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L1 and L2 language processing in written production and perception:

Null object arguments in English, Portuguese, and Spanish

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Abstract

This thesis studies the processing of null objects in the L2 English of two groups with a similar L1 background, Brazilian Portuguese and European Spanish native speakers. Previous research (Alamillo, 2009; Sainzmaza-Lecanda & Schwenter, 2017) reported similarities and contrasts in the two languages regarding null object expression. However, research on null objects lacks a fuller perspective that considers both production and perception processes, on the one hand; and more studies in L2 English, on the other. Especially considering the languages above.

The present study focuses on both language production and perception of null objects, by assessing null object expressions, pauses and revisions in production; and acceptability and reaction times in perception. To do so, 40 participants (*23 L1 Brazilian Portuguese and 17 L1 European Spanish speakers*) were recruited online, and two elicitation tasks were designed. The data was analyzed for differences between the groups in both their L1 and L2. The results indicated that the L1 Portuguese and the L1 Spanish speakers exhibit a somewhat different processing of null objects in L2 English. Overall, the L1 Portuguese speakers displayed processing difficulties in both tasks, whereas the L1 Spanish speakers showed more difficulties in perception. Despite these differences, both groups presented similarities in the number of pauses, revisions and characters during the production of null objects as well as in the acceptability rate of grammatical null objects in English.

When compared with models of written production and perception, both groups spent more time in the translating and reviewing steps of written production. In perception, the L1 Spanish speakers processed English null objects more native-like than the L1 Portuguese speakers.

Keywords: L2 sentence processing, transfer, cross-linguistic influence, null object, clitic pronoun, writing production, language perception, keystroke logging.

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Rocío

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Abbreviations

∅ Omitted element

1 First person

3 Third person

BP Brazilian Portuguese

IFM Infinitive marker

INF Infinitive

IPFV Imperfective

L1 First or native language

L2 Second language, as any language learned after the first, which includes second, third, fourth language, etc.

NO/s Null Object(s)

PST Past

Q Question marker

REFL Reflexive

RT/s Reaction time(s)

SG Singular

SP European Spanish

Chapter 1 Introduction

Null objects, as Isingoma (2020) describes them, are "object arguments that are specified in the lexical entries of given verbs but may be left unexpressed in a sentence without rendering it ungrammatical" (p.19). Therefore, null objects constitute a different way of expressing object arguments. To better illustrate what a null object is, let us look at the following example where an object argument is realized as overt and as implicit (*null*), respectively: *I am reading a book* vs. *I am reading*. Despite the two different realizations, the two sentences are acceptable in certain languages. We understand that something is being read in both sentences, although we cannot say exactly what in the second one, given the little context that we have.

In addition, null objects have been the focus of study for some time (Cyrino & Matos, 2016; Farrel, 1990; Fillmore, 1986; Huang, 1984; Isingoma, 2020; Ruda, 2014; among others). Previous studies have reported syntactic and semantic differences in null object parameters (Isingoma, 2020; Rothman & Iverson, 2013; Zyzik, 2008, among others). From these studies, we further understand that null objects are processed differently depending on the first/native language (hereafter L1), and that the processing of null objects in a second language (hereafter L2[1]) will depend on the parameters in the L2 learner's L1. The present study aims to investigate how null objects are processed in both the perception and production of L1 Spanish and Portuguese speakers in both their L1 (Portuguese or Spanish) and L2 English.

Most previous studies have focused on the written perception or spoken production of null objects, primarily in L1 and/or on children acquisition (e.g., Varlokosta, et al., 2016). This not only disregards what acquisition might look like in written production but also in adult L2 acquisition. One exception to these studies is Isingoma's (2020) typological comparison of indefinite null objects in English and Rutooro. This study identifies several factors that favor the occurrence of null objects in these languages, such as the markers of aspect and tense, among others. However, the most relevant finding was that the syntactic structure of verbs in both English and Rutooro is

[1] For clarification purposes, when I talk about L2 languages in this project, I am referring to any language learned after the first, which includes second, third, fourth language, etc.

identical regarding grammatical relations. Therefore, this study demonstrated that the syntactic differences between languages in null objects lie on the syntactic components that the language permits, which ultimately influence the arguments that verbs allow. Thus, although null objects can occur in multiple languages, they differ in type, frequency, and constraints between languages.

Moreover, a more complete scope of the processing of null objects can be offered by studying the structure in different modalities. That is why the present study focuses on both L1 and L2 written production and perception. To collect data and analyze the perception and writing processes of an L2 learner, previous studies have highlighted the use of keystroke logging (e.g., Spelman Miller, 2006, 2008) and reaction time software (e.g., Clahsen & Hong, 1995). These methods can offer an insight into how writing and perception may differ between L1 and L2, with a particular focus on language transfer or interference (Ortega, 2013; Smith, 1986; Weinreich, 1968).

To sum up, null objects have been widely researched (cf. Cyrino & Matos, 2016; Farrel, 1990; Fillmore, 1986; among others). The objective is to continue this work and enrich previous research with a more comprehensive overview of the L2 processing of null objects. This overview considers null objects in both written production and perception, while it also examines Brazilian Portuguese[2] and European Spanish[3] as L1s and English as L2. The novelty of this study therefore stems from both the research method used, which focuses on both production and perception, and the research data presented in these three languages. Considering all the above, this paper attempts at answering the following research questions:

RQ1: Is there an L1 interference for Spanish and Portuguese native speakers in the resolution of null object arguments in their L2 English?

RQ1.1: If so, is the interference present in both perception and written production?

[2] In the present study, the variety of Brazilian Portuguese is investigated. However, I will refer to it as 'Portuguese' from now on unless I am discussing differences between certain varieties of Portuguese.

[3] The variety of Spanish studied here is European Spanish, which I will refer to as 'Spanish' from now on, unless typological differences between other varieties of Spanish are discussed.

RQ1.1.1: If the interference is present in perception, can it be measured in terms of acceptability and reaction times in perception?

RQ1.1.2: If the interference is present in production, can it be measured through the analysis of pauses, revisions, and object expression?

RQ2: How do these results differ between Spanish and Portuguese native speakers in terms of L1 interference and processing null objects?

The above research questions will be addressed through a psycholinguistic experiment. The remainder of this thesis is structured as follows: Chapter 2 Theoretical background, Chapter 3 Current study, Chapter 4 Methodology, Chapter 5 Results, Chapter 6 Discussion and Chapter 7 Conclusions.

Chapter 2 Theoretical background

This chapter presents the theoretical framework and previous studies relevant to this research. It is divided into *Language processing: overview*, *L2 and transfer*, and *Null objects*.

2.1 Language processing: overview

There are several steps that we humans go through to express ourselves and to understand what we read or hear, that is, to process all the linguistic information that is available to us. Two main perspectives of language processing are language perception (listening and reading) and language production (speaking[4] and writing).

Language production refers to the processes involved in generating, planning, constructing, and uttering language (Carroll, 2008). There are two ways in which we can produce language: speaking and writing. However, most research in language production has focused on spoken production (e.g., Justeson, 1976; Bock, 1996). The general view of language production considered written language as a reflection of spoken language (Bloomfield, 1933), which led to the research of written production being neglected until the 1970s, when it started to increase (e.g., Perl, 1979; Raimes, 1985).

Language perception or comprehension, on the other hand, studies the processes involved in how we perceive and understand language, both spoken and written (Carroll, 2008). Overall, most research has focused on perception (Bock, 1996). This is due to the difficulty of controlling experimental conditions (Foss & Hakes, 1978, as cited in Bock, 1996) and of conducting experiments in language production (Carroll, 2008).

Therefore, examining both production and perception would provide more insight into what someone finds acceptable in language, as people may, for example, perceive expressions as valid even though they would not use them themselves and vice versa.

[4] Another way to produce language is also sign language.

2.1.1 Language processing in production

L1 production

In the past decades, several models of language production and perception have been proposed. Some influential models of spoken production were Levelt's (1989, as cited in De Bot, 2000) and Fromkin's (1971), which consider the steps involved in processing and producing spoken utterances, while accounting for speech errors and self-repair. These models identify three structures: a conceptualizer, a formulator and an articulator. The conceptualizer generates the message we wish to convey. The formulator encodes the message using the syntactic, lexical, and grammatical information available to us. Lastly, the articulator accesses the acoustic representation of the message and sends it to our motor muscles to articulate it. However, what is problematic about these models is that they do not consider more than one language. That is, they only explain how the speaking process occurs in the mind of a monolingual speaker who masters and uses one language.

As for written production, writing differs from speaking in that it is less spontaneous. There is more time to plan, translate, and review. These are the three main processes that Flower and Hayes (1980) identify in writing. The way they function is as follows: during *planning,* writing goals are set and a plan for producing the text according to these goals is made. In *translating,* the text is produced according to the plan already set. Lastly, in *reviewing,* what is written is read and edited. In addition to these processes, these authors (1980) also point out the important role of long-term memory [5] in writing and they establish three components in the writing process: *the task environment, long-term memory,* and *the writing process* (see Figure 1 below for a general overview of the process). What is important about these components is that they can occur simultaneously. That is, the writing process is not linear. Instead, these components trigger and interact with one another leaving "traces in the form of pauses, insertions, deletions and

[5] Kellogg (2008) also establishes the cognitive overload in the writing process and the access to information whether in long or short-term working memory.

movements" (Spelman Miller et al., 2008, p. 435). This is due to the fact that the writer has many aspects to consider during the task at hand, which becomes particularly important in L2 production.

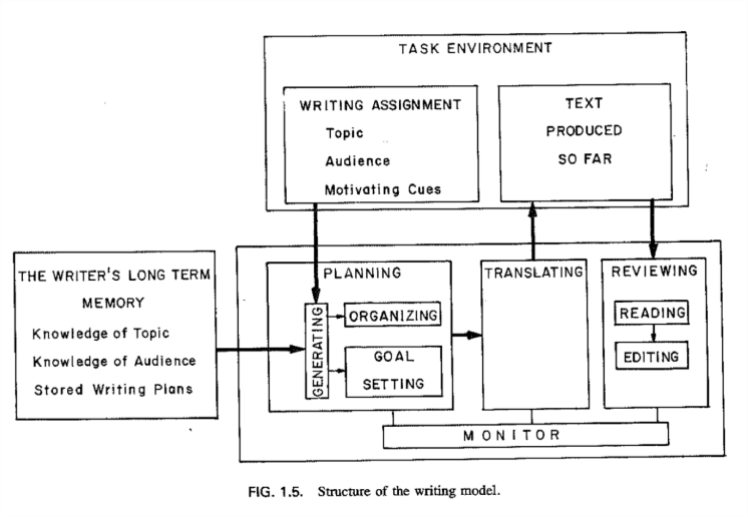

FIG. 1.5. Structure of the writing model.

Figure 1. Processes in Flower and Hayes's (1980) model of written production.

L2 production

Similar to L1 processing, research on L2 processing has usually directed its attention to perception (e.g., Clahsen & Hong, 1995; Dijkstra, 2005) and *spoken* language production (e.g., Zyzik, 2008). However, more studies have been carried out in *written* language production since the 2000s (e.g., Barkaoui, 2019; Spelman Miller et al., 2008).

The general conclusion of L2 written production studies is that there are differences between the writing process in L1 and L2. Spelman Miller et al. (2008) and Barkaoui (2019) summarize previous research by pointing out that L2 writers might spend more time focusing on "lower-level linguistic demands" or micro-planning than on higher-level factors or macro-planning (Spelman Miller et al., 2008). Very briefly, micro-planning involves lexical and grammatical decisions, among other things, while macro-planning has to do with more general aspects such as audience, style, etc. (Spelman Miller et al., 2008). This contrast between L1 and L2 writing processes usually leads to differences in "pausing and formulating behavior" (Spelman Miller et al., 2008, p. 438), which has to do with L1 being considered more automated than L2 (Spelman Miller et al., 2008). In addition, fluency is a factor that also plays a role in the overall writing skills of L2 writers

(Chenoweth & Hayes, 2001). Fluent L2 writers retrieve linguistic knowledge and forms more quickly, resulting in faster production as well as more capacity and working memory to focus on macro-planning (Spelman Miller et al., 2008).

Other L2 studies (e.g., Barkaoui, 2019; Spelman Miller, 2006; Whalen & Ménard, 1995) also pointed to differences between L1 and L2 in the location and duration of pauses as well as in lower productivity in the L2. These differences might be interpreted as processing difficulties. Specifically, Piolat et al. (2008) and Spelman Miller (2006) reported that processing difficulties lead to a higher cognitive effort, as evidenced by more and longer pauses as well as a slower rate of production. Spellman Miller (2006) also states that long pauses can be associated with macro-planning, whereas short pauses can be associated with micro-planning.

Lastly, in the previous section, I highlighted Flower and Hayes' (1980) model of written production to explain the writing process. However, this model does not explain how the writing process can be influenced by an L2. The most important aspect to consider is that all three steps of the writing process (planning, translating, and reviewing) are influenced by knowledge of other languages, including *interlanguages* (for a more comprehensive definition, see 2.2 L2 and transfer). If the results of Spelman Miller et al.'s (2008) are related to this model, the planning step would reflect difficulties in planning the text, choosing the right words, tone, etc. These difficulties will show as longer pauses since the L2 writer has knowledge of other languages and different proficiency in each of them. Due to these difficulties and differences in language proficiency, L2 writers also take longer to begin writing their text. Similarly, the translating step would reflect more pauses as the L2 writer composes and replans the text if they are not sure they have chosen the right words, spelling or tone. Lastly, the reviewing step would also reflect more pauses, revisions and production of characters as the L2 writer revises the language, spelling and content of the text. The number of pauses, characters or revisions may vary from writer to writer. However, the main influencing factor is language proficiency.

2.1.2 Language processing in perception

L1 perception

According to some views, language perception, whether spoken or written, occurs in several steps. Once we have recognized a sequence of words[6] or a *word string*, we begin to build a possible sentence structure (Warren, 2013). However, sentence processing is influenced by various factors. Some of these factors include grammatical information, syntactic complexity as well as the presence or absence of syntactic markers. However, prosodic information and punctuation can also influence our processing (Warren, 2013). The effects that these factors can have on our processing (see, for instance, *the garden-path effect* in Warren, 2013) have been evidenced by measuring reaction times (hereafter RTs), tracking eye movements during reading, and grammaticality/acceptability judgments, as all of these factors can lead to an easier (*shorter*) or more difficult (*longer*) processing.

Moreover, certain structures are more difficult to process than others (e.g., passives sentences are more difficult to process than active sentences (Gough, 1965)). Research also suggests that the syntactic structure of a sentence becomes clearer when syntactic markers are explicit, which facilitates the processing of the structure (Hakes, 1972). However, there is no significant difference in reaction time when the marker is present or not (Fodor, 2002). Nonetheless, according to Warren (2013), these markers provide "useful anchor points during processing" (p. 164) because they are brief and frequent in the language, making them easier to recognize (Valian & Coulson, 1988). In addition, prosodic cues such as intonation or punctuation also influence our processing and make the syntactic structure of the sentence more explicit (Warren, 2013). These prosodic cues, also known as "implicit prosody" (Warren, 2013, p. 164), have been shown to help disambiguate identical fragments (Marslen-Wilson et al., 1992) as we can access them during silent reading by hearing the sentence in our head. Additional information that affects our processing includes word category, as semantic and syntactic properties such as transitivity, animacy, and thematic roles are also accessed (e.g., Kennison, 2002). Last but not least, meaning and context also help

[6] Warren (2013) distinguishes several stages in visual reading perception: eye fixations, which leads to recognizing the shape and segmentation of boundaries in a text; grapheme identification, where we access the individual graphemes of which the word consists; and phoneme identification, where we access the sounds associated to the graphemes in the word. After all these stages, the stored word in our mental lexicon is accessed.

disambiguate syntactically identical sentences (Slobin, 1966) or prompt the reader to one of the possible sentence interpretations (Crain & Steedman, 2005).

Considering the above, researchers have proposed various parsing strategies (see *Minimal Attachment*, *Late Closure*, or *the principle of Right Association* in Warren, 2013) and models of perception. These models differ in their approach and range from those that consider sentence processing as an exclusively syntactic step to those in which semantic factors are considered and retrieved first (for an overview of perception models and theories, see Warren, 2013). In addition, there are also different views of sentence processing, which see it as a chunking process (see *Clausal hypothesis* in Warren, 2013) in which sentences are processed in clausal units, or as a cumulative process (Marslen-Wilson & Tyler, 1980) in which either one interpretation (*serial processing*) is considered until it proves unattainable (Frazier & Fodor, 1978), or one or more potential interpretations of the sentence (*parallel processing*) are built up and disregarded as more information is obtained (Frazier & Rayner, 1987).

L2 perception

In L2 perception, previous studies have examined the similarities and differences between L1 and L2, focusing on whether the processing strategies that L2 learners use are similar to those of a native speaker or more similar to their own L1 (e.g., Fitzpatrick & Izura, 2011; Frenck-Mestre & Pynte, 1997).

To investigate the differences between L1 and L2 processing, language activation is important. That is, whether knowledge of other languages is also active when an L2 learner reads (see section 2.2 L2 and transfer for a more detailed explanation). This can lead to language interference at different levels (phonetics, morphology, syntax, semantics, or pragmatics) (Dijkstra, 2005; Kroll & Stewart, 1994). L2 studies suggest that L2 processing speed is related to proficiency and that differences and similarities between L1 and L2 in spelling also play a role (e.g., Hamada & Koda, 2008). In addition, Sunderman (2014, as cited in Booth et al., 2008) suggests that processing difficulties are reflected in longer reaction times (RTs) and lower accuracy rates.

Moreover, Booth et al. (2008) examined how language proximity affects semantic and syntactic processing in L2 English. That is, similar structures that occur in both the learner's L1 and L2 may

be easier to learn, whereas when they differ greatly, the L2 learner relies on L1 knowledge. In Booth et al.'s (2008) study, two groups were tested. One group whose L1 was a Romance language (Italian, French, Spanish, Portuguese, or Romanian), and another group whose L1 was Japanese. Participants were presented with correct and incorrect word strings in syntactic and semantic judgment tasks. These tasks measured reaction time (RT) and accuracy. Briefly, the performance of L1 Japanese speakers was slower and less accurate in semantics. On the other hand, both groups performed equally in selecting correct syntactic strings. However, the L1 Italic Indo-European group reacted faster. These results suggest that the participants' L1 background influences their L2 perception. They also suggest that L2 reaction time is related to both language proficiency and proximity and that L2 processing can be influenced by proficiency.

Moreover, Kroll et al. (2012) summarize previous research on sentence and grammar processing. The main conclusion is that both the L1 and the L2 are available to the L2 learner when processing target structures, which may lead to priming effects. These priming effects occur whether these target structures are similar or not in both the L1 and the L2. However, it is important to note the bidirectionality of these priming and cross-linguistic effects because, as Kroll et al. (2012) points out, syntactic processing in the L1 can be affected by learning or by being "immersed in a second language" (p. 243).

Research also shows that native speakers have preferences in their syntactic processing strategies (*parsing strategies*) (e.g., Cuetos & Mitchell, 1988). However, this is unclear for L2 learners, considering all the different variables that may influence their processing (Frenck-Mestre, 2005). The results of previous studies are varied and show that L2 learners can process in a native-like manner, which depends primarily on the learner's L2 proficiency. However, these studies also show that transfer can occur (e.g., Clahsen & Hong, 1995; Fitzpatrick & Izura, 2011).

To summarize, research on language processing has focused more on perception than on production. However, models for both processes have been proposed. I have presented the most influential models and evaluated how they differ. In written production, I have remarked that writers consider many aspects of writing that create a cognitive load in long-term and working memory. This cognitive load and other processing effects can be analyzed through pauses and revisions. In written perception, I have summarized different steps and parsing strategies that can

be used. I have also presented several processing models and influencing factors that can be measured by RT, eye-tracking and grammaticality/acceptability judgment tests.

2.2 L2 and transfer

In section 2.1, I discussed the most influential models of language production and perception. However, they do not address having knowledge of an L2. Therefore, it is important to highlight Grosjean's (2012) proposal for a monolingual and a bilingual[7] mode in speaking production, as well as De Bot's (2000) proposal of a bilingual version of Levelt's speaking model (1989, as cited in De Bot, 2000), which considers for both perception and production.

When Grosjean (2012) speaks of monolingual and bilingual modes, he is referring to the conversational context in which two individuals may or may not share the same language skills. In a monolingual mode or context, both the speaker and the listener use the same language. Although the bilingual person knows another language, they avoid using it because the listener has no knowledge of it and may not understand the message. In a bilingual mode, the bilingual uses both languages because the speaker and the listener share the same language knowledge. Therefore, even if the present study does not deal with models of speaking production, some of the additions suggested by Grosjean (2012) or De Bot (2000) are important for the study of bilingualism, e.g., whether or not two language systems are connected, the account for cross-linguistic influences, or considering production and perception in a model of language processing.

In addition, along Grosjean (2012) and De Bot's (2000) lines, not only the factors we explained in section. 2.1 are important in L2 processing. We also need to consider the concept of *language activation* or *inhibition.* That is, whether one or all languages known by the L2 learner are active at the same time. This concept relates to connectionist models of perception (e.g., Marslen-Wilson, 1987), which state that the mental representations of one language hinders those of another, and thus knowledge of both languages may be active at the same time and may influence each another.

[7]Bilingualism can be understood as "the native-like control of two languages" (Bloomfield, 1933, p. 56). However, in the present study, a bilingual will be a person with knowledge of two or more languages, regardless of their proficiency and the time they learned those languages. It will then equal the definition of an L2 learner.

As aforementioned, previous research addressed the question of whether bilinguals activate both languages or only the one they are currently using. Kroll et al. (2012) propose that bilinguals activate both languages in both perception and production regardless of their proficiency (e.g., Marian & Spivey, 2003; Zyzik, 2008). Grosjean (2012) also explains that this activation occurs to varying degrees depending on the task or interlocutor. However, it is important to note that this activation affects bilinguals' performance at all linguistic levels (De Groot, 2012) and that language mixing often occurs in the weaker language (Grosjean, 2012). De Groot (2012) also adds that the competence, performance, and linguistic expressions of a bilingual differ from those of a monolingual speaker. In previous sections, I have also highlighted that L2 processing is usually slower than L1 processing (Ortega, 2013; Frenck-Mestre & Pynte, 1997); and that L2 learners sometimes use processing strategies similar to those of a native speaker of their L2, while in other occasions, these strategies resemble those of their own L1 (e.g., Jackson & Dussias, 2009).

Besides language activation, it is often presupposed that the L2 is influenced by the L2 learner's L1. However, language *transfer*[8] (also referred to as *crosslinguistic influence*, cf. Smith, 1986, or *interference*, cf. Weinreich, 1968) can occur in both the learner's L1 and L2. It can be symmetrical or even bidirectional, i.e., working in both directions and affecting both languages (Ortega, 2013; Van Wijnendaele & Brysbaert, 2002). Even so, determining its directionality is not an easy task, as numerous factors are involved. Therefore, Lanza (1998) suggests that transfer should be viewed as an individual process that varies from learner to learner. Previous research has also shown that although language proficiency is assumed to play a role (Grosjean, 2012; Ortega, 2013), these cross-linguistic influences can be found even in the most skilled L2 bilinguals (e.g., Van Hell & Dijkstra, 2002).

Moreover, Müller (1998) defines transfer as a strategy used when an ambiguous aspect emerges:

[8] On this study the term transfer is used as Müller describes it: the situation in which "two languages are in contact and may have some influence on each other" (Müller, 1998, p. 153).

> (…) two different grammatical hypotheses are compatible with the same surface string or a particular type of construction (…). In this case, the bilingual child, as a relief strategy, tries to solve the ambiguity by using features of the source language. (Müller, 1998, p. 153)

Ortega (2013) also refers to transfer as taking place "when there is a gap in L2 knowledge, and the best attainable solution is to rely on L1 knowledge" (p.33). What these two definitions have in common, however, is that they generally describe L1 transfer to an L2. Although, as I mentioned earlier, the reverse can also occur. Moreover, even though transfer can occur at several linguistic levels (De Groot, 2012), the present study will mainly focus on grammatical transfer or "language contact at a syntactic level which refers to particular syntactic features, not to elements of language A being present in language B" (Müller, 1998, p. 154).

As can be observed, transfer is not always a straightforward path, and it is often unpredictable. According to Ortega (2013), L1 transfer does not change or modify the acquisition of an L2. Rather, it affects the pace at which learners acquire their L2, meaning that some spend more time in a learning stage than others (Zobl, 1980b). This can be both positive and negative, as some factors can increase the pace of learning, while others delay it (Ortega, 2013). In addition, there are several strategies that may result from transfer, which include the following:

If some structures are considered difficult to learn in the L2, this often leads to *avoidance*. These structures are unlikely to be present in the learner's L1, and the avoidance may lead to a slower pace of learning in the L2. However, it could also be that learners avoid such a difficult structure, but on the occasions when they do use it, their performance is correct. Schachter (1974) studied the use of relative clauses in the writing of Chinese, Japanese, Persian and Arabic learners of English. She concluded that relativization works differently in English than in Chinese and Japanese, but is similar in English, Persian and Arabic. Therefore, Chinese and Japanese learners tended to avoid using relative clauses in English to avoid linguistic errors. In contrast, the strategies of *underuse* and *overuse* refer to structures that are also present in the learners L1 and are more or less likely to be used in their L2. Jarvis and Odlin (2000) investigated the use of prepositions in English by L1 speakers of Finnish and Swedish. Considering that Finnish is an agglutinative language and uses prepositions as suffixes, they found that the Finnish learners produced instances of zero preposition, thus they underused prepositions in English. At the same time, they used the

preposition ‘in’ even when this was not possible, resulting in an overuse of this preposition. In contrast, the Swedish learners did not use zero preposition. Instead, they used ‘in’ and ‘on’ (equivalents of *i* and *på* in Swedish), as their L1 functions similarly to English regarding spatial location.

In addition, *markedness* refers to the fact that certain elements or structures are more or less difficult to learn depending on whether they are more frequent (unmarked) or less frequent (marked) in the world’s languages. In general, structures that are marked in the L2 are more difficult to learn than those that are not. This presupposes that the structure is the same in both languages, but that the L2 counterpart has some aspects that are not present in the L1 system, making it more difficult to master. Zobl (1980b) investigated the negation marker in Spanish L2 learners of English. Although a negation structure is present in both languages, they differ in certain aspects, which poses difficulties for Spanish learners of English.

Related to markedness is *transferability***,** which refers to how transferable marked and unmarked structures are. Structures that are more language specific or marked in the L1 are less likely to be transferable to an L2. Considering Zobl’s (1980b) study, this refers to the aspects in which negation differs between Spanish and English. These aspects are less marked in Spanish and therefore transferable to English.

Other factors include motivation and age. The type of motivation influences the learning pace, with intrinsic motivation being the strongest for acquiring an L2 (Ortega, 2013). As for age, it is traditionally assumed that learning an L2 is more difficult the later in life it is acquired, and although adults initially have an advantage over young learners, this eventually fades (Ortega, 2013).

It is important to note, however, that not everything can be explained and attributed to transfer or L1 knowledge. According to Ortega (2013), some errors “reflect developmental universal processes (…) in the acquisition of human language in general.” (p. 51). At this point, the term *interlanguage* becomes essential. That is, “the language system that each learner constructs at any given point in development.” (Ortega, 2013, p. 110). Ortega (2013) adds that “it is more than the sum of the target input and the L1 influence.” (p. 141). This means that some structures that L2

learners construct might not resemble neither their L1 nor their L2 but are the result of "simultaneous L1 transfer and linguistic universal influences" (Ortega, 2013, p. 51). Ortega (2013) illustrates this phenomenon using the sentence *"How I do this?"* in English. She explains that this sentence uttered by speakers of Punjabi or Spanish would imply that they have relied on L1 knowledge, since both Punjabi and Spanish do not use inversion in questions. However, for speakers whose L1 allows inversions in questions, we would find a developmental stage in their English interlanguage where they use inversions. In this case, one cannot attribute the above result to L1 transfer. It could simply reflect a developmental stage.

In summary, in this section, I have considered other factors that are important in the study of bilingualism, which can lead transfer effects. At the same time, transfer may result in strategies of avoidance or overuse of a structure based on more specific aspects that affect syntactic processing, such as markedness or transferability. All of these factors can affect the pace of learning. However, some errors in the L2 might not be the result of transfer, but a developmental stage in the learner's interlanguage.

2.3 Null objects

Sections 2.1 and 2.2 discussed the different aspects of language processing in production and perception, and the differences between these processes in L1 and L2. This section focuses on the specific structure to be analyzed in this study, with a focus on English, Portuguese, and Spanish.

2.3.1 What are null objects?

Null objects, as introduced in Chapter 1, are arguments that take the object position in a sentence. Although they are not explicit, the sentence is still acceptable in the language. According to Isingoma (2020), the types of verbs that admit these unexpressed arguments are inherently transitive or even ditransitive[9] verbs. That is, those in which there is "an agent (subject) and a patient/theme (object) whether overtly expressed or lexically unexpressed." (Isingoma, 2020, p.

[9] In the case of ditransitive verbs, one of the object arguments is realized as null while the other is explicit in the sentence (Sainzmaza-Lecanda & Schwenter, 2017).

21). Moreover, null objects can occur in many languages, but they differ in verb use, frequency and constraints. For instance, the pro-drop parameter[10], the occurrence of null subjects, or the fact that the language is or not topic prominent have also been associated with the occurrence of null objects (Farrel, 1990; Huang, 1984).

I will not go into detail here about all the factors that influence the occurrence of null objects (for a more comprehensive overview, see Farrel, 1990; Isingoma, 2020; Lemos Soares Cosme, 2016; Sainzmaza-Lecanda & Schwenter, 2017). However, the type of sentence in which null objects often occur should be considered. According to Farrel (1990) and Isingoma (2020), null objects can also occur in both main and embedded clauses: relative clauses, coordinate clauses, adjunct clauses, conditional clauses, and in those sentences in which the topic of the sentence is left-dislocated. To illustrate, below are some examples of the realization of null objects:

(1) At this point you may wrap shells airtight and store ∅ at room temperature for up to 4 days or freeze ∅ for longer storage.

(English example from Culy, 1996 as cited in Ruda, 2014, p. 342)

(2) Esse livro, o João disse que a Maria comprou em Paris.
That book the João said that the Maria bought in Paris.
'That book, João said that Maria bought it in Paris.'

(Portuguese example from Barra Ferreira, 2000, p. 63)

(3) *Eu comprei* ***ec[11]*** *quando eu fui para o Rio.*
I bought ∅ when I went to Rio.
'I bought it when I went to Rio.'

[10] This concept emerges in Generative Grammar and refers to the allowance of pronoun dropping in a language. Particularly languages that allow subject or object arguments that are not expressed in the sentence but can be recoverable by grammar or context among other factors are referred to as pro-drop languages (e.g., Rizzi, 1982). More specifically, languages that allow null subjects are known as subject pro-drop languages, while those that allow null objects are referred to as object pro-drop languages.

[11] The annotation "ec" indicates 'empty category'.

(4) *Se você fizer* ***ec*** *para mim, eu enfeito* ***o bolo.***

If you make ∅ for me I decorate the cake.

'If you make it for me, I will decorate the cake.'

(Portuguese example from Farrel, 1990, pp. 328-336)

Example (1) above shows a null object structure in a coordinate clause; the remaining examples (2), (3), and (4), show null objects in left-dislocated, adverbial, and conditional clauses, respectively.

Moreover, other factors ranging from grammar to pragmatics are present in these structures, and they create a set of constraints on the occurrence of null objects (Isingoma, 2020). In addition, contextual variables and register-specific situations are also key (Isingoma, 2020; Ruda, 2014). That is, the occurrence of null objects also depends on the register and context used. The register here refers to what Glass (2014) calls a "particular community of practice" (p. 121). For example, as Isingoma (2020) explains, "I lifted" would be understood as "I lifted weights" in a community of athletes. Therefore, the null object argument would be easily recoverable in this community only.

A final aspect to consider is the recoverability of null objects. That is, how they can be understood without being overtly stated. Isingoma (2020) suggests that null objects can be recovered from encyclopedic information or anaphorically. Raposo (1986, as cited in Cyrino & Matos, 2016) also suggests context as a key aspect of recoverability.

2.3.2 Null objects in English, Portuguese, and Spanish

The occurrence of null objects has something to do not only with the factors that Isingoma (2020) points out, but also with the fact that the language in question has a pro-drop parameter, particularly an object pro-drop parameter (Farrel, 1990). Brazilian Portuguese has been classified as a mixed pro-drop language that allows object pro-drop (Alamillo, 2009). On the other hand, European Spanish and English generally do not allow null objects (Alamillo, 2009; Fillmore, 1986; Ruda, 2014). Besides the pro-drop parameter, animacy and person have also been associated with null objects (Alamillo, 2009), which will be discussed below in relation to English, Portuguese and Spanish.

Within the main varieties of Portuguese, the null object structure is encoded differently in European Portuguese and in Brazilian Portuguese. I will not make a detailed comparison between the two varieties, but Sainzmaza-Lecanda and Schwenter (2017) state that they are more common in Brazilian Portuguese than in European Portuguese, as they are associated with the loss of 3rd person clitics in the former (Kato et al., 2009, as cited in Montrul et al., 2011). In addition, these authors (2017) point to differences in the use of clitic vs tonic pronouns[12]. Montrul et al. (2011) also indicate that the use, position, and grammaticality judgments of clitic pronouns in Brazilian Portuguese vary between speakers. Moreover, clitics were retained and are more frequent in written language because they can be relearned in school (Kato et al., 2009, as cited in Montrul et al., 2011). However, the main constraints highlighted by the authors in Brazilian Portuguese regarding null objects are *animacy, specificity,* and *definiteness*.

The three parameters above – animacy, specificity, and definiteness – work as follows: animacy is the most influencing factor, followed by definiteness and specificity. Inanimate referents are more likely to be realized as null than animate ones (e.g., I moved stones vs. I moved people around me); definite objects are also more likely be expressed as null than indefinite ones, which are the least likely of all groups to be realized as null (e.g., I wrote the book vs. I wrote a book); and specific objects are more likely to be null objects than non-specific ones (e.g., I like the teachers in my school vs. I like teachers).

As aforementioned, European Spanish is not exactly a language that admits null objects (Alamillo, 2009). Most varieties of Spanish generally do not allow these structures (Alamillo, 2009; Cyrino, 2019; Sainzmaza-Lecanda & Schwenter, 2017). Therefore, null objects are not as acceptable in Spanish as in Portuguese. However, Basque Spanish and other varieties in Latin America are known to allow null objects in a less restrictive way (Alamillo, 2009; Franco & Landa, 1996; Sainzmaza-Lecanda & Schwenter, 2017).

[12] *Ele, ela, eles, elas*, are the 3rd person nominative pronouns that are used in the accusative form along with the clitic pronouns *me, te, nos*. Therefore, the 3rd person clitic pronouns (*o, a, os, as*) were mostly lost in Brazilian Portuguese (Kato et al., 2009 as cited in Montrul et al. 2011)

In terms of selection criteria, Sainzmaza-Lecanda and Schwenter (2017) suggest that bare NPs have the highest probability of being null objects (e.g., Teachers work for many hours), followed by indefinite (e.g., A teacher works for many hours) and definite NPs (e.g., The teacher works for many hours). In addition to the factors considered in Portuguese, they also considered priming effects in Spanish, which are only relevant when the object argument has been previously specified as overt or as null. In other words: If the object argument has previously been realized as overt, it is more likely to be produced as overt again. However, if the object has previously been omitted, it is more likely to be realized as null (Sainzmaza-Lecanda & Schwenter, 2017).

Moreover, the correlation between these factors in Spanish and Portuguese is related to the accusative marker *a* in Spanish, which is used with human and specific/definite direct objects (Sainzmaza-Lecanda & Schwenter, 2017). Therefore, those in which the marker is present, behave similarly to object arguments expressed with pronouns in Portuguese, while those without the marker are like null objects in Portuguese.

Lastly, Ruda (2014) and Fillmore (1986) point out that English generally does not allow null objects in a neutral register. However, the definiteness constraint also influences the occurrence of English null objects. Fillmore (1986) notes that indefinite null objects do not cause much trouble in English in terms of acceptability. It is the definite ones that cause ungrammaticality effects (Fillmore, 1986; Ruda, 2014). In addition, these latter have received special attention in registers such as recipes (Culy, 1996 as cited in Ruda, 2014; Ruda, 2014). Table 1 below shows a summary of the constraints in English, Portuguese and Spanish arranged from most to least influencing:

Table 1. Constraints on null objects in Portuguese, Spanish, and English.

Portuguese	Spanish	English
Animacy	Priming	Definiteness
Definiteness	Definiteness	
Specificity		

2.3.3 Pronominal system in English, Portuguese, and Spanish

So far, I have presented several null object expressions in English, Portuguese, and Spanish. However, there are other ways of expressing an object argument. For instance, they can occur

overtly or be replaced by a pronoun. Therefore, it is important to mention the pronoun systems available in these languages. As Montrul et al. (2011) indicate, English does not have clitic pronouns, but both Portuguese and Spanish have a set of clitic object pronouns that share similar features, although they may differ in their use and placement (see Montrul et al., 2009, for a detailed account of the system of clitic pronouns in Portuguese and Spanish). For example, consider the following examples in Portuguese from Farrell (1990):

(5)

Eu	*conheci*	***o***	***João***	*numa*	*festa.*
I	met	the	João	in-a	party.

'I met João at a party.'

(6)

Eu	***o***	*conheci*	*numa*	*festa.*
I	him	met	at-a	party.

'I met him at a party.'

(7)

Eu	*conheci*	***ele***	*numa*	*festa.*
I	met	him	at-a	party.

'I met him at a party.'

(8)

Eu	*conheci*	***ec***	*numa*	*festa.*
I	met	∅	at-a	party.

'I met (him) at a party.'

These examples present an explicit direct object in all cases except the last one. Example (5) shows the full form of the object argument. In (6) and (7), this object is replaced by a pronoun, while in (8), the argument is implicit/null and is recoverable by discourse factors (Farrel, 1990). In Spanish, however, all the above examples are possible structures in the language, except for (8).

Moreover, all the above examples show null objects in transitive structures. However, it would be interesting to study the behavior of ditransitive structures that favor the realization of null objects (see Sainzmaza-Lecanda & Schwenter, 2017, for a more comprehensive discussion). However, due to the scope of the study, these structures will not be discussed further.

Portuguese and Spanish also differ in their response to polar questions. English may sometimes use auxiliary verbs in this context, but this is a feature that neither Portuguese nor Spanish has. In

general, both use the same verbs mentioned in the question. However, Farrell (1990) points out that in colloquial Portuguese, the direct object present in the question may be implicit/null in the answer. Consider the following examples from English (Isingoma, 2020) and their translation into Portuguese and Spanish (my own translation):

(9)
a. Where is my cake?
b. *Jane ate **ec**.

(10)
a. *Quem comeu meu bolo?*
who ate my cake?
'Who ate my cake?'
b. *A Jane comeu* ***ec.***
Jane ate [it]
'Jane ate [it].'

(11)
a. *¿Quién se comió mi tarta?*
who REFL-PR.3SG ate my cake?
'Who ate my cake?'
b. **Jane* **ec** *comió.*
Jane [it] ate.
'Jane ate [it].'

In the above examples we can see that null objects are not possible in English or Spanish in this context, but they are in Portuguese, especially in colloquial speech. A more formal and *correct* way to answer would be, i.e., *A Jane o comeu* (Jane ate it). Spanish behaves similarly to English in (11).

In view of the above, null objects are more acceptable in Portuguese than in Spanish or English, as evidenced by the differences in parameters and object realizations. It is also important to note that Portuguese and Spanish have similar system of clitic pronouns, which English lacks.

2.3.4 Previous studies on null objects in L2

Having considered what a null object is and what aspects favor its occurrence, I turn to previous L2 research on this topic and related issues that specifically point to transfer effects.

As explained in section 2.3.3, when an object argument is not implicitly expressed, there are other possibilities such as the use of pronouns. Roberts et al. (2008) investigated pronoun resolution in non-null subject languages by L2 learners whose L1 was a null subject language. The authors (2008) reported that L2 learners found it difficult to integrate this null subject parameter in early acquisition, accepting sentences in which the subject was omitted as correct. At the same time, however, they also accepted sentences in which the subject was explicit, leading to the conclusion that participants were aware of the obligatory status of the subject in these non-null subject languages, although *incorrect* sentences were accepted.

In addition, Zobl (1980a), studied the placement of pronouns in English and French by L2 learners of these languages. Although these two languages differ in the position at which pronouns are placed, French learners of English had no difficulty in placing pronouns in English as opposed to English learners of French who struggled with it.

More related to null objects is Yuan's (1997) study that investigated the acceptability of null subjects and objects in the L2 English of native Chinese speakers. The results showed that native Chinese speakers classified null subjects in English as ungrammatical and had no difficulty in discarding ungrammatical null objects.

Wakabayashi (2002) also studied the acceptability of English null subjects, especially among Japanese and Spanish learners of English. He found that both native English and Japanese speakers were more likely to reject ungrammatical null subjects than native Spanish speakers. Wakabayashi (2002) also suggests L1 interference, among other linguistic aspects, especially for the Spanish learners of English,

Also worth mentioning is Clahsen and Hong's (1995) study of the reaction time of L1 German speakers and Korean L2 German learners to subject-verb agreement and null subjects. Participants were presented to grammatical and ungrammatical sentences. Native German speakers responded faster to grammatical sentences than to ungrammatical sentences in both conditions. A similar effect was found for Korean L2 learners of German. RTs (reaction times) were longer for the ungrammatical items than for the grammatical ones. Although the aim of their study was not

transfer, the RTs were twice as high for the L2 learners than for the native speaker group, which may have been influenced by transfer from the participants' L1, among other factors.

Lastly, Zyzik (2008) investigated Spanish null objects in both the perception and spoken production of English L2 learners. The results indicated that the L2 learners of Spanish rarely produced these structures, but only when they were easily recoverable. In perception, only advanced learners were able to reject ungrammatical null objects, while beginners accepted them more frequently. She attributed these results to the fact that advanced learners rely on syntactic cues, while beginners do so on semantic cues.

To sum up, the above studies show that it is difficult to determine all the factors that influence the processing of null objects. Although null objects have been mostly studied in perception, transfer effects were found in perception and in spoken production, through the acceptability/rejection of (un)grammatical null objects or the non-production of them.

2.3.5 Previous studies on null objects in English, Portuguese, and Spanish

While in section 2.3.4 I gave an overview of how null objects and their processing effects have been investigated in language production and perception, those studies focus on written perception and spoken production. In section 2.3.5, I will review two previous studies of written production and perception in English, Portuguese, and Spanish. However, Rothman and Iverson's (2013) study on the perception of null objects in Spanish by Brazilian L2 learners is acknowledged, as is Lee's (2014) study on Chinese null objects in written production and perception.

On the one hand, Montrul et al. (2009, 2011) studied the placement of clitics and object realization in L3 Portuguese by both L1 English and L1 Spanish learners. In this context, they investigated spoken production and written perception. The results suggest that null objects in Portuguese are not difficult structures for L2 learners to acquire. Both groups produced and perceived clitics and null objects, although transfer errors were noticeable. They concluded that these results might be related to language proximity and transfer, although not exclusively.

On the other hand, Lemos Soares Cosme (2016) studied null objects in bilingual English and Spanish learners of Portuguese as their L3, focusing on both spoken and written production. For spoken production, he used a contextualized translation task in the form of a dialog presented in

each of the two languages studied. The participants translated the last sentence into the other two languages. For the writing task, he used contextualized stories presented in English or Spanish, but the elicitation question at the end was in Portuguese and participants responded in Portuguese. These tasks controlled for verb referent (animate, human, and inanimate), frequent nouns in all three languages, and data elicitation only for 3rd person clitics or null objects. The results indicated that participants produced more clitic pronouns in the writing task, due to the formality of the exercise. The participants also showed knowledge of clitic and null objects, but they did not use them in a native-like manner, which left traces of transfer effects.

Considering the above, null object exist in several languages and their acceptability varies from one language to another. Regardless of language proximity, transfer is visible in both the perception and production of null arguments and clitics in certain languages, especially in L3 Portuguese. However, null objects in written production do not seem to have been widely investigated in either L1 or L2 research.

In addition, null objects have generally been studied with a grammaticality/ungrammaticality effect and clitic pronouns. Lastly, context, frequency, and vocabulary effects have also been controlled for in the data elicitation of previous studies.

Chapter 3 Current study

Chapter 2 shed some light on the status of null objects in L2 research and revealed the lack of studies on this topic that considers both written production and perception, particularly regarding Brazilian and Spanish L2 learners of English.

Having this in mind, it is especially important to note the contrast that null objects present in these languages. On the one hand, between English and Portuguese and, on the other, between Portuguese and Spanish, despite the two latter being typologically related languages. This implies not only that null objects are processed differently in these L1s, but also that this difference might show up differently in the L2 English of learners with typologically similar L1s such as Spanish and Portuguese. Thus, as aforementioned, the present study focuses on the written production and perception of null objects (hereafter NOs). These structures will be examined in Spanish and Portuguese as L1s and English as an L2 in adult language acquisition, to account for differences in the processing of null objects in L2 English.

The assessment is done in both their L1 and L2 for comparison purposes, as no control group participated in the study. Therefore, the production and perception tasks are given in English, Portuguese, and Spanish. The production task measures the production of NOs, pauses, revisions, and characters. The perception task measures reaction time and acceptability of NOs.

Given the research questions in Chapter 1 and the theoretical background in Chapter 2, the following hypotheses are presented.

3.1 Hypotheses

a. **Production**. It is difficult to predict how NOs are processed in written production, considering the lack of studies on this topic. However, based on the null object (hereafter NO) parameters in Portuguese and Spanish (e.g., Lemos Soares Cosme, 2016; Sainzmaza-Lecanda & Schwenter, 2017; Zyzik, 2008, among others), and the fact that L2 learners of English will be more familiar with the NO parameters in their L1, I hypothesize that:

   H1. *L1 Portuguese speakers will produce more null object structures in Portuguese than in English.*

H2. *L1 Spanish speakers will produce more null object structures in Spanish than in English.*

H3. *L1 Portuguese speakers will produce more null object structures in English than L1 Spanish speakers.*

Regarding pauses and revisions, no previous studies have investigated NOs. Based on previous L2 written production studies (e.g., Barkaoui, 2019; Spelman Miller et al., 2008), I hypothesize that:

H4. *L1 Portuguese and L1 Spanish speakers will produce object structures with greater effort than non-object structures regarding the number of produced characters, pauses, and revisions in both their L1 and L2.*

The above hypothesis assumes that object structures require more cognitive effort and that they cause ambiguity when being produced, given that the object argument can be left unexpressed. This hypothesis is also based on the differences between English, Portuguese, and Spanish in object expression. Therefore, such cognitive effort and ambiguity are considered to show as a higher number of pauses, characters and revisions.

H5. *L1 Portuguese and L1 Spanish speakers will produce object structures with greater effort, regarding the number of produced characters, pauses, and revisions in their L2 than in their L1.*

H5 is based on the ambiguity in the production of NOs, on the one hand; and on the expectation that processing speed will be slower in the L2 due to language activation and cognitive overload (Spelman Miller et al., 2008).

H6. *L1 Portuguese speakers will revise more during the written production of English null object structures than L1 Spanish speakers.*

H7. *L1 Portuguese speakers will pause more during the written production of English null object structures than L1 Spanish speakers.*

H6 and H7 are based on the larger NO acceptability in Portuguese as opposed to Spanish and English. Therefore, more transfer effects are expected in the English of L1 Portuguese speakers, reflected in more pausing and revising.

b. **Perception**. Given the lack of NO studies that investigate reaction times, this study will address RT and acceptability. In addition, considering the larger acceptability of NOs in Portuguese compared to Spanish and English (e.g., Lemos Soares Cosme, 2016; Sainzmaza-Lecanda & Schwenter, 2017; Ruda, 2014, among others), I hypothesize that:

H8. *L1 Portuguese speakers will accept more null objects structures in English than L1 Spanish speakers.*

H9. *L1 Portuguese speakers will accept more ungrammatical null object structures in English than L1 Spanish speakers.*

H8 and H9 assumes that L1 Portuguese speakers are more familiar with NOs regardless of the language, which will result in a positive transfer when accepting grammatical NOs and negative when accepting ungrammatical ones. Regarding reaction time, as aforementioned, to my knowledge, no studies on null objects used RT. However, considering that NOs exist in both Portuguese and Spanish regardless of their constraints, I hypothesize that:

H10. *L1 Portuguese speakers will have an equally fast reaction time to null objects in Portuguese than L1 Spanish speakers to null objects in Spanish.*

H10 considers that there will be no difference between the groups in RT given that NOs are present in both Portuguese and Spanish. It also assumes that the L1 Portuguese speakers and the L1 Spanish speakers will be more familiar with the parameters in their L1 than in their L2. In addition, considering the larger acceptability of NOs in Portuguese compared to Spanish on the one hand (Lemos Soares Cosme, 2016; Sainzmaza-Lecanda & Schwenter, 2017, among others), and the longer RTs reported on L2 learners (Clahsen & Hong, 1995) on the other:

H11. *L1 Portuguese speakers will have a longer reaction time to null objects in English than L1 Spanish speakers.*

This hypothesis is based on the contrast between the languages in NO parameters, which will be reflected as a longer RT for the L1 Portuguese speakers, despite NOs being more frequent in Portuguese than in English or Spanish.

H12. *L1 Portuguese speakers will have a longer reaction time to ungrammatical null objects in English than L1 Spanish speakers.*

Lastly, H12 assumes that the contrast between the languages in NO parameters and frequency will be evidenced in a longer RT to ungrammatical items for the L1 Portuguese speakers. This is not only based on previous studies on NOs (Lemos Soares Cosme, 2016; Sainzmaza-Lecanda & Schwenter, 2017), but also on the results of Clahsen and Hong (1995) who reported a longer RT to ungrammatical items.

Chapter 4 Methodology

The method consists of a psycholinguistic experiment that tested how null objects are processed in L1 and L2 production and perception. Two groups of participants with the same L1 background performed a written perception task that measured acceptability and RT, and a written production task that used keystroke logging. The tasks used two L1 languages (Portuguese and Spanish) and one L2 language (English) as follows: a) L1 Portuguese and L2 English, b) L1 Spanish and L2 English.

In what follows is the procedure used for the development of the study. It is divided into *Participants*, *Experimental design*, *Materials*, *Procedure*, *Ethical considerations*, *Analyses*, and *Data loss*.

4.1 Participants

42 participants between the ages of 18 and 35 took part in this study (*n= 23* Brazilian Portuguese speakers, *n= 19* European Spanish speakers). The inclusion criteria were that they were proficient in English as an L2 at least at a high-school level, to ensure the most homogeneous proficiency level; and that they were residents in the respective countries where their L1 is spoken, that is, Brazil and Spain. L1 and L2 proficiency were assessed using a language history self-assessment questionnaire (see Appendix) in which participants rated their proficiency in all skills (i.e., *grammar, listening, pronunciation, reading, speaking,* and *writing*). Considering the above, two participants were excluded from the Spanish group because they did not meet all the inclusion criteria.

In addition, to avoid confounding factors between fluency of writing and proficiency in the language, the participants' typing skills were calculated. Table 2 illustrates the L1 Portuguese and L1 Spanish speakers' distribution of age, self-rated proficiency level and typing skills (externally measured by mean transition times between letters within a word, excluding the 5% longest and shortest pauses). Overall, the participants' L2 typing skills were slower than their L1 skills, which agrees with previous studies (Spelman Miller et al., 2008). In addition, the participants's typing

skills in both the L1 and the L2 conform to those of adult fast typists also reported in previous studies (Wengelin, 2006).

Table 2. Distribution of age, proficiency level and typing skills per group.

	Age	Proficiency self-rating (Scale 0-5)	L1 typing skills	L2 typing skills in English
L1 Portuguese speakers (n= 23)				
Mean	24.21	3.90	0.13	0.15
SD	2.87	0.68	0.02	0.03
Range	19–29	2.5–5.0	0.10–0.20	0.10–0.20
L1 Spanish speakers (n= 16)				
Mean	24.52	4.03	0.13	0.15
SD	2.09	0.74	0.03	0.04
Range	18–27	2.3–5.0	0.10–0.20	0.10–0.30

4.1.1 Recruitment

Given the current travel restrictions due to Covid-19, the recruitment and the experiment took place online. Participants were recruited through personal and academic contacts and social media applications. They received no compensation for their participation. The participants' L1 (Portuguese or Spanish) was used during recruitment to ensure they fully understood what their participation entailed.

4.2 Experimental design

Two tasks were created to test both production and perception. Considering the complexity of the experiment (2 tasks and 3 languages), the experiment used a Latin Square design to ensure the task order did not induce learning effects. The interesting thing about a Latin Square design is that, depending on the number of conditions and participants, none of the subjects may perform the test in the same order. The present study used 4 conditions – L1 production, L1 perception, L2 production, and L2 perception – and approximately 20 subjects were recruited from each language background. Having this in mind, it was unlikely that any two participants from the same group would complete the tasks in the same order. However, due to technical difficulties, 12 participants in the L1 Portuguese group completed the tasks in the same order. That is, 6 patterns were used

twice. For clarity, Table 3 illustrates the Latin Square design used in the study for both groups, with the repeated patterns highlighted with an asterisk (*).

Table 3. Latin Square design for the 4-condition experiment (A=L1 production; B=L1 perception; C=L2 production; D=L2 perception).

A	B	C	D*	B	A	C	D*	C	D	A	B
A	B	D	C*	B	D	C	A	C	D	B	A
A	C	B	D*	B	C	A	D	D	C	B	A
A	C	D	B*	B	C	D	A	D	C	A	B
A	D	B	C*	C	A	D	B	D	A	B	C
A	D	C	B	C	B	A	D	D	A	C	B
B	D	A	C	C	A	B	D	D	B	A	C
B	A	D	C	C	B	D	A	D	B	C	A

4.2.1 Production task

An adapted version of Lemos Soares Cosme's (2016) interpretation and contextualized writing production task was used in writing, given its successful attempt at eliciting null objects. The experimental items in the present study were short stories followed by reading comprehension questions. Participants read these short stories and answered the questions based on the information contained in the text. This task was conducted in L1 Portuguese or Spanish and L2 English. The stories were close translations of one another in Portuguese and Spanish, but the same in L2 English for all participants (see examples in 4.3.2 Stimuli in the production task).

4.2.2 Perception task

The perception task was a reaction time (RT) experiment. In this type of experiment, participants are presented with and asked to react to stimuli in a given context; and the time taken to react to each stimulus is measured (Clahsen & Hong, 1995). In the present study, participants were presented with dialogs in L1 Portuguese or Spanish and L2 English (see examples in 4.3.3 Stimuli in the perception task). They were asked to decide whether these dialogs were acceptable/natural in each language by pressing a key on their keyboard as quickly as possible. This task thus investigated not only reaction time but also acceptability.

4.3 Materials

This section describes all the research material, which divides into *Equipment and software*, *Stimuli in the production task*, and *Stimuli in the perception task*. Considering that the experiment took place on distance, each participant used their own computers to complete the tasks, installing versions of the programs described below. Thus, data was collected and stored locally to avoid data loss due to network problems.

4.3.1 Equipment and software

Zoom

Zoom (version 5.4.7) was used as the contact medium during the experiment and it was run in the background to allow for questions and comments if necessary. This platform was preferred since it allows for the use and recording of video, audio, and file sharing.

ScriptLog

The keystroke logging program *ScriptLog* (Wengelin et al., 2019) was used for the production task. Bundled versions for *MacOS*, *Windows* and *Linux* OS were created for easier distribution. This program allows for recordings of the writing process and a detailed analysis of pauses and revisions. It is also a non-intrusive way of collecting written data since participants merely see a word processor where they can write and edit their texts as well as move back and forth among them. However, it allows the researcher to replay the writing session and to extract statistics and information on revisions and pauses afterwards.

Psychopy

For the perception task, the program *Psychopy* (version 2021.1.3) (Peirce, et al., 2019) was used. *Psychopy* allows for the presentation of written, visual, or spoken stimuli on a computer screen while controlling for reaction times and for the congruence of the answers.

4.3.2 Stimuli in the production task

Participants were presented with 6 unrelated short stories (see Appendix A). Each story was between 5 and 8 lines of text long to control for length and was followed by four enumerated

reading comprehension questions. The short story and questions were available to participants at the same time (see Figure 6). Each story was written by the experimenter to favor natural situations in which questions eliciting null objects could be used. Of the four questions in each text, only one was intended to elicit null objects. The elicitation question followed the pattern: *"What does/did **X** do **with the Y**?"*, where *X* is the subject of the sentence and the main character of the story, and *Y* is the object argument to be omitted[13]. Figure 2 shows an example of one of the English stories, where Q3 is the elicitation question, while Q1, Q2, and Q4 are distractors:

Victor usually plays with his toys and videogames. Today is a hot summer day and Victor remembered that he had seen his neighbours having a water balloon fight in the garden a couple of days ago and thought that a water balloon fight could be fun. He had some water balloons at home and his mom and sister went out this morning, so the plan was perfect. He put the balloons on top of the door, on the edge, so when his mom and sister arrived, they would open the door and the balloons would fall on them and he would get them soaked. He thinks it will be fun!

1. What does Victor usually play with?
2. What happened with Victor and his neighbours?
3. What did Victor do with the balloons?
4. Who is Victor waiting for?

Figure 2. Example of an elicitation text used in the L2 English production task.

The questions were presented according to the order of the information in the text. Thus, the elicitation question was not always presented in the same position in all 6 stories. In addition, all short stories were to be as similar as possible regarding length, structure, and lexicon for comparative reasons (Frenck-Mestre, 2005; Warren, 2013). Controlling for context and priming effects between the languages was also important. Therefore, the same set of verbs were used to elicit null objects in all three languages to make the material more comparable. Some of these verbs were inspired by the studies of Zyzik (2008), Lemos Soares Cosme (2016) and Varlokosta (2016): *wake up, comb, drink, eat, put, send*. The Portuguese and Spanish counterparts were *acordar*, *pentear*, *beber*, *comer*, *colocar*, *mandar*; and *despertar*, *peinar*, *beber*, *comer*, *poner*, respectively. These verbs were also chosen according to the semantic null object (NO) parameters

[13] Unfortunately, until this error was detected, it is acknowledged that 12 participants from the L1 Portuguese group were exposed to one story where the elicitation question did not contain a definite article (cf. 'What did the dog do with water?' vs. 'What did the dog do with *the* water?'). Yet the exposure to this difference in the stimuli led to no significant effect on the results.

that the languages set (see Appendix A). Particularly, when choosing the set of verbs for the task, the NO restrictions in Portuguese were considered first, since null objects (NOs) are more frequent in this language.

Similarly, the elicitation texts used the same language as in the current experimental setting as the focus of the study was to study null objects in L1 and L2 separately. That is, either Spanish, Portuguese, or English. Participants were also asked to answer in the same language throughout the task. Lastly, when designing the short stories, it was also important not to prompt participants to use pronouns and null objects. Therefore, these structures were avoided as much as possible. However, this may have caused certain unnaturalness.

4.3.3 Stimuli in the perception task

This task consisted of written dialogs between characters A and B. The dialogs were presented on a computer screen and participants had to answer whether the object structures were acceptable or not. Character A's interaction consisted of a maximum of 2 lines – more or less 8–10 words, while character B's consisted of a maximum of 2 lines and 2 words – more or less 10–12 words in total. Columns of the same dimensions (5.14x0.81 cm) were used to ensure that all stimuli had the same layout. Most importantly, the stimuli were similar in length, structure, and context, to avoid confusion from using different scenarios in each stimulus. Therefore, the target structure was always placed in the second interaction of the dialog, that is, as part of character B's interaction. Figure 3 shows an example of an English stimulus. In the example the word "writing" is highlighted. This sentence is an example of a null object ("writing [it]").

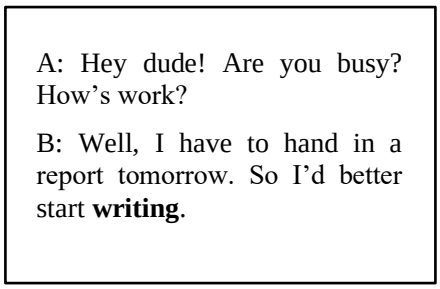

Figure 3. Example of a null object stimulus (bold-faced) in the L2 English perception task.

Regarding the stimuli, the corpora consisted of 36 items divided into 5 different conditions, as Table 4 illustrates (see Appendix for the complete list in all three languages):

Table 4. Conditions used in the perception task.

Target stimuli	Control stimuli
12x null objects	12x object clitics
	4x double clitic
	4x wrong verb-object order
	4x ungrammatical null object

The target stimuli were dialogs in which an object argument was omitted, but the sentence was acceptable. An almost identical pair to the *null object* condition was the *object clitic* condition, in which the object was replaced by an overt clitic or pronoun. Figure 4 illustrates these conditions in English, followed by the Portuguese and Spanish null object counterparts:

Target and control stimuli

A: Do you usually read in the morning, Mathew? B: Yeah, I wake up early, pick up a book and **read** in my room.	A: Did you buy anything in the new bookshop? B: A new edition of Pride and Prejudice! I've **read it** seven times.

Figure 4. Examples of the null object (left) and object clitic (right) conditions in the L2 English task.

A: *O que você f-ez ontem na biblioteca tão cedo ?*

the what you do- PST.3SG yesterday in-the library so early Q

'What did you do in the library so early yesterday?'

B: *Eu queria ler poesia, mas ∅ achei uns quadrinhos e ∅ comecei a* ***ler*** *∅.*

I want-PST.1SG read-INF poetry but [I] find-PST.1SG some comics and [I] begin-PST.1SG to-IFM read-INF [THEM]

'I wanted to read poetry, but I found some comics and started to read (them).'

A: ¿ *Qué hiciste* ∅ *ayer* *en la biblioteca tan temprano* ?

Q what do-PST.2SG [you] yesterday in the library so early Q

'What did you do in the library so early yesterday?'

B: ∅ *Quería* *leer* *poesía, pero* ∅ *encontré* *unos comics y* ∅ *empecé* *a* ***leer*** ***∅.***

[I] want-IPFV.1SG read-INF poetry but [I] find-PST.1SG some comics and [I] begin-PST.1SG to-IFM read-INF [THEM]

'I wanted to read poetry, but I found some comics and started to read (them).'

Figure 5. Examples of null objects in the L1 Portuguese (above) and L1 Spanish (below) tasks.

Moreover, to preserve the purpose of the study, 12 control items, adapted from Varlokosta et al.'s (2016) study, were added. These items were divided into three different conditions, as illustrated in English in Table 5:

Table 5. Examples of the control stimuli in the L2 English perception task.

Additional control stimuli		
Double clitic (x4)	Both an object argument and an overt pronoun are stated, but the sentence is ungrammatical.	*A: So, what drink are you gonna order?* *B: I'll have some coffee and I will drink it the coffee in a big mug.*
Wrong verb-object order (x4)	The position of the object argument in the sentence is altered and considered ungrammatical.	*A: Denise, did you finish fixing my jacket?* *B: Yeah. Here. The zip still works, but I couldn't properly it sew.*
Ungrammatical null object (x4)	The verb used does not allow a null object and the sentence is considered ungrammatical.	*A: Did you see that cute mug on the store window?* *B: Yeah, I think I'll buy for myself. I love it. It's so cute!*

Similar to the production task, it was important for the stimuli to be similar in length, structure, and context. Therefore, the same set of verbs were used in all three languages. These verbs could be used both with and without null objects in all three languages. Some of them modelled Lemos

Soares Cosme's (2016) and Varlokosta et al.'s. (2016) studies: *know (someone), read, see, write, understand, close, pay, know (something), draw, lose, kick, paint, cook, cut, study, leave, put, drink, sew, buy, water, clean and fix* (see Appendix for the full list of stimuli and their semantic parameters). Despite differences in semantic parameters, certain verbs allowed null objects in all three languages because they could be retrieved anaphorically.

Moreover, even though the stimuli were kept as similar as possible, some differences were applied to each condition. The null object and object clitic stimuli were kept similar to one another in context, length, and structure, to ensure that the participants only reacted to the difference between expressing the object argument as null or with an overt pronoun. On the other hand, the stimuli in the other three control conditions (double clitic, wrong verb-object order, and ungrammatical null object) differed from the null and object clitic stimuli, but they were similar in context to each other. In addition, the stimuli in L1 Portuguese and L1 Spanish were close translations of each other when the verb semantics allowed it. In cases where the verb could not be used in the same context, a similar context was kept, especially for the null object stimuli. On the other hand, for the English counterparts, the same verbs were used as in Portuguese and Spanish, but in a slightly different context to avoid learning effects between the languages. Even so, some stimuli were somewhat longer (no more than one or two words) than their counterpart in another language, despite the efforts to keep the stimuli as similar as possible.

Besides the experimental round, a trial was added at the beginning of the perception task. Four dialogs were used following the design described above. The conditions of these stimuli were different from the ones in the actual experiment to avoid the participants being familiar with and aware of the purpose of the experiment. These conditions contained either a grammatical error – the wrong preposition was used (e.g., 'I look **on** the pictures'), or a semantic error – the order of the arguments had been altered (e.g., 'I put **the table on the book'**).

4.4 Procedure

The experiment took place on distance. An online meeting between the experimenter and the participant was arranged using the online tool *Doodle* to give the participants guidance and

supervision during the tasks. Only the experimenter and the participant had access to the meeting link.

Participants were asked to download programs and experiment files through Box (2018) and they were given instructions on how to download and install them before the meeting. A screen recording video on how to complete the installation was also created and provided to them to ensure an easier procedure. Although participants' L1 was used during recruitment, the procedure and installation instructions were in English to ensure they could complete the task in English.

Before the experiment started, participants were informed of how the procedure would work, and the correct functioning of the programs was granted. Then, the experimenter sent a prompt in English (see Appendix D) via chat to obtain the participants' informed consent. Participants read this sentence aloud as their voice was being recorded.

Considering the unnaturalness of this procedure, several steps were taken to ensure that participants received guidance from the experimenter during the experiment, on the one hand; and that they could complete the tasks at ease, on the other. Therefore, participants were informed that they were not required to share their screen or have their camera and microphone on throughout the procedure. They were only asked to do so when testing the functioning of the programs and during trial rounds to better navigate the program. When assistance was needed, questions were asked and answered over the microphone. In addition, the experimenter's microphone was turned off while the participant was performing the task to avoid external distractions on the participant's performance.

As the experimental tasks were performed in two languages, the language used in the session was also considered influential on the results. Therefore, the language spoken was changed according to the language in which the task performed (i.e., if the task was in Spanish, Spanish was spoken and the same was true for tasks performed in English and Portuguese). However, this last measure could not be ensured in the following situations:

a) When at risk of misunderstanding the instructions in the English tasks, the participants' L1 (Portuguese or Spanish) was used.

b) As the experimenter's proficiency in Portuguese was not the same as that in English or Spanish, the language was changed to English for the experiment's sake when in risk of miscommunication.

Once all steps were completed, the experimenter informed the participant about what tasks to complete, in what order and how to complete them. Recall that the order of tasks varied for each participant according to the Latin Square design (see 4.2 Experimental design Once all tasks were finished, a language history questionnaire was sent out and completed (see Appendix). Lastly, participants were guided on how to retrieve and send all data files via chat or email. The whole procedure took about an hour.

4.4.1 Procedure of the production task.

During the production task in ScriptLog, the participant's screen resembled a word processor interface with two small windows, as illustrated in Figure 6: one of them presented the instructions and the elicitation text; the other was a blank page where the participants wrote their answers, and it cleared after every text.

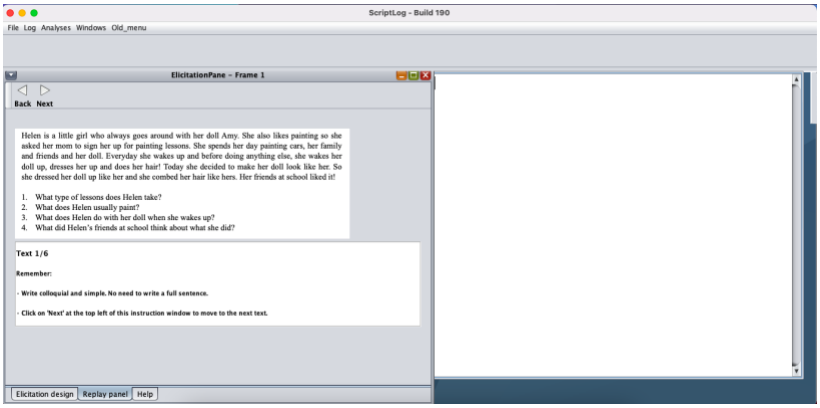

Figure 6. Production task's interface.

The short stories were presented one at a time in both the trial and the test rounds. Each short story was presented in a font of 10.5 pt., left-and-right aligned and with a space of 1.2 pt. to avoid secondary factors influencing the reading and visual pace of the participants during the task. In addition, the stories in the L1 tasks followed the same order. The order in the L2 tasks differed from the L1 tasks but was kept the same for participants from both language backgrounds. The L1

tasks also included a control question[14] at the end to check whether the formality of the task influenced the participants' responses (cf. an informal response that uses language similar to spoken language vs. a formal response that uses typically written language).

The production task began with instructions applicable to both the trial and test rounds. These instructions favored the use of colloquial language, considering that null objects (NOs) occur in an informal and colloquial context, on the one hand; and that a writing task might prompt formal language, on the other. Participants were asked to answer simply and colloquially, as if they were talking to a friend/family. They were asked to answer without giving too much thought, to enumerate their answers, and not write a full sentence. In addition, no time frame was given.

After that, participants completed a trial round in English to familiarize themselves with the task and the program. The trial round had two short stories, each followed by three reading comprehension questions, and was completed only once during the first production task – either in L1 or L2. Then, the test round described in 4.3.2 Stimuli in the production taskbegan. The experiment finished with a thank-you screen. This task lasted for approximately 20 min.

4.4.2 Procedure of the perception task.

When the perception task started in Psychopy (Peirce, et al., 2019), the participant was first presented with a welcome screen with general instructions. After that, a trial round in English was completed only once – either during the L1 or the L2 task. The left arrow was used for acceptable/natural items and the right arrow for unacceptable/unnatural items for all rounds. In addition, the instructions windows were not time framed. The participant was asked to press any key to continue once they had finished reading the text. Each stimulus in the trial round and the experiment was presented for 9.5 s considering the length of the speech material and an average reading pace. After this, the stimulus disappeared from the screen, but the participant could still

[14] *Pensando un poco en el test y las respuestas que has dado, ¿hay algo que hubieses respondido de forma distinta?* (Spanish) / *Pensando um pouco no teste e nas respostas que você deu, há algo que você teria respondido de algum outro jeito?* (Portuguese) (Reflecting on the previous test and answers you gave, is there any question that you would have answered differently?)

answer. The next stimulus was not presented until the participant had entered a response. This measure was taken to ensure that responses were given to every stimulus.

Moreover, all stimuli followed the pattern illustrated in Figure 7[15] to avoid secondary factors. White letters against a gray background were used for the stimuli and the instructions. Black letters against a gray background to mark a break in between the blocks. The letter height and position were 0.6 pt. and (0,0).

Figure 7. Examples of the perception task's interface.

Once the trial round was completed, a reminder of the instructions appeared, and the experiment began. The experiment was divided into two blocks with a break of 30 s in between. 18 stimuli were presented in a randomized order in each block: 12 target stimuli and 6 distractors. Once the experiment was finished, a thank-you screen appeared. All participants completed the task in approximately 20 min.

4.4.3 Language history questionnaire

A language history questionnaire was designed to collect relevant information about the participants' language background. This questionnaire was given in English and followed Gullberg and Indefrey's template (2003) (the full version of the questionnaire used in this study can be seen in Appendix). Participants filled it out after completing all tasks.

[15] Figure on the left: "This is a break. Take this time to rest! The next round will begin in 30 seconds."; Figure on the right: "A: Jenny, what is Mat doing now? Is he busy? B: He has an essay due today so I'll help him write it later."

4.5 Ethical considerations

Ethical considerations were taken following CODEX (2021) and Lund University's guidelines (2021a, 2021b). No sensitive data was collected. All collected data was stored on the experimenter's computer to ensure that only the experimenter had access to it.

At the time of the recruitment and before the experiment, the participants were informed about the aim of the study and about the procedure. They received written information about the procedure, their rights as participants and other ethical considerations (see Appendix D). They were also informed that their participation was voluntary and that they could withdraw their participation at any time. The participants also learned about the anonymity of their answers and data files[16], the storage rules following Lund University's protocol and the need to have documents sent from their computer to the experimenter's at the end of the meeting. They were also told that their data would be deleted once this study was finished and graded. Additional information included what was measured in every task, namely written answers and timed responses, as well as the filling out of the questionnaire form at the end. Lastly, participants were also informed about how it would be helpful to have them share their screen at the beginning of the procedure for better assistance and how they could complete their tasks as comfortably as they would like after that. Their spoken informed consent was recorded via Zoom and stored on the experimenter's computer before completing the tasks. The consent prompt can be found in Appendix D.

4.6 Analyses

4.6.1 Production

The production data was analyzed using *ScriptLog* (Wengelin et al., 2019) and *Microsoft Excel*. It was divided into two steps: first, object expression and second, an analysis of pauses and revisions.

Object expression

[16] Data files were coded according to group and gender. Spanish participants' codes followed the pattern SF01, for a Spanish female participant, and SM01 for a Spanish male participant. The same pattern was used for Brazilian participants: BF01 for a Brazilian female speaker, and BM01 for a Brazilian male speaker.

The number of objects produced and how they were expressed were analyzed in both L1 and L2. Only the experimental responses, that is the answers to the questions eliciting object structures were coded. Within the experimental responses, only the ones that elicited the same verb that was used in the text were considered. Therefore, one participant was excluded since none of their answers could be used in the analysis. A total of 392 responses (*n=224 for the Portuguese group, n= 168 for the SP group*) were analyzed for object expression. This data was screened and classified according to how the object was produced (*omission [null object], clitic/pronoun,* and *overt object*). Other options such as relative NP sentences occurred in a very infrequent manner and were removed from the analyses.

Pause and revision analysis

A total of 1760 responses were analyzed for number of produced characters in the linear text, pauses, revisions and total pause length per sentence. These responses were classified as object structures if they were meant to elicit null object structures (*n= 392; 224 for the Portuguese group and 168 for the SP group*) and as non-object structures if they were not (*n= 1368; 792 for the Portuguese group and 576 for the SP group*). An example of an object structure is an answer such as "Put them on the floor" to the question "What did Victor do with the balloons?" An example of a non-object structure is "Gustavo does" as a response to "Who wakes up first?" In addition, when responses to object structures did not include the same verb that was mentioned in the text, they were removed from the calculations to keep the analysis of syntactic structures as homogeneous as possible.

Additional criteria included a pause threshold of 1 s, which was set in *ScriptLog* (Wengelin et al., 2019). Pause outliers were also defined as values higher than 60s to avoid pauses as a result of distractions and external factors. Given the task design and that responses were numbered, several steps were taken to ensure that all data was analyzed following the same criteria.

Pause and revision criteria

Table 6. Pause and revision definition and examples.

Category	Definition	Coding	Example
Pause	A period in which writing production is interrupted for longer than 1 s. (Wengelin, 2006)	<pause>	2. **<19.248>**Eating sushi.<ENTER1>
Revision	Deletion, replacement, or correction of number of characters previously written.	<*backspace*>, <*replacement*>, <*delete*>, <*highlight*>, <*mouseclick*> or <left>	4) <19.176>He fot<**BACKSPACE1**>rgot to send it for **<BACKSPACE4>**<1.024>for his family<3.941><**MOUSECLICK><DELETE3>**to

1. Pauses and revisions were counted once the participants had enumerated their answers up until they had pressed the *enter/return* key, as illustrated by the bold-faced font in the example below:

(12) 1. **<4.101>Traveling<1.830>.**<ENTER1>

   a. I expected that many pauses that directly followed the question number may be attributed to rereading the text. Therefore, all these pauses were excluded from the analyses.

   b. The last responses to every text most often ended with a <*mouseclick*> rather than <*enter*>. In such cases, the last pause before the mouse click was not counted in as it was not indicative of planning, translating, or reviewing.

2. Revisions were calculated as the number of deleted characters (indicated by the notation 'backspace' in the log from ScriptLog). In addition, revisions were only considered if intended for editing and correction.

   a. For a more consistent analysis, when <*highlight*> appeared together with <*replace*>, only the former was considered, since <*highlight*> showed the range of characters highlighted and replaced, as observed in example 13:

(13) 4. <3.528>He forgot to sne<BACKSPACE2>end it<3.019><MOUSECLICK><MOUSECLICK><HIGHLIGHT68:64><MOUSECLICK><1.323><REPLACED>town

b. Revisions were typically considered to belong to the sentence under editing, even when those revisions occurred during the production of a different sentence.

Considering all the above criteria, one participant was excluded from this analysis as their total pause time equaled to 0.

4.6.2 Perception

The perception task measured reaction time (RT) in seconds and acceptability rate. Reaction times (RTs) were measured by *Psychopy* (Peirce, et al., 2019) and the output was organized and coded in *Microsoft Excel*.

Acceptability rate

The data was screened for outliers in RT to keep it homogeneous and avoid numerical values and responses due to technical or external factors (e.g., pressing the key too quickly, confusion, etc.) An outlier is defined here as value responses shorter than 2 s and longer than 12 s These numbers were established considering the length of the stimuli and that RT was measured from the moment the stimuli were presented. The stimuli were also coded according to acceptability as Table 7 presents per condition. In addition, correct/accepted answers mean they were considered acceptable in the language for both the experimental condition (*null object)* and the non-experimental conditions (*clitic, double clitic, wrong verb-object order* and *ungrammatical null object*).

Table 7 Coding of the stimuli in the perception task per condition.

Condition	Coding[17]	Acceptability
Null object	Left	Acceptable
Object clitic	Left	Acceptable
Double clitic	Right	Unacceptable
Wrong verb-object order	Right	Unacceptable
Ungrammatical null object	Right	Unacceptable

[17] The coding equaled the expected arrow-key to be pressed.

Reaction time (RT)

The mean RT was calculated using the raw RT values from each participant in each group. In addition, similar to the criteria for acceptability, the RT data was screened for the same outliers. The RTs of both correct and incorrect answers were considered.

4.6.3 Statistical analyses

All statistical analyses used *Microsoft Excel*. Descriptive and inferential statistics were performed for differences between the groups in proficiency level. Paired and independent-sample t-tests were conducted both in production and perception for significant differences within and between groups (all results are summarized in Appendix E). In addition, correlation analyses were performed between production and perception as well as between the participants' self-assessed grammar level of English and production/perception as follows: pause time in writing and RT to NOs in perception; null object expression in writing and acceptability rate of NOs in perception; and self-assessed grammar level of English and null object expression in writing.

4.7 Data loss and outliers

Due to technical issues in the design of one of the perception tasks, 3 stimuli in the English null object condition were not presented to 7 participants from the L1 Portuguese group. Therefore, the responses of these 7 participants to those 3 stimuli were not in the final calculations for both acceptability and reaction time.

Similarly, the pause and RT outlier criteria led to the exclusion of two participants, one L1 Portuguese speaker and one L1 Spanish speaker.

Chapter 5 Results

This chapter presents the results. First, I will begin with the results of the written production task followed by those of the perception task.

5.1 Production

The object argument expression and the occurrence of pauses and revisions were analyzed to investigate the processing of NOs. Hereunder are the results.

Object expression

One of the hypotheses (H1 above) concerning the use of NOs was that "*L1 Portuguese speakers will produce more null object structures in Portuguese than in English."* The results indicate that the L1 Portuguese speakers produced more NOs in Portuguese than in English ($t(21) = -2.495$, $p = .010$), as Figure 8 below illustrates. This figure shows the number of object expressions in the production task classified as *overt object* (e.g., I'll pay the bill), *clitic/pronoun* (e.g., I'll pay it), and *null object* (e.g., I'll pay).

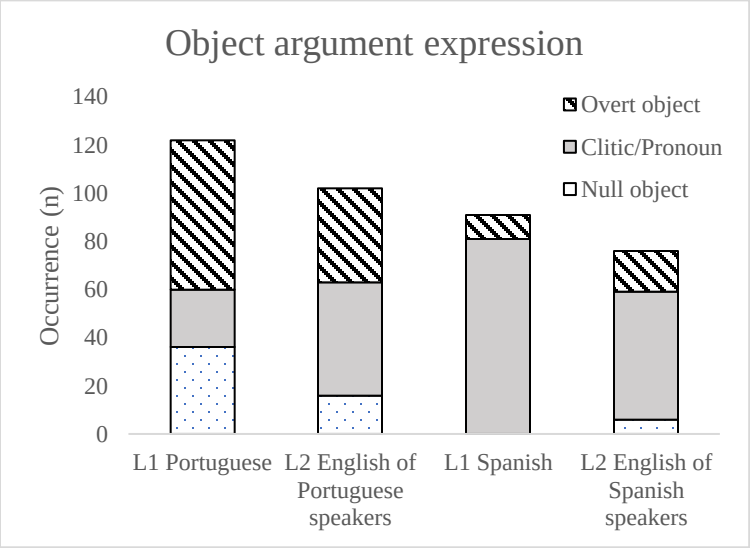

Figure 8. Object argument expression per group and language in the production task.

Along these lines, H2 stated that "*L1 Spanish speakers will produce more null object structures in Spanish than in English."* The results in Figure 8 show that the L1 Spanish speakers produced

significantly more NOs in English than in Spanish ($t(15) = -1.861$, $p = .041$), which is not consistent with my hypothesis.

H3 stated that "*L1 Portuguese speakers will produce more null object structures in English than L1 Spanish speakers."* The results in Figure 8 indicate that the L1 Portuguese speakers produced more NOs in English than the L1 Spanish speakers. However, the difference was not significant ($t(36) = -1.310$, $p = .099$).

In addition, due to the formality of a written task, overt objects were expected to be elicited, so they were considered as one category in this analysis. Having said that, it is observed that overall, the L1 Portuguese speakers produced more overt objects in both their L1 and L2 than the L1 Spanish speakers. Lastly, another observation is that the L1 Portuguese speakers generally produced somewhat longer sentences, omitted more pronouns, and used more synonyms of the verbs mentioned in the short stories than the L1 Spanish speakers.

Pause and revision analysis

Considering the crosslinguistic influences that might affect the occurrence of NOs in L1 and L2, I next examined the processing of NOs through the analysis of characters produced in the linear text (those in the final version and those previously produced and deleted), pauses, and revisions, which were regarded as a measure of cognitive effort. Table 8 illustrates the results of object structures, that is the sentences that were intended to elicit NOs, and of non-object structures, the sentences in which NOs were not prompted.

H4 stated that, *"L1 Portuguese and L1 Spanish speakers will produce object structures with a greater effort than non-object structures regarding the number of produced characters, pauses and revisions in both their L1 and L2."* Starting with L1, the results show that both groups produced more characters in non-object structures than in object structures (L1 Portuguese speakers $t(21) = -5.148$, $p > .001$; L1 Spanish speakers, $t(15) = -5.086$, $p > .001$) (see Table 8, left column). Regarding pauses, the L1 Portuguese speakers presented no significant difference between object and non-object structures ($t(21) = -0.024$, $p = .490$), while the L1 Spanish speakers produced more pauses in object than in non-object structures ($t(15) = -2.172$, $p = .023$) (see Table 8, the middle column). Lastly, concerning revisions, the L1 Portuguese speakers revised more in

non-object structures than in object structures ($t(19) = -2.639$, $p = .008$), and so did the L1 Spanish speakers ($t(14) = -1.279$, $p = .110$). However, this last difference was not significant (see Table 8, the right column). These results indicate that the L1 Portuguese and the L1 Spanish speakers produced more final characters in L1 non-object structures than in object structures. In addition, the L1 Portuguese speakers paused equally in both object and non-object structures, whereas the L1 Spanish speakers paused more in object structures. Lastly, the L1 Portuguese speakers revised more in non-object structures than in object structures, while the L1 Spanish speakers showed no significant difference between object and non-object structures in revisions.

In contrast, both groups produced significantly more characters in L2 object structures than in non-object structures (L1 Portuguese speakers $t(21) = -4.234$, $p > .001$; L1 Spanish speakers, $t(15) = -3.171$, $p = .003$) (see Table 8, left column). Similarly, both groups paused more in object structures than in non-object structures (L1 Portuguese speakers $t(21) = -5.591$, $p > .001$; L1 Spanish speakers, $t(15) = -1.886$, $p = .039$) (see Table 8, the middle column). In terms of revisions, both groups revised more in object structures than in non-object structures, but the differences are not significant (L1 Portuguese speakers $t(19) = -1.083$, $p = .146$; L1 Spanish speakers $t(14) = -1.541$, $p = .072$) (see Table 8, the right column). These results indicate that the L1 Portuguese and the L1 Spanish speakers produced more characters in object structures than in non-object structures in L2 English. Regarding pauses, the L1 Portuguese speakers and the L1 Spanish speakers paused more in object structures than in non-object structures. Lastly, the L1 Portuguese speakers and the L1 Spanish speakers present no significant difference in revisions between object and non-object structures. Therefore, both groups revised equally during object and non-object structures in L2 English.

Taken together, the results indicate that both the L1 Portuguese speakers and the L1 Spanish speakers produced object structures with greater effort in their L2 but not in their L1, as evidenced by the number of characters and pauses. In L1, the L1 Portuguese and the L1 Spanish speakers produced both types of structures similarly in terms of characters, while the L1 Spanish speakers paused more in object structures, and the L1 Portuguese speakers revised more in non-object structures.

Table 8. Pause and revision analyses of object structures (experimental condition) and non-object structures (non-experimental condition) in the production task.

	Mean no. of produced characters	Mean no. of pauses	Mean no. of revisions
Portuguese speakers:			
Object structures L1 Portuguese	29.01	1.46	3.34
Non-object structures L1 Portuguese	36.09	1.45	4.78
Object structures L2 English	42.54	2.78	4.44
Non-object structures L2 English	31.57	2.07	4.02
Spanish speakers:			
Object structures L1 Spanish	23.20	1.10	1.90
Non-object structures L1 Spanish	31.39	0.84	2.65
Object structures L2 English	39.65	3.30	5.01
Non-object structures L2 English	32.13	1.56	3.38

In addition, H5 stated that "*L1 Portuguese and L1 Spanish speakers will produce object structures with greater effort regarding the number of produced characters, pauses and revisions in their L2 than in their L1".* The results of an independent t-test between L1 and L2 object structures from each group indicate that both produced significantly more characters (L1 Portuguese speakers $t(21) = -5.304$, $p > .001$; L1 Spanish speakers, $t(15) = -6.180$, $p > .001$), pauses (L1 Portuguese, $t(21) = -5.591$, $p > .001$; L1 Spanish, $t(15) = 1.886$, $p = .039$) and revisions (L1 Portuguese, $t(19) = -1.876$, $p = .038$; L1 Spanish, $t(14) = 2.841$, $p = .006$) in the L2 English objects structures than in the L1 object structures. These results indicate that the L1 Portuguese produced object structures with more effort in L2 than in L1 regarding characters and pauses, while the L1 Spanish speakers did so regarding characters and revisions. For illustrative purposes, Figure 9 displays the differences between the groups in the mean number of produced characters, pauses and revisions.

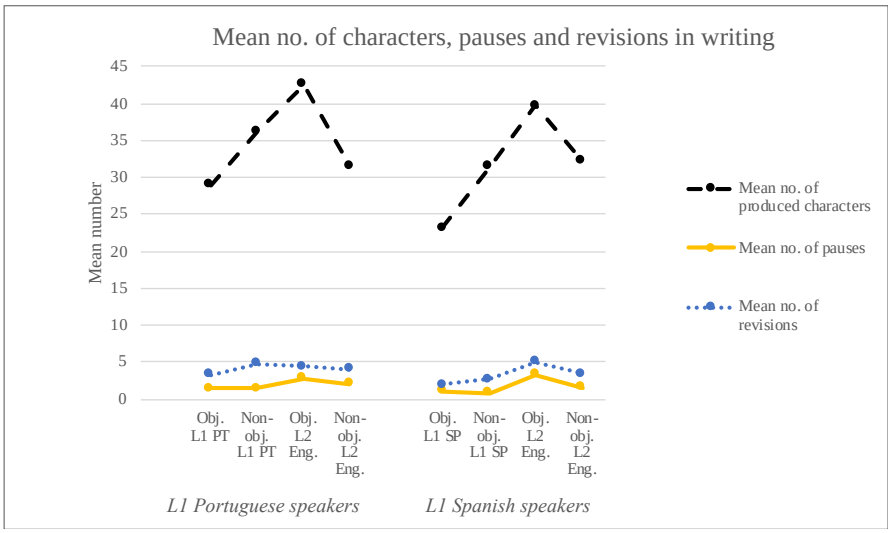

Figure 9. Mean number of produced characters, pauses and revisions in the production task (Obj. =object structures; non-obj. = non-object structures; PT = Portuguese; SP =Spanish; Eng. = English).

H6 stated that "*L1 Portuguese speakers will revise more during the written production of English object structures than L1 Spanish speakers."* As Figure 9 above shows, the L1 Spanish speakers produced more revisions in English object structures than the L1 Portuguese speakers (L1 Spanish speakers, M = 5.01; L1 Portuguese speakers, M = 4.44), but the difference between the groups was not significant ($t(32)$ = -0.080, p = .468). Therefore, there is no difference between the L1 Portuguese and the L1 Spanish speakers in the revision of English object structures.

Lastly, H7 stated that "*L1 Portuguese speakers will pause more during the written production of English object structures than L1 Spanish speakers."* The results in Figure 9 show no significant difference between the groups in the production of pauses in L2 English object structures ($t(36)$ = -0.556, p = .290). Therefore, there was no difference between the L1 Portuguese and the L1 Spanish speakers in this regard, so the hypothesis could not be confirmed.

Finally, one observation should be mentioned. Pauses were found right before the object expression in the L2 English of both groups, as can be observed in examples (14) and (15) from the L1 Portuguese group, and (16) and (17) from the L1 Spanish group below. However, they were more common in the L1 Portuguese group.

(14) <6.816>**put <2.306>on** top of the <5.591>door<11.266><ENTER1><1.130>

(15) <12.786><MOUSECLICK><HIGHLIGHT 77:74><MOUSECLICK><REPLACED>to<DOWN1>a<1.944><BACKSPACE1>he forgot to **send <1.665>it**

(16) <9.360>**Eat<3.522> it.<**3.413><MOUSECLICK><53.219>

(17) <7.364>Tha<BACKSPACE1>ey combed**<1.057> it** and braided it<ENTER1>

To summarize, the processing of NOs in written production was analyzed. The results indicated that the L1 Portuguese speakers produced NOs in both L1 and L2 writing, and more frequently than the L1 Spanish speakers. L1 Portuguese speakers also used an overt object more frequently than the L1 Spanish group in L2 English. On closer inspection, both groups showed a significantly greater effort in object than in non-object structures in L2 English. This difference was reflected in the number of characters and pauses. The L1 Spanish speakers revised more, but this difference was not significant between the groups.

5.2 Perception

The acceptability rate and the reaction time (RT) to NO were measured to study how these structures are perceived in the participants' L2 English. The results are displayed below. Recall that the conditions in the perception task included experimental (*null objects*) and control items (*clitic, double clitic, wrong verb-object order, and ungrammatical null object*). Only those results concerning the hypotheses are presented (*null object, clitic,* and *ungrammatical null object*).

Acceptability

The acceptability rate across conditions was calculated per group and language, which Table 9 presents. H8 stated that "*L1 Portuguese speakers will accept more null objects structures in English than L1 Spanish speakers."* The results in Table 9 show that the L1 Portuguese speakers accepted 74% of *NO* in L2 English, while the L1 Spanish speakers accepted 78%, which does not agree with the hypothesis. It is also noteworthy that despite the high acceptability rate of *NO* in L2 English, both groups showed greater acceptability of *clitics*, especially the L1 Portuguese group (L1 Portuguese speakers 90%; L1 Spanish speakers 82%). However, these results will not be discussed further as they are not part of the hypotheses.

Table 9. Acceptability rate of the conditions in the perception task (NO= null object; ungrammatical NO= ungrammatical null object).

	NO	Clitic	Ungrammatical NO
Portuguese speakers:			
L1 Portuguese	91%	76%	72%
L2 English	74%	90%	75%
Spanish speakers:			
L1 Spanish	87%	90%	21%
L2 English	78%	82%	46%

H9 stated that "*L1 Portuguese speakers will accept more ungrammatical null object structures in English than L1 Spanish speakers."* The results indicate that the L1 Portuguese speakers accepted 75% of *ungrammatical NO* and the L1 Spanish speakers accepted 46%, which is in line with the prediction (see Table 9, the far-right column).

Lastly, one observation should be noted. The L1 Portuguese speakers presented a high acceptability of *ungrammatical NO* both in L1 Portuguese (72%) and L2 English (75%).

Reaction time (RT)

H10 was that "*L1 Portuguese speakers will have an equally fast reaction time to null objects in Portuguese than L1 Spanish speakers to null objects in Spanish."* As Table 10 illustrates, the results indicate that the L1 Portuguese speakers reacted slightly faster than the L1 Spanish speakers, although the difference was not significant ($t(38)= -0.282$, $p = .390$). Therefore, in this respect, there was no difference between the L1 Portuguese and the L1 Spanish speakers.

Table 10. Mean RT in seconds (s) for focused conditions in the perception task (Experimental condition = null object; NO= null object; ungrammatical NO= ungrammatical null object).

	NO	Clitic	Ungrammatical NO
Portuguese speakers:			
L1 Portuguese	5.65	6.04	5.42
L2 English	7.12	7.10	7.53
Spanish speakers:			
L1 Spanish	5.47	5.47	5.43
L2 English	6.89	7.03	7.14

In addition, H11 stated that "*L1 Portuguese speakers will have a longer reaction time to null objects in English than L1 Spanish speakers.*" The results show no significant difference between the groups to English *NO* in RT (*t*(38)= -0.478, *p* =.318). Therefore, there is no difference in the RT to *NOs* between the L1 Portuguese and the L1 Spanish speakers in L2 English.

Moreover, H12 stated that "*L1 Portuguese speakers will have a longer reaction time to ungrammatical null objects in English than L1 Spanish speakers.*" Figure 10 shows a partially longer RT to the *ungrammatical NO* condition for the L1 Portuguese than for the L1 Spanish speakers in L2 English. However, the difference between the groups was not significant (*t*(38) = -0.850, *p* =.200). This indicates that there was no significant difference between the L1 Portuguese and the L1 Spanish speakers in RT to *ungrammatical NOs*.

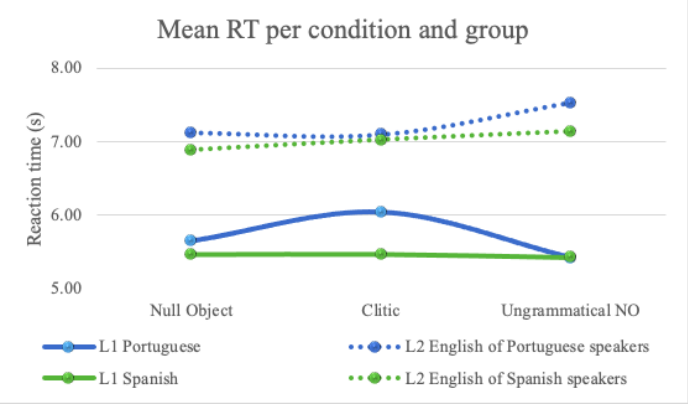

Figure 10. Mean RT per condition and language in each group in the perception task (Ungrammatical NO= ungrammatical null object).

When checking for significant differences within each group, the main comparisons concerned the contrast between grammatical and ungrammatical NO in L2 English and in a L1-L2 comparison (see Appendix E for a summary of the results). A significant difference was found in the *NO-Ungrammatical NO* conditions in the L2 English of Portuguese speakers (*t*(22)=-1.961, *p* =.031). In addition, the differences between L1 Portuguese and L2 English in the mean RT were significant overall for the two conditions considered: L1 *Portuguese-L2 English NO* (*t*(22)=-4.790, *p* = >.001); and L1 *Portuguese-L2 English ungrammatical NO* (*t*(22)=-9.865, *p* = >.001). Regarding the L1 Spanish group, the same significant differences were found in the L2 English *NO-Ungrammatical NO* conditions (*t*(16)=-1.896, p=.038) and between languages: L1 Spanish-L2

English *NO* (*t*(16)=-3.914 p= >.001), and the L1 Spanish-L2 English *ungrammatical NO* (*t*(16)=-4.052, p= >.001). On the one hand, these results indicate that both the L1 Portuguese and the L1 Spanish speakers react faster to *NO* than to *ungrammatical NO* in their L1. On the other, both groups reacted equally fast to *NO* in L1 and L2.

Additional comparisons with the clitic condition revealed no significant difference in RT between *NO* and *clitic* in the L2 English of Portuguese speakers (*t(*22)=-0.124, *p*=.451), and that of Spanish speakers (*t*(16)=-1.381, *p*=.093). However, a significant difference was found between L1 Portuguese and L2 English (*t*(22)=-5.722, *p*= >.001) and between L1 Spanish and L2 English (*t*(16)=-5.550, *p*= >.001). These results show that both groups processed sentences with a NO and sentences with an overt clitic pronoun in L2 English equally fast. However, the processing of these conditions differs from the participants' L1 to their L2.

The same comparisons were also made in the L1s. A significant difference was found between NO-Clitic in L1 Portuguese (*t*(22)=-3.760, *p*= >.001), but not in L1 Spanish (*t*(16)=-0.413, *p*=.342). Another comparison between NO-Ungrammatical NO revealed no significant differences in either L1 Portuguese (*t*(22)=-0.432, *p*=.334) or L1 Spanish (*t*(16)=-0.370), *p*=.358). These results indicate that the L1 Portuguese speakers reacted faster to *NO* than to *clitics* in L1 Portuguese. The L1 Spanish speakers, on the other hand, reacted equally fast to both conditions in L1 Spanish. Similarly, both the L1 Portuguese and the L1 Spanish speakers reacted equally fast to *NO* and to *ungrammatical NO* in Portuguese and Spanish respectively.

To summarize, the results in perception highlighted that both groups accepted NOs in L2 English equally. However, the L1 Portuguese group showed higher acceptability of ungrammatical NOs in English than the L1 Spanish speakers, as well as in Portuguese. In addition, both groups performed equally fast to NOs in L1, while the L1 Portuguese group reacted somewhat slower to both NOs and ungrammatical NOs in English than the L1 Spanish group.

5.3 Correlation analyses

Complementary correlation analyses were conducted for potential associations between the tasks. The results show a weak positive non-significant correlation between total pause time per sentence in writing and RT to NOs in perception for the L1 Spanish speakers in L2 English (*r*(14) = .229,

p = .393**)**. This correlation was weak negative non-significant for the L1 Portuguese speakers (*r*(20) = -0.472, *p*= .641), as Figure 11 illustrates. That is, the L1 Portuguese and the L1 Spanish speakers who used a longer pause time in producing NOs in L2 written English did not necessarily have a longer RT in perception.

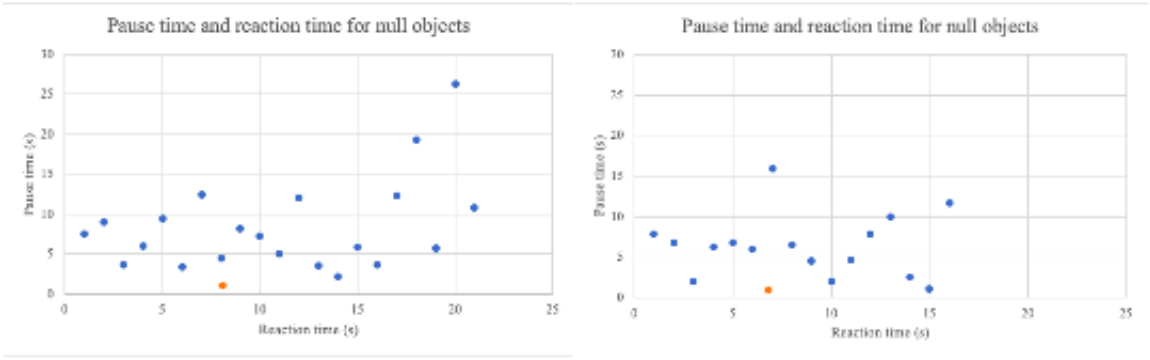

Figure 11. Correlation between pause time in writing and RT to NO in perception of the L1 Portuguese speakers (left) and the L1 Spanish speakers (right) in L2 English.

In addition, the correlation between NO expression in writing and acceptability of NOs was also weak negative non-significant for the L1 Spanish speakers (*r*(14) = -0.399, *p* = .124) and weak positive non-significant for the L1 Portuguese speakers (*r*(20) = -0.11, *p* = .958), as Figure 12 presents. These results indicate that the L1 Portuguese and the L1 Spanish speakers who produced more NOs in L2 written English did not necessarily accept more NOs in perception.

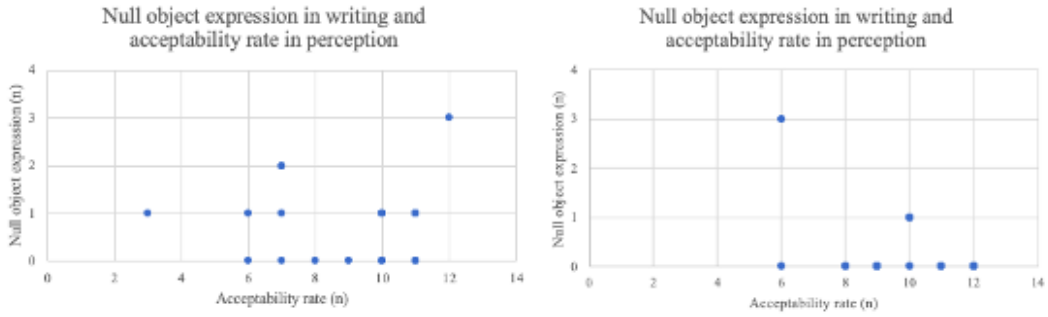

Figure 12. Correlation between null object expression in writing and acceptability rate in perception of NO by the L1 Portuguese speakers (left) and the L1 Spanish speakers (right) in L2 English.

Lastly, a significant difference was found between the groups in the self-assessed grammar level of English ($t(38) = -2.246$, $p = .010$). Therefore, a correlation analysis was conducted between the self-assessed grammar level per participant and the NO expression in writing, which revealed a weak negative non-significant difference for both groups (L1 Portuguese $r(20) = -0.333$, $p = .130$; L1 Spanish $r(14) = -0.105$, $p = .698$) (see Figure 13). That is, the L1 Portuguese speakers and the L1 Spanish speakers who were most proficient in English grammar did not necessarily produce more NOs in L2 written English.

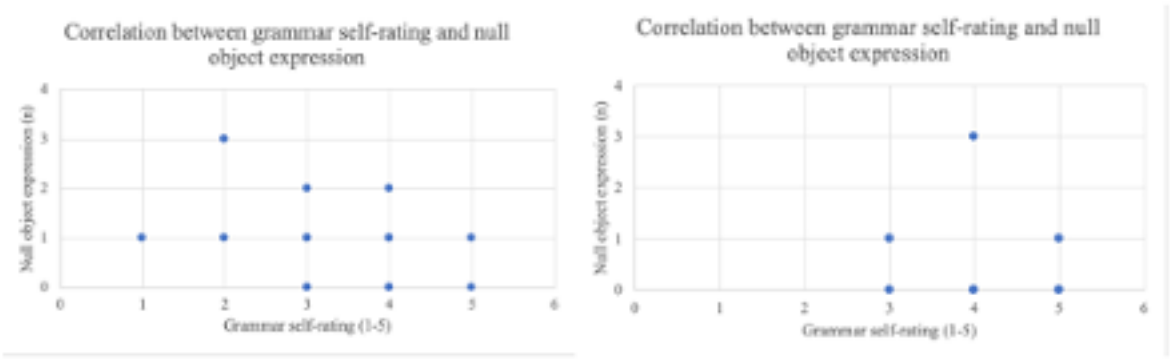

Figure 13. Correlation between self-assessed grammar level and null object expression in the written production of the L1 Portuguese speakers (left) and the L1 Spanish speakers (right) in L2 English.

In conclusion, the results of the production task indicated that the L1 Portuguese speakers produced more NOs in L2 English than the L1 Spanish speakers, but the differences in pauses and revisions were not significantly far apart. On the other hand, data from the perception task revealed that both groups accepted NOs similarly, although the L1 Portuguese speakers showed more acceptance of ungrammatical NOs. Regarding RT, both groups displayed an equal RT to NOs in L1, while the L1 Portuguese speakers showed a somewhat longer RT to both grammatical and ungrammatical NOs in L2 English.

Lastly, the L1 Portuguese and the L1 Spanish speakers who paused longer when writing answers with NO, were not more likely to show a longer RT to NOs in the perception task. In addition, the L1 Portuguese and the L1 Spanish speakers who used more NO structures in writing, were not more likely to accept more NOs in perception. Finally, the L1 Portuguese and the L1 Spanish speakers with advanced knowledge of English grammar were not more likely to produce more NOs in L2 English.

Chapter 6 Discussion

The present study attempted to answer research questions regarding the processing of NOs in both the written production and perception of two groups with similar L1 background, Portuguese speakers and Spanish speakers. This chapter discusses the results presented in Chapter 5. I will first discuss the results of production and then I will move onto the ones of perception. At the end I will discuss the results of both tasks together.

The main findings indicated the following:

i. The L1 Portuguese speakers produced more NOs in L2 written English than the L1 Spanish speakers. Although there were not considerable differences in pauses and revisions, the L1 Portuguese speakers exhibited more pauses right before the expression of an object argument.
ii. In perception, English NOs were equally accepted by both groups, although the L1 Portuguese speakers showed higher acceptability of ungrammatical NOs. This latter group also showed a somewhat slower RT to both conditions.
iii. The correlations tests revealed no significant differences in any of the associations studied: pause time in writing and RT in perception; NO expression in writing and acceptability in perception; or English grammar knowledge and NO expression in writing.

In addition, as general remark, the RTs as well as the number of pauses and revisions were generally doubled in both groups' L2 English tasks than in their L1 tasks. Similar results were reported in previous studies (Frenck-Mestre & Pynte, 1997; Ortega, 2013; Spelman Miller et al., 2008) and associated to a higher cognitive overload in L2 as opposed to L1.

6.1 Production

Object expression

The first hypothesis was that the L1 Portuguese speakers would produce more NOs in L1 Portuguese than in L2 English. This expectation considered that the L1 Portuguese speakers were more familiar with the NO parameters in their L1 than in their L2. It also considered that transfer effects from L1 Portuguese would occur in English. In Lemos Soares Cosme's (2016) study, NOs

were preferred over pronouns by the L1 Portuguese control group in written English. Unfortunately, to my knowledge, no studies have investigated NOs in L1 written Portuguese. However, the data from the present study supported my prediction and contradicted Lemos Soares Cosme's (2016), as pronouns were preferred over NOs in English in the present study. This contrast might be due to differences in the language proficiency and awareness of the Portuguese learners of English. That is, the participants in the present study were more aware of the linguistic differences between the object/pronoun expression and the fixed word order in English, which led them to produce NOs according to the Portuguese NO parameters, but not to the same extent as pronouns.

The next hypothesis was that the L1 Spanish speakers would construct more NO structures in L1 Spanish than in L2 English. This hypothesis assumed that the L1 Spanish speakers were more familiar with the NO parameters in Spanish than with those in English. To my knowledge, previous studies dealing with the production of English NOs by L1 Spanish speakers have not been conducted. However, other studies on clitic placement (Montrul et al., 2009, 2011; Zobl, 1980a) found transfer effects in Spanish L3 learners of Portuguese who accepted and produced more clitics than English L3 learners of Portuguese or native speakers of Portuguese. On the other hand, Zobl (1980a) found that French learners of English had no difficulty with pronoun placement. The results of the present study were not consistent with either my hypothesis, Montrul et al.'s (2009, 2011), or Zobl's (1980a), as L1 Spanish speakers produced significantly more NOs in English than in Spanish. A possible explanation for these results could be related to differences between English and Spanish in pronoun placement. In other words, clitics can occur both before and after the verb in Spanish, while pronouns are placed after the verb in English, due to its fixed word order. When pronouns in Spanish occur before the verb, they do so "independently" of it (i.e., unattached), whereas when they occur after the verb, both the clitic and the verb are *fused* into one word. Therefore, it might be omitted by the Spanish L2 learners when they associate both words as one.

Moreover, the L1 Portuguese speakers were expected to produce more NOs in English than L1 Spanish speakers. This hypothesis was based on the higher frequency and acceptability of NOs in Portuguese than in Spanish or English. Lemos Soares Cosme's (2016) reported that the L1 Portuguese speakers produced more NOs in the English written task than the L1 Spanish speakers.

Similar results were found in the present study, although the difference between the groups was not significant. A possible explanation for the contrast could lie in the stimuli design. That is, most stimuli in the English production task had inanimate object referents in the eyes of the L1 Portuguese participants. However, in the eyes of the L1 Spanish speakers, they consisted of definite referents. Recall that, unlike Spanish and English, NOs are governed by animacy rather than definiteness in Portuguese. However, all three languages agree that indefinite referents are more likely to be realized as null than definite ones. Thus, had both groups learned the English NO parameters, object arguments would have been realized either overt or with a pronoun in most cases. This was especially true for the L1 Spanish speakers, but not for the L1 Portuguese speakers, who produced more NOs. Therefore, these results suggest a possible cross-linguistic influence of L1 Portuguese. However, they cannot be attributed solely to transfer or easier learnability of the English NO parameters by the L1 Spanish speakers, as it is difficult to determine which of these factors had a greater influence. It is also worth mentioning that certain instances where the object was omitted in L2 English might be argued to be an intransitive use of verbs such as 'eat' or 'drink', in "To eat", "He likes to go drink and discuss the whole experience" or "Drink and discuss about them." Nonetheless, further research on this topic could be improved with more controlled and balanced material that more directly addresses L1 transfer.

The following observation is also in this direction: overall, the L1 Portuguese group expressed object arguments as overt in both their L1 and L2. They also did so more frequently than the L1 Spanish speakers. Similar results were reported by Lemos Soares Cosme (2016), but NOs and clitics/pronouns were preferred to overt objects. This contrast was not found in Montrul et al. (2009, 2011). The results of the present study suggest some influence by the formality of the task and that the participants were aware of the potential ambiguity of their responses when the object was expressed as null. However, the variation between the groups is noteworthy, which may indicate differences between a formal and an informal register in the expression of object arguments, especially in the participants' L1.

Another observational finding was that the L1 Portuguese speakers generally produced somewhat longer sentences, omitted more pronouns, and used more synonyms of the verbs mentioned in the short stories than the L1 Spanish speakers, in both the L1 and L2 tasks. To my knowledge, the

omission of pronouns and use of synonyms have not been investigated in relation to the production of NOs. However, Spelman Miller et al. (2008) reported that a lower productivity is associated with L2. Therefore, the results of the L1 Portuguese group do not seem to agree with Spelman Miller et al. (2008)'s, as opposed to the results of the L1 Spanish speakers. This contrast can be explained by the formality of the task, but not exclusively. That is, even though an attempt was made to control for certain factors, a written task can prompt different answers regarding length, verb use and the use of pronouns.

Pause and revision analyses

The first hypothesis was that object structures would be produced with a greater effort than non-object structures in both L1 and L2. The basis for this prediction was that NOs are structures that require grammatical and syntactic-semantic knowledge. There is also some ambiguity in their production. This combined would lead to the production of more pauses, revisions, and characters. Previous research does not tell us about the processing of NOs in either L1 or L2 writing. However, other studies (Spelman Miller et al., 2008) reported that L1 written production is more automated and therefore requires less pausing and revising at a higher level or macroplanning (i.e., planning or organizing the text). In contrast, L2 written production requires more pausing and revising at lower levels or microplanning (i.e., lexical or grammatical decisions choices). In addition, processing difficulties and higher cognitive effort have been found to equal a decrease in fluency and longer pauses (Barkaoui, 2019; Spelman Miller et al., 2008). In the study by Piolat et al. (2008), more words/min were also produced in L2 English than in L1 French. Although pauses and revisions were not analyzed by location in the present study, and not all pauses and revisions can be attributed to microplanning, the data only partially supported this prediction. Overall, the data could not confirm that object structures are produced with more effort in the participants' L1. Both groups produced more characters in L1 non-object structures than in object structures. In addition, the L1 Spanish speakers paused more in object structures and the L1 Portuguese speakers revised more in non-object structures. On the other hand, both groups produced more characters, pauses, and revisions in English object structures. However, these differences were only significant for the number of characters and pauses produced by both groups. One way to explain these results is that the L1 Portuguese and the L1 Spanish speakers were more comfortable producing object

structures in their L1. They were also more aware of resolving ambiguities in their L1 than in their L2, even though the L1 Spanish speakers show more difficulty regarding pauses in their L1 than the L1 Portuguese speakers.

The hypothesis that the L1 Portuguese and the L1 Spanish speakers would produce object structures more effortfully in their L2 English than in their L1 languages assumed that object structures require more cognitive effort than non-object structures, on the one hand, and differences between the participants' writing behaviors in L1 and L2, on the other. That is, it was expected that cognitive overload and processing difficulties in the L2 would show up in the number of characters, pauses, and revisions. Especially for the L1 Portuguese speakers, given the contrast between English and Portuguese in NO parameters. Previous studies (Barkaoui, 2019; Chenoweth & Hayes, 2001; Piolat et al., 2008; among others) pointed to differences in the writing behavior of L1 and L2 writers, such as longer pauses and more revisions at a lower linguistic level or microplanning in the L2. Regarding characters produced, L2 studies of written production (Piolat et al., 2008; Spelman Miller et al., 2008) generally reported a lower character production rate per minute in L2 compared to L1. To my knowledge, the number of characters produced in the linear text has not been studied in relation to ambiguity and difficulties in processing. However, the data from the present study confirmed the above prediction. The effort resulted in more pauses, characters, and revisions produced. However, the difference between the groups was not significant, which suggests that there was no difference between participants whose L1 is Portuguese and those whose L1 is Spanish. Therefore, these results could be due to an L2 processing effect. That is, the processing of an L2 differs from that of an L1 regarding speed and cognitive load, with the former being slower and requiring more effort than an L1, which is consistent with previous studies. However, object structures were also found to differ from non-object structures in the number of pauses and revisions, with the object structures requiring more of both. These results suggest that object structures require more effort to solve than non-object structures. However, it is unclear to what this difference between the two structures might be due to. As no significant difference was found between the groups, this difference might be caused by the ambiguity of resolving NOs. That is, it might have been difficult for the participants to determine whether NOs would be easily recoverable from the context or not.

In addition, the hypotheses that the L1 Portuguese speakers would revise and pause more in English object structures than the L1 Spanish speakers was based on the frequency and less restrictive NO parameters in Portuguese compared to Spanish. On this basis, a higher transfer effect was expected in the English of the L1 Portuguese speakers. To my knowledge, no studies have been conducted on the written production of NOs with pauses and revisions. However, general studies of L2 written production (Barkaoui, 2019; Chenoweth & Hayes, 2001; Spelman Miller et al., 2008) reported more frequent and longer pauses as well as revisions in L2 as opposed to L1, especially connected to L2 proficiency. However, the data from the present study contradicted my prediction. The L1 Spanish group produced more pauses and revisions, but the difference between the two groups was not significant. This suggests that there are no differences in the performance of the L1 Portuguese speakers and the L1 Spanish speakers in English object structures regarding pause length. One possible interpretation could be that NOs are equally problematic to solve in L2 English for both groups and that the data merely reflect a higher cognitive overload in L2 compared to L1 and slight differences in language proficiency.

Finally, previous research (e.g., Barkaoui, 2019; Spelman Miller et al., 2008) suggested a relationship between the location of pauses/revisions and processing difficulties. Although it is beyond the scope of this study to analyze and interpret pause placement regarding NO expression, pauses before an object expression in L2 English occurred more frequently for the L1 Portuguese than for the L1 Spanish group. These results indicate that although both groups performed similarly in object structures regarding pauses and revisions, the L1 Portuguese speakers may have hesitated more often about the object expression. One way to interpret these results could be as possible evidence for cross-linguistic processing effects. That is, considering that NOs are more frequent in Portuguese than in English and that knowledge of Portuguese might have interfered when producing NOs in English. This might have led to more hesitation as to how the object argument could be expressed and whether it was easily recoverable if omitted. However, these analyses alone cannot confirm this interpretation, but an analysis of pause and revision location is something that L2 acquisition research and NO studies could benefit from in the future. Other potential interpretations include that the L1 Portuguese speakers were aware of how ambiguous their

answers could be if they expressed the object argument as null, and differences in language proficiency between the groups might have also made the L1 Portuguese group more hesitant.

6.2 Perception

Acceptability

One hypothesis assumed that the L1 Portuguese speakers would accept more NOs in English than the L1 Spanish speakers. This considered that the Portuguese NO parameters would be more transferable to English, as NOs are more acceptable and frequent in Portuguese. To my knowledge, there are no previous studies that investigated the perception of NOs in L2 English comparing groups of L1 Spanish and L1 Portuguese speakers. However, Zyzik (2008) found that English learners of L2 Spanish had no difficulty accepting grammatical NO structures. Clahsen & Hong (1995) also reported that L2 learners do not generally have difficulty in accepting *grammatical* items in an L2. The analysis in the present study revealed that the L1 Spanish speakers accepted more English NOs than the L1 Portuguese speakers, which was not consistent with my prediction. However, the high acceptability of *grammatical* NOs by both groups is in line with previous studies. Even so, it is unclear to what this contrast between the groups is due, as the stimuli contained the same verbs in all three languages and that they could naturally be used with null and overt pronouns. One possible interpretation may be related to the participants' English grammar level. That is, although proficiency was not measured by a language test in this study, the difference in the self-assessed grammatical knowledge between the groups was significant. This could indicate that the L1 Spanish speakers might have been more familiar with English grammatical NOs than the L1 Portuguese group, which resulted in a higher acceptability of grammatical NOs than the L1 Portuguese speakers. However, the difference between the groups is not that great, which might simply indicate slight differences in their language developmental stage or English interlanguage.

Moreover, the hypothesis that the L1 Portuguese speakers would accept more ungrammatical NOs in English than the L1 Spanish speakers builds on the NO parameters in Portuguese, which are less restrictive compared to those in Spanish. Therefore, transfer effects were expected to occur more frequently for the L1 Portuguese than for the L1 Spanish speakers. Previous studies (Yuan,

1997) reported that Chinese L2 learners of English could efficiently reject ungrammatical NO in English. In contrast, Wakabayashi (2002) found that Spanish learners of L2 English had difficulty in rejecting them. Further research on NOs (Clahsen & Hong, 1995; Zyzik, 2008) suggests that the higher the proficiency level, the more ungrammatical items participants tend to reject and behave more natively. The data from the present study supported the prediction that the L1 Portuguese speakers would accept more ungrammatical NOs in English than the L1 Spanish speakers. These results might be due to differences in NO parameters between the languages. On the one hand, the verb referent of most ungrammatical NO stimuli in English was inanimate, which is allowed in Portuguese NOs. Therefore, this might have led the L1 Portuguese speakers to accept more ungrammatical NOs in English. However, these results cannot be only attributed to transfer as other factors such as language proficiency might have been involved. That is, the *real* language proficiency between the groups might have differed even though the self-assessed English level did not. This could have resulted in the L1 Spanish speakers rejecting more ungrammatical NOs in English than the L1 Portuguese speakers.

The following observation is also along these lines: the L1 Portuguese speakers accepted a higher number of ungrammatical NOs both in L1 Portuguese and in L2 English. To my knowledge, previous studies on the processing of null objects that used grammatical and ungrammatical sentences have not been used L1 Portuguese speakers. However, it is important to note that the present study measured acceptability and not grammaticality. In other words, there is often a consensus of what structures are grammatical or not in a language. However, acceptability varies from speaker to speaker. In addition, the stimuli in this study were revised by a small group of native speakers. Taken together the results suggest that the ungrammatical NOs stimuli in the present study might have not been suitable for examining NOs. At the same time, the present study could have benefited from control groups for each language.

Reaction time

Regarding L1 perception, the results supported the hypothesis that both the L1 Portuguese and the Spanish speakers would respond equally fast to NOs in their L1. This hypothesis assumed that both groups would be more familiar with the NO parameters in their L1 than in their L2. To my knowledge, no RT studies have been conducted on NOs. However, previous research on null

subjects and subject-verb agreement (Clahsen & Hong, 1995) found that RTs were shorter for grammatical items than for ungrammatical ones. Even though the L1 Spanish speakers responded faster than the L1 Portuguese speakers in the present study, the difference between the groups was not significant. These results are not surprising, considering, that the stimuli used the same verbs with a null and an overt pronoun naturally in all languages. Even so, the difference between the groups might indicate difficulty for the L1 Portuguese group in accepting NOs during a formal task.

Turning to L2 perception, the hypothesis that the L1 Portuguese speakers would have a longer RT to English NOs than the L1 Spanish speakers assumed that the contrast between Portuguese and English, as opposed to Spanish and English, in NO parameters would cause more processing difficulties for the L2 Portuguese speakers. Research on L2 English syntax and semantics (Booth et al., 2008) reported different RTs between groups with different L1 backgrounds, attributed to different proficiency levels and language proximity. Instead, the difference between the L1 Portuguese and the L1 Spanish speakers in RT was not significant in the present study, which suggests that these results may be more related to a general L2 processing effect due to different proficiency levels than to cross-linguistic influences.

In addition, the hypothesis that the L1 Portuguese speakers would have a longer RT to English ungrammatical NOs than the L1 Spanish speakers was also based on the fact that NO parameters in Portuguese are not as restrictive as in English or Spanish. This contrast between the languages would result in a longer RT for the L1 Portuguese speakers due to transfer effects. Clahsen and Hong's (1995) study reported a longer RT to ungrammatical items in the participants' L2. The present study revealed similar results, which might be due to an ungrammaticality effect. That is, incongruent items would cause the reanalysis of the stimuli and, therefore, a longer time is needed to reread and react to them. However, the ungrammatical NO stimuli in English consisted of verbs with inanimate referents, which Portuguese allows. Therefore, this should have decreased the L1 Portuguese participants' RT. Altogether, it is unclear why L1 Portuguese speakers presented a longer RT to English ungrammatical NOs. These results suggest that L1 Portuguese speakers were not able to reject as many NOs as the L1 Spanish speakers, which might simply reflect differences in language proficiency or the English interlanguage of the two groups. At the same time, when

taking together these results with those of acceptability, these stimuli might not have been suitable for the study.

Moreover, the contrast between the L1 Portuguese NO and the clitic in RT is worth addressing, even though it is not the focus of this study. Such contrast is not shown in the L1 Spanish group. To my knowledge, no studies on NOs or clitics have considered RT except for Clahsen and Hong (1995), who reported a longer RT to ungrammatical null subjects than to grammatical ones. In the present study, only the results of the L1 Spanish group agree with those of Clahsen and Hong (1995) regarding NOs, which means that the L1 Portuguese speakers exhibited a longer RT to grammatical than to ungrammatical NOs. This discrepancy between the groups might be due to the deception of the task. That is, when deciding whether stimuli were acceptable or not, the participants expected a certain ungrammaticality to occur, which led to longer RTs when they were trying to be careful with their answers. Despite that, the RTs of the L1 Spanish group seem to reflect the lack of variation between clitics and NOs in different registers since RTs are similar for both.

On a similar note, previous studies (Roberts et al., 2008) indicated that French learners of English had no difficulties with pronoun placement, as opposed to English learners of French. Additional comparisons in the present study revealed a significant difference between the L1 Portuguese and L2 English of the L1 Portuguese speakers in RT to clitics (pronouns), and between the L1 Spanish and L2 English of the L1 Spanish speakers. These results might reflect an L2 processing effect caused by differences between the languages in pronoun placement, which made RTs slower in the L2 compared to the L1.

6.3 Production and perception

One of the research questions of this study addressed how the results of the production and perception of null objects relate. The few studies that investigated both production and perception of null objects (Zyzik, 2008) also considered the proficiency level of the participants. These studies noted a correlation between proficiency and how NO structures are resolved: proficient learners depended more on syntax while less proficient learners relied more on semantics. Although this

aspect was not investigated in the present study, correlation tests relevant to the project were conducted.

A correlation test between the grammar self-rated level of the participants and the NO expression in writing revealed a negative non-significant association for both groups. These results agree with those of Zyzik's (2008) in a way, as the higher the participant's grammar level in L2 is, the lesser NOs are produced. This suggests that the participants' awareness of the syntactic word order in English is greater than their knowledge of the NO parameters. In fact, although both groups in the present study produced NO structures in their L2, a greater number of objects occurred with an overt pronoun, which is in line with previous research (Lemos Soares Cosme, 2016). In addition, a written production task usually prompts for a more formal register, which, in this case, implies a preference for using overt pronouns over NOs.

In addition, Zyzik (2008) reported a positive correlation between the acceptability of NOs and their oral production by English L2 learners of Spanish. This correlation was negative for the L1 Spanish speakers and positive for the L1 Portuguese group in the present study, but not significant. It indicates that a higher production of NOs does not necessarily correspond to a higher acceptability of NO in perception for both groups. Therefore, the relationship between perception and production of NOs in L2 English does not seem as straightforward, especially for the L1 Spanish speakers whose correlation was negative. Other factors not considered in this study might be involved. Previous studies (Zyzik, 2008) suggested that proficiency and the direct object clitic of Spanish influence the results. As for the L1 Portuguese group, the NO parameters in Portuguese seem to affect the participants' L2 processing, making them more prompt to accept and produce NOs in English even when the language does not allow it. However, the results of L1 Portuguese speakers might also suggest differences between the English interlanguage of both groups.

Moreover, an important observation regarding the acceptability of English NOs in L2 English is the even greater acceptability of clitics (pronouns). Previous research comparing L1 Portuguese and Spanish speakers has not yet been performed to my knowledge. However, Roberts et al. (2008) remarked that despite the acceptability of ungrammatical sentences, the fact that correct sentences are also accepted suggests the participants' awareness of the compulsory status of the grammatical structures. In this case, the use of overt pronouns in English. The results of the present study

indicate that both the L1 Portuguese and the L1 Spanish speakers were more conscious of the fixed word order of English and the use of pronouns than of English NO parameters. One possible explanation might be that knowledge of NO parameters is connected to proficiency. So, the more proficient participants are, the more aware they are of the fixed word order of English. However, NO parameters might require even more proficiency.

Turning to the correlation between pause time in writing and RT to NOs, to my knowledge, such correlation has not been investigated before, especially in L2 English. Despite that, the analysis in the present study showed a positive association for the L1 Spanish speakers and a negative one for the L1 Portuguese group. However, not significant. These results suggest that a longer pause time during the written production of NOs in L2 English does not necessarily correspond to a longer RT to NOs in the perception task. On the one hand, the correlations suggest that there is no difference between the L1 Portuguese and the L1 Spanish speakers in the production and perception of NOs, even though the correlations were not significant. That is, conclusions cannot be made whether one process occurs before the other. On the other hand, these results might also imply a relationship between NO parameters and the learnability of NO onto L2 English. That is, these results suggest an equal learnability of NOs in L2 English for both the L1 Portuguese and the L1 Spanish speakers, given that there is no difference between the production and perception of NOs in both groups and despite the similar NO parameters between English and Spanish, and the contrast between English and Portuguese.

Moreover, in order to answer the research question that compares production and perception results, we need to consider the above results with written and perception models on the one hand; and with the factors associated with L2 acquisition and transfer pointed out by Ortega (2013), on the other.

When compared with previous written production and perception models (Flower & Hayes, 1980; Fromkin, 1971; Levelt, 1989), these results indicate that multiple languages may have been active during both tasks. This resulted in the production of more pauses and revisions, in longer pauses and RTs, and in higher acceptability of ungrammatical NOs in L2 English. This could be due not only to language activation but also to the ambiguity in the production of NOs. That is, NOs seem to be more difficult to process than object structures with an explicit object argument, as evidenced

by the contrast between NOs and clitic in RTs. The results of both tasks also suggest that the L1 speakers of Spanish tend to process more like English native speakers, whereas difficulties are more often evident for the L1 Portuguese speakers. In addition, the typological similarity between Portuguese and Spanish also did not seem to have led to similar results in the two languages. It seems that the processing of English NOs by the L1 Portuguese speakers contains more errors than that by the L1 Spanish speakers. However, these results should be taken with caution, as the analysis of pauses and revisions only allow for inferences about processing in writing. Nevertheless, it is not surprising that the production task exhibited more characters, pauses and revisions in L2. As mentioned in Chapter 2, language activation can result in more pauses, revisions and characters in an L2 as opposed to an L1. In addition to that, the present study focused on a specific structure that draws on grammatical, syntactic, and semantic knowledge. Previous studies (e.g., Spelman Miller et al., 2008) reported that L2 writers spend more time at lower linguistic levels where grammatical and syntactic-semantic decisions are made. This also seems to be the area where L2 writers in the present study focused their attention in order to solve ambiguity and language-switching problems related to NOs. The number of pauses and revisions also suggests that the participants in the present study spent more time on the translating and reviewing steps of Flower and Hayes's (1980) written production model. This last conclusion needs to be carefully considered, as the pause and revision criteria chosen in the study excluded most initial pauses that could be associated with the planning. Nonetheless, the number of pauses and revisions also suggest that the L2 learners in the present study moved between the task environment and the monitor, where knowledge of the text produced is available and changes are made. The influence of long-term memory cannot be inferred from the analysis in the present study.

Moreover, as introduced in chapter 2, there are several factors that affect the pace of learning in an L2. Previous L2 studies (Jarvis & Odlin, 2000; Zobl, 1980b) pointed out differences in the use and markedness in structures shared in both the participants' L1 and L2. The results of the present study suggest that NO parameters in English are unmarked (or easier to learn) for the L1 speakers of Spanish and marked (or difficult to learn) for the L1 Portuguese speakers. This considers that the processing of Nos by the L1 Portuguese speakers contained more errors than that by the L1 Spanish speakers. Despite that, neither group seems to oversuse/underuse NO; rather, the results

show some overuse and errors in the English of the L1 Portuguese speakers. This suggests that the Portuguese NO parameters might be more likely to transfer into English than the Spanish parameters. At the same time, it also suggests differences between the groups in the development of their English interlanguage.

6.4 Methodological discussion

Taken all together, the adapted design of both the production and perception tasks was successful in eliciting null object structures in the written production in all three languages as well as in looking at cross-linguistic effects between them. However, modifications to the task and stimuli design might be fruitful for more focused and equally balanced studies.

Starting with production, the elicitation text proved to be a good method for NO elicitation. The pause and revision analyses are a suitable starting point for research on the processing difficulties of NOs in written production. However, the present study could have benefited from having a second coder as well as from using a pre-designed writing template that would have allowed for a clearer pause and revision criteria. This would have permitted the distinction between pauses to read the text and pauses to plan the utterance. Eye-tracking movements have also been used when investigating pauses, allowing triangulation of the data analyses as well as clearer inferences. This is also something future research could keep in mind.

The perception task of the present study was also favorable in observing cross-linguistic differences between the languages despite making use of the same set of verbs in all languages. A more direct and suitable approach to NOs would have used grammatical and ungrammatical NO structures as well as a more balanced distribution between the semantic parameters of NOs among the languages. Despite that, the collected data points out directions for future research in L2.

Finally, the present study could have benefited from using control groups for better data comparisons, given the lack of studies in this topic that investigate not only L2 English but also language production and perception.

Chapter 7 Conclusions

This thesis investigated the L2 processing of L1 speakers of typologically related languages. In particular, the written production and perception of null objects by Portuguese and Spanish L2 learners of English. In doing so, cross-linguistic differences and similarities were examined through the analysis of NO expression, pauses, and revisions in production as well as acceptability and reaction time in perception. The main research questions were whether L1 interference exists for L1 Portuguese and L1 Spanish speakers when resolving NO in L2 English, and how the results between the groups differ.

The present study proposed that the processing of English NO by L1 Portuguese and L1 Spanish speakers looks different despite the typological relation between Portuguese and Spanish, as their NO parameters differ. The data showed processing difficulties from Portuguese and Spanish in both production and perception, but not to the same extent. Overall, the L1 Portuguese speakers presented more errors in both tasks, whereas the L1 Spanish speakers mainly did in perception. Specifically, these errors appeared mainly in the production of NOs and the acceptability of ungrammatical NOs in the L2 English of the L1 Portuguese speakers. As for the L1 Spanish group, they processed more natively by producing fewer NOs and rejecting ungrammatical NOs in English, although errors were also observed.

Despite these differences, the two groups showed more production of pronouns than NOs as well as a similar number of pauses and revisions when producing English NOs. In perception, similarities included acceptability of English grammatical NOs and an even higher acceptability of pronouns. In addition, significant correlations were not found between production and perception, or a higher grammar level and the production of NOs in L2 English.

Taken together, the results indicated that the English NO presented more difficulty for the L1 Portuguese speakers in some respects and less for the L1 speakers of Spanish, possibly due to the shared NO parameters between English and Spanish. However, clear conclusions cannot be made. Despite that, both groups seemed to have been more conscious of the fixed word order of English than of the NO parameters.

The results also pointed to differences between the groups in the processing of English NOs. In production, both groups showed similarities in pausing and revising, which suggests that they focus on lower linguistic levels as well as in the translation and reviewing steps of the writing process. However, their production of NOs was not the same, and further analysis on pause and revision locations as well as a more balanced material would be beneficial for future research. Moreover, both groups had no difficulty accepting English grammatical NOs in perception. However, the L1 Portuguese speakers rejected fewer ungrammatical NOs than the L1 Spanish group. Nonetheless, a more controlled and balanced study is needed to confirm these results.

Overall, the present study sheds some light on the investigation of NO processing in both L1 and L2 written production and perception. It also offered an insight of how the processing of NOs in L2 English differs between groups with a typologically related L1 background. The findings also provided new evidence in the processing of NOs when considering a more complete scope of the issue. That is, by studying both written production and perception using a pause and revision analysis as well as RT. Lastly, the present study contributes to L2 learning studies by presenting how the processing of NOs in an L1 and an L2 interact.

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Appendix A

Production task stimuli[18]

SHORT STORY 1 – verb *colocar* (BP[19])/*poner* (SP[20])/ 'to put' (EN[21])

Portuguese version

Letícia vai convidar suas amigas a um lanche em casa amanhã, mas ela não sabe cozinhar. Ela pediu ajuda para sua mãe, que faz um bolo de cenoura muito gostoso. Então, Letícia e sua mãe vão fazer o bolo de tarde. Letícia perguntou para sua mãe como pode ajudar e aí sua mãe falou: "você pode colocar a cobertura de chocolate no bolo depois de eu acabar, desse jeito o chocolate vai esfriar durante a noite e o bolo ficará pronto para amanhã". No dia seguinte, as amigas da Letícia chegaram e mesmo que a Letícia tivesse falado para elas não trazerem nada, elas compraram pastéis e salgados.

1. Qual receita a Letícia e sua mãe irão fazer?
2. Por que a Letícia pediu ajuda para sua mãe?
3. O que a Letícia deve fazer com a cobertura de chocolate quando sua mãe acabar o bolo?
4. Quem comprou os pastéis e salgados?

Spanish version

Leticia va a invitar a sus amigas a merendar en casa mañana, pero no sabe cocinar. Le pidió ayuda a su madre, que hace un bizcocho de zanahoria muy rico. Entonces, Letícia y su madre van a hacer el bizcocho por la tarde. Leticia le preguntó a su madre cómo podía ayudar y su mamá le dijo: "puedes ponerle la cobertura de chocolate al bizcocho cuando yo termine, así el chocolate se enfriará durante la noche y el bizcocho estará listo para mañana". Al día siguiente, las amigas de Leticia llegaron y, aunque Leticia les había dicho que no trajesen nada, ellas compraron empanadillas y pasteles.

1. ¿Qué receta van a hacer Leticia y su madre?
2. ¿Por qué Leticia le pidió ayuda a su madre?
3. ¿Qué debe hacer Leticia con la cobertura de chocolate cuando su madre termine el bizcocho?
4. ¿Quién compró las empanadillas y los pasteles?

English version

[18] Translations of the Portuguese and Spanish versions can be found here.

[19] Brazilian Portuguese.

[20] European Spanish

[21] English.

Victor usually plays with his toys and videogames. Today is a hot summer day and Victor remembered that he had seen his neighbours having a water balloon fight in the garden a couple of days ago and thought that a water balloon fight could be fun. He had some water balloons at home and his mom and sister went out this morning, so the plan was perfect. He put the balloons on top of the door, on the edge, so when his mom and sister arrived, they would open the door and the balloons would fall on them and he would get them soaked. He thinks it will be fun!

1. What does Victor usually play with?
2. What happened with Victor and his neighbours?
3. What did Victor do with the balloons?
4. Who is Victor waiting for?

SHORT STORY 2 – verb *pentear* (BP)/*peinar* (SP)/ 'to comb' (EN)

Portuguese version

Guilherme trabalha muito, mas ele sempre arranja um tempo de tarde para estar com sua filha. Alguns dias eles vão passear no parque, outros dias eles jogam em casa, mas toda noite ele lê um livro para sua filha. Embora a bebê só tenha dois anos, ela já consegue fazer tudo sozinha: ela acorda sozinha, se veste sem ajuda, toma o café da manhã sozinha…Mas tem uma coisa que ela não faz sozinha: se pentear. Então Guilherme penteia o cabelo da sua filha e aí eles tomam o café da manhã. Depois disso ele leva a menina para a escola no caminho do trabalho.

1. O Guilherme tem tempo para estar com sua filha?
2. O que o Guilherme faz com o cabelo da sua filha nas manhãs?
3. O que o Guilherme faz com sua filha toda noite?
4. A filha do Guilherme consegue acordar sozinha?

Spanish version

Guillermo trabaja mucho, pero siempre hace tiempo por la tarde para estar con su hija. Algunos días van a pasear al parque, otros días juegan en casa, pero cada noche él le lee un libro a su hija. Aunque la bebé solo tiene dos años, ya se las arregla para hacer todo sola: se despierta sola, se viste sin ayuda, desayuna sola… Pero hay una cosa que no hace sola: peinarse. Entonces, Guillermo peina a su hija y después desayunan. Más tarde, Guillermo lleva a la niña a la escuela de camino al trabajo.

1. ¿Tiene Guillermo tiempo de estar con su hija?
2. ¿Qué hace Guillermo con su hija cada noche?
3. ¿Consigue la hija de Guillermo despertarse sola?
4. ¿Qué hace Guillermo con el pelo de su hija por las mañanas?

English version

Maria went to a party with her friends last Saturday. She was feeling a bit sad and thought it could be a good idea to meet new people. Before going to the party, her friends decided to take her to a beauty salon to cheer her up and Maria got her nails done and her hair combed and braided. When they arrived to the party, she was introduced to some other people and she immediately hit it off with Sarah. They exchanged phone numbers and started to meet and hang out at the city mall.

1. What did Maria do last Saturday with her friends?
2. Why did Maria's friends take her to the beauty salon?
3. What did they do with Maria's hair?
4. Where do Maria and Sarah usually hang out?

SHORT STORY 3 – verb *beber* (BP)/ (SP)/ 'to drink' (EN)

Portuguese version

Lydia é uma menina de 8 anos. Ela gosta muito de brincar com suas amigas e com um novo amigo que ela tem: um cachorro que seus pais deram para ela de presente pelo seu aniversário. Todos os dias a menina leva o cachorro ao parque para passear e brincar com ele. Cada vez que eles chegam a casa depois do passeio, o cachorro bebe toda a água que tem no seu pote. Além disso, ela também ajuda ele a tomar banho toda semana. As amigas de Lydia ainda não conhecem o cachorro e Lydia convidou elas esse fim de semana para brincar com ela e seu cachorro na casa.

1. O que o cachorro da Lydia faz com a água quando volta para casa?
2. Quem as amigas da Lydia ainda não conhecem?
3. O que a Lydia e as amigas dela irão fazer esse fim de semana?
4. Por que a Lydia convidou suas amigas para vir a casa dela?

Spanish version

Lidia es una niña de 8 años. Le encanta jugar con sus amigas y con un nuevo amigo que tiene: un perro que sus padres le regalaron por su cumpleaños. Todos los días Lidia lleva al perro al parque para pasear y jugar con él. Cada vez que ellos llegan a casa después del paseo, el perro bebe todo el agua que tiene en su bebedero. Además de eso, ella también ayuda a bañar al perro cada semana. Sus amigas aún no conocen al perro y Lidia las invitó este fin de semana a jugar con ella y su perro en la casa.

1. ¿Qué hace el perro de Lidia con el agua cuando llegan a casa?
2. ¿A quién no conocen todavía las amigas de Lidia?
3. ¿Qué van a hacer Lidia y sus amigas este fin de semana?
4. ¿Por qué Lidia invitó a sus amigas a su casa?

English version

Gabriel and Cindy have been dating for 8 months now. Since Cindy loves Asian food, Gabriel thought they could eat sushi this weekend. They often make sure that they spend time together. They like walking in the park, going to the gym, and they also make time for each other's hobbies. Cindy likes going to museums. Even though Gabriel is not a huge fan of these places, they go together from time to time. Cindy does not know a lot about wine too, but Gabriel likes wine so they go to wine tasting events where he can drink wines and discuss about the whole experience.

1. What does Cindy think about Asian food?
2. What are Gabriel and Cindy doing this weekend?
3. Does Cindy know a lot about wine?
4. What does Gabriel like to do with wines on tasting events?

SHORT STORY 4 – verb *acordar* (BP)/*despertarse* (SP)/ 'to wake up' (EN)

Portuguese version

Gustavo e Luiza comemoram esse ano 10 anos de casados. Seus amigos sempre perguntam o que eles fazem para continuarem a se sentir tão apaixonados como o primeiro dia de namoro. Aí Gustavo sempre responde que uma das coisas que eles sempre fazem é ir dormir juntos. Na hora de acordar, Gustavo acorda primeiro e prepara o café da manhã. Quando ele acaba, ele acorda a Luiza. Seus amigos também perguntaram como eles vão comemorar esse aniversário. Eles responderam que vão comemorar esse aniversário do mesmo jeito que todos os anos: comendo pizza e assistindo episódios da sua serie favorita, Friends.

1. Quantos anos o Gustavo e a Luiza têm de casados?
2. Quem acorda primeiro?
3. O que o Gustavo faz com a Luiza depois de preparar o café da manhã?
4. Como o Gustavo e a Luiza vão comemorar seu aniversário?

Spanish version

Gustavo y Luisa celebran este año 10 años de casados. Sus amigos siempre les preguntan qué hacen para seguir sintiéndose tan enamorados como el primer día. Entonces Gustavo siempre responde que una de las cosas que siempre hacen es irse a dormir juntos. A la hora de despertarse, Gustavo se despierta primero y prepara el desayuno. Cuando termina, despierta a Luisa. Sus amigos también les han preguntado cómo van a celebrar este aniversario. Ellos respondieron que celebrarán este aniversario de la misma manera que todos los años: comiendo pizza y viendo episodios de su serie favorita, Friends.

1. ¿Cuántos años de casados celebran Gustavo y Luisa?
2. ¿Quién se despierta primero?
3. ¿Qué hace Gustavo con Luisa después de preparar el desayuno?
4. ¿Cómo van a celebrar el aniversario Gustavo y Luisa?

English version

Helen is a little girl who always goes around with her doll Amy. She also likes painting so she asked her mom to sign her up for painting lessons. She spends her day painting cars, her family and friends and her doll. Everyday she wakes up and before doing anything else, she wakes her doll up, dresses her up and does her hair! Today she decided to make her doll look like her. So she dressed her doll up like her and she combed her hair like hers. Her friends at school liked it!

1. What type of lessons does Helen take?
2. What does Helen usually paint?
3. What does Helen do with her doll when she wakes up?
4. What did Helen's friends at school think about what she did?

SHORT STORY 5 – verb *mandar* (BP)/*enviar* (SP)/ 'to send' (EN)

Portuguese version

Pedro foi morar na Irlanda porque ele queria fazer intercâmbio de inglês na universidade Trinity College Dublin. Ele chegou faz dois dias e tem muita coisa para fazer além de visitar muitos lugares e fazer amigos. Por exemplo, ele já foi para o banco e criou uma conta para poder pagar o aluguel. Ele também tem que resolver um assunto com a universidade. A universidade pediu para o Pedro mandar uns papéis para finalizar o registro dele. Pedro vai mandar os papéis amanhã. Também se inscreveu em um curso de inglês e já conseguiu uma vaga nele. As aulas irão começar na próxima semana.

1. O que o Pedro faz na Irlanda?
2. Quando o Pedro chegou na Irlanda?
3. Para que o Pedro criou uma conta no banco?
4. O que Pedro vai fazer com os papéis amanhã?

Spanish version

Pedro se mudó a Irlanda porque quería hacer un intercambio de inglés en el Trinity College Dublin. Llegó hace dos días y tiene mucho que hacer además de visitar muchos lugares y hacer amigos. Por ejemplo, él ya fue al banco y creó una cuenta para poder pagar el alquiler. También tiene que resolver un problema con la universidad. La universidad le pidió a Pedro que enviara algunos papeles para finalizar su matrícula. Pedro enviará los papeles mañana. También se inscribió en un curso de inglés y ya obtuvo una plaza. Las clases comenzarán la próxima semana.

1. ¿Qué hace Pedro en Irlanda?
2. ¿Cuándo llegó a Irlanda?
3. ¿Para qué creó Pedro una cuenta en el banco?
4. ¿Qué hará Pedro mañana con los papeles?

English version

James decided to take a gap year after high school. He loves traveling and he is not sure about what he wants to do in the future, so he thought moving to another country might be a good idea. Plus he gets to see the world! He is now living in a little town in Colombia. James often takes pictures for his family and he enjoys sharing what his life is like over there with them. However, he thought of going the extra mile and prepare a parcel filled with typical things from Colombia for his family. He prepared it weeks ago but for some reason he has forgotten to send the parcel yet.

1. What does James love doing?
2. Where does James live now?
3. How does James usually share what his life is like with his family?
4. What has James forgotten to do with the parcel?

SHORT STORY 6 – verb *comer* (BP)/*comer* (SP)/ 'to eat' (EN)

Portuguese version

André estava trabalhando de noite no escritório quando começou a se perguntar se ele tinha escolhido um bom trabalho e se era feliz. Quando chegou em casa, ele procurou ajuda na internet. André achou um podcast sobre pequenas coisas que te podem fazer feliz e começou a escrever uma lista do que ele gostava de fazer. Por exemplo, no fim de semana ele gosta de passear no parque. Ele se senta em um banco para escrever. Às vezes, antes de ir, ele compra algo para comer e enquanto ele escreve, os pássaros comem a comida que o André dá, a maioria das vezes é minhocas. André continuou escrevendo mais coisas na lista e tudo isso serviu para recarregar forças e ser genuinamente feliz.

1. O que o André fez quando chegou em casa?
2. Quando ele começou a escrever a lista?
3. O que ele gosta de fazer no fim de semana?
4. O que os pássaros fazem com as minhocas?

Spanish version

Andrés estaba trabajando en la oficina por la noche cuando comenzó a preguntarse si había elegido un buen trabajo y si era feliz. Cuando llegó a casa, buscó ayuda en Internet. Andrés encontró un podcast sobre pequeñas cosas que pueden hacerte feliz y comenzó a escribir una lista de lo que le gustaba hacer. Por ejemplo, los fines de semana le gusta pasear por el parque, donde se sienta en un banco a escribir. A veces, antes de irse, compra algo de comer y mientras escribe, los pájaros comen la comida que les da Andrés, la mayoría de las veces son lombrices. Andrés siguió escribiendo más cosas en la lista y todo esto sirvió para recargar fuerzas y ser genuinamente feliz.

1. ¿Por qué Andrés buscó ayuda en internet?
2. ¿Cuándo empezó a escribir la lista?
3. ¿Qué le gusta hacer durante el fin de semana?
4. ¿Qué hacen los pájaros con las lombrices?

English version

Sam was doing groceries at Tesco and he came across a classmate from his bachelor's years at Sheffield University. They started to talk about how they are doing in their lives, their jobs as architects and they started to reminisce about the parties that they used to attend, the people they met, their professors! Clearly, as architects, they used to spend their days making sketches and models of buildings. Since they were having a good time, they decided to go out to eat some fish and chips and continue their chat over lunch.

1. Where does Sam knows his classmate from?
2. What do they both do for a living?
3. How did Sam and his classmate spend their days at university?
4. What did they decide to do with fish and chips?

Semantic parameters of verb referent:

Verbs (EN/BP/SP)	English	Brazilian Portuguese	Spanish
Put/colocar/poner	Definite	Inanimate	Definite
Comb/pentear/peinar	Definite	Inanimate	Definite
Drink//beber	Indefinite	Inanimate	Definite
Wake up/acordar/despertarse	Definite	Animate, human	Definite
Send/mandar/enviar	Definite	Inanimate	Definite
Eat/comer/comer	Indefinite	Animate, non-human	Definite

Expected answers based on the above parameters:

English	Brazilian Portuguese	Spanish
Definite referents prompt the use of pronouns, while indefinite referents may not.	Animate referents prompt the use of pronouns, while inanimate referents prompt null objects.	Definite referents prompt the use of pronouns, while indefinite referents may not.

Trial round stimuli

SHORT STORY 1

Joe is a mechanical engineering student. He is also good with drawings and photography. Whenever he has some spare time, he goes to the beach with his camera and takes some pictures. The beach is his favorite place in the city. He hasn't graduated yet, but his father wants Joe to work for his company, and Joe doesn't know if he wants to work as an engineer. For now, he will continue his studies and perhaps give his father's company a chance.

1. What does Joe do when he has some spare time?
2. What will Joe do for now?
3. What does he study?

SHORT STORY 2

Brian is taking his driving test in three days. He wants to practice more, even though he drives well so he's taking a few more lessons. During this one, he remembered what had happened in the first class: his teacher explained all the steps he must follow and he started to drive. While he was driving, the teacher kept explaining all the information he needed, but Brian yelled at his teacher because he was feeling nervous. Then, the teacher asked him to let his classmate drive instead. So Brian stayed on the backside watching how his classmate drove for the rest of the class.

1. When does he have his driving test?
2. How was Brian feeling when he yelled at his teacher?
3. What was Brian doing while his classmate was driving?

Appendix B

Perception task stimuli

Target stimuli – glossed examples can be consulted here.

Condition/Language	Portuguese	Spanish	English
Conhecer/Conocer/Know NULL	A: Você conhece o Pedro das aulas de inglês? B: Não, não conheço, mas vi ele algumas vezes nas aulas.	A: ¿Conoces a Pedro el de las clases de inglés? B: Conocer, no, pero lo he visto un par de veces en las clases.	A: Did you know my cousin is getting married? B: Oh yes! I have known for months now! We're good friends.
Conhecer/Conocer/Know + CLITIC	A: Ouvi que a Ana também esteve na festa ontem! B: Sim, eu finalmente a conheci! É uma pessoa bem legal.	A: ¡Me enteré que Ana estuvo en la fiesta ayer! B: ¡Sí! ¡Por fin la conocí! Es una persona muy simpática.	A: What's our new boss like? I've heard rumours. B: Honestly, I don't know her myself, but I've heard rumours too.
Ler/Leer/Read NULL	A: O que você fez ontem na biblioteca tão cedo? B: Eu queria ler poesia, mas achei uns quadrinhos e comecei a ler.	A: ¿Qué hiciste ayer en la biblioteca tan temprano? B: Quería leer poesía, pero encontré algunos cómics y empecé a leer.	A: Do you usually read in the morning, Mathew? B: Yeah, I wake up early, pick up a book and read in my room.
Ler/Leer/Read + CLITIC	A:O que você comprou na feira do livro ontem? B: Comprei os livros do Tolkien e os estive lendo a tarde toda.	A: ¿Qué compraste en la feria del libro ayer? B: Compré los libros de Tolkien y los estuve leyendo toda la tarde.	A: Did you buy anything in the new bookshop? B: A new edition of Pride and Prejudice! I've read it seven times.

Ver/Ver/See NULL	A: Miguel, não gostamos que você vá viajar sozinho. B: Viu só?! Vocês reagiriam assim se eu falasse alguma coisa.	A: Miguel, no nos gusta que vayas a hacer el viaje solo. B: ¿Veis? Sabía que ibais a reaccionar así si os decía algo.	A: Your dad and me think we all should go on a trip. B: See? I knew you two would like it! I have the best ideas!
Ver/Ver/See + CLITIC	A: Como o Lucas reagiu à surpresa da viagem então? B: Você não viu ele? Ficou furioso. Ele não gosta de surpresas.	A: ¿Cómo se tomó Lucas la sorpresa del viaje entonces? B: ¿No lo viste? Se puso hecho una furia. No quiere sorpresas.	A: Sandra, what if we start our trip next week instead? B: See that? You always make excuses. We said tomorrow.
Escrever/Escribir/Write + NULL	A: Jõao, quanto tempo! O que você tem feito? B: Pois é! Estou escrevendo para uma revista bem conhecida.	A: Juan, ¡cuánto tiempo! ¿A qué te dedicas ahora? B: Pues estoy escribiendo para una revista muy conocida.	A: Hey, dude! Are you busy? How's work? B: I have to hand in a report tomorrow, so I'd better start writing.
Escrever/Escribir/Write + clitic	A: Helena, o que você vai fazer hoje à tarde? B: Devo mandar uma carta, então eu vou escrever ela depois.	A: Elena, ¿qué vas a hacer hoy por la tarde? B: Tengo que enviar una carta, así que la escribiré después.	A: Jenny, what is Mat doing now? Is he busy? B: He has an essay due today, so I'll help him write it later.
Entender/Entender/Understand + NULL	A: Desculpe, mas você não atende aos requisitos. B: Eu entendo. Acho que vou tentar novamente no próximo ano.	A: Lo siento, pero no cumple los requisitos. B: Entiendo. Supongo que lo volveré a intentar el año que viene.	A: I'm afraid these papers do not meet the standards. B: Oh, I didn't notice that. I understand. I'll hand them in again.
Entender/Entender/Understand + clitic	A: Infelizmente, você não pode continuar nas provas.	A: Me temo que no puede seguir en las pruebas.	A: Sadly, we will continue with other candidates.

	B: Hm, tudo bem. Entendo isso. Talvez no próximo ano.	B: Bueno, no pasa nada. Lo entiendo. Quizás otro año será.	A: Oh, I understand that. Perhaps I am not a good fit here.
Fechar/Cerrar/Close NULL	A: Você sempre deixa a porta da frente aberta! B: Já vou fechar, mãe. Eu vim correndo da aula e esqueci.	A: Gabriel, ¡siempre dejas la puerta de casa abierta! B: Ya cierro, mamá. Vine de clase corriendo y se me olvidó.	A: Guys, who left the door open again this morning? B: Doesn't matter. Whoever got here late, forgot to close.
Fechar/Cerrar/Close + CLITIC	A: Eu poderia jurar que fechei essa janela antes. B: Não, fui eu. Estava com frio e me levantei para fechá-la.	A: Juraría que había cerrado esta ventana antes. B: No, fui yo. Tenía un poco de frío y me levanté a cerrarla.	A: Oh, I thought I left the car window open again. B: You definitely did, but I closed it when I took the car earlier.
Pagar/Pagar/Pay NULL	A: Você comprou uns sapatos na internet de novo? B: Sim, comprei, mas tudo bem. Paguei com o cartão do pai.	A: ¿Has vuelto a comprar zapatos por Internet? B: Sí, pero no pasa nada. De verdad. Pagué con la tarjeta de papá.	A: Have you bought anything from that bakery? B: Yes! Well, actually, not me. Jonah paid. But it was delicious!
Pagar/Pagar/Pay Clitic	A: Você recebeu sua conta de luz no final das contas? B: Sim, apenas ontem. Fui ao banco essa manhã para pagar ela.	A: Oye, ¿te ha llegado la factura de la luz al final? B: Sí, justamente ayer. Fui esta mañana al banco a pagarla.	A:Sandra, what are all these expensive bills about? B: They're from a new TV I bought, but I won't be paying them.
Saber/Saber/Know NULL	A: O que devo dar de presente para o meu pai? B: Se você não sabe, você podia perguntar para ele, né?	A: ¿Qué podría regalarle a mi padre? Es tan difícil… B: Si no sabes, le podrías preguntar. Puede que no le importe.	A: Did you tell your mom you can't buy her a gift yet? B: No, she wouldn't forgive me if she knew. She's excited.

Saber/Saber/Know + Clitic	A: Como você sabe que não gostei do seu presente? B: Realmente, eu não sabia isso até que sua mãe me contou.	A: ¿Cómo sabes que no me gustó tu regalo? B: En realidad no lo sabía hasta que me lo dijo tu madre.	A: I'm not sure you know, but Matthew gave me this. B: Oh, so cute! I knew it because Peter told me this morning.
Desenhar/Dibujar/Draw NULL	A: O que você mais gosta de fazer depois da aula? B: Eu gosto quando chego em casa e começo a desenhar.	A: ¿Qué te gusta más hacer después de las clases? B: Pues me gusta cuando llego a casa y me pongo a dibujar.	A: Hey, man. What are you doing later in the afternoon? B: I'll probably start to draw for real for the first time.
Desenhar/Dibujar/Draw + Clitic	A: Seu filho sempre desenha animais? B: Sim, sempre. Ele os desenha em todos os tipos e cores.	A: ¿Tu hijo suele dibujar animales siempre? B: Sí, normalmente. Los dibuja de todas clases y colores.	A: Did you draw the whole city of Florence? B: Yeah, I saw a picture on a book, and I started to draw it.
Perder/Perder/Lose NULL	A: O que aconteceu com o jogo de cartas ontem? B: João perdeu e teve que pagar uma rodada de cervejas.	A: ¿Qué pasó con la partida de cartas del otro día? B: Juan perdió y tuvo que invitar a todos a una ronda de cervezas.	A: Jeremy, you still play chess, don't you? B: Yeah, I played in a regional tournament last time and lost.
Perder/Perder/Lose + Clitic	A: Lucas, você não jogou poker na sexta passada? B: Sim, o jogo foi legal, mas eu o perdi. Estava desconcentrado.	A: Lucas, ¿no jugaste al póquer el viernes pasado? B: Sí, la partida estuvo muy bien, pero la perdí. Estaba desconcentrado.	A: Are you going to the baking contest next week? B: No, I don't think so. I already went last year and lost it.
Chutar/Chutar/Kick NULL	A: Mas o que devo fazer? Não sei jogar futebol! B: Você coloca a bola e depois chuta, mas mire no gol.	A: ¿Qué tengo que hacer? ¡No sé jugar al fútbol! B: Coloca la pelota y después chutas, y apunta a la portería.	A: But why don't you like football? It's fun! B: Well, it's all about kicking, kicking, and kicking.

Chutar/Chutar/Kick + Clitic	A: O que você fez hoje no treino de futebol, David? B: Apenas chutei a bola. Chutei-a, chutei-a e chutei-a.	A: ¿Qué hiciste hoy en el entrenamiento de fútbol, David? B: Sólo chutar la pelota. Chutarla, chutarla y chutarla.	A: What do I do with the ball when it comes my way? B: Really dude? When it comes, make sure you kick it!
Pintar/Pintar/Paint NULL	A: Amanda, quero pintar isso ali. Me ajuda? B: Sim, claro. Para pintar, primeiro você deve saber desenhar.	A: Amanda, quiero pintar eso de ahí. ¿Me ayudas? B: Sí, claro. Para pintar, primero hay que saber dibujar.	A: Sarah, what do you think of my painting? B: It's amazing! You really learned how to paint with charcoal!
Pintar/Pintar/Paint + Clitic	A: Lúcia, que lindo o desenho que você fez! B: Sim, agora só tenho que ter certeza de que estou o pintando direito.	A: Lucía, ¡qué bonito el dibujo que has hecho! B: Sí, ahora sólo me tengo que asegurar de pintarlo bien.	A: Hey, sweetie. What are you painting now? B: I saw a little dog in the park and started to paint it last week.

Control stimuli

Verb/language	Portuguese	Spanish	English
Cozinhar/Cocinar/Cook **PT: Double clitic** **SP: Double clitic** **EN: Wrong word order**	A: Mãe, o que a gente vai comer no Natal? B: Douradas, mas eu não vou poder cozinhá-las as douradas.	A: Mamá, ¿qué vamos a comer para Navidad? B: Dorada, pero yo no sé si voy a poder cocinarla la dorada.	A: Do you think there's enough food for all of us? B: Hmm, I have some chicken in the freezer. I'll it cook just in case!
Cortar/Cortar/Cut **PT: Ungrammatical null** **SP: Ungrammatical null**	A: Oi, Beatriz! O que você está fazendo aí?	A: ¡Hola, Beatriz! ¿Qué estás haciendo ahí?	A: Do you know what's wrong with this plant?

EN: Double clitic	B: Cuidando do meu jardim. Essa planta ficou doente e vou cortar.	B: Cuidando de mi jardín. Esta planta se enfermó y voy a cortar.	B: There are some leaves that are dried. Probably you need to cut them the leaves.
Estudar/Estudiar/Study **PT: Wrong order** **SP: Wrong order** **EN: Double clitic**	A: Lídia, você tem alguma prova na próxima semana? B: Tenho, sobre capitais do mundo, mas as não vou estudar.	A: Lidia, ¿tienes algún examen la semana próxima? B: Uno de las capitales del mundo, pero las no voy a estudiar.	A: Hey, Steve. How was the mat exam today? B: I'll fail because I didn't study them the fractions before.
Deixar/Dejar/Leave **PT: Ungrammatical null** **SP: Ungrammatical null** **EN: Wrong word order**	A: Você deixou o cachorro sozinho em casa? B: Tentei muitas vezes, mas sim, deixei sozinho em casa.	A: Lara, ¿dejaste al perro solo en casa? B: Pues, lo intenté muchas veces, pero sí, dejé solo en casa.	A: Any luck leaving the kids home alone? B: I'm looking for a nanny, so I haven't them left home alone.
Colocar/Colocar/Put **PT: Wrong word order** **SP: Wrong word order** **EN: Ungrammatical null object**	A: Teresa, não coloque os brinquedos aí. B: Mas eu não eles coloquei. Foi o Carlos, que estava brincando.	A: Teresa, no pongas los juguetes ahí. B: Pero, si no he colocado los yo. Fue Carlos el que estaba jugando.	A: Jake, are you done with my camera? B: Yeah, I finished hours ago. I think I put on your desk.
Beber/Beber/Drink **Pt: Wrong word order** **SP Wrong word order** **EN: Double clitic**	A: Você pediu um café e ainda não bebeu nada. B: Está muito quente, cara. Calma, eu o vou beber agora.	A: Has pedido un café y aún no has bebido nada. B: Está caliente, hombre. Tranquilo que me voy a lo beber.	A: So, what drink are you gonna order? B: I'll have some coffee and I will drink it the coffee in a big mug.
Costurar/Coser/Sew **PT: Ungrammatical null** **SP: Ungrammatical null** **EN: Wrong word order**	A: O que está fazendo com essa camisa social? B: Os botões estão quebrados, então eu vou costurar.	A: ¡Hola! ¿Qué haces con esa camisa? B: Pues que tiene los botones rotos, así que voy a coser.	A: Denise, did you finish fixing my jacket?

			B: Yeah. Here. The zip still works, but I couldn't properly it sew.
Comprar/Comprar/Buy **PT: Double clitic** **SP: Double clitic** **EN: Ungrammatical null object**	A: Você gostaria de comprar roupas no fim de semana? B: Sim, podemos ir esse sábado comprá-las as roupas, né?	A: ¿Te apetece ir este finde a comprar ropa conmigo? B: Sí, podemos ir este sábado a comprarla la ropa, ¿no?	A: Did you see that cute mug on the store window? B: Yeah, I think I'll buy for myself. I love it. It's so cute!
Regar/Regar/Water **PT: Double clitic** **SP: Double clitic** **EN: Ungrammatical null**	A: Pai, posso te ajudar com as plantas mais tarde? B: Sim, eu não vou fazer muita coisa, apenas regá-las as plantas.	A: Papá, ¿te puedo ayudar con las plantas más tarde? B: Claro, aunque no voy a hacer mucho, sólo regarlas las plantas.	A: This garden takes a lot of work. Where do we start? B: It would be necessary to remove the dead leaves first and to water after.
Lavar/Lavar/Wash **PT: Wrong word order** **SP: Wrong word order** **EN: Ungrammatical null**	A: Carlos, quem vai lavar a roupa? Você ou eu? B: Assim que o filme terminar, prometo que as eu vou lavar.	A: Carlos, ¿quién va a lavar la ropa? ¿Tú o yo? B: En cuanto termine esta película, te prometo que lavo las yo.	A: You're gonna wash those dirty jeans now, mister. B: Fine but let me wash when I'm done with this game.
Limpar/Limpiar/Clean **PT: Double clitic** **SP: Double clitic** **EN: Wrong word order**	A: Você ainda tem muito para fazer na cozinha? B: Um poco. Se alguém me ajudasse a limpá-la a cozinha…	A: ¿Te queda mucho por hacer en la cocina? B: Un poco. Si alguien me ayudara a limpiarla la cocina…	A: How much time do you have left with the car? B: A couple of hours, perhaps. I was about to it clean.
Reparar/Arreglar/Fix **PT: Ungrammatical null** **SP: Ungrammatical null** **EN: Double clitic**	A: Pai, a TV não funciona. O que está acontecendo? B: Não sei, vou chamar o técnico e mandar vir consertar.	A: Papá, la tele no funciona. ¿Qué es lo que le pasa? B: Pues no sé, llamaré al técnico y que vengan a arreglar.	A: Is the router broken? There's no Wi-fi here. B: Yeah, I tried to fix it the router but still nothing works.

Semantic parameters of verb referents

Target stimuli

Verbs (EN/BP/SP)	English	Brazilian Portuguese	Spanish
'To know' (something) /conhecer/conocer **null**	Definite	Animate, human	Definite
'To know' (something) /conhecer/conocer **clitic**	Definite	Animate, human	Definite
'To read'/ler/leer **null**	Indefinite	Inanimate	Indefinite
'To read'/ler/leer **clitic**	Definite	Inanimate	Definite
'to see'/ver/ver **null**	Indefinite	Inanimate	Indefinite
'to see'/ver/ver **clitic**	Definite	Animate, human	Definite
'to write'/escrever/escribir **null**	Indefinite	Inanimate	Indefinite
'To write'/escrever/escribir **clitic**	Indefinite	Inanimate	Indefinite
'To understand'/entender/entender **null**	Indefinite	Inanimate	Indefinite
'To understand'/entender/entender **clitic**	Definite	Inanimate	Definite
'to close'/fechar/cerrar **null**	Definite	Inanimate	Definite
'To close'/fechar/cerrar **clitic**	Definite	Inanimate	Definite
'to pay'/pagar/pagar **null**	Indefinite	Inanimate	Indefinite
'to pay'/pagar/pagar **clitic**	Definite	Inanimate	Definite
'To know' (something)/saber/saber **null**	Indefinite	Inanimate	Indefinite
'To know' (something)/saber/saber **clitic**	Indefinite	Inanimate	Indefinite
'to draw'/desenhar/dibujar **null**	Indefinite	Inanimate	Indefinite
'To draw'/desenhar/dibujar **clitic**	Definite	Animate	Definite
'To lose'/perder/perder **null**	Indefinite	Inanimate	Definite
'To lose'/perder/perder **clitic**	Definite	Inanimate	Definite
'To kick'/chutar/chutar **null**	Indefinite	Inanimate	Definite
'To kick'/chutar/chutar **clitic**	Definite	Inanimate	Definite

‘To paint’/pintar/pintar **null**	Indefinite	Inanimate	Indefinite
‘To paint’/pintar/pintar **clitic**	Indefinite	Inanimate	Definite

Control stimuli

Verb (EN/BP/SP)	English	Brazilian Portuguese	Spanish
‘To cook’/cozinhar/cocinar	Indefinite	Inanimate	Definite
‘To cut’/cortar/cortar	Definite	Animate	Definite
‘To study’/estudar/estudiar	Definite	Inanimate	Definite
‘To leave’/deixar/dejar	Definite	Animate	Definite
‘To put’/colocar/colocar	Definite	Inanimate	Definite
‘To drink’/beber/beber	Definite	Inanimate	Definite
‘To sew’/costurar/coser	Definite	Inanimate	Definite
‘To buy’/comprar/comprar	Definite	Inanimate	Indefinite
‘To water’/regar/regar	Definite	Animate	Definite
‘To wash’/lavar/lavar	Definite	Inanimate	Definite
‘To clean’/limpar/limpiar	Definite	Inanimate	Definite
‘To fix’/consertar/arreglar	Definite	Inanimate	Definite

Appendix C

Language history questionnaire

LANGUAGE HISTORY QUESTIONNAIRE

Participant code:

Date:

BACKGROUND

Below are questions about your education and use of language. Please answer them as honestly and completely as possible.

Age:

Gender:

What is your highest level of finished education? (High school, university degree, formative course)

What is your profession (e.g. student, engineer)

Were you born in Brazil/Spain? Yes No

If yes:

Have you lived in Brazil/Spain since birth? Yes No
If no, where else have you lived and how long?

LANGUAGE BACKGROUND

What is your native language/s?

Please list any other languages that you know below. For each, rate how well you can use the language on the following scale:

Not Good 1 2 3 4 5 Very Good

Language	Speaking	Listening	Writing	Reading	Grammar	Pronunciation
1						
2						

Language	Speaking	Listening	Writing	Reading	Grammar	Pronunciation
3						
4						

If any of the languages you listed in the table above were **Portuguese**, **Spanish** or **English**, please indicate below the place and age at which you learned them, and if applicable, whether you learned them by formal lessons (e.g., at school or a course), or by informal learning (e.g., at home, at work, from friends).

Language	Country	Age	Lessons (yes/no)	Duration of lessons	Informal (yes/no)	Duration of informal learning
1						
2						
3						
4						

In general, how well do you *like* to learn new languages?

Dislike 1 2 3 4 5 Like

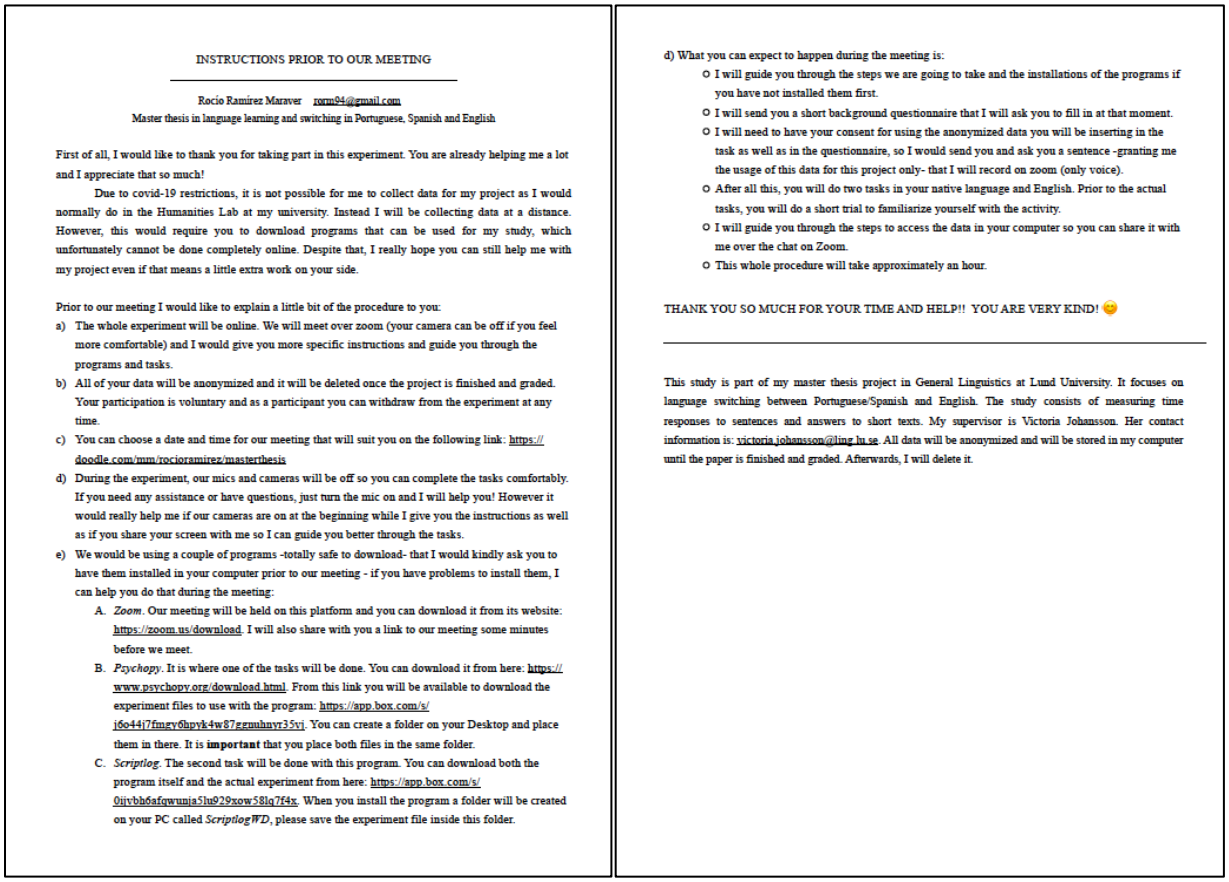
In general, how *easy* do you find learning new languages?

Difficult 1 2 3 4 5 Easy

If you have any other remarks about your language history that you think may be important for your ability to use these languages, please feel free to write them here:

Appendix D

Instructions prior to the meeting



INSTRUCTIONS PRIOR TO OUR MEETING

Rocío Ramírez Maraver rorm94@gmail.com
Master thesis in language learning and switching in Portuguese, Spanish and English

First of all, I would like to thank you for taking part in this experiment. You are already helping me a lot and I appreciate that so much!

Due to covid-19 restrictions, it is not possible for me to collect data for my project as I would normally do in the Humanities Lab at my university. Instead I will be collecting data at a distance. However, this would require you to download programs that can be used for my study, which unfortunately cannot be done completely online. Despite that, I really hope you can still help me with my project even if that means a little extra work on your side.

Prior to our meeting I would like to explain a little bit of the procedure to you:

a) The whole experiment will be online. We will meet over zoom (your camera can be off if you feel more comfortable) and I would give you more specific instructions and guide you through the programs and tasks.
b) All of your data will be anonymized and it will be deleted once the project is finished and graded. Your participation is voluntary and as a participant you can withdraw from the experiment at any time.
c) You can choose a date and time for our meeting that will suit you on the following link: https://doodle.com/mm/rocioramirez/masterthesis
d) During the experiment, our mics and cameras will be off so you can complete the tasks comfortably. If you need any assistance or have questions, just turn the mic on and I will help you! However it would really help me if our cameras are on at the beginning while I give you the instructions as well as if you share your screen with me so I can guide you better through the tasks.
e) We would be using a couple of programs -totally safe to download- that I would kindly ask you to have them installed in your computer prior to our meeting - if you have problems to install them, I can help you do that during the meeting:
   A. *Zoom*. Our meeting will be held on this platform and you can download it from its website: https://zoom.us/download. I will also share with you a link to our meeting some minutes before we meet.
   B. *Psychopy*. It is where one of the tasks will be done. You can download it from here: https://www.psychopy.org/download.html. From this link you will be available to download the experiment files to use with the program: https://app.box.com/s/j6o44j7fmgv6hpvk4w87gzmuhnyr35vj. You can create a folder on your Desktop and place them in there. It is **important** that you place both files in the same folder.
   C. *Scriptlog*. The second task will be done with this program. You can download both the program itself and the actual experiment from here: https://app.box.com/s/0ijvbh6afqwunja5lu929xow58lq7f4x. When you install the program a folder will be created on your PC called *ScriptlogWD*, please save the experiment file inside this folder.

d) What you can expect to happen during the meeting is:
   - I will guide you through the steps we are going to take and the installations of the programs if you have not installed them first.
   - I will send you a short background questionnaire that I will ask you to fill in at that moment.
   - I will need to have your consent for using the anonymized data you will be inserting in the task as well as in the questionnaire, so I would send you and ask you a sentence -granting me the usage of this data for this project only- that I will record on zoom (only voice).
   - After all this, you will do two tasks in your native language and English. Prior to the actual tasks, you will do a short trial to familiarize yourself with the activity.
   - I will guide you through the steps to access the data in your computer so you can share it with me over the chat on Zoom.
   - This whole procedure will take approximately an hour.

THANK YOU SO MUCH FOR YOUR TIME AND HELP!! YOU ARE VERY KIND! 😊

This study is part of my master thesis project in General Linguistics at Lund University. It focuses on language switching between Portuguese/Spanish and English. The study consists of measuring time responses to sentences and answers to short texts. My supervisor is Victoria Johansson. Her contact information is: victoria.johansson@ling.lu.se. All data will be anonymized and will be stored in my computer until the paper is finished and graded. Afterwards, I will delete it.

Informed consent prompt

I consent that my answers may be used for the investigation of language learning and switching in relation to English, Portuguese, and Spanish in the master thesis by Rocío Ramírez. I have been informed that the data consists of reaction times and written answers, and it will be anonymized. I have also been informed that my data and consent will be removed when the thesis is finished and graded.

Appendix E

T-test results of perception task in the NO, clitic, and ungrammatical NO conditions from both groups as well as from comparisons between conditions (*NO = null object, ungrammatical NO = ungrammatical null object*).

Condition	df	t	p
Portuguese speakers:			
L1 conditions			
NO-Clitic	22	-3.760	>.001
NO-Ungrammatical NO	22	-0.432	.334
L2 conditions			
NO-Clitic	22	-0.124	.451
NO-Ungrammatical NO	22	-1.961	.031
L1-L2 conditions			
NO	22	-4.790	>.001
Clitic	22	-5.772	>.001
Ungrammatical NO	22	-9.865	.000
Spanish speakers:			
L1 conditions			
NO-Clitic	16	-0.413	.342
NO-Ungrammatical NO	16	-0.370	.358
L2 conditions			
NO-Clitic	16	-1.381	.093
NO-Ungrammatical NO	16	-1.896	.038
L1-L2 conditions			
NO	16	-3.914	>.001
Clitic	16	-5.500	>.001
Ungrammatical NO	16	-4.052	>.001