the participants had performed according to the result files. At the end, the participants received an information sheet of the area at which they had showed the most difficulty together with their vocabulary size score. To this aim, the researcher had prepared three information sheets targeting each of the test areas (segmental, prosodic and phonotactic) with the title ‘Pronunciation tips for Brazilians’. This type of feedback was intended to help the participants to increase their phonological self-awareness. Additionally, the participants received a participation certificate which they could exchange for a course credit, and R$20 (approx. 7€) as a compensation for their time. The duration of the whole data collection session was 75-90min.

The L1 AmE data collection sessions followed the same structure of the L1 BP participants’ data collection sessions with a few changes. After the initial introduction, the L1 AmE participants began the data collection session by filling in the language background questionnaire (cf. *Ch.8.6.3*). At this point, language background, familiarity with Brazilian Portuguese and hand dominance were confirmed.

The first task the L1 AmE participants took was the *Foreign Accent Rating Task* (cf. *Ch.8.4.2*). In this task, the L1 AmE participants served as native speaker judges evaluating the degree of foreign accent of the L1 BP participants. After this, the three phonological awareness tasks followed in the same order as with the L1 BP participants. Vocabulary size was not tested as it was not relevant for the purposes of the present study. After finishing with the *Phonological Judgment Task*, the L1 AmE participants received a certificate for their participation as well as R$30 (approx. 10€) as a compensation for their time.

All the participants were tested in the same room at the Faculty of Language and Communication at the Federal University of Santa Catarina, and with the same equipment. Namely, Acer Extensa lap top computer, Roland RH-5 monitor headphones, Sony PCM-M10 recorder and Shure SM58 cardioid microphone.

Chapter summary:

The current chapter has provided a summary of the procedures used to collect data for the present study. Data was collected in two piloting occasions before the actual data collection, which took place in Florianópolis in 2013. Additional Brazilian Portuguese sentence production data was collected in 2014.

10. Results

The aim of this chapter is to present the results for each of the subdomain tasks (segmental, phonotactic, prosodic) as well as the results for the research questions posed in *Chapter 6*. The first three sections of the chapter discuss the results for the segmental, phonotactic and prosodic awareness subdomains, respectively. *Section 10.4* lays out the results from the three subdomains in relation to the individual variables examined. Section 10.5 is devoted to the discussion of the answers to the research questions formulated in *Chapter 6*. All the data was analyzed using SPSS for Windows version 15.0.[88]

10.1. Segmental awareness

The task used to access segmental awareness in the present study was *Phonological Judgment Task*. Description of the task and an overview of the data analyses are found in *Chapter 8.1*. Before we discuss the participants' behavior in the task, let us take a look at some preliminary analyses carried out on the data.

First the normality of the distribution of the data was assessed. Kolmogorov-Smirnof values and distribution of the scores in the histograms, inspected separately for L1 BP and L1 AmE speakers, showed that the data was normally distributed. In terms of missing data, two data points were missing from the practice trials, but no data was

[88] As the preliminary step in all the analyses, responses from the L1 AmE speakers who reported to be multilingual (*np11*, *np12*), to have an extremely high Portuguese use (*np17*) or to suffer from hearing loss to some extent (*np07*) were carefully inspected and compared to the L1 AmE means. In none of the comparisons, differences between these participants and the remaining L1 AmE speakers were found, thus they were normally included in the analyses as L1 AmE speakers.
The following abbreviations will be used in the course of the chapter: *M*=Mean, *SD*= Standard deviation, RT= Response time, FA= Foreign accent

missing from the actual test trials. This shows that the set ‘time out’ and the relistening option were enough for the participants to make a decision about the trials presented.

Presence of outliers was examined next. *Np01* was identified as an outlier by SPSS for having a score beyond 1.5 times the interquartile range (‘total mean accuracy’ for L1 AmE speakers =72.50% [*SD*=7.18] cf. 51.02% for *np01*) and because of this, he was left outside the analyses involving segmental awareness. No other outliers were identified, the number of participants included for the segmental awareness analyses being 71 for L1 BP speakers and 18 for L1 AmE speakers.

Next, item analysis was carried out in order to examine whether some items were systematically perceived as more difficult than others. Two analyses were done: computation of a mean accuracy score for each item and computation of the relistening rate for each item. The two analyses identified four items with overall identification accuracy below 20% and three items with a relistening rate of over 10%. The items with the lowest identification accuracy involved devoicing, aspiration and vowel quality. The items with the highest relistening rate involved items with the interdental voiceless fricative, final devoicing and delateralization. The items with the lowest response accuracy and highest repetition rate were re-inspected auditorily and visually in Praat and were confirmed to present the target pronunciation deviations. Consequently, no problems were found with the stimuli that obtained the lowest identification accuracy and that was repeated to the most.

Next, lemma frequency (combined COBUILD frequency/million words, Appendix D) of the trial words was examined in order to determine whether word frequency had an effect on the L1 BP speakers’ mean identification accuracy. A Pearson correlation between lemma frequency and mean identification accuracy showed that the two variables were unrelated (*r*=.104, *n*=30, *p*=.58) indicating that word frequency of the trial words did not have an effect on the participants' responses.

The responses to the segmentation practice trials (cf. *Ch.8.1.2*, p.215) were explored next. L1 BP participants showed a mean accuracy of 43.68% (*SD* 22.84) and L1 AmE participants a mean accuracy of 64.80% (*SD* 20.12). This indicates that the concept of 'sound' was grasped with difficulty at the beginning of the task, justifying the use of the segmentation practice trials. As the last step of the preliminary analyses, Cronbach's Alpha was calculated for all the trials (*n*=98) in order to confirm task reliability. Alpha value of .86 confirmed that the *Phonological Judgment Task* was reliable.

Following the preliminary analyses, the participants' performance in the task was examined in order to examine the nature (quantity and quality) of their phonological awareness in the segmental domain.[89] First, the L1 BP and L1 AmE participants' identification accuracy in the non-native speaker and native speaker trials was investigated. The aim was to determine, on the one hand, whether differences could be observed as a function of trial type, and on the other hand, whether the response accuracy between the L1 BP and L1 AmE participants differed. It was predicted that the L1 AmE participants would show a higher identification accuracy than the L1 BP participants, making evident their higher degree of segmental awareness. Descriptive statistics for the

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[89] As BP presents some regional variation in the production of segments (cf. *Ch.5.1.2*), the effect of region of birth on identification accuracy was examined through Mann-Whitney U-tests comparing those participants who had been born in the South of Brazil (*n*=57) with those who had been born in other regions (*n*=14). Other birth regions were grouped together as the number of participants/region was very small. The only area in which significant differences were found between the two groups was *Devoiced* trials spoken by native English speakers (*Z*=-.2.74, *p*=.006), so that those born in South of Brazil identified the devoiced trials correctly to a significantly smaller degree (*M*=71.71, *SD*=19.41) than those who had been born in other regions (*M*=87.50, *SD*=14.70). This is rather suprising as no differences as to devoicing should occur in Brazilian Portuguese, the major differences involving the pronunciation of rhotics and fricatives vs. affricates. However, no difference in identification accuracy was observed as a result of birth region in the *Consonant* trials. More importantly, no difference in identification accuracy as a function of birth region was observed for any of the trials spoken by L1 BP speakers, performance in which was seen to reflect L2 segmental awareness most faithfully. Overall, it can be concluded that the L1 dialect did not have an effect on segmental awareness in the BP participants.

identification accuracy by trial type and L1 listener group are seen in Table 10.1 and the distribution of the identification accuracy scores can be seen in Figure 10.1.

Speaker	**Listener**			
	L1 BP (*n*=71)		**L1 AmE (*n*=18)**	
	M	***SD***	***M***	***SD***
Non-native (*n*=65)	41.25	14.74	64.44	12.16
Native (*n*=32)	86.17	8.58	88.38	7.58

Table 10.1. Mean identification accuracy (%) for the native and non-native speaker trials in the *Phonological Judgment Task*.

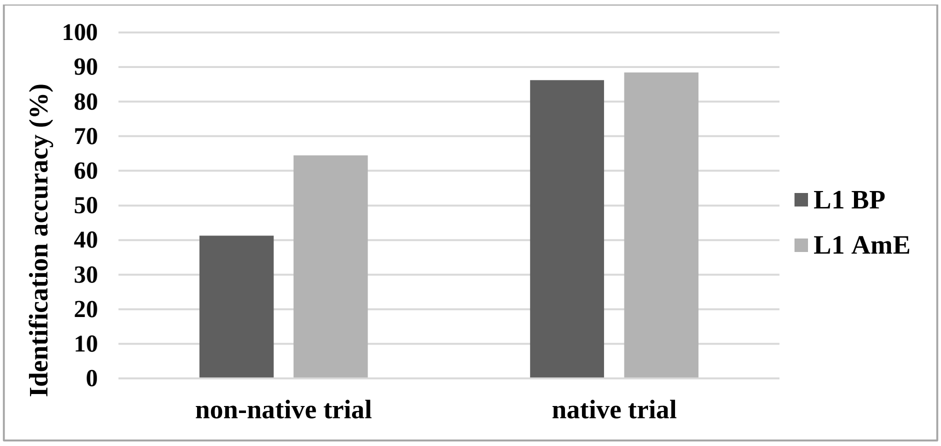

Figure 10.1. Mean identification accuracy (%) for the *Phonological Judgment Task*.

Overall, pronunciation deviations present in the L1 BP speaker trials were identified rather poorly, as manifested by the mean accuracy scores for both L1 groups (L1 BP=41.2%, L1 AmE= 64.4%). On the other hand, performance in the native speaker trials was almost equally high for both L1 groups (L1 BP, M=86.17%, L1 AmE, M=88.38%).

A mixed ANOVA with Bonferroni-adjusted pairwise comparisons was conducted with *Speaker* (native/ non-native) as the within-subjects variable, *Listener* (L1 BP/L1 AmE) as the between-subjects variable and *Identification Accuracy* as the dependent measure. The ANOVA showed a significant main effect of *Speaker* (F[1,87]= 214.90,

p<.001, η^2=.71), *Listener* (F[1,87]= 39.91, p<.001, η^2=.31) as well as a *Speaker* x *Listener* interaction (F[1,87]= 19.94, p<.001, η^2=.18). The interaction effect between the two independent variables, as confirmed by post-hoc independent samples t-tests, was due to the fact that the two listener groups differed significantly in the accuracy of the non-native speaker trials (t[87]=-6.15, p<.001) but not in the native speaker trials (t[87]= -.99, p=.32). The significant main effect of *Speaker* showed that the identification of non-native speaker pronunciation deviations was more difficult than the acceptance of native pronunciations. This phenomenon was noted in both listener groups, L1 BP and L1 AmE. More importantly, the ability to identify pronunciation deviations significantly differed between the L1 BP ELF learners and the native AmE speakers, the former showing a poorer identification accuracy than the latter, thus manifesting their incomplete L2 phonological awareness.

Having established that the response accuracy in the non-native speaker trials was rather poor for both participant groups, the mistake identification accuracy in the non-native speaker trials was further examined as a function of pronunciation deviation type. Namely, whether the pronunciation deviation type had an effect on the mistake identification accuracy and if it did, whether the effect would be the same for both participant groups. Identification accuracy by pronunciation deviation type for both participant groups can be seen in Table 10.2 and Figure 10.2 on the following page.

Deviation Type	**L1 BP (*n*=71)**		**L1 AmE (*n*=18)**	
	M	***SD***	***M***	***SD***
Orthographic Transfer	52.58	24.50	83.33	17.14
Consonant	49.67	18.26	65.18	14.01
Devoicing	39.24	16.15	64.81	15.81
Vowel	38.41	18.37	66.97	12.56
VOT	30.98	24.70	48.48	24.35

Table 10.2. Mean mistake identification accuracy (%) for the deviation types in the *Phonological Judgment Task*.

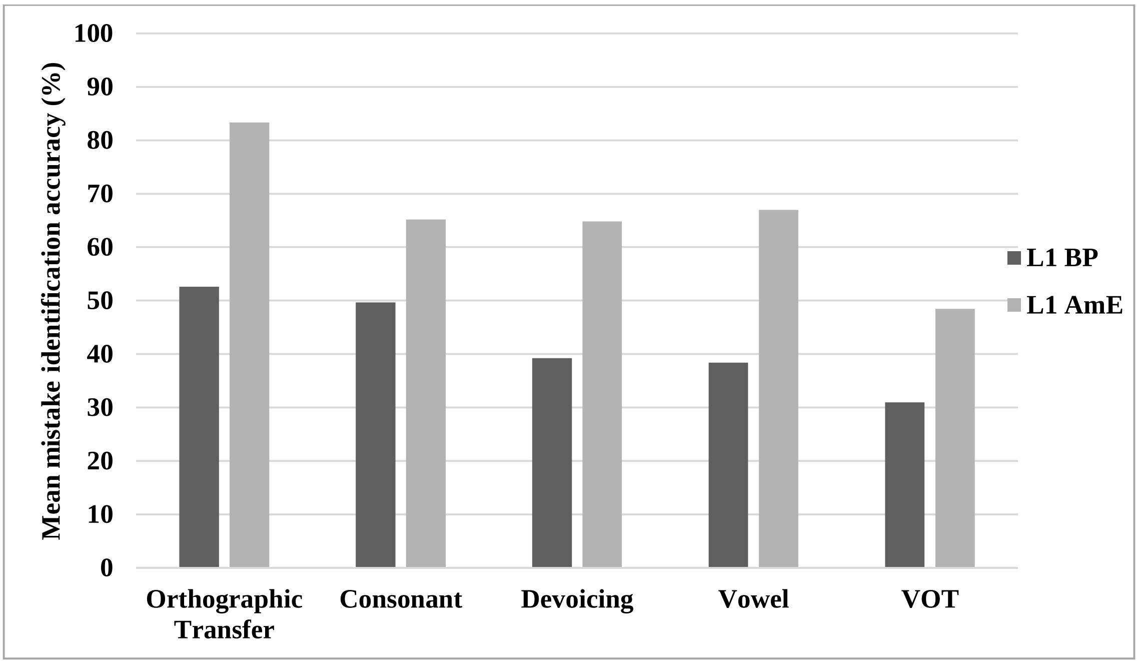

Figure 10.2. Mistake identification accuracy by types for the *Phonological Judgment Task*.

As can be seen from above, some variation can be observed not only as a function of the pronunciation deviation type, but also as a function of the participants' L1: the L1 AmE participants' identification accuracy in all categories is higher than that of the L1 BP participants'. A mixed ANOVA with Bonferroni corrected pairwise comparisons with *Pronunciation Deviation Type* (consonant/ vowel/ devoicing/ VOT/ orthographic transfer) as the within-subjects factor, *L1* (BP/AmE) as the between-groups factor and

Mistake Identification Accuracy as the dependent factor was carried out in order to determine whether the differences in the identification accuracy by pronunciation deviation types and L1 were statistically significant. The ANOVA showed a significant main effect of *Pronunciation Deviation Type* ($F[4,84]= 16.67$, $p<.001$, $\eta^2 =.44$) as well as a significant main effect of *L1* ($F[1,87]= 36.59$, $p<.001$, $\eta^2 =.29$). The interaction between *Pronunciation Deviation Type* x *L1* was also significant ($F[4,84]= 3.28$, $p=.014$, $\eta^2 =.13$). The interaction effect occurred because the mistake identification accuracy in some of the pronunciation deviation types did not differ significantly. For the L1 BP participants, this was the case with *Orthographic Transfer* and *Consonant* ($p=.26$), and *Devoicing* and *Vowel* ($p=.66$). For L1 AmE participants, differences between *Consonant* and *Devoicing* ($p=.89$), *Consonant* and *Vowel* ($p=.62$), and *Devoicing* and *Vowel* ($p=.50$) were non-significant.

The significant main effect of *L1* was due to the fact that the L1 BP EFL learners showed a significantly poorer mistake identification accuracy in all categories in comparison to the native AmE speakers. The significant main effect of *Pronunciation Deviation Type* revealed that mistake identification accuracy differed as a function of the pronunciation deviation type. Mistakes were most accurately identified in the *Orthographic Transfer* group for both L1 groups. Pronunciation deviations were identified the poorest in the *VOT* group for both L1 BP and L1 AmE speakers. The most accurately and the poorest identified types were thus the same for the two participant groups. This indicates that performance was not only due to L2 phonological awareness, but perhaps also to perceptual salience of the items. Items with short-lag VOT were identified as erroneous with difficulty even by native L1 AmE speakers.

Once it had been confirmed that pronunciation deviation type had an effect on the mistake identification accuracy in the non-native speaker trials, the L1 BP participants' answers as a function of deviation type were taken under scrutiny. Namely, it was examined whether the same pattern of identification accuracy by pronunciation deviation types earlier identified for non-native speaker trials would also be observed for native speaker trials. This examination was undertaken due to the reasoning that if the same areas of difficulty would arise in the native and non-native speaker trials for the L1 BP participants, we could argue that the L1 BP participants' phonological awareness would be especially low for that area. This is because poor identification accuracy in the native speaker trials would indicate that the listener is perceiving a pronunciation mistake when there is none.

L1 BP mean identification accuracy by pronunciation deviation type for native and non-native speaker trials can be seen in Table 10.3. As discussed earlier, a large difference in the identification accuracy can be observed between non-native speaker stimuli and native speaker stimuli, the latter being correctly identified to a higher degree. When comparing the order, it can be observed that the poorest identification accuracy in the non-native stimuli occurred in the *VOT* trials whereas in the native stimuli the poorest identification accuracy was observed in the *Consonant* trials.

Deviation Type	**Non-native speaker stimuli**		**Native speaker stimuli**	
	M	***SD***	***M***	***SD***
VOT	30.98	24.70	92.15	12.26
Vowel	38.41	18.37	91.54	11.52
Devoicing	39.24	16.15	74.82	19.53
Consonant	49.67	18.26	83.97	16.11
Orthographic transfer	52.58	24.50	97.88	10.12

Table 10.3. Mean identification accuracy (%) across pronunciation deviation types for the L1 BP participants.

A two-way ANOVA was conducted for the L1 BP participants with *Speaker* (L1 BP/L1 AmE) and *Pronunciation Deviation Type* (consonant/ vowel/ devoicing/ VOT/

orthographic transfer) as the independent variables and *Identification Accuracy* as the dependent variable. The results revealed a significant main effect of *Speaker* (F[1,70]=466.78, p<.001, η^2 =.87) and *Pronunciation Deviation Type* (F[4,67]=26.51, p<.001, η^2 =.61), and a significant *Speaker* x *Pronunciation Deviation Type* interaction (F[4,67]=14.14, p<.001, η^2 =.45). A set of paired samples t-tests was conducted separately for the native speaker and non-native speaker stimuli in order to examine the interaction effect. The interaction effect was due to the fact that not all the deviation types differed from each other in terms of identification accuracy. This was the case for *Devoicing* and *Vowel* (t[70]=.44, p=.66), and *Consonant* and *Orthographic Transfer* (t[70]= -1.12, p=.26) for the non-native speaker trials, and for *Vowel* and *VOT* (t[70]=.35, p=.72), for the native speaker trials. The remaining comparisons differed from each other at the p<.005 level.

The significant main effect of *Speaker* indicated, as was earlier established, that the native speaker trials were identified to a higher extent than the non-native speaker trials. The significant main effect of *Pronunciation Deviation Type* indicated that the identification accuracy also depended on the pronunciation deviation type. In both, non-native and native speaker stimuli, the highest identification accuracy occurred in the *Orthographic Transfer* trials, showing that the L1 BP participants found this category the easiest. However, in the remaining deviation types, the areas of difficulty differed depending on whether the stimuli were spoken by a native or a non-native speaker. The following degree of difficulty was observed:

- Non-native stimuli: VOT > Vowel = Devoicing > Consonant = Orthographic Transfer
- Native stimuli: Devoicing > Consonant > Vowel = VOT > Orthographic Transfer

As the same difficulty pattern was not observed in the native speaker trials, it cannot be established that one of the deviation types would have been especially difficult for the L1 BP participants. This finding indicates that the L1 BP participants did not present exceptionally low degrees of segmental awareness concentrating on specific deviation types. Taking into account the L2 proficiency level of the L1 BP participants in the study, this is not surprising.

An issue which could affect the identification of the pronunciation deviations in the non-native speaker trials is the saliency of the pronunciation deviation. As pronunciation mistakes which are phonological in nature change meanings, whereas pronunciation deviations of allophonic nature do not, phonological mistakes might be more perceptually salient and consequently, the mistake identification accuracy in the trials involving phonological mistakes could be higher than in the trials involving mistakes of allophonic nature. For example, spotting the pronunciation deviation in pill [pʰɪl] pronounced as [bɪl] may be easier than when pronounced as [pɪl]. Consequently, the mistake identification accuracy in the non-native speaker trials was examined for the L1 BP and L1 AmE participants.

The L1 BP participants' mean mistake identification accuracy in the trials involving phonological mistakes (*Vowel*, *Consonant* and *Orthographic transfer*) was 44.92% (*SD*=15.59) and in the trials involving allophonic mistakes (*Final devoicing* and *VOT*) 35.75% (*SD*=16.31). The L1 AmE participants' mean mistake identification accuracy for both trial types was higher than the L1 BP participants': 68.80% (*SD*=10.11) for the trials involving phonological mistakes and 57.90% (*SD*=16.86) for the trials involving allophonic mistakes.

A mixed ANOVA was conducted in order to determine whether the observed differences were statistically significant. *Saliency Group* (Phonological/Allophonic) was the within-subjects factor and *L1* (BP/AmE) as the between- subjects factor. The dependent variable was *Mistake Identification Accuracy* in the non-native speaker trials. The results showed a significant main effect of *Saliency Group* (F[1,87]=41.65, p<.001, η^2 =.32) and a significant main effect of *L1* (F[1,87]= 36.57, p<.001, η^2 =.29), but no *L1* x *Saliency Group* interaction. The main effects indicate, on the one hand, that both L1 groups identified the pronunciation deviations significantly better in the *Phonological* condition than in the *Allophonic* condition. On the other hand, they show that the L1 AmE participants' mistake identification accuracy was significantly higher than the L1 BP participants' in both conditions. These findings indicate that allophonic deviations present a lower perceptual salience than phonological deviations, following VanPatten's (1996) postulations (cf. *Ch.4.1.1.3*).

Finally, as the *Phonological Judgment Task* allowed the participants to relisten the trials if desired, participants' relistening behavior in the non-native speaker trials was examined with two objectives in mind. First, it was thought that the relistening data could provide additional indications about which deviation type the participants found the most difficult. Second, we wanted to see whether the amount of relistening was related to response accuracy. The relistening rates by the two participant groups across the pronunciation deviation types are presented in Table 10.4.

Deviation Type	**L1 BP (*n*=71)**		**L1 AmE (*n*=18)**	
	M	***SD***	***M***	***SD***
Consonant	7.13	11.61	4.07	6.91
Orthographic transfer	6.33	12.07	1.85	7.85
Devoicing	5.63	9.99	4.07	15.69
Vowel	5.00	9.67	5.55	11.90
VOT	3.20	6.53	1.51	4.67

Table 10.4. Mean relistening rate (mean % of relistening/condition) for non-native speaker stimuli across pronunciation deviation types.

As can be seen from Table 10.4, the L1 BP participants relistened most the stimuli from the *Consonant* group and least from the *VOT* group. The L1 AmE participants showed the highest relistening rate to the *Vowel* stimuli and the lowest to the *VOT* group. Individual participants differed greatly in the amount of relistening, as evidenced by the large standard deviations. The overall relistening rate was very low, not reaching 10% in none of the pronunciation deviation types.

A mixed ANOVA with *Pronunciation Deviation Type* (consonant/ vowel/ devoicing/ VOT/ orthographic transfer) as the within-factor and *L1* (BP/AmE) as the between-groups factor was conducted. The dependent variable was the *Mean Repetition Rate* in the non-native trials. A significant main effect of *Pronunciation Deviation Type* ($F[4,84]= 3.38$, $p=.013$, $\eta^2 =.13$) was observed. The effect of *L1* was non-significant ($p=.37$), and there was no interaction effect between the two variables. Post-hoc comparisons showed that the deviation groups that significantly differed from each other in terms of relistening were: *Consonant* - *VOT* ($p=.02$) and *VOT* - *Vowel* ($p=.02$). The L1 BP participants did not relisten significantly more than the L1 AmE participants. Although some statistical differences were found in the relistening rates among the different deviation types, these did not reach a high significance level. It could be thus concluded that relistening was practiced to a low extent by the two participant groups and that the participants relistened to items from all of the deviation types nearly to the same extent.

A further Pearson correlation was conducted between *Mean Repetition Rate* and *Identification Accuracy* in order to confirm that the effect of relistening did not have an effect on the participants' performance. This was confirmed by the lack of correlation between the two ($r=.08$, $n=89$, $p=.43$). Altogether the relistening results indicate that relistening was practiced to low extent. Participants who relistened more did not show differences in their task performance in comparison to the participants who did not relisten or did it only to a small extent.

<u>*Section summary:*</u>

In this section, results specific to the segmental awareness domain, as measured by the Phonological Judgment Task, were presented. It was seen that the overall mistake identification accuracy in the non-native speaker trials was low for both, L1 BP and L1 AmE participants, indicating that the task was rather difficult. Pronunciation deviation type was found to have an effect on the mistake identification accuracy: both participant groups identified mistakes of orthographic nature with the highest ease and mistakes involving VOT with the highest difficulty. Likewise, the saliency of the pronunciation deviation was found to have an effect on the mistake identification accuracy for both participant groups. Mistakes of phonological nature were identified easier than mistakes of allophonic nature. Overall, the performance of the native AmE participants was consistently higher than that of the L1 BP EFL learners. This confirms the general prediction that segmental awareness is lower in language learners than in native speakers.

10.2. Phonotactic awareness

Results for phonotactic awareness, as measured by the *Lexical Decision Task* are presented in this section. The description of the task and the data analyses were detailed in *Chapter 8.2*. Some preliminary analyses are seen before discussing the participants' response time and response accuracy behavior in the task.

Normality of the distribution of the reaction time and response accuracy data was examined through Kolmogorov-Smirnof values and histograms. Whereas the reaction time data was normally distributed, this cannot be said for the accuracy data, most of which was skewed to the right, and consequently was transformed with a *reflect and square root*-formula (new variable= square root [largest possible value +1 – old variable]) for the analyses for which non-parametric alternatives were not available.

The reaction time and response accuracy data were inspected for outliers. No outliers were found for the reaction time data as a whole but two L1 AmE outliers were identified for the *Phonotactic Awareness Score* (*np03* & *np15*) as well as for the accuracy data (*np10* & *np15*) for having a score beyond 1.5 times the interquartile range. The sample size for the task-specific analyses for phonotactic awareness was 71 L1 BP speakers and 19 L1 AmE speakers for the reaction time data as a whole, and 71 L1 BP speakers and 17 L1 AmE speakers for the accuracy data and analyses involving the *Phonotactic Awareness Score*.

As the next step, answers to the practice trials were examined for the amount of 'too slow'- responses. Not surprisingly, most of the missed responses in the practice trials occurred in the very first trial (*n*=17). In the remaining of the practice trials, only 1.1% were responded to too slow. This indicates that the participants learned during the practice block to respond as fast as they could.

Finally, task reliability was inspected through the amount of missing values and wrong responses. There were in total 104 missing values (0.04%) which were due to a too long response (over 2500 ms). 17.5% of the responses presented the wrong answer (L1 BP=19.8%, L1 AmE=9.1%). The wrong responses were excluded from the reaction time data analyses. The number of trials to be analyzed for the reaction time data was thus 17,428 (82.4%) and the number of trials to be analyzed for the accuracy data was 21,150.

The extremely low amount of missing values and the relatively low amount of wrong answers suggests that the task is reliable.

The first analysis was carried out in order to determine whether the two-member and three-member consonant cluster items would be comparable in terms of reaction times. Based on the piloting results, no reaction time differences were expected between the two- and the three-member cluster items. However, the reaction to illegal CCC nonwords might be faster than to the CC items because of the larger perceptual salience of the illegality, and as a result, larger deviation from word-likeness. The mean reaction times to the stimulus types by the two participant groups can be seen in Table 10.5.

L1	**Stimulus Type**											
	Legal				**Illegal**				**Word**			
	CC		**CCC**		**CC**		**CCC**		**CC**		**CCC**	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
L1 BP (*n*=71)	724.24	192.22	749.47	194.05	576.91	184.52	446.08	208.13	431.75	100.83	425.08	139.69
L1 AmE (*n*=19)	465.89	109.06	458.78	132.96	417.81	141.32	262.22	162.54	329.08	85.58	354.34	116.71

Table 10.5. Mean reaction time to two-and three-member cluster items across stimulus types.

A mixed ANOVA with *Consonant* (CC/CCC) and *Stimulus Type* (legal/illegal/word) as the within participants factors, *L1* (BP/AmE) as the between participants factor, and *Reaction Time* as the dependent variable was conducted. The analysis showed a significant main effect of *Consonant* ($F[1,88]=21.33$, $p<.001$, $\eta^2=.19$) and *Stimulus Type* ($F[2,87]=102.07$, $p<.001$, $\eta^2=.70$) as well as *L1* ($F[1,88]=26.39$, $p<.001$, $\eta^2=.23$). Also interactions between *Consonant x Stimulus Type* ($F[2,87]=36.85$, $p<.001$, $\eta^2=.45$) and *Stimulus Type x L1* ($F[2,87]=13.75$, $p<.001$, $\eta^2=.24$) were found. In order to examine the interaction effects, a set of paired samples t-tests were conducted for the two L1 groups separately across the three stimulus categories. The results showed that for both L1 groups, the only condition in which reaction times between the two- and three-member cluster items were significantly different was for illegal nonwords (L1 BP: *t*[70]=9.82, *p*<.001; L1 AmE: *t*[18]=5.87, p<.001).[90] This difference was due to the responses to the three member clusters being significantly faster than to the two-member clusters. This confirms the initial prediction that the CCC illegal nonwords are more salient than the CC illegal nonwords and can be thus rejected faster.

As there was one category in which significant reaction time differences were found, Pearson correlation was used to determine whether the reaction times for the CC illegal nonwords and CCC illegal nonwords were nevertheless related. A strong positive correlation (*r*=.84, *n*=71, *p*<.001) between the two was found, indicating that at the individual level, the participants responded similarly to the two cluster types: the participants who responded fast to the two-member clusters also responded fast to the three-member clusters. Thus it was concluded that the two and the three member cluster items could be grouped together in all the three stimulus categories for the further analyses.

Next, the relation of stimulus characteristics, namely, phonotactic probability, neighborhood density and lemma frequency (for the words) to the reaction times was examined. Based on previous research, phonotactic probability and phonological neighborhood density were expected to have an inhibitory effect on the reaction times: the higher the phonotactic probability and neighborhood density, the slower the reaction time (cf. *Ch.8.2.1*, p.224). Likewise, based on previous research, lemma frequency was

[90] Legal nonwords: L1 BP *t*(70)=-1.41, *p*=.16; L1 AmE *t*(18)=.33, *p*=.74. Words: L1 BP *t*(70)=.64, *p*=.52, L1 AmE *t*(18)=-1.53, *p*=.14)

expected to show a facilitative effect on the reaction times for the word items (cf. *Ch.8.2.1*, p.223): more frequent words are identified faster.

With the aim of examining the relation between the stimulus characteristics and the reaction times, Pearson correlations were conducted.[91] Correlations were conducted separately for the three stimulus types as well as for all of them together. Mean reaction time for all the participants together was used as the measure for reaction time as it, expectedly, showed strong correlations to the L1 BP mean reaction time (*r*=.95) and to the L1 AmE reaction time (*r*=.89). Table 10.6 presents the results of the correlations.

Variable	**Legal nonwords (*n*=50)**		**Illegal nonwords (*n*=50)**		**Words (*n*=75)**		**All stimuli (*n*=235)**	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Biphone Positional Sum	.182	.207	.047	.746	**.288**	**.012**	.017	.794
Phoneme Positional Sum	-.036	.802	-.021	.885	.119	309	-.010	.875
Phonological Neighborhood Size	**.376**	**.007**	**.416**	**.003**	**.231**	**.046**	-.097	.138
Lemma frequency	-	-	-	-	**-.229**	**.048**	-	-

Table 10.6. Results of Pearson correlations between stimulus characteristics and mean reaction times.

The phonotactic probability measures (biphone positional sum & phoneme positional sum) were not related to the reaction time in nonwords. In words, the relation was small, explaining 8.2% of the variation in the reaction time for word items. The higher the biphone positional sum of the word item, the slower the reaction time. This finding goes in line with previous research with lexical decision tasks (cf. *Ch.8.2.*, p.224). Phonological neighborhood size was moderately correlated with the *nonword* stimuli on the one hand, and with the *word* stimuli on the other hand; the higher the phonological

[91] Descriptive statistics for the stimulus characteristics are presented in *Chapter 8.2*, Table 8.3 (nonwords) and Table 8.4 (words)

neighborhood size, the slower the reaction time. This finding also goes in line with previous research (cf. *Ch.8.2*.1, p.224). The effect sizes show that the effect of phonological neighborhood size was larger for nonwords than for words, explaining on average around 15% of the variance in the nonword response times, but only 5.3% in the word response times. Also in line with previous research was the negative correlation observed between lemma frequency and reaction time for words. Although the correlation was small, lemma frequency still showed a small facilitating effect so that the more frequent the word, the faster the reaction time.

The small effects of the stimulus characteristics are somewhat surprising when compared to the large effects of phonotactic probability and phonological neighborhood density found in previous studies (e.g., Luce & Pisoni, 1998; Vitevitch & Luce, 1999). Most likely, this is due to the small variations across these characteristics in the present study, showing that the stimuli was homogeneous enough in these dimensions so as not to generate differences in the reaction times. It could thus be concluded that the careful selection of the stimuli taking into account these dimensions was successful.

Awareness of the English phonotactic rules involving initial consonant clusters was examined next. This was done by comparing the reaction times between *words*, *illegal nonwords* and *legal nonwords*. It was expected that if the participants had developed awareness about the L2 phonotactics, they would show a clear *Reaction Time Effect*: RT words > RT illegal nonwords > legal nonwords. This is because reaction times should be the fastest for the words because lexical search will be fast. Reaction times should also be fast for illegal nonwords for the same reason. Reaction times should be the longest for legal nonwords as the lexical search and eventual rejection takes the longest. Based on the piloting results, L1 AmE participants were expected to respond faster than the L1 BP participants, and to show a clear *Reaction Time Effect*. L1 BP participants were also expected to show a *Reaction Time Effect*, however the size of the effect might be smaller in the L1 BP participants due to their incomplete phonotactic knowledge.

Descriptives can be seen in Table 10.7 and the participants' *Response Time Effect* can be seen in Figure 10.3.

Stimulus type	**L1 BP (*n*=71)**		**L1 AmE (*n*=19)**	
	M	***SD***	***M***	***SD***
Legal nonword	731.06	180.94	463.10	108.72
Illegal nonword	523.93	184.92	354.83	137.50
Word	430.63	103.99	334.28	87.97

Table 10.7. Mean reaction time (ms) to stimulus types in the *Lexical Decision Task*.

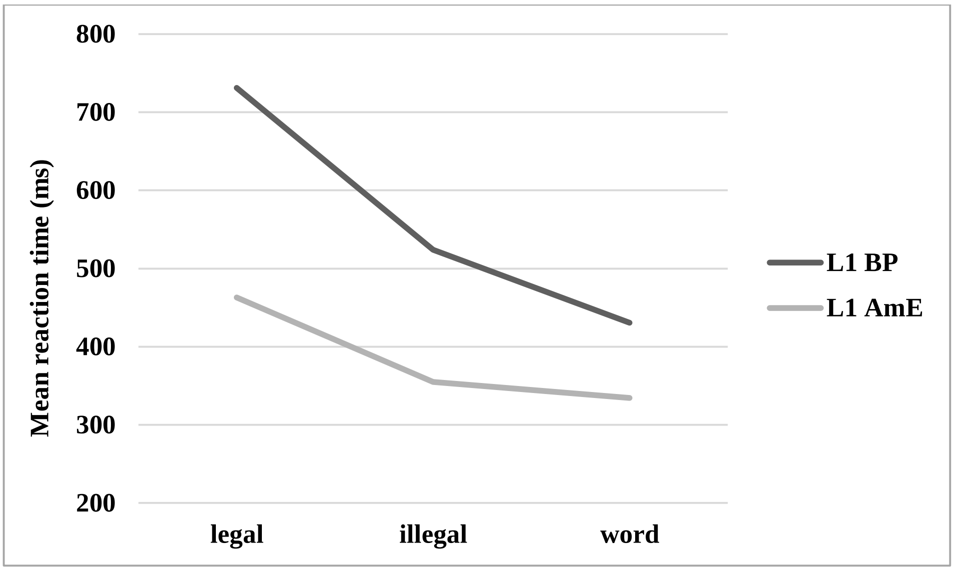

Figure 10.3. *Response Time Effect* across stimulus types and participant L1s.

In order to examine whether these reaction time differences were statistically significant, a mixed ANOVA with Bonferroni-adjusted pairwise comparisons was conducted with *Stimulus Type* (illegal nonword/legal nonword/word) as the within-variable, *L1* (BP/AmE) as the between-variable and *Reaction Time* as the dependent variable. The ANOVA showed a significant main effect of *Stimulus Type* (F[2, 87]=101.97, p<.001; η^2 =.70) as well as *L1* (F[1, 88]=27.16, p<.001; η^2 =.23), and a *Stimulus Type* x *L1* interaction (F[2, 87]=12.89, p<.001, η^2 =.22). The interaction effect was due to the fact than for the L1 AmE participants, the reaction times between the illegal nonwords and words did not differ significantly (p=.47).

The planned comparison confirmed that the reaction time to all the three stimulus types differed significantly from each other in the L1 BP participants, so that reactions to word items were the fastest and reactions to legal nonwords the slowest. The main effect of *L1* was due to the fact that the L1 AmE speakers responded significantly faster than the L1 BP speakers in all the stimulus categories. These results confirm the initial prediction of reaction times being the fastest for words and the slowest for the legal nonwords. Nevertheless, perhaps surprisingly, the reaction time between the illegal nonwords and word items was not significantly different for the L1 AmE participants, both mean reaction times being very fast.

To further examine the differences between L1 BP and L1 AmE participants in terms of the reaction time difference between legal and illegal nonwords, an independent samples t-test was conducted between the two L1 groups using the *Phonotactic Awareness Score* as the dependent measure.[92] Two L1 AmE speakers were identified as outliers for this score, consequently, the number of L1 AmE speakers for this analysis was 17. No significant differences were found between the L1 BP (M=29.00, SD=14.11) and the L1 AmE (M=28.21, SD=13.32) participants in terms of their phonotactic awareness scores (t[86]=.20, p=.83). This finding is rather surprising as the native L1

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[92] 1- (RT illegal/ RT legal)*100. The resulting number represents the difference (in %) between the reaction time of the illegal nonwords and the legal nonwords. The larger the difference, the better the participant is distinguishing between the illegal and legal nonwords.

AmE speakers are expected to possess larger amounts of phonotactic awareness which should be reflected in the reaction time difference between the legal and illegal nonwords. This however was not the case as the L1 BP participants showed a slightly larger mean difference between the two types of nonwords than the L1 AmE participants, although this difference was statistically not significant, as was seen. A possible explanation to the lack of larger differences in the L1 AmE reaction times is the fact that the L1 AmE participants reacted very fast to all stimulus types, as can be seen in Figure 10.3. Although differences in individual reaction speed were taken into account in the calculation of the *Phonotactic Awareness Score* by using the reaction time for the legal nonwords as the baseline data for the calculation of the reaction time difference, it is possible that in fast reactors the differences between the different categories cannot be very large as there are physiological limits as to how fast a response can be made by pressing a key after hearing the stimulus.

To summarize, both L1 groups showed a *Reaction Time Effect*, reacting fastest to the words, then to the illegal nonwords and slowest to the legal nonwords, although the difference between the illegal nonwords and words was not significant for the L1 AmE participants. The L1 AmE participants reacted to all the stimulus types significantly faster than the L1 BP participants. However, the reaction time difference between legal and illegal nonwords was not significant between the two L1 groups. This indicates that the L1 BP participants had acquired large amounts of L2 phonotactic awareness, and as a group behaved in a native-like manner, as testified by their *Phonotactic Awareness Score*. Nevertheless, their overall reaction speed was significantly lower than the native L1 AmE speakers' reaction speed.

The Reaction Time Effect was further examined in relation to the stimulus characteristics. Namely, the aim was to determine whether the observed *Reaction Time*

Effect would persist when phonotactic probability and phonological neighborhood size would be taken into account.

A one-way between groups ANCOVA was carried out with the aim of examining the effect of the stimulus characteristics on the *Reaction Time Effect*. The independent between-items variable was *Stimulus Type* (illegal/legal/word) and the dependent variable was the *Mean Reaction Time* from all the participants combined. *Biphone positional sum*, *phoneme positional sum* and *neighborhood density* were included as covariates. First, preliminary analyses were conducted to ensure that the assumptions of normality, linearity, homogeneity of variance and homogeneity of regression slopes were not violated. As all assumptions were met, the ANCOVA was performed. The results revealed that the effect of *Stimulus Type* remained significant after controlling for phonotactic probability and neighborhood density measures (F[2,169]=94.75, p<.001; η^2 =.52). The partial eta squared showed that 52.9% of the variance in the reaction times was explained by the stimulus type. The effects of the phonotactic probability measures were not significant on the reaction times. However, neighborhood density showed a significant effect (F[1,169]=14.12, p<.001, η^2 =.07), explaining 7.7% of the variation in the mean reaction times. As could be expected from the earlier finding about the small effect of stimulus characteristics on reaction times, the *Reaction Time Effect* was robust against phonotactic probability and phonological neighborhood density characteristics, as it was still significant at p<.001 level after controlling for these variables.

Having examined the response time data, we will now turn to the response accuracy data. First the effect of the stimulus type (legal/illegal/word) on the response accuracy was examined. Descriptive statistics can be seen in Table 10.8 and the distribution of the scores can be seen in Figure 10.4.[93]

Stimulus type	L1 BP (*n*=71)		L1 AmE (*n*=17)	
	M	***SD***	***M***	***SD***
Word	93.49	5.62	96.07	3.31
Legal nonword	57.99	18.59	93.27	4.07
Illegal nonword	76.55	10.68	81.38	5.16

Table 10.8. Mean response accuracy (%) in the *Lexical Decision Task*.

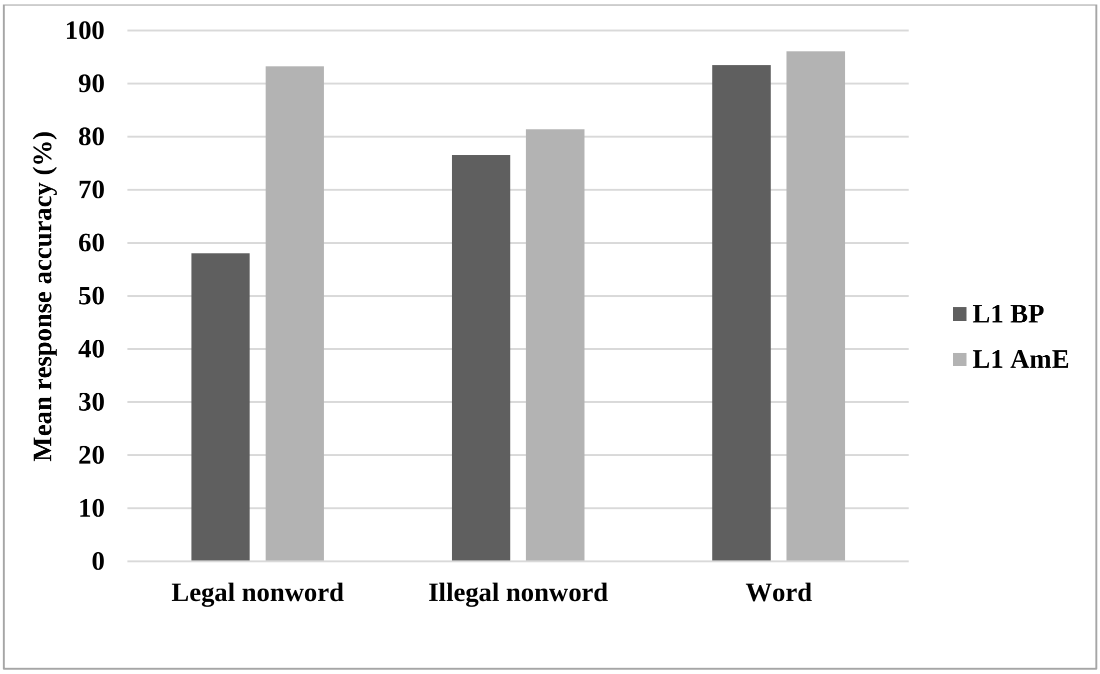

Figure 10.4. Mean response accuracy (%) across stimulus categories in the *Lexical Decision Task*.

As can be seen from above, response accuracy varied as a function of stimulus type as well as L1. The L1 AmE participants showed a higher response accuracy than the L1 BP participants across all stimulus categories. A mixed ANOVA with *Stimulus Type*

[93] As the accuracy data was not normally distributed, the data was transformed, and analyses were conducted with the transformed variable. However, the original descriptives are shown here for the sake of clarity.

(legal/illegal/word) and *L1* (BP/AmE) as the independent variables and *Response Accuracy* as the dependent measure was performed with the aim of examining whether these differences were statistically significant.

The ANOVA showed a significant main effect of *Stimulus Type* ($F[2,85]=58.77$, $p<.001$, $\eta^2=.58$), as well as *L1* ($F[1,86]=75.67$, $p<.001$, $\eta^2=.46$), and a significant *Stimulus Type* x *L1* interaction ($F(2,85)=71.61$, $p<.001$, $\eta^2=.62$). The post-hoc Bonferroni-adjusted comparisons revealed that the response accuracy differed significantly ($p<.001$) between the nonwords and the words (legal-word & illegal-word) but not within the nonwords ($p>1.00$) in both participant groups, which contributed to the observed interaction effect. Moreover, although the L1 AmE participants manifested a higher response accuracy in all categories, a post-hoc Mann-Whitney U-test showed that the difference to the L1 BP participants was significant only in the legal nonword category ($Z=-6.18$, $p<.001$). For illegal nonwords ($Z=-1.69$, $p=.09$) and words ($Z=-1.82$, $p=.06$) the response accuracy was not significantly different between the L1 BP and L1 AmE participants.

For the L1 BP speakers, the following response accuracy pattern was observed: accuracy in the word items was the highest, followed by the illegal nonwords. The legal nonwords had the lowest response accuracy. This is not unexpected as the lexical decision on legal nonwords can be difficult for L2 speakers as the items resemble closely real words. The L1 AmE speakers showed a different accuracy pattern. The highest response accuracy was manifested with words, as with the L1 BP speakers, but the worst identification accuracy occurred in the illegal nonwords. This pattern is also not surprising. For native speakers, telling apart real and imaginary words should be very easy, which is manifested in the high accuracy rates for the word and the legal nonword items. The lowest identification accuracy occurs in the illegal nonword group, most likely due to perceptual illusions, which might lead to perceiving some of the illegal nonwords as real words (for example *sgil* as *skill*).

Finally, the relationship between response time data and response accuracy data was investigated with Spearman's Rank Order correlations. This was done in order to examine whether participants who responded more accurately also responded faster than participants showing a lower accuracy. Medium strong negative correlations were observed for each pair: legal RT - legal accuracy: (rho= -.54, n=88, p<.001, r^2=.29), illegal RT - illegal accuracy: (rho= -.44 n=88, p<.001, r^2=.18) and word RT - word accuracy: (rho= -.26, n=88, p=.012, r^2=.08). In other words, the participants who responded faster also responded more accurately than the participants who responded slower.

<u>*Section summary*</u>:

In this section, the results for phonotactic awareness, as measured by the Lexical Decision Task, have been presented. The L1 BP participants were found to possess phonotactic awareness about L2 English consonant clusters. This was evident through their Reaction Time Effect and through differences in the reaction times between the legal and the illegal nonwords. Although their overall reaction speed was significantly slower than the L1 AmE participants', they approximated to the native L1 AmE participants in terms of phonotactic awareness about the English consonant clusters. In terms of response accuracy, the L1 BP participants statistically differed from the L1 AmE participants only in legal nonwords, manifesting high accuracy rates for illegal nonwords and words.

10.3. Prosodic awareness

In this section, results specific to prosodic awareness are presented. Description of the task and detailed discussion of the analyses are found in *Chapter 8.3*. First, some preliminary analyses are discussed.

Normality of the data was confirmed through the inspection of Kolmogorov-Smirnof values and histograms. Participants *p28*, *p43*, *np01*, *np06* and *np08* were identified as outliers for having a score beyond 1.5 times the interquartile range, and they were left outside the analyses involving prosodic awareness. Consequently, the number of participants for prosodic awareness analyses is 69 for L1 BP and 16 for L1 AmE.

Next, trial analysis was carried out in order to examine responses to individual trials more closely. To begin with, the data was inspected for missing values and none were found. This is not surprising as the participants had 10 seconds to respond to each trial, which clearly was sufficient. Then, trials with extremely low response accuracy were inspected. All of the trials with low response accuracy (<50%) were ‘no’ trials. In other words, the participants accepted these trials as correct in English although theoretically they should be unacceptable. This was the case with the only two trials having a response accuracy below 50% for the L1 AmE speakers. Both sentences (*T125* & *T150*) were unaccusatives following an SV pattern, which is improbable in a neutral context in English. However, Zubizarreta and Nava (2011) argue that this pattern is acceptable for unaccusative sentences in English when the information content of the sentence is unexpected and considered especially noteworthy (cf. thetic vs. categorical distinction in *Ch.5.3.1*, p.150). This was not the case in either of the sentences.

As the next step, responses to practice trials were analyzed. The mean response accuracy for the practice trials was 53.80% for L1 BP participants and 72.65% for the L1

AmE participants. These percentages are low in comparison to the mean accuracy in the test trials (L1 BP= 65.75%, L1 AmE=86.33%), which indicates that there was a learning curve during task, which is not surprising as none of the participants reported to be familiar with low-pass filtered speech.

Then, mean response accuracy to the control transitive items was examined. The L1 BP participants showed a surprisingly low (75.94%) response accuracy rate in comparison to the L1 AmE participants (91.25%), taken into account that these trials follow the same nuclear stress assignment pattern in Brazilian Portuguese and in General American. It might be that this difference was observed due to the difficulties of performing the task in the L2.

Finally, task reliability was examined by calculating a Cronbach's Alpha value for all the prosodic awareness test trials (*n*=72). An alpha value of .86 confirmed the reliability of the task.

In order to examine the participants' awareness about English nuclear stress assignment, response accuracy was examined as a function of sentence structure (unaccusative/deaccented) and intonation pattern legality ('yes'/'no'). It was hypothesized that it would be more difficult for the L2 learners to reject the L1 intonation pattern transposed to L2 ('no' trials) than to accept the L2 intonation structure as correct ('yes' trials), as the former is cognitively more demanding, requiring a higher degree of phonological awareness. Previous research with L1 Spanish speakers suggests that the acquisition of *Anaphoric Deaccenting Rule* is easier than the restructuring of the *Romance Nuclear Stress Rule* (Nava & Zubizarreta, 2008, 2010), which is why response accuracy in the deaccented trials was expected to be higher than in the unaccusative trials. Finally, it was predicted that the L1 BP participants would manifest a lower degree of prosodic awareness than the L1 AmE participants due to their developing L2 phonology.

The mean response accuracy across stimulus types for both participant groups is presented in Table 10.9. Figure 10.5 shows response accuracy across categories in a more visual manner. As can be appreciated, the L1 AmE participants manifested a higher response accuracy than the L1 BP participants across all stimulus types. Differences can also be observed between the 'yes' trials and the 'no' trials, the former showing a higher response accuracy.

Stimulus type		**L1 BP (*n*=69)**		**L1 AmE (*n*=16)**	
		M	***SD***	***M***	***SD***
Unaccusative	**'yes'**	67.94	20.95	92.64	10.84
	'no'	39.73	20.06	70.31	21.72
Deaccented	**'yes'**	84.21	10.01	90.78	10.78
	'no'	62.31	15.76	86.36	9.09

Table 10.9. Mean response accuracy by categories in the *Low-pass Filtered Intonation Identification Task*.

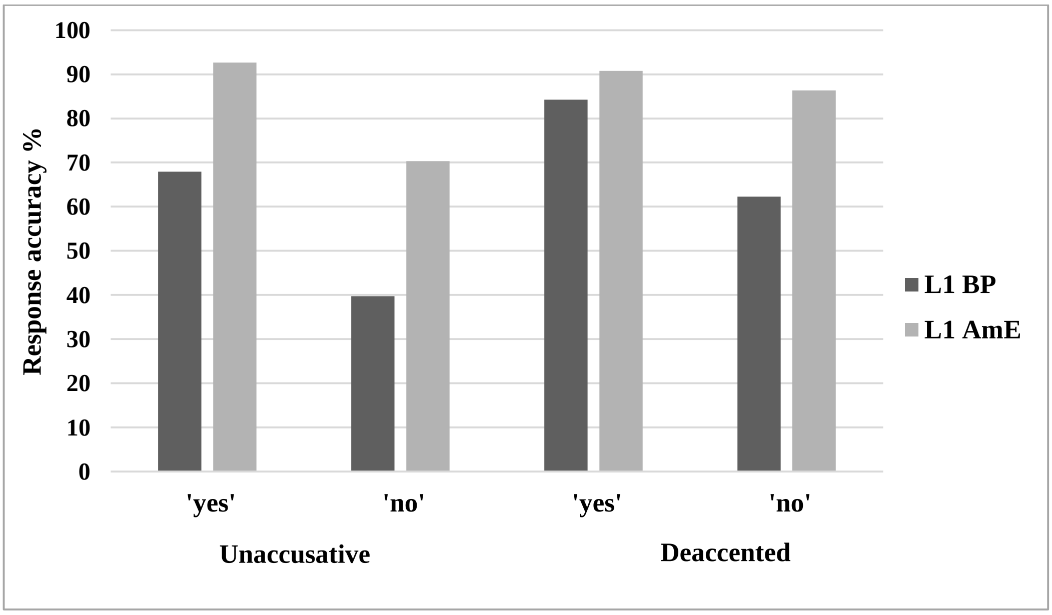

Figure 10.5. Mean response accuracy across categories for the *Low-pass Filtered Intonation Identification Task*.

A mixed ANOVA was performed in order to determine whether these differences were statistically significant. Two within-subjects variables were used. These were *Sentence Type* (Unaccusative/Deaccented) and *Intonation Pattern* (correct/incorrect). The between-subjects variable was *L1* (BP/AmE) and the dependent variable was *Response Accuracy*. The ANOVA yielded significant main effects of *Sentence Type* ($F[1, 83]=45.98$, $p<.001$, $\eta^2=.35$), *Intonation Pattern* ($F[1, 83]=58.26$, $p<.001$, $\eta^2=.41$) and *L1* ($F[1, 83]=52.47$, $p<.001$, $\eta^2=.38$). The *Sentence Type* x *L1* interaction ($F[1, 83]=9.93$, $p=.002$, $\eta^2=.10$) and the *Intonation Pattern* x *L1* interaction ($F[1,83]=5.37$, $p=.023$, $\eta^2=.06$) were also significant. The observed interactions were due to the fact that the L1 BP participants showed a significantly higher accuracy rate in the correct ('yes') trials than in the incorrect ('no') trials in both unaccusative and deaccented sentence types, ($p<.001$) whereas the L1 AmE participants did not. For the L1 AmE participants, the difference between the deaccented 'yes' and 'no' trials was not significant ($p=.26$).

Both L1 groups showed a higher accuracy rate in the deaccented sentences than in the unaccusative sentences. The L1 AmE speakers had a significantly higher response accuracy than the L1 BP speakers in all the categories.[94]. The initial predictions about the effect of sentence type, intonation pattern and L1 were confirmed. Deaccented trials were overall easier than the unaccusative trials. This effect was also observed for native L1 AmE speakers, which indicates that differences between acquisition and restructuring cannot be the sole explanation. As predicted, accuracy was higher in the 'yes' trials than in the 'no' trials, indicating that for L2 users, accepting appropriate intonation patterns is cognitively less demanding than rejecting inappropriate intonation patterns. Finally, the L1 AmE participants presented higher response accuracy rates consistently over all test

[94] the differences were significant at $p<.001$ level in all pairs except deaccented 'yes', for which the difference was significant at $p=.022$

categories than the L1 BP participants, who nevertheless performed above chance level in all but one (unaccusative 'no') trials, indicating awareness of English nuclear stress assignment.

L1 BP participants' response accuracy in the deaccented subcategories (functional/given/relative) was investigated next. This examination was undertaken due to the results of the small-scale sentence reading study conducted with L1 BP speakers, which showed differences in focal stress placement across the deaccented subcategories categories (cf. *Ch.5.3.2.2*). Based on the results, response accuracy in the *given* trials could be higher than in the other subgroups. This is because, this was the category presenting the largest number of focal stress placement, which coincided with the equivalent AmE nuclear stress. If placement of focal stress is a readily available option in sentences including given information, and this focal stress coincides with the L2 nuclear stress, then this strategy could be positively transferred into the L2, resulting in higher accuracy in the *given* subgroup. Likewise, the deaccented subcategory which received the smallest amount of focal stresses was *relative*. If placement of a focal stress is not frequently used in this category in the L1, then the acquisition of the L2 nuclear stress placement in this subcategory could be especially difficult.

Descriptive statistics for the deaccented subcategories for 'yes' and 'no' trials are presented in Table 10.10 on the following page. As was seen in the earlier analysis, response accuracy in the 'yes' trials was consistently higher than in the 'no' trials. Response accuracy differences across the deaccented subcategories were also found: the *functional* subcategory presented the highest accuracy whereas the *relative* trials were the most difficult.

Trial	**Deaccented subcategory**					
	Functional		**Given**		**Relative**	
	M	***SD***	***M***	***SD***	***M***	***SD***
'yes'	90.68	11.44	83.25	12.29	71.98	28.36
'no'	75.90	17.84	59.58	21.04	45.50	22.72

Table 10.10. L1 BP mean response accuracy (%) for the deaccented subcategories in the *Low-pass Filtered Intonation Identification Task*.

The subcategories of the deaccented trials were not normally distributed, but mostly skewed to the right. Because of this, Friedman tests were employed to examine whether the response accuracy differences in the deaccented subcategories were statistically significant. The test was run separately for the 'yes' and the 'no' trials.Results of both Friedman tests revealed that the response accuracy between the deaccented subcategories differed significantly in both, 'yes' ($X^2[2]=17.63$, $p<.001$) and 'no' ($X^2[2]=62.45$, $p<.001$), conditions. Posthoc Wilcoxon Signed Rank Tests confirmed that the response accuracy differences were significant in all conditions.[95] The response accuracy in both conditions followed the same order: functional > given > relative. Judging the intonation pattern adequacy in the sentences ending in functional categories was the easiest for the L1 BP EFL learners. On the other hand, judging the intonation pattern adequacy in sentences ending in relative clauses was the most challenging.

As functional categories are not deaccented in Brazilian Portuguese, the results indicate that the L1 BP EFL learners had acquired phonological awareness of the L2 nuclear stress assignment. From the results, it would seem that if placement of a focal stress is an available option in the L1 in these contexts, the strategy is not transferred into

[95] 'No' trials: *given–functional*: Z= -5.56, $p<.001$; *given–relative*: Z= -4.10, $p<.001$; *functional–relative*: Z=-6.55, $p<.001$. 'Yes' trials: *given-functional*: Z=-3.63, $p<.001$; *given-relative*: Z=-2.49, p=.013; *functional-relative*: Z=-5.00, $p<.001$.

the L2, as the category with the most focal stress placement was *given*, which nevertheless did not show the highest response accuracy in the L2 trials.

An explanation to why EFL learners may find the nuclear stress assignment in utterances ending in functional categories easier than in given information is given by Nava and Zubizarreta (2010). They argue that because accenting functional categories follows certain rules (strong and weak forms) which can be learnt, but accenting given information does not, as it is context dependent and thus cannot be memorized, assigning nuclear stress correctly in utterances ending in functional categories is easier.

As the next step, the effect of focus domain on the response accuracy in the deaccented trials was investigated for the L1 BP participants. As the placement of a focal stress is an option in Brazilian Portuguese narrow focus sentences, and the focal stress frequently coincides with the AmE nuclear stress, performance in the narrow focus trials could be more accurate than in the broad focus trials. However, if placement of a focal stress is a marginal phenomenon in the L1 or it is not strictly confined to narrow focus context, response accuracy differences between narrow and broad focus trials are not expected to occur.

To examine whether the L1 BP participants differed in the response accuracy between the broad focus and the narrow focus trials, paired comparisons were conducted separately for the 'yes' and the 'no' trials. As the 'yes' variables were not normally distributed, non-parametric tests were used for all the comparisons. Wilcoxon Signed Ranks tests revealed a significant difference in the response accuracy in the 'no' trials (Z= -3.39, p=.001), but not in the 'yes' trials (p=.14; broad: M=85.28, SD=11.16; narrow: M=81.88, SD=17.79). The broad focus 'no' trials (M=65.12, SD=17.97) were identified significantly better than the narrow focus 'no' trials (M=53.31, SD=18.31). These results suggest that if the placement of a focal stress in narrow focus deaccented sentences is a recurrent strategy in Brazilian Portuguese, it was not positively transferred into the L2.

Finally, in order to examine more closely the relationship between focal stress placement in the L1 and the response accuracy in the deaccented trials in the L2, the data from the six L1 BP participants who participated in the *Low-pass Filtered Intonation Identification Task* as well as in the BP sentence reading task *(*cf. *Ch.5.3.2.2)* was investigated. As the L1 sentences were a subset of the *Low-pass Filtered Intonation Identification Task* trials, a comparison between L1 and L2 behavior was possible. Placing a focal stress in the L1 might aid with accurate responding in L2. However, answering correctly without having placed a focal stress in the L1 should be as frequent, as this would be a manifestation of acquired L2 prosodic knowledge, instead of simple positive transfer.

The behavior of the six L1 BP participants who took part in both tasks was compared. The comparisons are presented in Table 10.11. The comparison of the behavior in the two tasks shows that in most cases a focal stress was not placed in the L1 (73.7%). The most frequent pattern was not placing a focal stress in the L1 but answering correctly in the L2 task (47.6%). The second most frequent pattern was not placing a focal stress in the L1 but answering incorrectly in the L2 task (26.1%). In the cases in which a focal stress *was* placed in the L1, in 10 cases the participant placed a focal stress in L1 and answered correctly in the L2 task (23.8%). However, the opposite, placing a focal stress in the L1 and answering incorrectly in the L2 occurred in only one case (2.3%). We could thus conclude that if a focal stress was placed in the L1, the likelihood of answering correctly in the L2 was very high. It could be that the participants were transferring their L1 strategy in these cases. However, proper L2 prosodic awareness had been acquired as well, as answering correctly occurred frequently when a focal stress hadn’t been placed in the L1.

Trial		Type: focus	Theoretically possible to place L1 focal stress	Participant	Answer to the trial in the Low-pass filtered intonation identification task *	Focal stress placed on the equivalent constituent in the L1 sentence reading
t_146	What would you like to drink? – I'll have some of the wine you bought.	Relative: narrow	YES	p10	YES	NO
				p22	YES	NO
				p46	YES	NO
				p47	YES	NO
				p55	NO	NO
				p62	YES	NO
t_148	What's that? - That's the book John wrote.	Relative: narrow	YES	p10	NO	NO
				p22	YES	NO
				p46	NO	NO
				p47	NO	NO
				p55	NO	NO
				p62	NO	NO
t_138	Have you seen my glasses? - Tom has your glasses.	Given: narrow	YES	p10	YES	YES
				p22	YES	YES
				p46	YES	YES**
				p47	YES	YES
				p55	YES	YES**
				p62	YES	YES
t_155	Did you buy carrots? - I also bought some other vegetables.	Given: broad	?	p10	YES	NO
				p22	NO	NO
				p46	NO	NO
				p47	YES	YES
				p55	NO	NO
				p62	YES	NO
t_136	Do you know any Mexicans? - I'm married to a Mexican.	Given: broad	?	p10	YES	NO
				p22	YES	NO
				p46	YES	YES
				p47	YES	YES
				p55	NO	NO
				p62	NO	YES
t_144	Could you prepare dinner? - I hate cooking.	Given: broad	?	p10	YES	NO
				p22	YES	NO
				p46	YES	NO
				p47	YES	NO
				p55	YES	YES
				p62	YES	NO
t_039	Why did you buy that old painting? - Because I collect paintings.	Given: broad	?	p10	YES	NO
				p22	NO	NO
				p46	YES	NO
				p47	YES	NO
				p55	YES	NO
				p62	YES	NO

Table 10.11. Comparison of the prosodic behavior in L1 and L2 for six L1 BP participants.

* All the trials were correct in English, so the correct answer to all of them is 'yes'.

** No focal stress was placed, but the sentences presenting chunking so that the intonation boundary coincided with the English nuclear stress.

<u>*Section summary:*</u>

Results concerning the prosodic domain, as measured by the Low-pass Filtered Intonation Identification Task, were presented in this section. It was seen that the L1 BP participants had acquired some L2 prosodic awareness, as evident by their response accuracy rate across categories. Response accuracy was higher in the deaccented trials than in the unaccusative trials, a phenomenon also observed for native AmE participants. Moreover, focal stress placement in the L1 did not appear to be positively transferred into English nuclear stress placement as evident by the analyses involving the deaccented subcategories, the focus domain, and the L1 sentence reading experiment. We can thus conclude, that the L1 BP participants had acquired awareness about L2 prosody, and were not simply transferring the L1 strategies into the L2. Their behavior was nevertheless, non-native-like, as the response accuracy of the L1 AmE speakers was higher in all the test categories.

10.4. Individual variables and segmental, phonotactic and prosodic awareness

In this section, performance in the three phonological awareness domains is examined in relation to individual variables. Some preliminary analyses with the dependent variables are discussed first.

A score was calculated for each task as specified earlier (cf. *Ch.8.1.3* for the calculation of the *Segmental Awareness Score*, *Ch.8.2.3* for *Phonotactic Awareness Score* and *Ch.8.3.3* for *Prosodic Awareness Score*). The three scores were normally distributed as indicated by non-significant Kolmogorov-Smirnof values. Next, presence of outliers was inspected for each score, separately for the L1 BP and L1 AmE participants. Outliers were defined as having a score beyond 1.5 times the interquartile range. The only L1 BP outliers were identified for the *Prosodic Awareness Score* (*p28*=11.76 and *p43*=35.29, L1 BP *M*=54.34). L1 AmE outliers were found for each score. For the *Segmental Awareness Score*, *np01* with score of 32.31 (L1 AmE *M*=64.44). For the *Phonotactic Awareness Score*, *np03* and *np15* with scores of 5.52 and -7.78, respectively (L1 AmE *M*= 28.21). And for the *Prosodic Awareness Score*, *np01* (41.18), *np06* (47.06) and *np08* (29.41) (L1 AmE mean=80.69). As a result, the number of participant involving the *Segmental Awareness Score* is 71 L1 BP and 18 L1 AmE, the *Phonotactic Awareness Score* is 71 L1 BP and 17 L1 AmE, and the *Prosodic Awareness Score* is 69 L1 BP and 16 L1 AmE. Descriptive statistics of the three scores are presented in Table 10.12.

Analyses carried out with the three phonological awareness domains and individual variables are presented next. Although the analyses were carried out separately for the three tasks, the results are presented together in order to make cross-domain comparisons easier.

Subdomain	L1 BP					L1 AmE				
	N	***Mean***	***SD***	***Min***	***Max***	***N***	***Mean***	***SD***	***Min***	***Max***
Segmental	71	41.25	14.74	6.15	76.92	18	64.44	12.16	43.08	81.54
Phonotactic	71	29.00	14.11	-1.54	59.15	17	28.21	13.32	10.64	53.68
Prosodic	69	54.34	14.46	29.41	91.18	16	80.69	11.90	55.88	94.12

Table 10.12. Descriptive statistics for the phonological awareness scores for the subdomains.

First, self-reported task behavior in the *Phonological Judgment Task* and in the *Low-pass Filtered Intonation Identification Task* was examined. The aim was to determine on the one hand, what strategies (use of *guessing*, *intuition* or a *knowledge of a rule*) the L1 BP and L1 AmE participants reported having used in the tasks, and on the other hand, whether self-reported task behavior had an effect on response accuracy.

The dependent variable in the analyses which follow is *Segmental Awareness Score* for segmental awareness and *Prosodic Awareness Score* for prosodic awareness. The independent variable is *Self-reported Task Behavior*.[96] Participants were divided into three groups for each strategy (guessing/intuition/knowledge of a rule) depending on their self-reported use of that strategy: *low, medium* and *high* use.(cf. *Ch.8.6.2*).

Self-reported task behavior in the segmental awareness task (*Phonological Judgment Task*) is discussed first. Frequencies for each strategy use are shown in the following Table 10.13. It can be seen that the strategy used most by the L1 BP and L1 AmE speakers was the use of intuition, as could be expected for a task targeting the phonological awareness based on proceduralized knowledge. The L1 AmE speakers used

[96] Participants' evaluation of their use of guessing, intuition and knowledge of a rule during the task on a scale from 1 to 5 (never, rarely, sometimes, often, all the time) as answered to a questionnaire administered after the task (cf. *Ch.8.6.2*)

intuition to a larger extent than the L1 BP speakers: 88.88% of the L1 AmE speakers reported a high use of intuition, whereas 50.70% of the L1 BP speakers did so.

Strategy	'Frequency of use' group	L1 BP (*n*=71)	L1 AmE (*n*=18)
Guessing	Low	43.66	66.66
	Medium	42.25	27.77
	High	14.08	5.55
Intuition	Low	16.90	5.55
	Medium	32.39	5.55
	High	50.70	88.88
Knowledge of a rule	Low	26.76	44.44
	Medium	35.21	33.33
	High	38.02	22.22

Table 10.13. Distribution of participants (in %) by their self-reported strategy use in the *Phonological Judgment Task*.

A chi-square test for independence showed that this difference was statistically significant (X^2[2, *N*=89]= 8.68, *p*=.013). The second most frequent strategy in both groups was the use of a knowledge of a rule. A chi-square test for independence showed that both groups employed this strategy to the same extent (X^2[2, *N*=89]= 2.52, *p*=.28): 38.02% of the L1 BP speakers reported a high use of knowledge of a rule, whereas 22.22% of the L1 AmE speakers did so. Both groups reported to be guessing to a small extent: 85.90% of the L1 BP speakers and 94.4% of the L1 AmE speakers reported to have guessed rarely or only sometimes. From the above comparisons, it can be seen that some differences in the self-reported strategy use can be observed for the two participant groups.

In order to examine the effect of self-reported strategy use on the performance in the segmental awareness task, as measured by the *Segmental Awareness Score*, three one-way ANOVAs (one for each strategy) were conducted with *Strategy Use* (low/mid/high) as the grouping variable. None of the three ANOVAs found a significant effect of *Strategy*

Use: guessing (*F*[2,68]=1.76, *p*=.17), intuition (*F*[2,68]=.33, *p*=.71) and rule (*F*[2,68]=1.59, *p*=.21), indicating that the performance of the participants in the *Phonological Judgment Task* was not related to their self-reported frequency of use of guessing, intuition or knowledge of a rule when performing the task.

Turning to the results of self-reported strategy use in the prosodic awareness task (*Low-pass Filtered Intonation Identification*), frequency of each strategy use can be seen in Table 10.14.

Strategy	'Frequency of use' group	L1 BP (*n*=69)	L1 AmE (*n*=16)
Guessing	**Low**	24.63	68.75
	Medium	60.86	31.25
	High	14.49	0.00
Intuition	**Low**	8.69	6.25
	Medium	18.84	18.75
	High	72.46	75.00
Knowledge of a rule	**Low**	53.62	31.25
	Medium	31.88	25.00
	High	14.49	43.75

Table 10.14. Distribution of the participants (in %) by their self-reported strategy use in the *Low-pass Filtered Intonation Identification Task*

From the table above, it can be seen that the most used strategy was intuition in both groups. 72.46% of the L1 BP participants and 75% of the L1 AmE participants reported a high use of intuition. A chi-square test for independence indicated that there was no statistical difference in the use of intonation between the two groups in the *Low-pass Filtered Intonation Identification Task* (X^2 [2, *N*=85] =.10, *p*=.94). For the L1 AmE participants, the second most used strategy was the use of knowledge of a rule with 43.75% reporting to have used this strategy 'often' or 'all the time'. For the L1 BP participants, guessing and using rules were performed to the same extent. 14.50% of the participants reported to have employed these strategies often or all the time. A chi-square test for independence indicated that the L1 AmE speakers reported to use rules significantly more than the L1 BP speakers (X^2 [2, *N*=85]= 7.07, *p*=.029). Guessing differentiated the two participant groups. Whereas 68.75% of the native English speakers reported to have guessed never or rarely, only 24.63% of the L1 BP participants said this to be the case.

In order to examine whether the self-reported strategy use had an effect on performance in the *Low-pass Filtered Intonation Identification Task*, as measured by the *Prosodic Awareness Score*, three one-way ANOVAs (one for each strategy) were conducted with *Strategy Use* (low/mid/high) as the grouping variable. *Strategy Use* was non-significant in all the ANOVAs: guessing (F[2,66]=2.24, *p*=.11), intuition (F[2,66]=.36, *p*=.69) and rule (F[2,66]=.863, *p*=.86) indicating that self-reported strategy use did not have an effect on the performance in the task measuring prosodic awareness.

Overall the results from both tasks are similar. Self-reported strategy use did not have an effect on the performance in the segmental or in the prosodic awareness tasks. The most frequently used strategy for both tasks was the use of intuition for both participant groups, suggesting that the participants were in fact accessing proceduralized knowledge when deciding on the correct response (cf. *Ch.8.6.2*). The L1 BP participants reported to have used intuition more in the prosodic awareness task than in the segmental awareness task (72% vs. 50%), whereas the L1 AmE participants behaved in the opposite way (75% vs. 88%). Use of a rule was more frequent in the segmental awareness task for the L1 BP participants (38% vs. 14%), whereas for the L1 AmE participants use of a rule was more frequent in the prosodic awareness task (43% vs. 22%). Guessing was used to the same extent in both tasks.[97]

[97] It should be noted that the self-reported task behavior is based on the participant's own impression of the strategy use and it was not confirmed objectively. For example, when participants report having used rules to decide on the correct answer in the task, they were not asked to verbalize these rules in any way. Because

Next, the relationship between individual variables and the three phonological awareness domains was investigated for the L1 BP participants. In order to examine the relation of the independent variables to the *Segmental Awareness Score*, *Phonotactic Awareness Score* and the *Prosodic Awareness Score*, t-tests and correlations were conducted.

First, differences in phonological awareness between English majors and those not majoring in English were explored. As the English experience of the English majors is most likely higher than that of the participants not majoring in English, the English majors might show a higher degree of phonological awareness. Independent samples t-tests were conducted with *Major* (English/Other) as the independent variable and *Segmental/Phonotactic/Prosodic Awareness Score* as the dependent variable. No differences between the two major groups were observed for segmental ($t[69]=-.22$, $p=.82$) or phonotactic ($t[69]=1.37$, $p=.17$) awareness, but English majors ($M=58.91$, $SD=14.71$) performed significantly better in the prosodic awareness task ($t[67]=2.45$, $p=.017$) than those who did not major in English ($M=50.61$, $SD=13.31$). However, it is worth noticing that the *Prosodic Awareness Score* of both major groups approximated to chance level (50%), indicating that most likely, neither of the groups had actually acquired L2 prosodic awareness.

Relation of L2 vocabulary size, L2 experience, language use, quality of L2 input, knowledge of other foreign languages, amount of L3 daily use, L2 phonetics and phonology teaching and phonological self-awareness, to each of the phonological

of this, what constitutes a 'rule' might vary across participants and because most of the participants had not received English phonetics and phonology instruction, it is unlikely that all the participants who reported to have used rules in order to answer in *the Phonological Judgment Task* and *Low-pass Filtered Intonation Identification Task*, in fact did so.

awareness domains was examined next through correlations. [98] Results of the correlations are seen in Table 10.15.

Independent variables		Phonological awareness domains								
		Segmental Awareness Score			Phonotactic Awareness Score			Prosodic Awareness Score		
		n	***r***	***p***	***n***	***r***	***p***	***n***	***r***	***p***
L2 Vocabulary Size		60	**.325**	**.011**	60	**.390**	**.002**	59	**.323**	**.013**
Language experience	**AOL English**	71	**-.307**	**.009**	71	-.092	.447	69	-.163	.180
	Academic English Experience	71	.021	.864	71	.149	.216	69	.074	.545
	Native English Experience*	71	-.055	.646	71	-.150	.213	69	-.118	.335
	English Experience Score*	71	.001	.994	71	.039	.747	69	-.115	.349
Language use	**L1 Use Average***	71	.020	.865	71	-.232	.052	69	-.236	.051
	L2 Use Average*	71	-.016	.892	71	**.241**	**.043**	69	**.239**	**.048**
	L1 Use Total Score*	71	.118	.325	71	-.071	.554	69	**-.281**	**.019**
	L2 Use Total Score*	71	.029	.810	71	**.266**	**.025**	69	.187	.125
	L2-L1 Use Ratio*	71	-.025	.836	71	.187	.118	69	**.286**	**.017**
Quality of L2 Input Score*		71	.003	.981	71	.087	.470	69	-.083	.500
L3 daily use*		71	-.071	.557	70	-.040	.743	68	.034	.780
L2 Phonetics Experience		71	-.148	.219	71	-.072	.553	69	-.023	.849
Phonological Self-awareness		71	**.464**	**<.001**	71	.159	.186	69	.135	.267

Table 10.15. Correlations between the phonological awareness domains and the individual variables for L1 BP participants. Non-parametric correlations due to the abnormal distribution of the independent variable indicated by an asterisk.

L2 Vocabulary Size showed a medium strong positive correlation with the three phonological awareness domains.[99] This is not surprising as language learners with a higher proficiency level (as manifested by L2 vocabulary size, in the present study), have more L2 experience, and their L2 input and L2 use are likely to be higher than in lower level language learners.

[98]Short descriptions of the measures are provided in the footnotes for convenience. The full description and descriptive statistics for the individual variables are found in *Chapter 8.6*.

[99] L2 Vocabulary Size: Scale: 0-10,000 words measured through X_lex + Y_lex (cf. *Ch.8.5.1*). Participants with 5 or more mistakes in either of the vocabulary tasks were excluded. *n*=60; *M*= 6672.50.

L2 experience was measured in the present study through four measures: *Age of Onset of Learning (AOL) English*, *Academic English Experience*, *Native English Experience* and *English Experience Score.*[100] Somewhat surprisingly, as seen in Table 10.15, none of the L2 experience measures showed a clear relation to any of the phonological awareness domains. The exception was *AOL English* and segmental awareness which shared a medium strong negative relation, indicating that the earlier the participant had begun to study English, the higher the *Segmental Awareness Score* was.

Two reasons can be thought of as to why no positive relation between L2 experience and the three phonological awareness subdomains was found. Perhaps the language experience measures used in the present study were not reliable or accurate enough in order to capture real differences in L2 experience in spite of there being several measures which together covered 5 years and different contexts. The other explanation is that L2 phonological awareness may not develop as a result of L2 language experience. It can be only hypothesized why segmental awareness and language experience, as measured through AOL, make an exception.

Language use in the present study was measured through five related measures: *L1 Use Average*, *L2 Use Average*, *L1 Use Total Score*, *L2 Use Total Score* and *L1/L2 Ratio.*[101] The L1 and the L2 use measures are almost exact opposites and naturally

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[100] *AOL English* =Age in years, *M*= 9.28.
Academic English Experience= Sum of the years spent in different learning environments: *M*=17.65.
Native English Experience= Time spent in English speaking countries in months. *M* =4.33.
English Experience Score= Academic English Experience + Native English experience, the higher the score, the more experience with English. *M*=21.98.

[101] *L1 Use Average*= Mean percentage of L1 use in the last 5 years *n*=69, *M* =77.02.
L2 Use Average= Mean percentage of L2 use in the last 5 years *n*=69, *M*= 21.73.
L1 Use Total Score= The sum of L1 daily use at different contexts: university, work, social and home. *n*=69, M= 14.55.
L2 Use Total Score= The sum of L2 daily use at different contexts: university, work, social and home.. *M*= 6.48 (1.91).
L1/L2 Ratio= A ratio between L2 use total score and L1 use total score. The higher the ratio, the more L2 is used in comparison to L1; 1= both languages are used the same amount, 1< L2 is used more than L1, 1> L1 is used more than L2. *M*= .50.

correlate negatively; the higher the L1 use, the lower the L2 use. As seen in Table 10.15, weak positive correlations were found between L2 use and phonotactic awareness, as well as L2 use and prosodic awareness. No relation was observed for language use and segmental awareness. Again, the small effect of L2 use to the three components of phonological awareness is rather surprising, indicating that in the present study phonological awareness and language use were not found to be positively related.

The amount of interaction with native speakers was measured through the *Quality of L2 Input Score*.[102] It was expected that those participants whose English interactions occurred mainly with native English speakers might have a higher phonological awareness in the three domains than those whose English input came mainly from non-native English speakers. This prediction was not confirmed for any of the phonological awareness domains, which showed no relation to the quality of input, as can be seen in Table 10.15.

The effect of the knowledge of other foreign languages on English phonological awareness in the three domains was examined next. It was hypothesized that an increased use of foreign languages in general might increase L2 phonological awareness. However, this was not confirmed by the lack of correlation between *L3 Daily Use* and the three phonological awareness domains as seen in Table 10.15.[103] As the amount of L3 use was low in most of the participants, additional one-way ANOVAs with *Number of Foreign Languages Known* (apart from English) (0/1/2+) as the grouping variable were conducted for each of the phonological awareness domains. The effect of *Number of Foreign Languages* was non-significant for the three domains (segmental: $F[2,68]=.942$, $p=.39$; phonotactic: $F[2,68]=1.08$, $p=.34$; prosodic: $F[2,66]=1.49$, $p=.23$), confirming that the

[102] Sum of the amount of interaction with native English speakers at different contexts: university, work, social and home. $M= 16.17$.
[103] Number of hours spoken in L3 daily. $n=69$, $M= .10$.

knowledge of additional foreign languages did not have an effect on phonological awareness at the three phonological awareness domains.

The effect of English pronunciation instruction on L2 phonological awareness at the three domains was examined next. As can be seen from Table 10.15, no relation was found between *L2 Phonetics Experience* and performance in any of the three tasks.[104] As the variation in the L2 Phonetics Experience scores was rather small, the participants were divided into three groups based on their L2 phonetics experience score (at 33% and 66% cut-offs). This new variable was used as a grouping variable (low/mid/high) in additional one-way ANOVAs for each of the three domains. The three ANOVAs all showed a non-significant effect of L2 Phonetics Experience (segmental: $F[2,68]=.47$, $p=.62$, phonotactic: $F[2,68]=.007$, $p=.99$; prosodic: $F[2,66]=.96$, $p=.38$) showing that the amount of English pronunciation instruction did not have an effect on phonological awareness at the three domains.

Finally, the relation between phonological self-awareness and the three phonological awareness domains was inspected. Phonological self-awareness was operationalized as the ability to make judgments of phonological nature and it was measured through the *Phonological Self-awareness Score*.[105] As observed in Table 10.15, phonological self-awareness and segmental awareness showed a medium strong positive relation ($r=.46$, $p<.001$), but no relation was observed for phonotactic awareness or prosodic awareness.

Overall, the results from the three phonological awareness domains and the individual variables for the L1 BP participants indicate that the measured individual

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[104] An overall measure of the person's experience with explicit L2 phonetics teaching. The higher the score, the more explicit pronunciation teaching the person has received.. $n=69$, $M= 18.32$.

[105] A sum of 11 questionnaire items targeting phonological self-awareness. Tells overall how easy the participant finds different phonological awareness skills; the higher the sum the easier he finds phonological judgments.

variables were not strongly related to the three phonological awareness domains. L2 experience was found to bear only a weak relation to L2 phonological awareness, and this was only observed in the segmental domain. L2 use was found to be only moderately related to L2 phonotactic and prosodic awareness, but not to L2 segmental awareness. Phonological self-awareness was found to be related to segmental awareness. L2 phonetics and phonology experience, quality of L2 input, knowledge of other foreign languages and the daily L3 use, were not related to the three phonological awareness domains. On the other hand, L2 proficiency, as measured through L2 vocabulary size, was found to be related to the three phonological awareness domains.

To conclude, the relation between the linguistic variables and the three phonological awareness domains was examined for the L1 AmE participants. It was hypothesized that high amounts of foreign language experience and use (especially Brazilian Portuguese) might lead native speakers to be less sensitive about L1 phonology. The relation between linguistic variables and the performance in the three phonological awareness tasks for native English speakers was examined through correlations. Results of the correlations can be seen in Table 10.16.

Independent variables	**Phonological awareness domains**								
	Segmental Awareness Score			**Phonotactic Awareness Score**			**Prosodic Awareness Score**		
	n	***r***	***p***	***n***	***r***	***p***	***n***	***r***	***p***
AOL Portuguese*	18	.317	.201	17	-.453	.068	16	-.296	.266
Portuguese Experience Score	18	-.094	.710	17	-.142	.587	16	.210	.435
L1 Use Average	18	.019	.940	17	-.241	352	16	155	.566
L2 Use Average	18	-.235	.347	17	.187	.472	16	.174	.520
L3 daily use*	18	260	.297	17	193,	.458	16	-.293	.272
Phonological self-awareness	18	-.027	.917	17	-.207	.426	16	-.153	.572

Table 10.16. Correlations between the phonological awareness domains and the individual variables for L1 AmE participants. Non-parametric correlations due to the abnormal distribution of the independent variable indicated by an asterisk.

None of the examined variables correlated significantly with the three phonological awareness subdomain scores. This was the case for the language experience variables, *AOL Portuguese* and *Portuguese Experience Score*, and for the language use variables, none of which showed a clear relation to L1 phonological awareness.[106] Relation between task performance and phonological self-awareness was also investigated since for the L1 BP participants, a relation was found in the segmental domain. For the L1 AmE participants, phonological self-awareness was found to be unrelated to the three subdomains, as seen in Table 10.16.

Taken together, the results for the L1 AmE participants indicate that the phonological awareness in the three subdomains was rather unaffected by several individual variables in native speakers. On the one hand, this might occur due to the measures used and the selected participant population, which might not have been heterogeneous enough to conduct correlations. On the other hand, it is possible that native phonological awareness is not related to variation in these individual variables. This might even be expected if we consider native speaker phonological awareness as a fully developed stable system in comparison to the incomplete phonological awareness of non-native speakers.

10.5. L2 phonological awareness and L2 pronunciation

In this section, results to the research questions formulated in *Chapter 6* are answered. Presentation of the results follows the order of the research questions. Before

[106] *AOL Portuguese*= Age of Onset of Portuguese (age in years). *n*=19, *M*=23.35
Portuguese Experience Score= Sum of two measures: *Academic Portuguese Experience* (measured as the time of Portuguese studied and *Native Portuguese Experience* (measured as the length of stay in Brazil), the higher the score, the more experience with Portuguese the person has.

addressing the main results, calculation of the *Composite Phonological Awareness Score* is discussed.

In order to obtain a single measure, covering awareness evident from the three tasks, a ***Composite Phonological Awareness Score*** was computed. Each of the phonological awareness domains was represented by a score, which in the case of segmental and prosodic awareness corresponded to the percentage of response accuracy in certain trials and in the case of phonotactic awareness, the percentage of distance (in ms) between the illegal and legal nonword response times. [107] Since no previous research is available as to the relative weight of each subdomain, we will assume that each subdomain bears the same weight in defining phonological awareness as a single construct. Consequently, the scores from the three tasks were combined into a single *Composite Phonological Awareness Score* through addition (Composite Phonological Awareness Score = Segmental Awareness Score + Prosodic Awareness Score + Phonotactic Awareness Score).[108]

Distribution of the *Composite Phonological Awareness Score* is discussed next. The participants who were identified as outliers, as having a score beyond 1.5 times the interquartile range for any of the subdomain scores, were excluded from the analyses, leaving the number of L1 BP participants in 69 and L1 AmE participants in 14 for the main analyses involving this score. Normality of the distribution was inspected separately for the two participant groups and scores on both were judged as normally distributed (Kolmogorov-Smirnof =.200). Descriptives for the score are seen in Table 10.17. The descriptives show that the L1 AmE participants' mean *Composite Phonological*

[107] See the introduction to the previous section, 10..4, for the description of the domain specific scores.
[108] In an alternative computation, z-scores for the scores representing each subdomain were obtained and the z-scores were added up in order to form a single phonological awareness score. Comparison of the ranking of participants between this measure and the selected *Composite Phonological Awareness Score* showed no differences between the two which is why the current measure was kept.

Awareness Score was higher than the L1 BP participants', as could be expected. However, at the individual level, participants' phonological awareness varied substantially, as evidenced by the large range in both participant groups.

Statistic	**L1 BP (*n*=69)**	**L1 AmE (*n*=14)**
Mean	125.56	174.49
SD	28.99	23.47
***Min*.**	62.53	126.74
***Max*.**	191.41	212.85

Table 10.17. Descriptive statistics for the *Composite Phonological Awareness Score*.

Having presented the dependent measure in the analyses that follow, we will turn to responding the research questions by beginning with the questions examining the nature of L2 phonological awareness.

- **RQ 1: Is there a difference in phonological awareness between native speakers and foreign language learners?**

  Predictions: *Native speakers are expected to possess a higher degree of phonological awareness than non-native speakers because phonological awareness is expected to develop as a result of language experience and contact, and L2 users' phonology is still developing.*

Distribution of the *Composite Phonological Awareness Score* for both groups can be seen in Figure 10.6. (descriptives on Table 10.17).

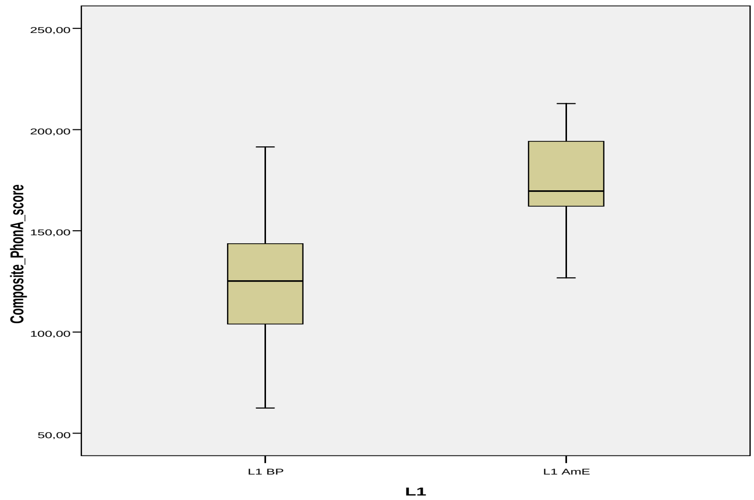

Figure 10.6. Boxplots for the *Composite Phonological Awareness Score*.
L1 BP participants on the left, L1 AmE participants on the right.

An independent samples t-test was conducted in order to determine whether the differences observed for L1 BP and L1 AmE participants' scores were statistically significant. The results indicate that the two L1 groups differed significantly in their phonological awareness ($t[81]= -5.92$, $p<.001$). The L1 AmE participants had significantly higher *Composite Phonological Awareness Scores*. In fact, the lowest L1 AmE score, 126.74, was higher than the L1 BP mean (125.56). The results thus confirm the initial prediction that phonological awareness is higher in native speakers than in L2 users.

- **RQ 2: To what extent are the segmental, phonotactic and suprasegmental domains of L2 phonological awareness related to one another?**

  Predictions: *Each of the three tasks taps into different aspects of phonological awareness. Consequently, it is possible that the scores in each domain are not strongly related, albeit they measure different aspects of the same underlying construct, namely, phonological awareness.*

Pearson product-moment correlations were conducted between the three domains in order to establish whether they were related or not. Results of the correlations are seen in Table 10.18.

	Segmental Awareness Score		Phonotactic Awareness Score		Prosodic Awareness Score	
	r	***p***	***r***	***p***	***r***	***p***
Segmental Awareness Score	-	-	**.303**	**.011**	.117	.337
Phonotactic Awareness Score	**.303**	**.011**	-	-	.156	.199
Prosodic Awareness Score	.117	.337	.156	.199	-	-

Table 10.18. Correlations among the three phonological awareness sub-domains for L1 BP speakers (*n*=69).

The only significant correlation between the three tasks was found between segmental awareness and phonotactic awareness (r=.30) indicating that high scores in the *Phonological Judgment Task* were related to high scores in the *Lexical Decision Task*. However, the effect size (r^2) shows that the variables share only 9% of the variance. Perhaps surprisingly, prosodic awareness did not correlate with neither of the domains. These results suggest that the three domains of phonological awareness are relatively independent, each tapping into a different type of knowledge. As a consequence, it would seem that the employment of domain-specific tasks is beneficial when L2 phonological awareness is tested as the subareas were found not to overlap.

- **RQ 3: Do participants who report having received L2 phonetics and phonology instruction show a different degree of L2 phonological awareness than participants who report to be phonetically naïve?**

Predictions: *Phonological awareness is assumed to develop through language contact. Receiving explicit phonetics and phonology instruction is thus not expected to be a requisite for the development of phonological awareness at the present level of analysis (noticing). However, if the participant has been frequently exposed to consciousness-raising activities in phonetics classes, an increase in phonological awareness might be observed.*

A Pearson correlation was conducted between *Composite Phonological Awareness Score* and *Phonetics Experience Score* (cf. *Ch.8.6.1*, p.298) with the aim of examining whether a relationship between the two existed. A non-significant correlation (r=-.08, n=69, p=.48) indicated that English pronunciation instruction and L2 phonological awareness were not related. In the same manner as when examining the role of phonetics instruction on the phonological awareness subdomains (cf. *Ch.10.4*, p.359), the results obtained from the correlation were confirmed with a one-way ANOVA for which the participants were divided into three groups (at 33% and 66% cut-offs) based on their *Phonetics Experience* scores. The ANOVA confirmed the results of the correlation, indicating that the three phonetics experience groups (high/mid/low) did not differ significantly in terms of their *Composite Phonological Awareness Scores* (F[2,66]=.133, p=.87).

The results found in here as well as for each of the subdomains in (cf. *Ch.10.4*, p.359) suggest that L2 phonological awareness is not affected by L2 pronunciation instruction. However, these results need to be interpreted with caution as the amount of phonetics instruction received by the participants in the present study was relatively low. Different results might be obtained with larger variation in the amount of L2 phonetics instruction.

- **RQ 4: Is phonological self-awareness (metacognition) related to L2 phonological awareness?**

  Predictions: *Phonological self-awareness is assumed to be an aspect of phonological awareness and as such it is expected to bear a positive relation to L2 phonological awareness.*

A Pearson correlation was conducted between L2 phonological awareness (as measured by the *Composite Phonological Awareness Score*) and phonological self-awareness (as measured by the *Phonological Self-awareness Score* [cf. *Ch.8.6.2*, p.303]). A medium strong positive correlation was found between the two variables (r=.35, n=69, p=.003). This indicates that the two seem to be somewhat related so that high degrees of phonological self-awareness are associated to high degrees of phonological awareness. The effect size (r^2) shows that the shared variance between the two variables is 12%.

Initial predictions of the relationship between phonological self-awareness and phonological awareness were confirmed. It is not surprising that participants who report to be more insightful in relation to phonology in fact perform better in tasks measuring phonological awareness than those who report not to possess this quality. However, the small effect size indicates that the two domains only partially overlap.

- **RQ 5: How much of the variation in L2 phonological awareness can be explained by individual variables such as: language experience, language use, and L2 vocabulary size?**

  Predictions: *The three individual variables are expected to be positively related to L2 phonological awareness. Phonological awareness is assumed to increase* *with language experience (cf. Ch.4.1.3, p.107). Consequently, language experience and language use are expected to explain part of the variation observed in the phonological awareness scores. L2 vocabulary size is understood in the present study to be an indication of the participant's general L2 proficiency (cf. Ch.8.5). High L2 proficiency is associated to large amounts of L2 input and, most often than not, to a high L2 use. As these factors are assumed to be beneficial for the development of L2 phonological awareness, L2 vocabulary size is expected to contribute to the L2 phonological awareness scores.*

A standard multiple regression was conducted in order to determine to what extent L2 phonological awareness could be predicted by language experience (measured by *AOL*), language use (measured by *L2 Use Average* and *L2 Use Total Score*), and L2 proficiency (measured as *L2 vocabulary size*) .[109]

Assumptions of multiple regression were first inspected. Assumptions of multicollinearity and collinearity were met by inspecting the correlations among the variables and the collinearity statistics. *L2 Use Average* and *L2 Use Total Score* were found to correlate to a large extent (r=.81), however the collinearity statistics reported normal values (tolerance >.10, VIF <10.0). Normality and homoscedasticity of the residuals were inspected from the residuals scatterplot and the normal probability plot of the residuals. Presence of outliers was inspected from the residuals scatterplot and from the Mahalanobis distances and determined as having a standardized residual score of +/-3 or a Mahalanobis distance score over 18.47. No outliers were found. All the other preliminary assumptions were met.

[109] Preliminary correlations were conducted between the language experience and language use measures and the *Composite Phonological Awareness Score*, and the variables showing the largest correlations were selected as predictors.

Correlations between the predictor variables and the dependent measure are reported first. The strongest correlation was found between the *Composite Phonological Awareness Score* and *L2 Vocabulary Size* (r=.40, n=69, p<.001). A weak negative correlation was observed between the dependent measure and *AOL English* (r= -.27, n=69, p=.012). The language use variables did not significantly predict scores in the dependent measure (*L2 Use Average*, r=.12; *L2 Use Total Score*, r=.18).

Examining the model itself, the model as a whole explained 25% of the variance in L2 phonological awareness (r^2 =.25), and this result was statistically significant (p=.001). The variable which had the largest impact on L2 phonological awareness, as measured by the *Composite Phonological Awareness Score*, was *L2 Vocabulary Size* (beta coefficient=.39, b coefficient = .010 [standard error=.003], p=.001, r^2= .16). The second largest impact was found for *L2 Use Total Score* (beta coefficient = -.25, b coefficient = 3.92 [*SE*=2.80], p=.16, r^2=.02). However, the only predictors making a unique contribution to the model were *L2 Vocabulary Size* and *AOL English* (beta coefficient= -.24, b coefficient= -2.59 [*SE* 1.15], p=.02, r^2 =.07). The two language use predictors did not make a unique contribution to the model, indicating that they most likely overlapped. *L2 Vocabulary Size* explained 16.4 % and *AOL English* 7.30% of the variance in the *Composite Phonological Awareness Scores*.

As a whole, the results of the multiple regression suggest that L2 proficiency, operationalized as L2 vocabulary size, is the largest predictor for L2 phonological awareness, followed by L2 experience, which nevertheless only explained a small amount of the variation in L2 phonological awareness. The fact that no relation was found between L2 use and L2 phonological awareness, is a reflection of the results observed for each of the subdomains (cf. *Ch.10.4*, p.358), which showed non-existent to small relations between each domain and L2 use.

- **RQ 6: To what extent is L2 phonological awareness related to L2 pronunciation accuracy?**

  Predictions: *Language learners with high degrees of phonological awareness are expected to have a more native-like L2 pronunciation than language learners with a low degree of phonological awareness (cf. Ch.4.2). Previous research has observed a positive relationship between language awareness and general language proficiency (e.g., Renou, 2001; Roehr, 2008), between explicit L2 phonological awareness and pronunciation (Kennedy et al., 2014; Venkatagiri & Levis, 2007), and between non-verbalizable phonological awareness and accurate target feature production (Mora et al., 2014). These findings are expected to be extended to L2 phonological awareness based on proceduralized knowledge and L2 pronunciation.*

This research question was addressed with two analyses. First, the general relationship between L2 phonological awareness and L2 pronunciation was inspected with a correlation. Then, the effect of each of the phonological awareness subdomains (segmental, phonotactic and prosodic) on L2 pronunciation was examined with a multiple regression.

The relation between L2 phonological awareness, as measured by the *Composite Phonological Awareness Score*, and L2 pronunciation, as measured by the *Foreign Accent (FA) Score* can be visually inspected in Figure 10.7. [110]

[110] FA score= a mean foreign accentedness rating on a scale 1-9 (1=native-like, 9=a very strong foreign accent), *n*=69, *M* =5.73. Cf. *Ch.8.4.2* for the computation of the score.

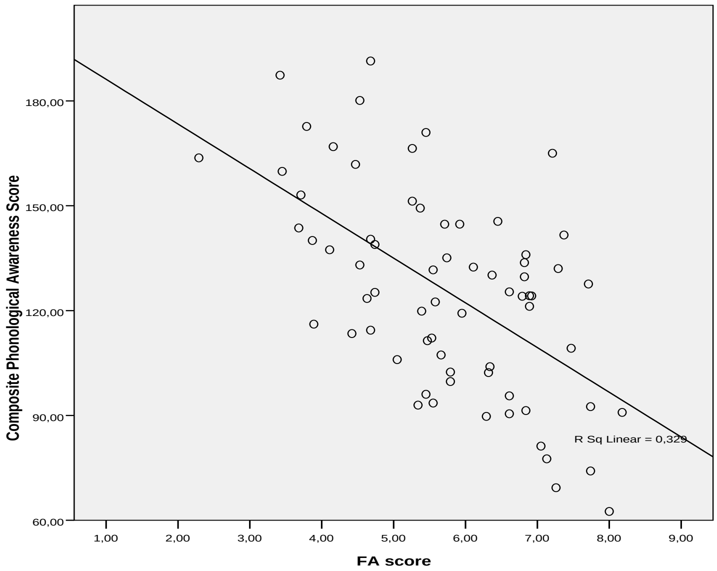

Figure 10.7. Scatterplot of the relation between L2 Phonological Awareness and L2 Pronunciation.

In order to examine the relation between the two variables statistically, a Pearson product-moment correlation was conducted. A strong negative correlation was found between the two variables (r= -.57, n=69, p<.001) indicating that high levels of phonological awareness were associated to low foreign accent ratings. In other words, L1 BP EFL learners with high phonological awareness also had high L2 pronunciation accuracy. The effect size (r^2) explained 32.8 % of the shared variance between the two variables.

As the next step, the relationship between the individual components of L2 phonological awareness (segmental, phonotactic and prosodic domains) and L2 pronunciation was examined. Namely, the aim was to determine, how much of the variation in L2 pronunciation could be explained by each of the subdomains.

A standard multiple regression was conducted in order to determine the effect of each domain to L2 pronunciation. The predictors were: *Segmental Awareness Score*, *Phonotactic Awareness Score* and *Prosodic Awareness Score*. The dependent variable was *Foreign Accent Score*.

Preliminary assumptions of multiple regression were first inspected. Assumptions of multicollinearity and collinearity were met by inspecting the correlations among the variables and the collinearity statistics. Normality and homoscedasticity of the residuals were inspected from the residuals scatterplot and the normal probability plot of the residuals. Presence of outliers was inspected from the residuals scatterplot and from the Mahalanobis distances, and determined as having a standardized residual score of +/-3 or a Mahalanobis distance score over 16.27. No outliers were identified. All the preliminary assumptions were met.

Each of the predictor variables showed a medium negative correlation with the dependent FA measure. The highest correlation was found between *FA Score* and *Phonotactic Awareness Score* (r=-.46, n=69, p<.001) (*Segmental Awareness Score* and *FA:* r= -.37, n=69, p=.001, *Prosodic Awareness Score* and *FA:* r= -.32, n=69, p=.003).

The model as a whole explained 33.6% of the variance in the foreign accent ratings (r^2 =.33) reaching statistical significance (p<.001). The variable which had the largest impact on the *Foreign Accent Score* was *Phonotactic Awareness Score* (beta coefficient= -.35, b coefficient = -.03 [standard error=.010], p=.001, r^2= .14). Prosodic awareness (beta coefficient = -.24, b coefficient = -.02 [*SE*=.009], p=.021, r^2=.08) and segmental awareness (beta coefficient = -.237, b coefficient= -.022 [*SE*=.010], p=.029, r^2= .07) also contributed to the model significantly. In other words, all the three domains made a statistically significant unique contribution to the model. Segmental awareness explained 7%, prosodic awareness 8%, and phonotactic awareness 14.7% of the variance in the L2 pronunciation.

To recapitule, the initial prediction about a positive relation between L2 phonological awareness and L2 pronunciation was confirmed. The correlational analysis showed that a strong negative relation existed between L2 phonological awareness and the degree of foreign accent, in other words, participants with high L2 phonological awareness also had more accurate L2 pronunciation. The results of the multiple regression further indicated that each of phonological awareness subdomains predicted unique variance in L2 pronunciation.

<u>*Chapter summary:*</u>

The chapter began by examining the results to each of the three phonological awareness tasks measuring segmental, phonotactic and prosodic awareness. It was established that the L1 BP participants had acquired phonological awareness at each of the subdomains to varying extents. In Section 10.4, the relation of each of the subdomains to a set of individual variables was examined. It was seen that the three domains behaved differently: segmental awareness bore a relation to language experience and phonological self-awareness, whereas phonotactic and prosodic awareness showed a weak relation to L2 use. The strongest relation affecting all of the domains was found in relation to L2 proficiency (as measured by L2 vocabulary size).

The final section of the chapter focused on examining the nature of L2 phonological awareness and the relationship between L2 phonological awareness and L2 pronunciation. The section began by examining the nature of L2 phonological awareness. It was seen that L2 phonological awareness and L1 phonological awareness differ to some extent, as testified by the differences in the performance of the L1 BP and L1 AmE participants. It was also seen, that the three subdomains of phonological awareness were relatively independent as testified by the lack of correlations among *them. L2 phonological awareness was found to be related to overall L2 proficiency (as measured by L2 vocabulary size), to phonological self-awareness, as well as to a smaller extent to L2 language experience. No relation was found between L2 phonological awareness and L2 pronunciation instruction or between L2 phonological awareness and L2 use.*

The chapter ended with an examination on the relationship between L2 phonological awareness and L2 pronunciation. It was seen that the initial prediction of a positive relation between L2 phonological awareness and L2 pronunciation was confirmed. Additionally, it was seen that each of the phonological awareness subdomains made a unique contribution to the L2 pronunciation measure.

PART III

DISCUSSION

AND

CONCLUSIONS

The aim of *Part III* is to provide an interpretation of the results and to offer a comprehensive review of the dissertation. This final part is divided into two chapters.

Chapter 11 presents a general discussion of the results, tying together the present study examined in *Part II* and the theoretical framework discussed in *Part I*. The discussion centers on the general findings of the dissertation and how they can be reviewed in the framework of cognition, language awareness and L2 phonological awareness. The chapter also discusses limitations of the study.

Chapter 12 presents the concluding remarks to the dissertation. It offers an overall review of how the research was conducted and what results were observed. Finally, some suggestions for future research are made.

11. General discussion

The aim of the present chapter is to discuss in depth the findings obtained in the previous chapter and their implications for L2 phonological awareness research in specific and L2 speech research in general. Let us begin by recapitulating the main findings. The nature of L2 phonological awareness was examined in the segmental, phonotactic and prosodic domains. Additionally, its relation to L2 pronunciation was explored together with some individual variables. Participants were tested in three domain-specific phonological awareness tasks and their L2 pronunciation was measured through foreign accent ratings.

L1 BP speakers' phonological awareness in the three domains varied, the poorest performance occurring in the segmental domain. Additionally, the three domains were found to be relatively independent. The L1 BP EFL learners' performance was significantly inferior to the native L1 AmE speakers in all the domains, with the exception of the phonotactic domain in which no differences were observed between the native and the non-native participants. Altogether, the L1 BP participants manifested significantly lower degrees of phonological awareness as measured by the *Composite Phonological Awareness Score*.

The most important finding of the study was that L2 phonological awareness and L2 pronunciation were found to be strongly related, so that high degrees of phonological awareness were found to be related to more native-like pronunciation. Language use and language experience, as well as phonetic instruction were not found to bear a significant relation to L2 phonological awareness, whereas L2 vocabulary size was found to be positively related.

Having restated the main findings of the study, the remaining of the chapter is organized around the three subdomains and the research questions presented in *Chapter 6*, which have been divided around two main topics: the nature of L2 phonological awareness and the relationship between L2 phonological awareness and L2 pronunciation.

11.1. Segmental awareness

The *Phonological Judgment Task* which was used to measure the participants' phonological awareness in the segmental domain revealed that as a group, the L1 BP EFL learners' segmental awareness was poor, as testified by the low *Segmental Awareness Scores* (mean accuracy=41.25%). The L1 AmE participants performed significantly better than the L1 BP EFL learners (cf. *Ch.10.1*, p.319). However, the native L1 AmE participants also found the perception of pronunciation deviations more difficult than the acceptance of native pronunciations. This indicates that the task was difficult, even for native speakers. There are several reasons which may explain poor performance in the task.

Generally speaking, it appears that the perception of segmental pronunciation deviations is difficult. One possible explanation to this is that phones in isolation are very short and because of this they require large amounts of effort from the part of the listener, as once the phone is heard in isolation, it needs to be compared to the listener's long-term memory representation of it and if no match is found, it needs to be rejected. The fact that in the present task, this comparison had to be made based on very short segments and the decisions needed to be made on the spot, made the enterprise even more challenging. Apart from the inherent nature of segments causing problems, the task structure presented the phones in isolation. Whereas this presentation model was found to function better in focusing the listeners' attention into the phones (cf. *Ch.8.1.2,* p.213), segmenting speech is not a natural way to represent language, and the participants were likely to have had difficulties due to this. Language users' inexperience with paying conscious attention to individual sounds was evident not only in the low *Segmental Awareness Scores*, but also in the problems the participants had during the practice block with conceptualizing a 'sound' (cf. *Ch.10.1*, p.317). This suggests that linguistically naïve language users are not experienced with focusing on individual speech sounds, but most likely, they rather pay attention to the meaning of the message as a whole, as suggested by the 'primacy of meaning'- postulation of VanPatten (1996).

Contrary to the problems in identifying non-native speaker pronunciation deviations, the L1 BP EFL learners' performance in the native speaker trials did not significantly differ from the L1 AmE participants (cf. *Ch.10.1*, p.319). This indicates that accepting native speaker pronunciations as correct is relatively easy for advanced language learners. There are no valid reasons to believe that the ability to accept native speaker pronunciations as correct could be taken as evidence for segmental awareness. This is because these responses are likely to be made based on positive evidence from the input. Foreign language learners, as well as L1 speakers, would simply positively match the presented phone into their mental representation of what the phone should be like.

On the contrary, this matching strategy cannot be employed when pronunciation deviations are correctly identified, as in this case, the deviations cannot be directly mapped, as no positive evidence from native speaker input exists. Moreover, it is important to recall that the non-native participants of the study were acquiring English in a classroom setting, in which most of the English interaction took place with other non-native speakers. What this means is that the L1 BP participants of the study were likely to be constantly exposed to similar L2 pronunciation deviations as those presented to them in the *Phonological Judgment Task,* as these deviations have been testified to be very frequent among L1 BP speakers (cf. *Ch.5.1.3*). In other words, the L1 BP participants may have received false evidence indicating that these deviant pronunciations are target-like. Should this be the case, their performance is likely to have been affected in that rejecting the deviant segments becomes even more challenging, not only due to the low L2 phonological awareness, but also because some of the participants might have never been exposed to target-like L2 phones.

The differences in the response accuracy between ‘pronunciation deviation’- trials and ‘correct native speaker’- trials paralles previous findings on grammaticality judgment tasks. Response accuracy has been found to be higher in grammatical trials than in ungrammatical trials (Gutiérrez, 2013b, R. Ellis, 2005). In addition to the previously discussed explanation of positive evidence from the input as the reason to higher accuracy in the ‘correct’ trials, it has been proposed that grammatical and ungrammatical trials tap into different types of knowledge. Namely, grammatical trials tap into declarative knowledge whereas ungrammatical trials tap into procedural knowledge (Gutiérrez, 2013b).[111] Whether this distinction applies to the realm of phonological awareness and the instrument used in the present study cannot be confirmed with the current data. Analysis of the self-reported strategy use during the task suggested that both types of knowledge, declarative and proceduralized were employed during the task, but data was not collected on how these were divided between the two types of trials (cf. *Ch.10.4*, Table. 10.13, p.352). Taken together, it is safe to say that responses to ‘pronunciation deviation’- trials constitute a more reliable measure of L2 phonological awareness than

[111] The opposite interpretation, namely that grammatical trials tap into implicit and ungrammatical into explicit knowledge, was made by R. Ellis (2005).

responses to ‘correct native speaker’- trials as the former are less susceptible to be confounded with positive input evidence and encyclopedic knowledge, as suggested by some previous research.

Another issue emerging from the L1 BP behavior in the tasks needs to be considered. Whereas the L1 AmE participants manifested awareness in the segmental domain in their L1 (*Segmental Awareness Score M*=64%), can we argue that also the L1 BP participants possessed L2 segmental awareness? The low identification accuracy score, which was below the chance level (41.25 %), suggests that the L1 BP EFL learners as a group did not manifest L2 segmental awareness. Nevertheless, the scores of a few (*n*=8) L1 BP participants were comparable to native speakers (>60 %). It is safe to say that these participants had acquired L2 phonological awareness in the segmental domain.

The question as to why only a few of the advanced English learners manifested segmental awareness in their L2 is difficult to answer with the current data. For once, the *Phonological Judgment Task* was the most difficult of the three tasks, suggesting that the acquisition of L2 segmental awareness is challenging. However, it is possible that different results would be obtained if different type of task is employed. The analyses with individual difference variables showed that language experience (as measured by the AOL) and phonological self-awareness were positively related to L2 segmental awareness, but not to the other subdomains. This suggests that L2 segmental awareness benefits not only from early language exposure but also from the individual’s self-perceived ability to make phonological judgments.

The fact that AOL and phonological self-awareness were not found to bear a relation to the phonotactic and prosodic subdomains is explained by the results that the three phonological awareness subdomains were found to be relatively independent as testified by the lack of correlation among the three (cf. *Ch.10.5*, p.365). Segmental awareness shared a medium strong positive correlation with phonotactic awareness, whereas prosodic awareness did not correlate with either of the other two subdomains. It is difficult to explain why a relation was observed between segmental and phonotactic domains but not for the prosodic domain. One possible explanation is that the segmental and the phonotactic domains deal with smaller units, namely syllables and lexical items, contrary to the prosodic domain, which extends over an entire intonation phrase.

On the one hand, the finding that the three phonological awareness subdomains seem to be rather independent suggests that awareness in these three domains taps into different aspects of phonological awareness, and that high awareness in one domain does not necessarily translate into high awareness in another domain. This in turn means that each of the three phonological awareness subdomains should be represented in the instruments if the aim is to obtain a comprehensive account of the individual's L2 phonological awareness.

11.2. Phonotactic awareness

Contrary to what was observed for segmental awareness, the L1 BP EFL learners clearly manifested to have acquired phonotactic awareness of L2 English. This was testified by their *Phonotactic Awareness Scores*, which did not significantly differ from the native L1 AmE participants' scores (cf. *Ch.10.2*, p.334). This finding was rather surprising as native speakers are expected to possess larger amounts of phonotactic awareness of the permissible consonant combinations than non-native speakers, a difference which should be reflected in their reaction times in a lexical decision task. Previous research suggests that native speakers of English show a clear reaction time difference between legal nonwords, illegal nonwords and words. It has also been established that a lexical decision task, like the one used in the present study, adequately measures non-verbalizable phonotactic awareness through this reaction time difference (Mikhaylova, 2009; Stone & van Orden, 1993). In the present study, the L1 AmE participants did present a *Reaction Time Effect* in the expected direction, but the reaction time to illegal nonwords was not significantly different from words (cf. *Ch.10.2*, p.334). Additionally, the *Phonotactic Awareness Scores* of the L1 AmE participants were not higher than the L1 BP EFL learners' scores, contrary to the initial predictions.

As the *Lexical Decision Task* in the present study did not confirm native speakers to possess more phonotactic awareness than foreign language learners, can we consider that the task accurately measured phonotactic awareness? There are several reasons to believe that we can. First, previous research using a similar task paradigm (lexical decision with legal/illegal onset clusters), reports having successfully measured phonotactic awareness (Trapman & Kager, 2009). Second, the native speakers in the present study *did* differ significantly in the reaction times between the legal and the illegal nonwords, although they did not do so between the illegal nonwords and words. In other words, they were aware of the phonotactic differences between the two types of nonwords. Some possible reasons come to mind as to why the differences between the native L1 AmE speakers and the L1 BP EFL learners were not larger.

Native speakers have been shown to suffer from perceptual ‘deafness’ when listening to illegal L1 sequences so that they are perceived as legal sequences (e.g., Dupoux et al., 1999). For example, French speakers have been shown to perceive the illegal /dl/ as /gl/, which conforms to French phonotactics (Hallé et al., 1998). In the present study, the possible perceptual deafness effect in the L1 AmE participants cannot be confirmed as the participants were not asked to verbalize the items they heard. However, the response accuracy data gives indications that this phenomenon was also present in the current study. The nonword *sgil* [sgil] was classified as a real word by all of the L1 AmE participants, who most likely perceived it as *skill*. If the L1 AmE participants perceived some of the illegal nonwords as having a legal onset, this would have had a clear impact on their reaction times, making the difference between the illegal and legal nonwords smaller.

The L1 AmE participants in the study were also very fast at responding to all stimulus types. Their mean reaction time range (334-463 ms cf. 430-731 ms for L1 BP) may have been too small to allow for as clear differentiation between the three stimulus types as observed in the L1 BP participants, although the *Phonotactic Awareness Score* was calculated as a ratio. Theoretically, the computation of the reaction time difference between the legal and the illegal nonwords as a ratio seems valid, as it is this reaction time difference through which the awareness of phonotactics is manifested. To my knowledge, in the previous research with this task paradigm, this measure however has not been previously employed, and phonotactic awareness has been understood to be present through the *Reaction Time Effect*: word < illegal < legal. Although the use of this measure seems theoretically confounded, more research is required on whether such a gradient measure can be used to distinguish among differences in phonotactic awareness or whether phonotactic awareness does not easily render for such small-grained divisions.

As the foreign language learners showed to have acquired fairly large amounts of English phonotactic awareness, examining ways to increase it does not seem as urgent matter as in the case of segmental awareness. What is clear from these results is that future studies with different task types are needed in order to examine phonotactic awareness in both native and non-native speakers. Especially interesting would be to see if the results would be replicated with tasks using psycholinguistic or neurolinguistic measures, such as the priming effect or event-related potentials, as these measures may be especially suitable in their objectivity in capturing phonotactic awareness.

11.3. Prosodic awareness

Prosodic awareness was examined through the *Low-pass Filtered Intonation Identification Task*. The L1 AmE participants were found not to differ between the 'yes' and the 'no' (correct and incorrect) trials, and they showed a high degree of accuracy in both types, making evident their prosodic awareness. The L1 BP participants were found to perform significantly poorer in all the test categories ('yes'-'no', 'deaccented'-'unaccusative') than the L1 AmE participants. Their performance in the 'no' trials, which were incorrect in English but correct if transposed into the L1, was remarkably poorer than in the 'yes' trials (cf. *Ch.10.3*, p.343). This suggests that it is cognitively more demanding for language learners to reject the 'correct' L1 pattern for the L2 than to identify the correct L2 patterns. This parallels the phenomenon observed for segmental awareness for which the identification of pronunciation deviations was more difficult than accepting correct native pronunciations (cf. *Ch.11.1*). This seems to indicate that whereas for the 'correct' trials, awareness of the L2 phonology is confounded with positive evidence from the L2 input, for the 'incorrect' trials, phonological awareness can be observed with more clarity, as responding correctly cannot be based on imitation or positive evidence but on awareness developed about the target phonology.

The L1 BP participants performed better in the deaccented trials (62.31%) than in the unaccusative trials (39.73%) (cf. *Ch.10.3.*, p.343), which extends Nava and Zubizarreta's (2010) results on the easier mastery of the *Lexical Anaphora Deaccenting Rule* than the *Germanic Nuclear Stress Rule* for L1 BP speakers (cf. *Ch.5.3.3*). According to the authors, it is easier to acquire a new rule (deaccenting) than to restructure an existing nuclear stress rule to accommodate the English nuclear stress movement. However, in the present study, the L1 AmE speakers were also found to perform significantly better in the deaccented trials (86.36%) than in the unaccusative trials (70.31%). As native speakers show the same response behavior than the foreign language learners, the reason cannot be attributed solely on the differences between acquisition and restructuring. A possible explanation to the poorer performance in the unaccusative trials lies in the frequency of occurrence of these items in the input. Unaccusative constructions are formed by a relatively small number of verbs and the SV sentence structure occurs in the input with less frequency than the SVO pattern.

It is also important to recall that previous research has indicated that native English speakers may also use the alternative nuclear stress pattern (S<u>V</u>) in intransitive utterances. For example, Nava and Zubizarreta (2010) found that L1 English speakers produced unaccusative sentences with the nuclear stress on the object in 3% of the cases when the verb involved change of location and in 2% of the cases when the verb involved change of state. These figures are very small, but indicate that not all native English speakers find the SV nuclear stress pattern inappropriate for unaccusative sentences.

As was reviewed in *Chapter 5.3.1* (p.150), the chosen nuclear stress pattern appears to be based on whether the speaker views the action denoted by the verb as thetic or categorical. Whereas unaccusative verbs have been shown to favor a thetic interpretation and thus the stress falls on the subject, a categorical interpretation with the stress on the verb is also not impossible if the information is interpreted to be especially noteworthy. Although all the unaccusative test sentences in the *Low-pass Filtered Intonation Identification Task* were designed to be neutral, and consequently the appropriate stress pattern should be SV, it is possible that some listeners interpreted them as especially noteworthy and thus rejected the neutral pattern. This might the case especially when considering the fact that it is very common for language users to add background information for utterances and to 'read between the lines' as frequently occurs when an email or text message is misinterpreted.

At the first glance, it seems that the L1 BP participants as a group had not acquired L2 prosodic awareness as testified by their low mean *Prosodic Awareness Score* (54.24%). However, at further inspection, only the response accuracy for the unaccusative 'no' trials was below chance-level (39%), whereas the deaccented 'no' scores were well above it (62.31%). Thus, we could conclude that the L1 BP participants had acquired prosodic awareness about the nuclear stress assignment in English deaccented structures but not in the unaccusatives. Further evidence for the existence of L2 prosodic awareness can be obtained when the matter of L1 focal stress assignment is addressed.

First, it was noted that the deaccented utterances ending in given information were not especially easy for the L1 BP participants, contrary to what could be expected as this was the category that in the L1 presented the highest rate of focal stress assignment (cf. *Ch.10.3,* p.345) . Second, it was observed that accuracy in the narrow focus trials was not higher than in the broad focus trials although the L1 BP focal stress should theoretically only appear in narrow focus context which should make this context easier in the L2 as well (cf. *Ch.10.3*, p.346). Finally, when the L2 nuclear stress assignment and L1 focal stress assignment was compared within a subset of participants, it became evident that the L1 BP participants were able to correctly identify English nuclear stress patterns even when in a parallel L1 context a focal stress had not been placed (cf. *Ch.10.3,* p.347). These findings suggest that if focal stress assignment is a readily available option in deaccented utterances in Brazilian Portuguese, this strategy is not positively transferred into the L2 English nuclear stress assignment. Moreover, this suggests that as the observed results could not be traced back to L1 prominence assignment strategies, L2 prosodic awareness had been acquired.

Nevertheless, the accuracy rates for both sentence types were low for the L1 BP participants, suggesting that development of L2 prosodic awareness is challenging. The poor results could be partly attributed to the task structure which employed low-pass filtered speech. However, when the answers to the ‘yes’ trials are observed, the L1 AmE participants performed extremely well (>90% correct) and the L1 BP participants also performed significantly better than in the ‘no’ trials (*M*= 76.07% cf. 51.02%). As low-pass filtering was applied to all test trials and accuracy in the ‘correct’ trials was high, it is unlikely that the poor results in the ‘no’ trials would be due to stimulus presentation. Rather, it appears that overall L1 BP speakers have a little awareness about English nuclear stress assignment. Based on this finding and the fact that L2 prosodic awareness was found to have a unique positive impact on L2 pronunciation, it would be beneficial to reinforce prosody teaching in the English curriculum in Brazil.

11.4. The nature of L2 phonological awareness

The L1 BP EFL learners were found to possess significantly lower degrees of phonological awareness, as measured by the *Composite Phonological Awareness Scores*, than the native L1 AmE participants (*M*=125 cf. 177) (cf. *Ch.10.5*, p.360). This finding is not surprising, as the phonological system of foreign language learners is incomplete in comparison to native speakers whose phonology is stable and complete, enabling accurate perception and production of native phonology. The results obtained in the present study, extend this observation to phonological awareness and indicate that native speakers also possess higher degrees of phonological awareness than foreign language learners. As with phonological acquisition in general, the reasons to why this occurs are likely to be similar: differences in the amount of language experience and amount of input, and the existence of the L1 phonological system through which the L2 phonology is perceived.

Examination of the L1 BP participants' *Composite Phonological Awareness Scores* showed large individual variation (range: 62-191, *M*=125), with only 11 participants performing within the L1 AmE range (range: 156 -212, *M*=177). Why did some of the language learners show phonological awareness comparable to native speakers, while others demonstrated practically no awareness at all? This issue was explored by examining the relation of some individual differences to phonological awareness.

General L2 proficiency, as measured by L2 vocabulary size, was found to explain 16.4% of the variance in the *Composite Phonological Awareness Scores*. In the current study, high levels of L2 proficiency were found to be related to higher degrees of L2 phonological awareness (cf. *Ch.10.5*, p.369). Consequently, it would seem that some of the factors which explain variation in L2 proficiency also affect phonological awareness. Some of these factors, such as language experience and use, were examined in the present study, whereas the role of many others (e.g., attention control, working memory, phonological short term memory, language aptitude, motivation, personality and differences in learning strategies) remains to be determined by future studies. The findings indicate that L2 proficiency needs to be taken into account in L2 phonological awareness testing, so that differences in L2 proficiency are not confounded with variation in L2 phonological awareness.

The effect of language experience and language use in relation to L2 phonological awareness was examined through several measures. The only language experience measure having an effect on L2 phonological awareness was AOL, which explained 7.30% of the variance in the *Composite Phonological Awareness Scores*. None of the L2 use measures were found to be related to L2 phonological awareness. In other words, the effect of language experience on L2 phonological awareness was found to be small, and no relation was observed for language use (cf. *Ch.10.5*, p.369). These findings are rather surprising, and the initial predictions of the positive effect of language experience and use on L2 phonological awareness were not met. Why language experience and use were found not to bear a relation to L2 phonological awareness? Let us begin by discussing some methodological reasons.

To begin with, the data on L2 experience and use was obtained through questionnaires. Whereas this has been by far the commonest method of obtaining information about individual's language experience, and it is generally considered reliable, it is based on subjective accounts which cannot be verified by the researcher. In fact, the only measure which was found to bear a relation to L2 phonological awareness, AOL, is more reliable in these terms, as participants had no problems on recalling at what age they had begun to study English. This might not have been the case with the language use measures, which were based on the participant's estimates on the amount of L1, L2 and L3 use on a daily basis. Language use may vary significantly at different times, for example due to travel, and this type of variation was taken into account by asking the participants to provide an estimate of their language use at different time periods (in general, last five days/weeks/months/years). However, it cannot be confirmed how reliably the participants actually provided these estimates. Some participants might overestimate their language use, whereas others might play it down, and yet others might simply not recall.

Moreover, the participants were asked to estimate their language use in terms of *speaking* not in terms of listening and/or reading. Had the measures been for listening and reading, which are skills learners in a foreign language context employ more frequently than actual production, a relation may have been found. Kennedy and Trofimovich (2010) found a strong positive relation between the participants' self-reported amount of listening and qualitative phonological awareness.

The second possible explanation to the lack of relation between L2 phonological awareness and L2 experience and L2 use variables involves the participants of the study. All the participants were foreign language learners who had acquired English in a classroom context in Brazil. Because of this, the L2 learner population was rather homogenous in terms of L2 experience and L2 use. Only 10 of the L1 BP participants had been exposed to English before the beginning of the obligatory education and most of the participants only used English to a small extent on a daily basis (*M*=21.73 [% of the time]). In other words, the environment in which the L1 BP participants acquired English did not offer many opportunities for English input. A different pattern might be observed in an immersion context or in a naturalistic language setting. Consequently, before any conclusions can be drawn about the relationship between L2 experience and use and phonological awareness, these populations need to be tested. Should the results still find no relation between the variables, it could then be concluded that L2 phonological awareness is not affected by the amount of L2 experience and use. At the moment such conclusions cannot be safely reached based on the present results.

However, the lack of relation between language experience and L2 phonological awareness is not unattested in previous research. Kennedy (2012) presented a more fine-grained analysis of the Kennedy and Trofimovich (2010) participants' language use data and found no relation between it and qualitative phonological awareness. Likewise, Venkatagiri and Levis (2007) found no relation with language experience (number of years of L2 study and months living in the L2 country) and explicit L2 phonological awareness. Whereas both of these studies examined language learners in a naturalistic setting, their conceptualization of L2 phonological awareness was different than the one adopted in the present study, which is why more research is required examining the non-verbalizable aspect of L2 phonological awareness in naturalistic settings.

Let us take a moment to consider what it would imply if other studies arrived to the same conclusion in terms of language experience and use after testing naturalistic language users. Namely, that L2 use and L2 experience would still not have a significant impact on L2 phonological awareness. Two possible explanations arise.

On the one hand, regular L2 input might not create sufficient conditions for noticing phonology. In other words, it might be that L2 phonological awareness cannot simply be 'picked up' from contact with the L2. As discussed in *Chapter 4.1.1.3,* aspects of L2 pronunciation are not easily noticed due to the preference for meaning over form, which only makes the noticing of L2 pronunciation features possible when enough attentional resources are freed from processing the meaning (VanPatten, 1996). It might be that specific training or the use of consciousness-raising activities which draw attention into phonology are necessary for the majority of the language learners for noticing of phonological aspects to take place.

On the other hand, it is clear that some individuals are simply better at noticing: they pick up patterns and structures with ease and quickly notice deviations from these. Could it be that L2 phonological awareness is governed by some, relatively stable, cognitive properties which are not affected by the individual's language experience or use after a certain stage? Should this be the case, could those individuals who are poor at noticing benefit from activities designed to enhance the salience of phonology with the aim of facilitating noticing? Research examining the effectiveness of L2 pronunciation instruction and perceptual training suggests that this indeed might be the case. Previous studies show that perceptual training and general pronunciation instruction can improve language learners' L2 perception and production (e.g., Bradlow et al., 1999; Cebrian & Carlet, 2014; Ramírez Verdugo, 2006; Silveira, 2004). However, these studies have not employed measures of L2 phonological awareness *per se*, so although it seems intuitive to think that pronunciation instruction would lead to increased L2 phonological awareness, as evidenced by increased accuracy in L2 speech, this is yet to be empirically proven.

Necessarily, L2 experience and L2 use need to play some role in the acquisition of L2 phonological awareness, because otherwise the L2 users would not manifest any degree of L2 phonological awareness, and complete beginners and highly advanced L2 learners would perform equally poorly. It could be hypothesized that some sort of threshold might exist, so that some aspects of L2 phonological awareness could be picked up relatively easily from regular L2 input, whereas other aspects might be less salient and their noticing might require extra help for the majority of the individuals. From the present results, permissibility of consonant clusters would be an example of a feature that may be picked up relatively easily, whereas the ability to tell apart target-like and non-target-like phones would be an example of an aspect which might require that extra help. Enhancing the input by drawing the language learners' attention in the structures to be noticed would especially benefit those language learners who are not 'good' at noticing by nature. On the contrary, the language learners who are 'good' at noticing, might not need any form of enhanced input, as they would be able to pick up on more aspects from regular L2 interaction.

In the present study, phonetic instruction in the L2 was found not to bear a relation to L2 phonological awareness. However this should *not* be taken to mean that phonetic instruction, and more specifically, consciousness-raising activities, are not beneficial for the development of L2 phonological awareness. There are several likely reasons why phonetic instruction in the present study was not found to be related to L2 phonological awareness. To begin with, the variation in the amount of phonological instruction the participants had received was small: the vast majority (88.70 %) had not attended an English phonetics and phonology course. Additionally, for those who reported to have attended English phonetics and phonology instruction, this had taken place on average 2.6 years before the data collection (cf. *Ch.7*, p.194). As a long period of time had passed since the instruction, it is possible that its effects in increasing sensitivity to phonology were not as evident. Finally and most importantly, the present study was not designed to test the effect of pronunciation instruction on L2 phonological awareness, and the information on the attendance on such courses was obtained as part of the linguistic background questionnaire to gather information on individual differences of the participants.

Consequently, the question whether phonetic instruction can have a positive effect on the development of L2 phonological awareness cannot be answered based on the data from the present research. In order to answer this question, it is crucial to carry out research with this aim specifically in mind. Whereas previous research on L2 pronunciation instruction has shown its indirect effect on L2 phonological awareness through improved L2 performance, none of the studies, to the best of my knowledge, have explicitly stated the examination of L2 phonological awareness as their objective, or employed a specific instrument to measure it. Thus, for the time being, the available evidence about the effectivity of pronunciation instruction on L2 phonological awareness is indirect. Once pronunciation instruction studies employing specific measures for L2 phonological awareness are conducted, it is important to test whether the nature of the phonetic instruction plays a role. For example, theoretical accounts on phonological systems and speech processing may be found to be not enough for noticing to take place, whereas practical pronunciation activities and specially designed consciousness-raising activities might offer a better foreground for noticing.

11.5. L2 phonological awareness and L2 pronunciation

L2 phonological awareness and the accuracy of L2 pronunciation were found to be strongly related, the two of them sharing 32.8% of the variance (cf. *Ch.10.5,* p.371). Each of the three phonological awareness subdomains was found to be uniquely related to L2 pronunciation, phonotactic awareness explaining the largest amount of variance (14.7%) (cf. *Ch.10.5*, p.372). These findings parallel the findings observed between general language proficiency and language awareness (Calderón, 2013; Renou, 2001;

Roehr, 2008). They also add to the previous research about L2 phonological awareness and pronunciation which has observed a relation between the accurate production of target features and implicit L2 phonological awareness (Baker & Trofimovich, 2006; Mora et al., 2014), and between L2 pronunciation and explicit L2 phonological awareness (Kennedy et al., 2014; Kennedy & Trofimovich, 2010; Venkatagiri & Levis, 2007). Whereas previous studies on L2 phonological awareness either focused on its explicit aspect or measured the accurate production of some features, the findings from the present study show a relationship between the non-verbalizable aspect of L2 phonological awareness and L2 pronunciation as a whole.

It is necessary to remark that although a strong relation between the two variables was observed, the causality of this relation cannot be established with security based on the present data.[112] However, we have strong theoretically founded reasons to believe that variation in L2 phonological awareness leads to variation in L2 pronunciation and not the other way around. As was seen in *Chapter 4,* following Schmidt's views, phonological awareness develops necessarily through *noticing* (cf. *Ch.4.1.1.1*). In other words, the accurate production of a given feature requires that it has been previously noticed and further processed in the long-term memory. Inaccurate production, on the other hand, suggests that the given feature has not been noticed and no awareness about it has been developed. The opposite view, namely that differences in L2 pronunciation result in variation in phonological awareness, would be more difficult to argue as this would go against the *noticing hypothesis* and on how L2 speech processing is currently contemplated: conceptualization and comprehension precede articulation (Kormos,

[112] In order to confirm the directionality of the relation, a longitudinal design in which language learners would be followed from the beginning of their learning trajectory, and periodically tested for their L2 pronunciation and phonological awareness in order to determine which one develops first would be required.

2006). Moreover, most of the current L2 speech research is based on the assumption that at least part of the production errors have a perceptual origin. With all this in mind, until empirical data on the issue exist, it seems safe to make a preliminary assumption that in the observed relation between L2 phonological awareness and L2 pronunciation, the former influences the latter or that the relationship is reciprocal: learners with higher L2 phonological awareness develop higher accuracy in L2 pronunciation, and the increased accuracy in pronunciation leads to more *noticing* by enabling the relocation of attention to less salient features. Whichever the direction of the relationship proves to be, the finding that it is positive is interesting for its practical implications.

Theoretically speaking, the finding that L2 phonological awareness and the accuracy of L2 pronunciation are positively related is remarkable because phonological awareness has not been included as an independent variable in studies involving L2 pronunciation. For decades, SLA researchers have been trying to define why foreign language users differ in the accuracy of their pronunciation. In other words, why do some L2 speakers have a heavy foreign accent even after years of L2 experience, whereas others could pass for (near) native speakers? In an attempt to answer this question, several individual variables affecting the degree of foreign accent have been identified. Among them, amount of L2 experience, amount of L2 use, and most importantly, age of acquisition. The results obtained from the present study suggest that L2 phonological awareness should be included among the variables to be examined.

Practical applications to the finding on the positive relation between L2 phonological awareness and L2 pronunciation are extensive for language learners, researchers, teachers and language learners alike. For researchers, the creation of activities to increase phonological awareness and the comparison of gains depending on the chosen methodology would be appealing. For teachers, including phonological awareness activities as a part of the didactic plan and learning how to employ them would be of the primary interest. Finally, and perhaps most importantly, from the point of view of the language learner, learning how to increase phonological awareness would not only be reflected in improved L2 pronunciation, but it would also increase learner autonomy by providing tools on how to improve phonological awareness outside the classroom.

11.6. Limitations

The present study is subject to a number of limitations which need to be kept in mind when interpreting and generalizing the results. At least four important limitations can be identified involving the methodology of the study.

Firstly, it is important to bear in mind that the results obtained apply only to a very specific population. Namely, Brazilian university students acquiring English in a foreign language context. This population presents some specific characteristics which differentiate it from other English student populations in Brazil.

To begin with, the participants were selected on the basis of their relatively high level of proficiency in English. They also took part in the research voluntarily. Volunteering is likely to attract language learners with higher proficiency levels whereas the language learners with poorer proficiency might not feel confident enough to participate. Additionally, many of the L1 BP participants had attended private English classes and/or private schools, and quite a few of them had traveled to English speaking countries. This makes these participants different from other Brazilian English learners, such as those following the English curriculum in the public schools in which the quality and quantity of English instruction is significantly inferior. It is also possible that different results might be obtained if naturalistic second language acquisition would be examined instead, as the characteristics and the language learning environment are so different.

The second substantial limitation of the study involves the baseline data provided by the L1 AmE participants. The L1 AmE participants were recruited in Florianópolis and most of them were university students in their stay-abroad period. Use of such speakers as representative for completely monolingual behavior presents serious limitations for several reasons.

First, being in a foreign country means that the participants' contact with Brazilian Portuguese was constant, in spite of the fact that most of them lived and interacted mostly with other native English speakers. This might have affected the L1 AmE participants' behavior in two ways. On the one hand, it might have favored the bilingual processing mode (Grosjean, 1989). On the other hand, it has been shown that contact with another languages affects the L1. For example, the ability to detect foreign accents in the L1 has been shown to be affected by long-term residence abroad (Major & Baptista, 2007). Native speakers have also been shown to present a phonetic drift from their L1 even after brief exposure to L2 (Chang, 2012). These issues might negatively affect native speakers' performance in an L1 task.

Second, the type of L1 AmE participants obtained in this way is affected by the characteristics of the students who decide to leave for a study abroad period, or in the case of four participants, live abroad. It is possible that people who decide to undertake this endeavor might in general have more contact with foreign languages and have higher language learning motivation than the students who stay at home.

As recruiting L1 AmE speakers living in the US was not possible, these limitations were tried to be addressed by recruiting participants who had not stayed in Brazil for long and who did not report to be fluent in Brazilian Portuguese. Nevertheless it is likely that more reliable monolingual baseline data would have been obtained from native speakers living in a monolingual environment.

The lack of L1 AmE speakers in Florianópolis also had an effect on the *Foreign Accent Rating Task*, which might affect how the L1 BP speakers' L2 proficiency was evaluated. Due to the lack of availability of L1 AmE speakers, an L1 BP male was used to record the question prompts for the *Delayed Sentence Repetition Task* (cf. *Ch.8.4.1*, p.283). Whereas this was not judged to be a problem because the targets (answers) were pronounced by a native AmE speaker, it is true that if the L1 BP participants were able to identify that the male voice in the task was non-native, their performance might have worsened as a result of the bilingual processing mode (Grosjean, 1989).

Additionally, the shortage of L1 AmE speakers meant that two native speakers from other English varieties were included in the resulting *Foreign Accent Rating Task* with the aim of increasing task reliability (cf. *Ch.8.4.2*, p.288). As the raters' variety was General American, some of them rated the native speakers of other English varieties as non-native-like. Additionally, only 10 utterances (2x5 speakers) from native English speakers were obtained in comparison to the 142 (2x71 speakers) from L1 BP participants. It has been suggested that when the presence of native speakers is small in the sample, the foreign language learners may receive better ratings than when the portion of native speakers is larger because in the latter case the foreign accented productions stand out more (Flege & Fletcher, 1992).

What is also likely to affect the foreign accent ratings given for the L1 BP speakers is that the samples were obtained through delayed sentence repetition paradigm, which due to being highly controlled elicitation form, has been accused of providing non-representative speech from the foreign language users (Long 2005 p.289, as cited in Schmid & Hopp, 2014). Due to the reasons mentioned above, it is possible that the L1

BP participants might have been judged as more foreign accented had more native English speakers been presented to the judges and had the elicitation method been different.

Finally, the limitations involving the phonological awareness tasks need to be mentioned. While the creation of tasks for segmental awareness and prosodic awareness, and the application of lexical decision paradigm for phonotactic awareness can be considered as one of the major contributions of the study, they also present limitations.

Most importantly, these tasks were used for the first time in this research project and whereas extensive piloting was carried out, they can still be considered as rudimentary versions which need more polishing. A possible shortcoming of the *Phonological Judgment Task* and the *Low-pass Filtered Intonation Task* was that they were virtually self-paced: in the former, the participant had 20 s to give an answer and relistening of the trials was allowed, and in the latter 10 s were given to provide a response. These long response windows were adopted in order to decrease task demands in the two tasks which were already considered to put high demands on attentional resources due to their structure. If task demands are too high, the participant's performance is likely to suffer. However, it is possible that by not including a time pressure, the tasks favored the accessing of declarative, rather than proceduralized knowledge. This could mean that the responses were not as accurate as they could have been, as language learners are thought to respond more consistently when accessing proceduralized knowledge than when accessing declarative knowledge (R. Ellis, 2004, 2005). As proceduralized knowledge is accessed faster than declarative knowledge, including a time pressure in a task could increase the likelihood of the participants responding based on their proceduralized knowledge (Cho & Reinders, 2013; R. Ellis, 2004). However, the participants' self-reported source attributions during the two tasks in the present study suggests that they resorted more to intuitive, proceduralized knowledge than to knowledge of explicit rules (Cf. *Ch.10.4*, Tables 10.13 and 10.14). Further studies could examine whether the presence of a time pressure in the tasks would have an effect on the accuracy of the answers as well as on self-reported source attributions.

As testing every aspect of L2 phonological awareness is nearly impossible due to the enormity of the task, a selection needed to be made not only about the tasks to be used but also about the target areas. Within each subdomain, one target area was identified through cross-linguistic comparisons (cf. *Ch.5*). However, when one area or task type is selected, others are excluded. Because of this and due to the fact that we still know little about L2 phonological awareness, task development is an important endeavor to be undertaken by future research.

Experimentation with different tasks types is needed in order to see which task type is the most reliable and cost-effective, and how the different tasks are related to others so that new contributions can be made without overlapping. Through extensive testing and comparisons, a subset of tests would be obtained which then could be used to measure L2 phonological awareness in a very comprehensive way.

<u>*Chapter summary:*</u>

In the current chapter, the main contributions of the present research were discussed. Some important implications arose from the findings of the study. However, these must be interpreted with certain caution due to this study being the first of its kind in exploring L2 phonological awareness in the segmental, phonotactic and prosodic subdomains. Many questions about the nature of L2 phonological awareness remain.

The main finding of the study was the positive relation between L2 phonological awareness and L2 pronunciation. This finding represents an important contribution to *the field of psycholinguistics and second language speech. On the one hand, it was suggested that L2 phonological awareness would be added among other individual variables when examining the degree of foreign accent. On the other hand, should future research confirm that the three domains of L2 phonological awareness benefit from specific training, the practical applications for L2 speech learning are important.*

The present study did not find a significant relation between L2 phonological awareness and language use. While more studies need to be undertaken to either confirm or refute this finding, it was suggested that L2 input alone might not be enough for the development of L2 phonological awareness after a certain threshold. A recommendation is made to carry out future studies in order to examine whether phonetic training can increase oL2 phonological awareness. Should this be the case, especially the individuals with poor-to-average noticing abilities would vastly benefit. This is because not only would they be able to increase their L2 phonological awareness, but also because they would be likely to experience gains in the accuracy of their L2 pronunciation.

12. Conclusions

In this final chapter, the concluding remarks to the dissertation are provided. We will begin with recapitulating the methodology and the main findings of the study, and then discuss their implications for L2 speech learning. Finally suggestions for future research are given.

This dissertation investigated the understudied area of L2 phonological awareness in the segmental, phonotactic and prosodic domains. Whereas the field of language awareness has been widely studied, awareness about the L2 phonology has received little attention. Moreover, the existing studies about L2 phonological awareness have mainly focused on its explicit aspect. However, phonetically naïve language learners' verbalizable knowledge about the L2 phonology is limited. L2 learners, nevertheless, manifest sensitivity to L2 phones, phonotactics and prosody as evidenced by their ability to identify a foreign accent, perceive and produce L2 consonant clusters, and to convey different meanings through intonation, for example. Consequently, the present study set to examine the non-verbalizable aspect of L2 phonological awareness underlying the speech behavior of phonetically naïve language learners.

A set of research questions was formulated in order to examine L1 Brazilian Portuguese EFL learners' awareness of English segments, phonotactics and prosody. In addition, as little is known about L2 phonological awareness, it was deemed necessary to understand better how it is related to some individual differences such as language experience and use. Finally, due to the far-reaching practical implications, it was considered crucial to determine whether L2 phonological awareness would be related to L2 pronunciation.

So as to answer these questions, domain-specific phonological awareness tasks were created. As the first step, a potential problem area for L1 BP EFL learners was identified through a rigorous comparison of Brazilian Portuguese and General American segmental, phonotactic and prosodic inventories. For the segmental awareness, vowels and consonants which have been shown to cause perception and production problems were selected. To test phonotactic awareness, possible and impossible initial consonant clusters were examined. Finally, for prosodic awareness, the assignment of nuclear stress was chosen as the target structure.

As no suitable tasks for segmental and prosodic awareness could be identified from previous research, task development was undertaken next. For phonotactic awareness, a suitable instrument was found from psycholinguistic research in which lexical decision tasks had been employed successfully to measure phonotactic awareness through reaction times to legal and illegal consonant clusters. Consequently, phonotactic awareness in the present study was measured through a lexical decision task from which two reaction time measures were derived. First, it was observed whether the L1 BP participants would follow the pattern observed in native speakers by reacting the fastest to words, then to illegal nonwords and finally to legal nonwords. Second, a specific phonotactic awareness score was obtained as a ratio difference between the reaction times to the illegal and legal nonwords. These two measures were expected to show whether the L1 BP participants had developed English phonotactic awareness or not.

To test segmental awareness, suitable tasks could not be identified from the preceding research. Instead, a novel task was created with the aim of paralleling grammaticality judgment tasks. The resulted task, *Phonological Judgment Task*, tested the individual's ability to identify segmental pronunciation deviations from aurally presented segments. The degree to which the individual was able to detect divergence from native-like phones was taken to indicate the degree of L2 segmental awareness, and it was computed as the percentage of accurate pronunciation deviation identification.

As within the segmental domain, no suitable tasks could be identified to test L2 prosodic awareness. A novel task was created by drawing from previous research employing low-pass filtered speech. In the created task, the *Low-pass Filtered Intonation Identification Task*, individual's ability to detect inadequate intonation patterns presented in a context was taken to reflect the developed L2 prosodic awareness.

L1 Brazilian Portuguese EFL learners (*n*=71) were tested in these three phonological awareness tasks and two vocabulary size measures (X_Lex and Y_Lex). The accuracy of L2 pronunciation was evaluated by L1 AmE judges in a *Foreign Accent Rating Task* in which foreign accent samples obtained through a *Delayed Sentence Repetition paradigm* were presented. In addition, demographic, linguistic and attitudinal data was obtained from the participants through questionnaires which measured the individual differences examined in the study. Baseline data for phonological awareness was provided by 19 L1 AmE speakers who were tested on the same tasks as the language learners.

Results about the three phonological awareness domains revealed that L1 BP EFL learners' phonological awareness in the segmental and prosodic domains was very low. Phonotactic awareness, on the contrary, was found to be comparable to native AmE speakers. The three domains were found to be relatively independent with only segmental and phonotactic domain sharing a medium strong positive relation. AOL and phonological self-awareness were found to be related to segmental awareness, whereas language use was found to bear a weak positive relation to phonotactic and prosodic awareness. Quality of L2 input, knowledge of other foreign languages apart from English and L3 daily use were not found to be related to any of the three domains.

When L2 phonological awareness as a whole was examined, it was confirmed that L1 BP EFL learners' phonological awareness was significantly lower than L1 AmE speakers' awareness. This finding confirms the initial predictions that native speakers' phonological awareness is higher than non-native speakers, even if the non-native speakers have a high L2 proficiency. L2 phonological awareness was also found to be positively related to L2 proficiency, which indicates that part of the variation in EFL learners' L2 phonological awareness was due to L2 proficiency. L2 phonological awareness and phonological self-awareness were also found to bear a medium strong positive relation so that individuals who reported greater ease with making phonological judgments, also performed better overall.

Relation to language experience was found to be small, and the only language experience measure which was found to be related to L2 phonological awareness was AOL English. Language use on the contrary was found not to be related to L2 phonological awareness. As was hypothesized earlier (cf. *Ch.11.4*, p.391), this might be due to participants' low use of L2 in general, which could be confirmed or refuted by conducting studies with naturalistic language learners. It was also suggested, that regular L2 input may not be enough for the majority of the language learners for the development of L2 phonological awareness after a certain threshold is reached.

In the present study, phonetic instruction was found not to be related to L2 phonological awareness, but this finding needs to be interpreted with extreme caution, as the amount of phonetic instruction the participants had received was very small and the instruction had taken place years before the data collection. Additionally, the present study was not especially designed to test the effects of phonetic instruction on L2 phonological awareness, which is why it is crucial to conduct future studies dedicated to the creation and comparison of consciousness-raising activities.

The main finding of the study was that L2 phonological awareness was found to bear a strong positive relation to L2 pronunciation. Moreover, each of the three subdomains, segmental, phonotactic and prosodic, was found to make a unique contribution to the foreign accent ratings. Two important implications arise from this finding. On the one hand, it was suggested that in the research examining individual variation in the degree of foreign accent, L2 phonological awareness should be taken into account. On the other hand, more studies were called for in order to examine the inter-relation between L2 phonological awareness, L2 pronunciation and phonetic training, as an increase in L2 phonological awareness would most likely benefit L2 pronunciation.

To conclude, suggestions for future research are presented. Many questions about the nature of L2 phonological awareness still remain and consequently many lines of investigation can be pursued.

Task development is a necessary research line in any new field and this is also the case with L2 phonological awareness. New tasks which take into account the specific nature of L2 phonological awareness are needed in order to increase reliability of the findings. Tasks should be based on perception rather production in order to avoid the effect of motoric limitations to be confounded with poor awareness. Task structures which could be further examined include, but are not limited to: forced identification (yes/no), discrimination (ABX), priming, gating, rating and judging tasks. The suitability of measures such as brain imaging and eye-tracking, successfully used with language awareness research, and reaction times, used in the present research, should be examined in relation to L2 phonological awareness. The examination of the suitability of such measures is especially relevant for the investigation of phonological awareness based on proceduralized knowledge as they are able to tap directly in the physiological responses to stimuli and thus access the purest form of intuitive, non-verbalizable awareness. Also the role of qualitative data should not be disregarded: In the present research, self-awareness was measured through a questionnaire and was found to bear a relation to L2 phonological awareness, thus offering interesting data.

An interesting line of investigation is the comparison of L1 and L2 phonological awareness. Testing participants in their L1 and L2 might reveal us important information on whether the two share some common ground or not. To the best of my knowledge, L1 phonological awareness, defined as proceduralized knowledge about the L1 phonological system, has not been studied before, and although intuitively it seems that the variation may not be as large as in L2 phonological awareness as the awareness would be based on a stable phonological system, it is also possible that substantial variation in L1 phonological awareness could be observed. Whether this variation would be related to variation in L2 phonological awareness remains to be studied.

Studies examining other language combinations are also welcomed. The languages in the present study, Portuguese and English, were not closely related, one being a Romance and the other a Germanic language. It would be interesting to see whether higher degrees of L2 phonological awareness would be observed in speakers of languages which are more closely related such as Swedish and Danish, English and Dutch or Spanish and Portuguese, for example. Moreover, it would be beneficial to obtain more research on L2s other than English. Whereas the role of English as a lingua franca is undeniable, testing only L2 English speakers leads to the risk of generalizing findings observed in EFL leaners to involve other foreign language learners.

Examining L2 phonological awareness in language learners in contexts in which the L2 input is significantly higher, such as immersion programs and especially, naturalistic language setting, is likely to increase our knowledge about L2 phonological awareness. Most urgently, the role of L2 experience and L2 use in L2 phonological awareness should be determined more accurately. In addition, it would be interesting to see how foreign language learners and naturalistic language users would compare in terms of L2 phonological awareness. Would the results of the present study be replicated or would some differences be found?

Other individual differences which might be related to L2 phonological awareness should be studied in order to understand better how L2 phonological awareness develops. Among these variables, the role of language aptitude, attention control, working memory, phonological short-term memory and motivation could be especially interesting. By determining the relation, or the lack of relation thereof, of some of these variables, we would be one step closer to understanding how L2 phonological awareness develops and operates.

Finally, as already mentioned, determining the role of phonetic training on L2 phonological awareness is a crucial next step to take. Finding ways to increase language learner's L2 phonological awareness would be an important conquest due to its reflection on L2 pronunciation. It is important to point out that increasing L2 pronunciation does not necessarily mean sounding native-like. Native-like pronunciation is an unattainable and unnecessary goal for most of the language learners. However, in many cases, the inaccurate perception and production of the L2 results in a communication failure, a situation which is usually wanted to be avoided. Moreover, prosodic aspects of speech such as speech rate and fluency have been shown to affect how L2 speakers are perceived (cf. e.g., Flege, 1987 for a review), and being perceived as dysfluent may have a negative impact on language learner's self-esteem and willingness to communicate in the L2. Consequently, the aim of increasing L2 phonological awareness in order to improve L2 pronunciation should not be the approximation to monolingual target language speakers, but the reduction of communication obstacles standing in the way of cross-linguistic interactions.

This dissertation examined L2 phonological awareness in segmental, phonotactic and prosodic domains in L1 BP learners of English. The findings of the study suggest, on the one hand, that L2 learners possess smaller degrees of phonological awareness than native speakers. On the other hand, out of the individual differences examined, only L2 proficiency was found to be related to L2 phonological awareness, whereas the role of language experience and use remained unsettled. Most importantly, L2 phonological awareness and L2 pronunciation were found to be positively related. These findings contribute not only to our understanding of L2 phonological awareness, but also to L2 speech acquisition in general. The results suggest that the language learner's awareness about the L2 phonology should be taken into account when differences in L2 pronunciation are examined. Moreover, increasing L2 phonological awareness should be beneficial for the accuracy of L2 pronunciation. Whereas several important discoveries on the nature of L2 phonological awareness were made, many questions remain to be answered. What can be determined for sure at this point is that L2 phonological awareness has the potential to be a very promising research field in second language speech acquisition.

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APPENDIX A
Demographic and linguistic characteristics of the L1 BP participants

ID	Sex	Age	Region of birth	Major	AOL Eng	Academic Eng exp.	Native Eng exp.	Eng exp. score	L1 Use Average	L2 Use Average	Quality of L2 Input	N° of FAs	L3 Daily Use	Phonetics/Phonology Exp.	L2 Phonetics Experience Score
p01	f	22	South	English	11	16	0.5	16.5	60.0	40.0	10	0	0	y	26
p02	m	25	Southeast	English	10	16	0	16.0	82.5	17.5	22	1	0	n	16
p03	f	34	South	English	16	14	0	14.0	70.0	30.0	7	0	0	n	19
p04	f	36	Southeast	English	10	17	12.0	29.0	75.0	25.0	57	0	0	n	21
p05	m	24	South	F. sciences	13	10	12.0	22.0	92.5	7.5	15	1	0	n	17
p06	f	21	South	A. sciences	10	15	0	15.0	90.0	10.0	7	1	0	n	21
p07	f	17	South	A. sciences	6	17	0.5	17.5	92.5	7.5	6	2≤	0	n	10
p08	f	24	South	English	6	19	0	19.0	77.5	22.5	5	0	0	n	19
p09	f	26	South	N. sciences	11	18	0	18.0	92.5	7.5	26	0	0	n	20
p10	m	20	South	English	10	18	0	18.0	75.0	25.0	19	2≤	0	n	18
p11	f	24	South	N. sciences	8	17	1.0	18.0	80.0	15.0	16	1	0.29	n	17
p12	f	22	Central-West	English	12	17	0.3	17.3	82.5	17.5	8	2≤	0	n	15
p13	m	21	Southeast	A. sciences	7	20	0	20.0	70.0	30.0	5	0	0	n	20
p14	m	30	South	N/A	10	17	5.0	22.0	90.0	10.0	15	0	0	n	12
p15	f	23	South	English	10	14	60.0	74.0	77.5	22.5	16	0	0	y	19
p16	f	48	South	English	12	21	1.0	22.0	67.5	32.5	7	1	0	n	13
p17	m	25	South	English	6	16	0	16.0	82.5	17.5	9	0	0	n	21
p18	m	25	South	English	5	19	0.3	19.3	62.5	17.5	25	1	.	n	15
p19	m	21	South	S. sciences	11	16	0	16.0	90.0	10.0	5	0	0	n	18
p20	f	30	South	N/A	18	11	1.5	12.5	95.0	5.0	4	1	0	n	20
p21	f	19	South	S. sciences	6	16	6.0	22.0	77.5	22.5	16	0	0	n	11
p22	f	25	Southeast	English	12	16	0	16.0	70.0	30.0	6	0	0	n	16
p23	f	18	Southeast	S. sciences	6	21	2.5	23.5	80.0	15.0	29	2≤	0.43	n	26

ID	Sex	Age	Region of birth	Major	AOL Eng	Academic Eng exp.	Native Eng exp.	Eng exp. score	L1 Use Average	L2 Use Average	Quality of L2 Input	N° of FAs	L3 Daily Use	Phonetics/Phonology Exp.	L2 Phonetics Experience Score
p24	m	50	Southeast	N/A	11	15	0.5	15.5	90.0	10.0	5	2≤	0	n	16
p25	f	22	South	A. sciences	11	18	0	18.0	90.0	10.0	10	0	0	n	12
p26	f	20	South	N. sciences	10	20	0	20.0	90.0	10.0	5	0	0	n	22
p27	f	19	South	Hum.	4	20	0	20.0	82.5	17.5	5	1	0	n	22
p28	f	37	South	English	11	19	0	19.0	70.0	30.0	17	0	0	n	28
p29	m	22	South	English	7	22	0	22.0	77.5	17.5	20	1	0.29	n	18
p30	m	25	Northeast	English	10	22	0	22.0	87.5	12.5	17	2≤	0	n	22
p31	m	21	South	English	10	16	0	16.0	75.0	25.0	7	1	0	y	21
p32	f	25	South	English	10	18	0	18.0	67.5	32.5	19	0	0	n	20
p33	m	45	Southeast	English	11	18	1.0	19.0	80.0	20.0	6	1	0	y	22
p34	m	21	South	English	6	15	0	15.0	70.0	30.0	8	0	0	n	17
p35	m	18	South	A. sciences	9	20	0	20.0	87.5	12.5	35	1	0	n	17
p36	f	21	South	Hum.	7	19	12.0	31.0	72.5	17.5	51	2≤	4.43	n	25
p37	m	20	South	English	10	15	0	15.0	77.5	22.5	8	0	0	y	23
p38	f	21	South	N. sciences	9	15	0	15.0	90.0	10.0	15	1	0	n	24
p39	m	20	South	A. sciences	10	18	11.0	29.0	87.5	12.5	26	0	0	n	14
p40	m	21	South	A. sciences	5	18	0.5	18.5	85.0	15.0	5	1	0	n	15
p41	f	27	South	English	10	18	0.5	18.5	60.0	40.0	18	2≤	0	n	14
p42	f	22	South	English	11	17	0	17.0	60.0	37.5	8	1	0	n	19
p43	f	31	Southeast	A. sciences	10	14	0.5	14.5	90.0	10.0	62	2≤	0	n	22
p44	f	23	South	English	7	18	0	18.0	60.0	40.0	8	0	0	n	13
p45	f	26	South	English	2	29	0.3	29.3	15.0	85.0	20	1	0.43	n	27
p46	f	27	Central-West	English	4	20	5.0	25.0	45.0	47.5	59	1	0.57	n	7
p47	f	27	South	English	8	19	4.0	23.0	85.0	15.0	15	0	0	n	14
p48	f	23	South	English	9	20	2.0	22.0	82.5	15.0	16	1	0	n	18
p49	f	21	Southeast	A. sciences	11	17	0	17.0	82.5	15.0	16	1	0	n	22
p50	f	30	South	Hum.	8	18	12.0	30.0	92.5	7.5	16	0	0	n	7

ID	Sex	Age	Region of birth	Major	AOL Eng	Academic Eng exp.	Native Eng exp.	Eng exp. score	L1 Use Average	L2 Use Average	Quality of L2 Input	N° of FAs	L3 Daily Use	Phonetics/Phonology Exp.	L2 Phonetics Experience Score
p51	m	24	South	A. sciences	13	17	0	17.0	87.5	12.5	5	0	0	n	25
p52	f	31	South	English	7	18	10.5	28.5	65.0	35.0	7	1	0	n	13
p53	f	21	South	A. sciences	7	17	0	17.0	85.0	10.0	5	1	0.57	n	18
p54	f	55	Southeast	N/A	10	18	1.0	19.0	90.0	10.0	16	2≤	0	n	23
p55	m	27	South	English	12	23	0	23.0	70.0	25.0	7	1	0	n	18
p56	m	25	South	A. sciences	10	15	0	15.0	90.0	10.0	5	1	0	n	13
p57	f	20	South	A. sciences	7	14	0	14.0	82.5	17.5	27	0	0	n	22
p58	f	19	South	English	11	17	0	17.0	80.0	20.0	30	0	0	n	18
p59	f	18	South	N. sciences	5	22	0	22.0	80.0	20.0	6	1	0	n	23
p60	f	39	South	English	9	21	36.0	57.0	70.0	30.0	16	1	0	y	20
p61	m	31	South	A. sciences	11	14	0	14.0	90.0	10.0	16	0	0	n	15
p62	f	27	South	English	8	23	0	23.0	57.5	42.5	43	2≤	0	n	21
p63	f	31	South	English	12	14	0	14.0	75.0	25.0	19	0	0	y	18
p64	f	30	South	A. sciences	10	17	0.5	17.5	87.5	12.5	5	0	0	n	30
p65	f	27	South	English	12	21	36.0	57.0	27.5	70.0	19	0	0	n	15
p66	m	20	South	F. sciences	11	12	0	12.0	82.5	17.5	57	0	0	n	16
p67	f	20	Southeast	A. sciences	6	18	0.5	18.5	70.0	20.0	14	2≤	0.43	n	15
p68	f	26	South	A. sciences	10	15	4.0	19.0	82.5	12.5	6	2≤	0	n	18
p69	f	27	South	N/A	12	15	4.5	19.5	80.0	20.0	15	1	0	y	19
p70	f	26	South	N. sciences	10	19	0	19.0	92.5	10.0	16	0	0	n	24
p71	f	38	South	English	11	22	55.0	77.0	45.0	55.0	29	1	0	n	19

Key: ID= Identification, Major= English= English language, literature and translation, Hum=Humanities except language, S.sciences= social sciences, N.Sciences =natural sciences, F. sciences = formal sciences, A. sciences =applied sciences, N/A= Not a student; AOL Eng= *Age of Onset of Learning of English* (age in years); Academic Eng exp= *Academic English Experience* (time in years spent formally studying English), Native Eng exp= *Native English Experience* (length of stay in English speaking countries in months), Eng exp. score= *English Experience Score*; *L1 Use Average*= % of L1 use over 5 years; *L2 Use Average*= % of English use over 5 years; Quality of L2 Input= *Quality of L2 Input Score* (amount of interaction with L1 English speakers);N° of FAs= Number of foreign languages besides English; L3 Daily Use (hours); Phonetics/Phonology Exp= attended a class in English Phonetics and Phonology (yes/no); *L2 Phonetics Experience Score* (overall experience with English pronunciation instruction). See *Section 8.6.1* for a description of the variables.

APPENDIX B
Demographic and linguistic characteristics of the L1 AmE participants

ID	Sex	Age	Home Language	Region of birth	Occupa tion	AOL BP	Academic BP exp.	Native BP exp.	BP exp. score	L1 Use Average	L2 Use Average	N° of FAs	L3 Daily Use	ESL exp.	Phonetics/ Phonology Exp.
np01	m	29	AmE/BP	Midwest	EFL	28	1-2 y	1-2 y	9	75.0	25.0	0	0	n	n
np02	f	35	AmE/BP	Midwest	EFL	34	6-12 m	2-4 y	9	80.0	20.0	0	0	n	n
np03	m	20	AmE	South	student	20	1-6 m	0-3 m	3	85.0	15.0	0	0	n	n
np04	m	28	AmE	Midwest	other	28	0	0-3 m	2	67.5	5.0	1	2	n	n
np05	f	23	AmE	Northeast	student	23	1-6 m	0-3 m	3	87.5	12.5	2≤	0	n	n
np06	f	20	AmE	Midwest	student	20	1-6 m	3-6 m	4	50.0	50.0	2≤	0	y	n
np07	f	32	AmE	West	other	31	1-6 m	0-3 m	3	80.0	5.00	0	0	n	y
np08	f	22	AmE	West	student	22	1-6 m	3-6 m	4	77.5	22.5	1	0	n	n
np09	m	21	AmE	Northeast	student	18	1-2 y	3-6 m	6	77.5	15.0	2≤	0	n	n
np10	m	21	AmE	South	student	19	2-4 y	0-3 m	6	80.0	20.0	1	0	n	n
np11	f	19	AmE/Sp	West	student	19	1-6 m	0-3 m	3	57.5	12.5	0	3	n	n
np12	f	20	AmE/Fr	South	student	18	6-12 m	3-6 m	5	70.0	22.5	1	2	n	n
np13	m	22	AmE	Midwest	EFL	22	1-6 m	0-3 m	3	80.0	17.5	1	0	n	n
np14	f	23	AmE	South	student	23	1-6 m	0-3 m	3	82.5	17.5	1	0	n	n
np15	f	20	AmE	West	student	19	1-6 m	0-3 m	3	67.5	27.5	1	0	n	n
np16	f	18	AmE	West	student	18	1-6 m	0-3 m	3	87.5	12.5	2≤	0	n	y
np17	m	44	AmE/BP	South	student	34	1-6 m	5< y	9	75.0	25.0	1	0	n	n
np18	f	21	AmE/It	West	student	21	6-12 m	3-6 m	5	70.0	22.5	2≤	1	y	n
np19	f	20	AmE	Northeast	student	19	1-2 y	3-6 m	6	65.0	35.0	1	0	n	n

Key: ID= Identification, Home language (languages spoken regularly at home: AmE=American English, BP= Brazilian Portuguese, Sp= Spanish, Fr= French, It=Italian), AOL BP= Age of Onset of Learning of Portuguese (age in years); Academic BP exp= *Academic Portuguese Experience* (time in m[onths] or y[ears] spent formally studying BP), Native BP exp= *Native Portuguese Experience* (length of stay in Brazil in months or years), BP exp. Score= *Portuguese Experience Score*, N° of FAs= Number of foreign languages besides BP, L3 Daily Use (hours); ESL exp.= Attendance on English as a foreign language teaching course (yes/no) Phonetics/Phonology Exp= attended a class in Phonetics and Phonology (yes/no). See *Section 8.6.3* for a description of the variables.

APPENDIX C

The 45 potential words for the Phonological Judgment Task

The target sounds are underlined and/or in bold.

Ba**g**

Car

Ch**ee**se

Ch**ur**ch

C**oo**k

Dr**ea**m

Fee**l**

Gym

Ha**m**

Hi**ll**

Hu**g**

J**ea**ns

J**o**b

K**ey**s

Kill

Ki**ng**

L**ear**ned

M**o**nth

Pa**ge**

Pai**d**

Pi**gs**

P**oo**l

P**ur**se

R**a**n

Ra**re**

Ri**ch**

Ro**se**

S**a**d

Scr**ea**m

S**ee**n

St**oo**d

Str**o**ng

T**ea**ch

T**ee**th

Te**ll**

Th**in**

Thi**ng**

Th**ir**d

Thi**s**

Toes

T**o**ngue

Whee**l**

Woo**d**

Wor**d**

Y**ou**ng

APPENDIX D
Word frequency measures for the 45 potential Phonological Judgment Task test words

Target	Combined COBUILD frequency/ million words for lemmas[113]	Target	Combined COBUILD frequency/ million words for lemmas	Target	Combined COBUILD frequency/ million words for lemmas
bag	82	king	99	stayed	253
car	354	learned	312	stood	499
cheese	31	month	316	strong	212
church	183	page	98	teach	143
cook	90	paid	372	teeth	88
dream	114	pigs	43	tell	1061
feel	885	pool	46	thin	87
gym	4	purse	14	thing	1037
ham	8	ran	514	third	203
hill	119	rare	54	this	4734
hug	14	rich	139	toes	30
jeans	13	rose	215	tongue	40
job	333	sad	49	wheel	51
keys	89	scream	59	young	515
kill	213	seen	2060		

[113] The COBUILD frequency/ million words calculated for the lemmas counts frequency separately for each word class (*bag* n/ *bag* v.), however in the Phonological Judgment Task the words were presented in isolation and the participant did not know which meaning of the word was intended. Thus, in order to better describe the stimuli, the word class frequencies have been add up so that the combined COBUILD frequency/million words for *bag* is 82 (80 n. + 2 v.)

APPENDIX E
Demographic characteristics and participation of the participants in piloting

A cross indicates participation in a given task.

ID	Demographic characteristics								Task participation					
	L1	Age	Sex	Hand dominance	L2	L2 Fluency	Phonetics class	Course	Phonetic Judgment v. 2 (pen & paper)	Phonetic Judgment v.3 (final)	NID	Lexical Decision	Intonation ID	Low-pass filtered intonation ID
ns01	AmE	20	F	R	BP	No	No		X		X	X	X	
ns02*	BrE	-	M	R	-	-	-		X		X	X	X	
ns03	AmE	20	M	L	Sp	No	No		X		X		X	
ns04	AuE	28	F	R	BP	No	Yes		X		X	X	X	
ns05	AmE	51	F	R	BP	Yes	No		X		X	X	X	
ns06	AmE	34	M	R	Sp	No	No			X		X		X
p01	BP	21	F	R	Fr	No	Yes	U-i	X		X	X	X	
p02	BP	17	F	R	AmE	Yes	No	U-i	X		X	X	X	
p03	BP	32	F	R	AmE	No	No	U-i	X		X	X	X	
p04	BP	22	M	R	AmE	Yes	Yes	MA	X		X	X	X	
p05	BP	22	F	R	AmE	No	Yes	U-i	X		X	X	X	
p06	BP	17	F	R	AmE	No	No	U-i	X		X	X	X	
p07	BP	26	F	R	AmE	No	No	U-i	X		X	X	X	
p08	BP	20	F	L	AmE	No	No	U-i	X		X		X	
p09	BP	19	F	R	AmE	No	Yes	U-i	X		X	X	X	
p10	BP	18	F	R	AmE	Yes	No	U-i	X			X	X	
p11	BP	24	F	R	AmE	No	No	U-i		X	X	X		X
p12	BP	22	M	R	AmE	No	No	U-i		X	X	X		X
p13	BP	27	F	R	AmE	No	No	U-i		X	X	X		X
p14	BP	18	M	R	AmE	Yes	No	U-i		X	X	X		X
p15	BP	24	F	R	AmE	No	No	U-i		X	X	X		X

Key: L1: AmE =American English, BrE= British English, AuE= Australian English, BP= Brazilian Portuguese; L2: Sp= Spanish, Fr=French; L2 Fluency = Self-estimated fluency in the L2; Phonetics class = Attendance to a course on phonetics & phonology; Course= The course the L1 BP speakers were currently enrolled in, U-i= *Extra* Upper-intermediate level, MA= MA in English language and literature; NID = Nonword Illegality Decision, Intonation ID = Intonation Identification.

* Questionnaire data regarding ns02 was not collected by mistake.

APPENDIX F
Probability calculations for the preliminary nonword stimuli

LEGAL	Phonological neighborhood density	Sum of phoneme positional probabilities	Sum of biphone positional probabilities	ILLEGAL	Phonological neighborhood density	Sum of phoneme positional probabilities	Sum of biphone positional probabilities
/sp-/				***/sb-/**			
spɑp	10	0.1794	0.0124	sbɑp	5	0.1673	0.0021
spæd	12	0.1913	0.0106	sbæk	7	0.1813	0.0036
spæk	17	0.1933	0.0133	sbæl	2	0.1746	0.0013
spæl	11	0.1866	0.011	sbæs	2	0.1891	0.0027
spæp	7	0.1873	0.0112	sbip	5	0.1658	0.0008
spæs	10	0.2012	0.0124	sbɪd	4	0.186	0.0013
spip	9	0.1778	0.0106	mean	4.2	0.1774	0.0020
spis	13	0.1917	0.0108	***/sd-/**			
spit	16	0.231	0.0112	sdæp	3	0.1753	0.0015
spɛn	19	0.1951	0.0164	sdæt	6	0.2284	0.0022
spɛs	9	0.1985	0.0134	sdit	4	0.219	0.0025
spɛt	15	0.2378	0.012	sdɛl	8	0.1719	0.002
spɪd	15	0.1981	0.0121	sdɪn	4	0.1926	0.004
spɪp	10	0.1941	0.0136	sdɪp	5	0.182	0.0032
spɪs	12	0.2079	0.0146	mean	5	0.1949	0.0026
mean	12.3	0.1981	0.0124	***/sg-/**			
/st-/				sgɑp	4	0.1642	0.002
stɑs	6	0.2002	0.0212	sgæl	2	0.1714	0.0011
stæd	19	0.1983	0.0207	sgik	5	0.1687	0.0012
stæl	17	0.1935	0.0211	sgit	4	0.2158	0.0012
stæp	18	0.1942	0.0213	sgɛn	3	0.1799	0.0056
stæt	18	0.2474	0.022	sgɪl	6	0.1782	0.0022
stæs	13	0.2081	0.0225	mean	4	0.1797	0.0033
stik	19	0.1908	0.0196	***/dl-/**			
stis	8	0.1986	0.0192	dlɑt	7	0.2063	0.0035
stit	17	0.2379	0.0195	dlæd	5	0.165	0.0079
stɛk	15	0.1975	0.0227	dlæs	5	0.1749	0.0097
stɛl	21	0.1908	0.0211	dlik	4	0.1576	0.0039
stɛs	8	0.2054	0.0218	dlip	4	0.1515	0.0032
stɪd	25	0.205	0.0206	dlɛs	4	0.1722	0.0064
stɪn	18	0.2115	0.0229	dlɛt	3	0.2115	0.005
stɪp	18	0.201	0.022	dlɪd	4	0.1718	0.0054
stɪs	11	0.2148	0.0231	dlɪs	4	0.1816	0.008

stɪt	21	0.2541	0.0221
mean	16	0.2088	0.0214
/sk-/			
skɑd	11	0.1905	0.0103
skɑk	7	0.1925	0.011
skɑs	6	0.2003	0.0108
skæk	10	0.2003	0.0121
skæl	14	0.1936	0.0097
skæp	15	0.1943	0.0099
skæs	7	0.2082	0.0111
skik	11	0.1909	0.0091
skil	18	0.1842	0.0087
skin	15	0.1954	0.0089
skɛd	10	0.1957	0.01
skɛk	5	0.1976	0.0116
skɛl	16	0.1909	0.0099
skɛn	8	0.2021	0.0137
skɛp	8	0.1916	0.0092
skɛs	8	0.2055	0.0106
skɛt	13	0.2448	0.0092
skɪk	13	0.2071	0.0122
skɪs	12	0.2149	0.0123
mean	10.9	0.2000	0.0105
/sl-/			
slɑd	15	0.2077	0.0073
slɑk	17	0.2097	0.008
slæd	20	0.2156	0.012
slæl	9	0.2109	0.0124
slæs	18	0.2254	0.0137
slid	22	0.2061	0.0083
slin	17	0.2126	0.0077
slis	13	0.216	0.0076
slɛk	9	0.2149	0.0114
slɛl	8	0.2082	0.0098
slɛn	6	0.2194	0.0136
slɛs	7	0.2227	0.0105
slɛt	13	0.262	0.0091
slɪl	12	0.2176	0.0107
slɪn	13	0.2289	0.0119

mean	4.4	0.1769	0.0059
*/tl-/			
tlæd	5	0.1577	0.0079
tlæs	6	0.1675	0.0097
tlik	6	0.1502	0.0039
tlin	5	0.1548	0.0036
tlɛn	3	0.1615	0.0095
tlɛs	5	0.1648	0.0064
tlɪk	8	0.1665	0.0079
mean	5.4	0.1604	0.0070
*/bz-/			
bzɑs	2	0.1228	0.0018
bzæp	1	0.1168	0.0012
bzik	2	0.1134	0.0014
bzɛk	2	0.1202	0.0032
bzɛn	3	0.1247	0.0054
bzɪs	2	0.1375	0.0036
mean	2	0.1226	0.0031
*/sɹ-/			
sɹæn	9	0.2687	0.0176
sɹis	7	0.2626	0.0088
sɹit	9	0.3019	0.0092
sɹɪk	11	0.2709	0.0167
mean	9	0.2760	0.0131
*/zbl-/			
zblæn	1	0.1766	0.0063
zblit	0	0.2073	0.0076
zblɪk	0	0.1711	0.0154
zblɪs	1	0.1882	0.0097
mean	0.5	0.1858	0.0098
*/zbɹ-/			
zbɹæd	1	0.1391	0.0028
zbɹin	0	0.2077	0.0097
zbɹɛt	1	0.1954	0.0047
zbɹɪk	2	0.1758	0.0134
zbɹɪl	1	0.183	0.0072
mean	1	0.1802	0.0076
*/zgɹ-/			
zgɹɑp	0	0.1231	0.0026

mean	13.3	0.2185	0.0103
/sm-/			
smɑp	7	0.1782	0.004
smɑs	2	0.1921	0.0038
smæd	4	0.1902	0.0032
smæl	7	0.1855	0.0036
smæn	9	0.1967	0.0097
smæp	6	0.1861	0.0038
smæs	6	0.2	0.005
smæt	13	0.2393	0.0045
smid	8	0.1807	0.0037
smik	10	0.1827	0.0034
smin	6	0.1872	0.0031
smis	4	0.1905	0.003
smit	9	0.2298	0.0033
smɛd	7	0.1875	0.0044
smɛn	5	0.194	0.0081
smɛs	2	0.1973	0.0051
smɛt	8	0.2366	0.0037
smɪk	12	0.1989	0.006
smɪl	13	0.1922	0.0047
smɪn	7	0.2034	0.0059
mean	7.3	0.1974	0.0046
/ʃɹ-/			
ʃɹɑk	10	0.1636	0.0102
ʃɹɑp	4	0.1576	0.0101
ʃɹɑs	5	0.1714	0.0099
ʃɹɑt	3	0.2107	0.0098
ʃɹæk	7	0.1715	0.0149
ʃɹæl	2	0.1648	0.0125
ʃɹæn	7	0.176	0.0186
ʃɹæt	2	0.2186	0.0134
ʃɹin	8	0.1665	0.0099
ʃɹip	5	0.156	0.0095
ʃɹis	7	0.1699	0.0098
ʃɹit	7	0.2092	0.0102
ʃɹel	4	0.1621	0.01
ʃɹɪd	6	0.1763	0.0152
ʃɹɪk	11	0.1782	0.0177
ʃɹɪn	6	0.1828	0.0176
zgɹæk	0	0.1409	0.0042
zgɹæl	0	0.148	0.0053
zgɹis	1	0.1843	0.0086
zgɹɪd	1	0.1678	0.0065
mean	0.4	0.1528	0.0054
***/stl-/**			
stlɑk	1	0.2586	0.0207
stlæk	3	0.258	0.0214
stlæt	3	0.2997	0.0211
stlɛd	2	0.2629	0.021
stlɛn	0	0.3051	0.027
stlɪd	1	0.285	0.0255
mean	1.7	0.2782	0.0228

ʃɹɪt	6	0.2254	0.0168
ʃɹet	6	0.2159	0.0093
mean	5.9	0.1820	0.0125
/θɹ-/			
θɹɑp	4	0.1547	0.011
θɹɑs	8	0.1685	0.0108
θɹɑt	5	0.2078	0.0107
θɹæk	5	0.1686	0.0157
θɹæl	3	0.1619	0.0134
θɹæp	5	0.1625	0.0135
θɹæt	6	0.2157	0.0142
θɹid	8	0.1571	0.0114
θɹik	7	0.1591	0.011
θɹil	6	0.1524	0.0106
θɹin	7	0.1636	0.0108
θɹip	4	0.1531	0.0104
θɹɛk	7	0.1659	0.0125
θɹɛl	5	0.1592	0.0109
θɹɛn	6	0.1704	0.0147
θɹɛp	5	0.1598	0.0102
θɹɪn	6	0.1798	0.0184
θɹɪk	8	0.1753	0.0185
θɹɪs	7	0.1832	0.0186
θɹɪt	7	0.2225	0.0176
mean	6.0	0.1721	0.0132
/spl-/			
splɑd	1	0.2468	0.0127
splɑn	5	0.289	0.0147
splæn	5	0.2885	0.0163
splid	4	0.2726	0.0177
splik	3	0.2775	0.0174
splip	2	0.2592	0.0169
splis	2	0.2946	0.0174
split	5	0.3192	0.0175
splɛd	4	0.256	0.0136
splɛk	1	0.2609	0.0166
splɛn	1	0.2982	0.0196
splɛp	0	0.2425	0.0147
splɛt	2	0.3026	0.0155
splɪk	3	0.283	0.0253

splɪn	4	0.3203	0.0198
splɪs	5	0.3	0.0197
mean	2.9	0.2806	0.0172
/spɹ-/			
spɹɑd	4	0.2515	0.0138
spɹɑn	2	0.2938	0.0158
spɹɑk	0	0.2564	0.0144
spɹɑs	1	0.2735	0.0141
spɹæd	3	0.251	0.0141
spɹæn	3	0.2932	0.0174
spɹid	5	0.2773	0.0199
spɹik	4	0.2822	0.0196
spɹin	6	0.3195	0.021
spɹip	3	0.2639	0.0191
spɹis	4	0.2993	0.0196
spɹɛk	2	0.2656	0.0171
spɹɛn	2	0.3029	0.0201
spɹɛp	3	0.2472	0.0152
spɹɛt	4	0.3073	0.016
spɹɪk	4	0.2877	0.0247
spɹɪl	4	0.2948	0.0185
mean	3.2	0.2804	0.0177
/skɹ-/			
skɹɑn	2	0.3008	0.0138
skɹɑp	5	0.2451	0.0116
skɹɑs	2	0.2805	0.0122
skɹæd	4	0.258	0.0121
skɹæk	4	0.2629	0.0132
skɹæl	4	0.27	0.0143
skɹik	6	0.2892	0.0177
skɹip	8	0.2709	0.0171
skɹis	4	0.3063	0.0176
skrit	8	0.3309	0.0178
skɹɛn	1	0.3099	0.0182
skɹɛp	4	0.2542	0.0132
skɹɪd	7	0.2898	0.0155
skɹɪn	4	0.332	0.0172
skɹɪs	3	0.3118	0.0171
mean	4.4	0.2875	0.0152

/stɹ-/			
stɹɑd	7	0.2584	0.0256
stɹɑk	8	0.2633	0.0262
stɹɑs	3	0.2804	0.0259
stɹæk	8	0.2628	0.027
stɹæn	6	0.3001	0.0293
stɹæt	9	0.3045	0.0267
stɹid	11	0.2842	0.0318
stɹin	10	0.3265	0.0329
stɹis	8	0.3062	0.0314
stɹɛd	11	0.2676	0.026
stɹɛk	11	0.2725	0.0289
stɹɪd	8	0.2897	0.0292
stɹɪl	6	0.3018	0.0303
stɹɪn	7	0.3319	0.0309
stɹɪs	6	0.3117	0.0308
mean	7.9	0.2908	0.0289

APPENDIX G
Independent samples t-tests for the preliminary set of nonword stimuli

Measure	CC legal – CC illegal					CCC legal – CCC illegal				
	CC legal (*n*=124)		CC illegal (*n*=44)		t-test	CCC legal (*n*=63)		CCC illegal (*n*=20)		t-test
	M	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	
Phonological neighborhood density	9.94	5.06	4.66	2.18	$t(159)=9.4$, $p<.001$	4.54	2.71	0.95	.94	$t(80)=9.93$, $p<.001$
Sum of phoneme positional probabilities	.1956	.02	.1787	0.04	$t(53)=2.623$, $p=.011$	.2849	.02	.2038	.05	$t(21)=6.35$, $p<.001$
Sum of biphone positional probabilities	.0119	.005	.0048	.003	$t(166)=8.396$, $p<.001$	.0196	.005	.0120	.007	$t(25)=3.93$, $p=.001$

APPENDIX H
Prosodic awareness piloting results comparing the two task versions

	Task version				
Stimulus type	**Normal version (*n*=10)**		**Low-pass filtered version (*n*=5)**		**Mann-Whitney**
	M	***SD***	***M***	***SD***	
Unaccusative 'yes'	67.05	26.48	61.17	15.30	*Z*= -.555; *p*=.579
Deaccented 'yes'	86.00	12.20	84.00	10.83	*Z*= -.371; p=.711
Unaccusative 'no'	40.00	22.63	30.00	5.90	*Z*= -.990; *p*=.322
Deaccented 'no'	68.18	18.05	46.36	13.00	*Z*= -2.090; *p*=.037*
Control transitive	88.00	16.86	84.00	8.90	*Z*= -.804; *p*=.421

APPENDIX I
Linguistic background questionnaire for the L1 BP participants

The actual questionnaire was filled out electronically and its outlay slightly differs from the one presented here.

* Required

Personal information

1. Full name *
first name, last name

2. Email *

3. Contact telephone number

4. Place of birth *
city,country

5. Age *

6. Place of residence *

7. Occupation *

7.b.If you are a full-time student, what are you studying?
Answer only if you are a student

8. Which is your dominant hand? *

- ◯ Left
- ◯ Right

9. Have you been diagnosed with any kind of hearing problem? *

- ◯ Yes
- ◯ No

Language information

10. First language *

11. What language(s) do you speak at home? *

12. Were both of your parents born and raised in Brazil? *

- ◯ Yes
- ◯ No

12b. If no, where were your parents born and raised?

Answer only if you said "no" to the previous question.

13. Other languages (in order of proficiency) *

14. I consider myself fluent in the following languages *

(select as many as needed)

- [ ] Portuguese
- [ ] English
- [ ] Spanish
- [ ] French
- [ ] Other

English experience

15. How old were you when you started studying English for the first time? *

Either at school, language academy, at home or abroad

16. How many years have you studied English in.....? *

	0	1	2	3	4	5	5+
Pre-school	○	○	○	○	○	○	○
Obligatory education (ensino fundamental)	○	○	○	○	○	○	○
High school (ensino médio)	○	○	○	○	○	○	○
Language schools or private classes	○	○	○	○	○	○	○
University	○	○	○	○	○	○	○

17. Are you currently studying English? *

- ○ Yes
- ○ No

17b. If yes, where and what level?

Answer only if you said "yes" to the previous question

- ○ UFSC, English undergraduate program 2nd year
- ○ UFSC, English undergraduate program 3rd year
- ○ UFSC, English undergraduate program 4th year
- ○ UFSC, MA in English
- ○ UFSC, PhD in English
- ○ UFSC, Extra language classes level 7
- ○ UFSC, Extra language classes level 8
- ○ UFSC, Extra language classes advanced

○ UFSC, Extra language classes TOEFL
○ Other

18.In all the English classes you have attended, what % of the teachers were native speakers of English and what % were non-native speakers ? *
native speaker of English= teacher whose first language is English; non-native speaker of English = teacher whose first language is Portuguese or any other except English. Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Native English teachers	○	○	○	○	○	○	○	○	○	○	○
Non-native teachers (either Brazilian or other)	○	○	○	○	○	○	○	○	○	○	○

19. Estimate your English proficiency in the following skills: *

	Native-like	Advanced	Upper-intermediate	Intermediate	Basic
Speaking	○	○	○	○	○
Writing	○	○	○	○	○
Listening	○	○	○	○	○
Reading	○	○	○	○	○

20. Have you taken any English proficiency tests? *
e.g. at the university: to access an undergraduate/graduate program/language course, TOEFL, Cambridge PET/FCE/CAE/CPE.

○ Yes
○ No

20b. If yes, which test and what is the highest level you obtained?
Answer only if you said "yes" to the previous question

21. Have you ever been to an English speaking country? *

○ Yes
○ No

21b. If yes, where, when and for how long?
Answer only if you said "yes" to the previous question.

22. Which variety of English are you the most familiar with? *
Through TV/movies/friends/classes

- American
- British
- Australian
- Other
- I don't know

23. In all the English classes you have attended, how often were you taught pronunciation? *

- In every class
- In most of the classes
- In some of the classes
- Rarely
- Never

23b. If you have been taught English pronunciation, what aspects were taught and how often?

	Very often	Often	Sometimes	Rarely	Never
Rhythm and intonation	○	○	○	○	○
How a certain word is pronounced	○	○	○	○	○
Correspondence between letters and sounds	○	○	○	○	○
How to use your mouth to produce a certain sound	○	○	○	○	○
Differences between English and Portuguese sounds	○	○	○	○	○

24. Have you ever attended a specialized course on English pronunciation? *
At the university/language schools etc.

- Yes
- No

24b. If yes, what was the name of the course, where, and for how long?
Answer only if you said "yes" to the previous question.

25. Which variety of English do you use as the model for your pronunciation? *

- American
- British
- Australian
- Other
- I don't know

English language use

26. On a daily basis, how many hours do you speak English in the following contexts *

	0h	1-2h	2-4h	4-6h	6+ h
University	○	○	○	○	○
Work	○	○	○	○	○
Friends/Socializing	○	○	○	○	○
At home	○	○	○	○	○

27. With whom do you normally speak in English in the following contexts: *
native speaker of English= a person whose 1st language is English, a non-native speaker of English= a person whose first language is Portuguese or any other language apart from English

	Only native speakers of English	Mainly native speakers of English	50% native speakers and 50% of non-native speakers	Mainly non-native speakers of English	Only non-native speakers of English	I don't speak English in this context
University	○	○	○	○	○	○
Work	○	○	○	○	○	○
Friends/Socializing	○	○	○	○	○	○

Home						

28. In the last 5 DAYS, how much of the time (in %) did you speak in English and in Portuguese? *

Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English											
Portuguese											
(Other language)											

29. In the last 5 WEEKS, how much of the time (in %) did you speak in English and in Portuguese? *

Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English											
Portuguese											
(Other language)											

30. In the last 5 MONTHS, how much of the time (in %) did you speak in English and in Portuguese? *

Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English											
Portuguese											
(Other language)											

31. In the last 5 YEARS, how much of the time (in %) did you speak in English and in Portuguese? *

Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English											
Portuguese											
(Other language)											

Portuguese language use

32. On a daily basis, how many hours do you speak Portuguese in the following contexts *

	0h	1-2h	2-4h	4-6h	6+ h
University	○	○	○	○	○
Work	○	○	○	○	○
Friends/Socializing	○	○	○	○	○
At home	○	○	○	○	○

Other language use

33. Do you use any other languages besides English/Portuguese on a daily basis? *

○ Yes

○ No

33b. If yes, what language(s), how often and in what situations?

Answer only if you said "yes" to the previous question.

Comments, questions or additions

If you have any other comments or additions to the questions, please write them here.

Add the question number you are making reference to

APPENDIX J
Linguistic background questionnaire for L1 AmE speakers

The actual questionnaire was filled out electronically and its outlay slightly differs from the one presented here.

* Required

Personal information

1. Full name *
first name, last name

2. Email *

3. Age *

4. Place of birth *
city,country

5. Place of residence *
city, state

6. Highest educational degree obtained *

7. Occupation *

7.b.If you are a full-time student, what are you studying?
Answer only if you are a student

8. Which is your dominant hand? *

- Left
- Right

9. Have you been diagnosed with any kind of hearing problem? *

- Yes
- No

Language information

10. First language *

11. What language(s) do you speak at home? *

12. Were both of your parents born and raised in North America? *

- Yes
- No

12b. If no, where were your parents born and raised?
Answer only if you said "no" to the previous question.

13. Were any other languages than English spoken at your childhood home? *

- Yes
- No

13b. If yes, what languages and by whom?
Answer only if you said "yes" to the previous question.

14. Other languages (in order of proficiency) *

15. I consider myself fluent in the following languages *
(select as many as needed)

- [ ] English
- [ ] Portuguese
- [ ] Spanish
- [ ] French
- [ ] Other

16. Have you ever attended a specialized course on linguistics or teaching English? *

- ◯ Yes
- ◯ No

16b. If yes, what was the name of the course, where, and for how long?
Answer only if you said "yes" to the previous question.

17. Have you ever attended a specialized course on phonetics/phonology/ pronunciation? *
At the university/language schools etc.

- ◯ Yes
- ◯ No

17b. If yes, what was the name of the course, where, and for how long?
Answer only if you said "yes" to the previous question.

Portuguese experience and language use

18. How old were you when you started studying Portuguese for the first time? *
Either at school, language academy, at home or abroad

19. How long have you studied Portuguese? *

- ◯ I have never formally studied Portuguese
- ◯ Less than 6 months
- ◯ 6-12 months

- ◯ 1-2 years
- ◯ 2-4 years
- ◯ more than 5 years

20. How long have you been in Brazil? *

- ◯ Less than 3 months
- ◯ 3-6 months
- ◯ 6-9 months
- ◯ 9-12 months
- ◯ 1-2 years
- ◯ 2-4 years
- ◯ more than 5 years

21. Estimate your Portuguese proficiency in the following skills: *

Select one option/line

	Native-like	Advanced	Upper-intermediate	Intermediate	Basic
Speaking	◯	◯	◯	◯	◯
Writing	◯	◯	◯	◯	◯
Listening	◯	◯	◯	◯	◯
Reading	◯	◯	◯	◯	◯

22. On a daily basis, how many hours do you speak Portuguese in the following contexts *

Select one option/line

	0h	1-2h	2-4h	4-6h	6+ h
University	◯	◯	◯	◯	◯
Work	◯	◯	◯	◯	◯
Friends/Socializing	◯	◯	◯	◯	◯
At home	◯	◯	◯	◯	◯

English language use

23. In the last 5 DAYS, how much of the time (in %) did you speak in English and in Portuguese? *

Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Portuguese	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

(Other language)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

24. In the last 5 WEEKS, how much of the time (in %) did you speak in English and in Portuguese? *
Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Portuguese	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(Other language)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

25. In the last 5 MONTHS, how much of the time (in %) did you speak in English and in Portuguese? *
Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Portuguese	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(Other language)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

26. In the last 5 YEARS, how much of the time (in %) did you speak in English and in Portuguese? *
Total =100%

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Portuguese	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(Other language)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Other language use

27. Have you studied any other foreign languages beside Portuguese? *

◯ Yes

◯ No

27b. If yes, what language(s), how old were you and for how long?
Answer only if you said "yes" to the previous question.

28. Do you currently use any other languages besides English/Portuguese on a daily basis? *

- Yes
- No

28b. If yes, what language(s), how often and in what situations?
Answer only if you said "yes" to the previous question.

Phonological awareness

Give your opinion on the following statements

29. Give your opinion on the following statements *
Select one option/line

	Strongly agree	Agree	Somewhat agree	Disagree	Strongly disagree
There are some English sounds that are difficult for Brazilians	○	○	○	○	○
There are some specific features in English intonation and rhythm that are difficult for Brazilians	○	○	○	○	○
Brazilians have a characteristic accent when they speak in English	○	○	○	○	○

30. How easy it is for you to.... *
Select one option/line

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
Notice pronunciation mistakes in the production of INDIVIDUAL SOUNDS in foreigners' speech when they speak in English?	○	○	○	○	○
notice pronunciation mistakes in the INTONATION and RHYTHM in foreigners' speech when they speak in English?	○	○	○	○	○

31. How easy it is for you to.... *
Select one option/line

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
tell where a NATIVE speaker of English comes from based on their accent?	○	○	○	○	○
tell whether a NON-NATIVE speaker of English is Brazilian based on their English accent?	○	○	○	○	○
tell where a NON-NATIVE speaker of English (other than Brazilian) comes from based on their English accent?	○	○	○	○	○

32. How easy it is for you to.... *
Select one option/line

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
NOTICE whether a sound combination you	○	○	○	○	○

hear is possible in English or not?					
NOTICE whether the intonation and rhythm you hear in an English sentence are possible or not?	◯	◯	◯	◯	◯
NOTICE whether an individual sound you hear is pronounced correctly in English or not?	◯	◯	◯	◯	◯

33. How easy it is for you to.... *
Select one option/line

	Very easy	Quite easy	Quite difficult	Very difficult	I can't do this at all
EXPLAIN why a sound combination you hear is possible or impossible in English?	◯	◯	◯	◯	◯
EXPLAIN why the intonation and rhythm you hear are correct or incorrect in English?	◯	◯	◯	◯	◯
EXPLAIN why an individual sound you hear isn't pronounced correctly in English?	◯	◯	◯	◯	◯

Comments, questions or additions

If you have any other comments or additions to the questions, please write them here.
Add the question number you are making reference to

APPENDIX K
Consent form for the L1 BP participants

CONSENT FORM

You have been invited to participate in a data collection for PhD thesis "Phonological Awareness and Pronunciation in a Second Language". Your participation will help researchers to understand better the relationship between phonological awareness and pronunciation in a second language. You have been selected as a possible participant because you are an intermediate to advanced Brazilian learner of English. Please read this form carefully and ask any questions you may have before agreeing to participate in the study.

This study is being conducted by **Hanna Kivistö-de Souza**, a PhD candidate from the University of Barcelona under the supervision of Prof. Joan Carles Mora.

Purpose of the study

This study aims to understand better the difficulties Brazilian learners of English have when learning English pronunciation and the possible relations between pronunciation proficiency and phonological awareness.

Procedures

You will be tested individually in a quiet room. The overall duration of the testing session is about 60-90 minutes, including short breaks. If you agree to participate, you will do the following things:

- English language sample (~5min)
You will read a text in English and repeat sentences you hear through headphones. The researcher will record your productions.

- Lexical decision task (~10min).
You will listen to words and non-words and decide whether what you heard was a word or not in English.

- Prosodic awareness task (~15min)
You will hear English sentences and decide whether they were spoken in adequate intonation or not.

- Segmental awareness task (~15min)
You will hear parts of English words and decide whether they were pronounced correctly in English or not.

- Vocabulary size measure I: X_lex (~3min)

You will be presented with English words and non-words and decide whether what you saw was a word or not in English.

- Vocabulary size measure II: Y_lex (3min)
The same as before, but with more advanced vocabulary.

- Questionnaire (~10min)
You will fill in a brief questionnaire regarding the contents of the tasks and your opinions about pronunciation and language learning.

Confidentiality

You will be assigned a subject number and all the future references to your data will be through this number. Your personal information (name, email, phone number etc.) will **under no circumstances** be disclosed to third parties. Apart from the PhD thesis, your data may be used in related articles or conference presentations, always maintaining the confidentiality.

Compensation

You will receive R$20 and a certificate of participating in research (5h) which will be given to you at the end of your data collection session. If you withdraw from the study before its completion, you will receive a 1h certificate as a compensation for your time. In case you reject the compensation or a part of it, you are asked to sign a document to confirm that.

Voluntary nature of the study

Your participation in this study is voluntary. You can decide to interrupt your participation at any moment. Leaving the study will not suppose any penalty or loss of benefits.

Contact for questions or problems

For any questions or problems you can contact the main researcher, Hanna Kivistö- de Souza by email at datacollection.ufsc.2013@gmail.com.

By signing, you show that you have read and understood the information presented in this form and agree to take part in the research project.

Date and place

Signature

Clarification of signature