Syntactic and Logophoric Anaphora Under the Perspective of Experimental Syntax

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Abstract

In order to avoid repetition of noun phrases in a sentence the use of anaphora is present in most languages. In English, for example, Reinhart and Reuland (1993) pointed out that syntactic anaphora, besides natural, is guided by c-command (Chomsky, 1981) and related to syntactic factors, and logophoric anaphora is guided by extra-syntactic information. This study aims to observe the influence of c-command in Brazilian Portuguese syntactic anaphora "a si mesmo (a)" during language processing, as well as verify the acceptability of the logophoric anaphora "ele mesmo". For this, two psycholinguistic experiments were made that showed the influence of c-command during the reading of the anaphora "a si mesmo (a)" and that the sentences with logophoric anaphora "ele mesmo" are considered acceptable in Brazilian Portuguese.

Keywords: anaphora, logophoric anaphora, c-command, biding theory, language processing

1. Introduction

1.1 The Problem of Logophoric Anaphora

The use of anaphora is commonplace in languages in general. This is an issue that has motivated numerous research efforts in the field of Linguistics, and it is common to encounter various studies aimed at understanding the structural aspects involved in the process of referring back to a previous term.

Chomsky's Binding Theory (1981) describes the syntactic constraints that govern the licensing of grammatical antecedents for anaphors, pronouns, and referential expressions in sentence generation. However, there are conflicting approaches for cases in which anaphora does not seem to be guided by syntactic factors. An example of this is logophoric anaphora, which relies on extra syntactic information (Reinhart & Reuland, 1993).

1.2 Understanding the Experiment

Anaphora is understood as a constituent that refers to another previously mentioned constituent, as Kenedy (2013) states that "when a new constituent in a sentence refers to (or has the same reference as) another constituent already mentioned in the sentence or discourse, we name this new constituent an anaphor" (Kenedy, 2013, p. 267).

Syntactic anaphors are those that adhere to the constraints of Binding Theory (Chomsky, 1981), while logophoric anaphors are discourse-dependent (Foraker, 2003). According to Reinhart and Reuland (1993), anaphors that obey syntactic restrictions, such as indexation and c-command, are guided by binding conditions, while logophoric anaphors appear not to be guided by syntactic constraints as they make use of extra syntactic information.

In the examples below, developed by Foraker (2003), a syntactic anaphora and a logophoric anaphora are shown in (1) and (2), respectively:

(1) Judy said that Bill$_i$ expressed himself$_i$ clearly.

(2) Bill$_i$ explained to Judy that writers like himself$_i$ were in short supply.

The sentences exemplified above contain an anaphora guided by binding conditions, the syntactic anaphora (1), and an anaphora that is not restricted by these conditions, the logophoric anaphora (2).

In Brazilian Portuguese (BP), this type of structure can also be observed in sentences like (3) and (4). In (3), the anaphora is syntactic because the expression "ele mesmo" is a co-argument of the same predicate to which the antecedent "Flávio" belongs. In (4), the anaphora is logophoric because it cannot, by itself, be a co-argument of its antecedent. Let's see:

(3) Flávio$_i$ elogiou ele mesmo$_i$ na festa ontem. (Note 1)

(4) Flávio$_i$ disse que Carla queria convidar Maria e [ele mesmo]$_i$ para a festa ontem (Note 2).

According to Reinhart and Reuland (1993), logophoric anaphora can be replaced by a pronoun, as in (5):

(5) Flávio$_i$ disse que Carla queria convidar a Maria e ele$_i$ para a festa ontem (Note 3).

In (4) and (5), although "ele mesmo" and "ele" are interchangeable in this position, only "ele" allows an ambiguous reading (it could be Flávio or another man who is part of the discourse universe of the interlocutors). With "ele mesmo," the only possible reading is Flávio, even though Flávio is an antecedent positioned outside the binding domain.

As we can observe in the examples above, the distinction in representation between syntactic anaphora and logophoric anaphora is related to the reflexive being a co-argument of its antecedent and being able to be syntactically interpreted on its own. When the reflexive does not share the same predicate with its antecedent, syntax alone is not sufficient for interpretation. The latter requires information beyond syntax for the creation of the correct referent. Reinhart and Reuland (1993) suggest that this extra syntactic information should be understood as a level of representation. Syntactic anaphora, as the name itself suggests, is guided by syntactic factors such as indexation and c-command, while logophoric anaphora is related to discourse factors.

Based on the above, this research aimed to determine whether the notion of c-command is psychologically real and to verify whether structures with logophoric anaphora are acceptable in Brazilian Portuguese (BP), supporting Reinhart and Reuland's (1993) assertion that this is a structure that should be considered grammatical.

In current related literature on language processing, there isn't any works on logophoric anaphora in Brazilian Portuguese language. For this reason, we believe this study can bring relevant scholarship for the area. To better organize this research, we divided it into five sections, including this introductory one. Following it, there is the literature review, which deals with the most important theoretical concepts. In the next topic the method of experimental syntax is explained. Afterwards, there is the general discussion about the two experiments, and at last, our final considerations.

2. Literature Review

2.1 The Notion of C-Command by Chomsky (1981)

In the theoretical scope of syntax, a theory that deals with the domain of binding is the Binding Theory (Chomsky, 1981). It has been relevant because its principles address the structural properties of linguistic expressions that have the potential for reference. In other words, this theory is dedicated to the phenomenon of binding and encompasses issues related to referential dependencies.

According to Raposo (1992), it can be said that a linguistic expression has the potential for reference when it can designate entities (people, things, ideas, etc.) or situations in the discourse universe. Entities that have this potential for reference are referred to as DP (Determiner Phrase). Therefore, it becomes necessary to study the relationships between the phrases in order to understand the relationships of referential dependency.

Referential dependency refers to the linguistic situation in which the referential value of one DP is acquired indirectly through the referential value of another DP present in the discourse (Raposo, 1992). This dependency results in one expression being indexed to another, meaning both expressions refer to the same discourse entity. Let's see below examples in BP of sentences with coindexing:

(6) Maria$_i$ disse que ela$_i$ e Daniel comeram o sanduíche (Note 4).

(7) Os irmãos$_i$ brigavam [uns com os outros]$_i$ ontem (Note 5).

In (6), the pronoun "ela" has the DP "Maria" as its antecedent, and in (7), "uns com os outros" has the DP "os irmãos" as its antecedent. The antecedent of a DP "a" is a DP "b" with an identical index (Raposo, 1992). Thus, according to this author, in these cases, there is a relationship of referential dependency because both have the same index.

The study of DP involves possibilities and impossibilities in the distribution of reference indices among them. The Binding Theory studies these relationships and presents three principles that govern the distribution of the following linguistic forms: anaphors, pronouns, and referential expressions. These are encompassed by principles A, B, and C, respectively.

Principle A imposes restrictions on anaphor resolution and predicts that an anaphor must obligatorily have an antecedent that c-commands it. Furthermore, anaphors must be bound to a local antecedent with the same referential index. Principle B, on the other hand, places restrictions on pronouns by stating that they must be free, not having an antecedent within their local domain. Principle C pertains to referential expressions, which must be free in any syntactic context. Examples in (8–10) illustrate these principles:

(8) José$_i$ cortou-se$_i$ hoje (Note 6).

(9) José$_i$ falou para Carla que ele$_i$ já correu no parque hoje (Note 7).

(10) Ela disse que Marta estava completamente bêbada (Note 8).

In sentence (8), we notice that the anaphor "se" must be linked to "José" because it is its local antecedent and is c-commanded by it. In (9), the pronoun "ele" is not in the same domain as its antecedent "José." In (10), the referential expression "a Marta" is not bound.

According to the Binding Theory, anaphors and pronouns are in complementary distribution. That is, one element can appear in a sentence only where the other cannot. Therefore, for a sentence to be considered grammatical, these elements must occur in opposite environments. An anaphor must be bound, and a pronoun must be free. Hence, if an anaphor has an antecedent within the same clause that includes it, the sentence is grammatical. However, if there is a pronoun instead of an anaphor in the same sentence, it would be ungrammatical.

It is essential, first, to define Chomsky's (1981) notion of c-command, which is presented below:

C-command

A c-commands B if and only if:

A doesn't govern B;

B doesn't govern A;

The first bounding node which governs A also governs B.

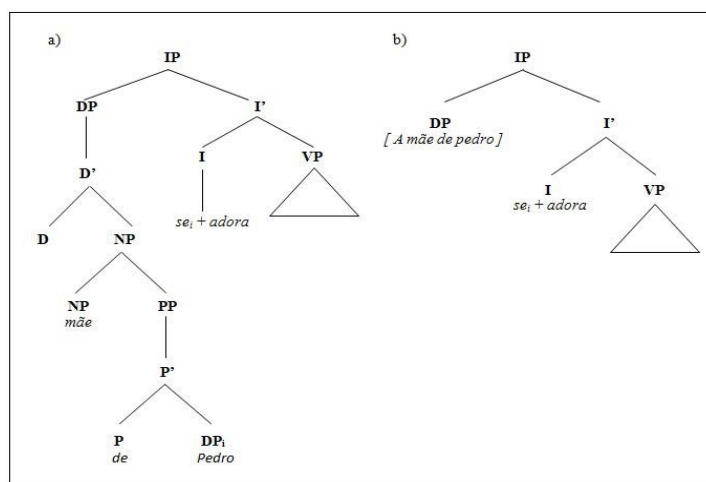The structural relation c-command and non c-command is exemplified as follows:

Figure 1. Arboreal representation for c-command (b) and non c-command (a)

Source: Mioto et al., 2010.

In (a), we have an example of a DP_i (Pedro) that does not c-command the anaphor "se." In contrast, in (b), this anaphor is c-commanded by the DP_i (A mãe de Pedro). The constraints outlined above are defined within the nodes of a tree according to the x-bar theory framework. These nodes have rigidity in their relationships, making it essential to adhere to these relationships in syntax. The relationship considered in this theory is the binding relationship, which is embedded in Principle A of Binding Theory. The concept of binding is defined by Chomsky (1981) as follows:

Binding

A category A binds a category B if:

A is co-indexed with B, and

A c-commands B.

Binding within Chomsky's Theory is, thus, addressed through the possession of referential indices and c-command. When two elements share the same index, and one c-commands the

other, they are co-referential and bound. When these indices diverge, there is neither binding nor co-reference relationship.

2.2 The Notion of Logophoricity by Reinhart and Reuland (1993)

The Theory of Reflexivity proposed by Reinhart and Reuland (1993) arises from the need for a reformulation of Binding Theory (Chomsky, 1981), justified by the numerous empirical challenges presented by the principles A and B of this theory.

The authors also demonstrate that the complementary distribution of anaphors and pronouns is not always observable since sentences like (11) are considered grammatical.

(11)Mateus$_i$ sabia que ninguém gosta de João e dele mesmo$_i$/dele$_i$ por causa de suas personalidades (Note 9).

The proposal by Reinhart and Reuland (1993) suggests that anaphors like in (11) should be observed based on the concept of arguments and remain grammatical if they are not co-arguments of the same predicate. The fundamental idea is that complementary distribution does not exist in sentences like (11), which contain a logophoric anaphor.

As mentioned earlier, in Chomsky's Binding Theory (1981), an anaphor adheres to syntactic conditions such as locality and c-command. However, these conditions are revised by Reinhart and Reuland (1993), who argue that anaphors reflect a predicate when they are co-arguments of the same predicate as their antecedent. Thus, according to the authors, they are termed syntactic anaphors. Therefore, syntactic anaphora is governed by syntax. Let's see:

(12)Luiza$_i$ machucou ela mesma$_i$ com a faca (Note 10).

In (12), the anaphor "ela mesma" is a co-argument of the same predicate as its antecedent "Luiza," making this a syntactic anaphor.

Reinhart and Reuland (1993) also view the distribution of these forms based on the coreference relationship between co-arguments of a predicate when there is no syntactic anaphor. The coreference relationship in this work, like the binding relationship, is governed by the Theory of Reflexivity, which extends the distribution of these forms beyond syntax.

The authors distinguish binding relationships from coreference relationships. In their interpretation, binding occurs only when there is a syntactic interpretation of co-indexation. They argue that coreference is not directly governed by syntax but, like many problems in anaphoric resolution, is governed by discourse. Thus, co-indexation is irrelevant to coreference (Note 11). According to the authors:

> Technically, coreference can be obtained only when a pronoun or an anaphor is not coindexed with an antecedent (since when a pronoun or an anaphor is syntactically bound, the only permitted interpretation is that of variable binding) (Reinhart & Reuland, 1993, p. 674).

In the example below, coreferential interpretation can only be allowed if Lucie and herself are not co-indexed. However, given the Condition A of their theory, it is required that they be

co-indexed.

(13) Lucie praised herself.

A case frequently cited by the authors to illustrate cases of coreference is when there is a logophoric anaphora because the relationship between it and the antecedent can only be one of coreference. Observe:

(14) Luiza$_i$ machucou [Joana e ela mesma]$_i$ com a faca (Note 12).

The anaphor "ela mesma" in (14) is included in the argument, but it is not an argument by itself. The expression "Joana e ela mesma" is the argument of the verb. Although "ela mesma" is not an argument on its own, it is allowed. It is not bound, but the gender feature allows a coreferential reading with the antecedent "Luiza."

Here, Reinhart and Reuland (1993) assume that the anaphor in coordination is not an argument. Their justification is that "ele mesmo" alone is not an argument and, therefore, does not reflexivize the predicate. Thus, it should be considered logophoric.

Thus, the authors point out that this type of anaphor is logophoric and exempt from Binding Theory, as the relationship is one of coreference.

Therefore, if the element is co-indexed, it is bound, and if it is not co-indexed, the coreference relationship is allowed. For the authors, co-indexation is the determining factor for binding. Reinhart and Reuland (1993) also note that logophoric anaphors are interchangeable with pronouns. Observe:

(15)   Vítor$_i$ adora piadas sobre ele mesmo$_i$ (Note 13)·

(16)   Vítor$_i$ adora piadas sobre ele$_i$ (Note 14)·

The above examples show that sentences in which there is an anaphora and a pronoun occurring in the same position can be considered grammatical, since the anaphora is logophoric.

In summary, a syntactic anaphora is a referentially dependent NP, observing the syntactic conditions. According to Reinhart and Reuland (1993), a logophoric anaphora, in its turn, is free of syntactic conditions, despite being also referentially dependent.

From this, it is interesting to observe how the constraints of the Binding Principles proposed by the Binding Theory act when they are processed by the speakers. Also, a pertinent question is: are the antecedents that are not c-commanded considered when a subject sees a sentence in real-time processing?

3. Method: Experimental Syntax

Experimental syntax provides support to researchers who wish to investigate the descriptions and explanations presented in syntactic theory. Therefore, in addition to analyzing sentences in a language, it is possible to observe whether native speakers of BP judge the target

sentences as acceptable, making it feasible to discover linguistic regularities in various types of sentences that could not previously be detailed using intuition alone. This can be achieved through psycholinguistic experiments in which the speaker reads the sentence naturally, and the reading time (an online measure) and/or judgment (an offline measure) are recorded.

Although the term "Experimental Syntax" was first used by Cowart (1997), this practice has been applied since the 1960s in research within the subfield of Psycholinguistics. This subfield, known as Sentence Processing, aims to demonstrate the psychological reality of grammatical constructions. Like Sentence Processing, Experimental Syntax aims to establish a connection between Theoretical Linguistics and Experimental Psycholinguistics.

3.1 An Experimental Approach to C-Command and Logophoricity

There is a vast literature (see Badecker & Straub, 2002; Sturt, 2003) on anaphora that seeks to answer various questions about the operation of Chomsky's Binding Principles (1981). These studies visualize the intrasentential coreference processing in two stages: in the first, the principles guide the processor in establishing coreference, and in the second, it is possible for antecedents that are unavailable according to the principles to exert influence on processing. This occurs, for example, when there are unavailable antecedents that match in gender with the anaphora/pronoun.

Some authors (Sturt, 2003; Kuno, 1975; Reinhart, 1993) present other proposals in an attempt to explain more comprehensively the distribution of anaphoric forms and focus not only on the structural constraints involved in coreferential resolution, but also on semantic-discursive constraints. These authors assert that discursive and semantic factors significantly influence certain contexts.

In an eye-tracking experiment, Sturt (2003) investigated the processing of anaphora with available and unavailable antecedents according to the Binding Principles, meaning that both syntactic and discursive information could be accessed in the analyzed sentences. Antecedents within the binding domain of the anaphora were called "available," and those outside its binding domain were called "unavailable." The author found evidence that syntax influenced coreference processing initially, while discourse had a later influence. Despite this result, Sturt (2003) does not dismiss the idea that discourse is activated in the moment of processing.

In Brazilian Portuguese (BP), Oliveira, Leitão and Henrique (2012) investigated how adults process the reflexive anaphor "a si mesmo" in contexts where antecedents were available and unavailable to the anaphor, with the aim of determining whether only structurally available antecedents influence anaphoric resolution. The results of the experiment showed that reading times for the critical segment, when the available antecedent matched in gender with the anaphor, were read more quickly than when there was an unavailable antecedent with the same gender as the anaphor. According to Oliveira et al. (2012), this means that the binding principle restricts anaphor resolution in the early stages of processing. Based on these studies, we propose to experimentally verify the c-command relationship between the anaphora and its antecedent, as there are not many studies in Brazilian Portuguese that confirm the notion

of c-command through experiments.

3.2 Experiment 1

In the first experiment, the behavior of the anaphor "a si mesmo (a)" was investigated with two types of antecedents: one that c-commands the anaphora and another that does not c-commands it, taking into account the issues that seem to be involved in the process of resumption of this antecedent, in order to address the performance of the notion of c-command in the anaphoric resolution in the sentential scope.

It was taken as a working hypothesis that, in sentences where the anaphora has an antecedent that c-commands it, online coreferential resolution is easier. That is, individuals would find it easier to read these types of sentences, in which syntactic aspects are taken into account, than in sentences in which the anaphora establishes the connection outside this notion, by taking into account processes beyond the syntactic. As for gender, it is expected under the conditions in which the anaphora has the same gender as the antecedent that the c-commands is read faster than under conditions where the gender of the resume does not match the antecedent that c-commands it.

3.2.1 Methods and Procedures

The experiment was designed using the *Psyscope* program on an Apple MacBook, employing a self-paced online reading technique.

In this technique, participants guide their own reading in front of the computer screen and keyboard. Phrases from the experiment are read at a natural pace, divided into segments presented one by one each time the participant presses the "L" key on the keyboard in front of them. Each time this key is pressed, the segment being read disappears, and the next segment automatically appears until the end of the sentence, which is marked with a period. After finishing reading the sentence, a comprehension question about the sentence just read appears for the participant to answer "Yes" if it's true or "No" if it's false. The purpose of this question is to identify whether the subject was attentive to the sentences read.

3.2.2 Participants

In this study, 24 students from the Federal University of Paraíba (UFPB), native speakers of Brazilian Portuguese, with an average age of 23 years, participated voluntarily in the experiment.

All volunteers who participated were individually subjected to the experiment in the LAPROL-UFPB room. Before starting to read the sentences, they were orally instructed on how to proceed, and the instructions on the computer were also read aloud. A practice similar to the experimental task was conducted before reading to familiarize them with the task.

Table 1. Example of experimental conditions

EXPERIMENTAL CONDITIONS	SENTENCES
FMRF - Female, male, female reflexive	A neta/ de Beto/ pintou/ a si mesma/ no atelier/ dearte. A neta de Beto se pintou? (Note 15)
FMRM - Female, male, male reflexive	A neta/ de Beto/ pintou/ a si mesmo/ no atelier/ de arte. O Beto se pintou? (Note 16)
MFRM - Male, female, male reflexive	O neto/ de Márcia/ pintou/ a si mesmo/ no atelier/ de arte. O neto de Márcia se pintou? (Note 17)
MFRF - Male, female, female reflexive	O neto /de Márcia/ pintou/ a si mesma/ no atelier / de arte. A Márcia se pintou? (Note 18)
FFRF - Female, female, female reflexive	A neta/ de Márcia/ pintou/ a si mesma/ no atelier/de arte. A Márcia se pintou? (Note 19)
MMRM - Male, Male, Male reflexive	O neto/ de Beto/ pintou/ a si mesmo/ no atelier/ de arte. O Beto se pintou? (Note 20)

Source: Research data.

3.2.3 Results and Discussion: Experiment 1

The results indicate that there was no main effect, but there was an interaction effect between the first antecedent and the anaphoric continuation ($p < 0.0001$). However, in the interaction between the second antecedent and the continuation, we did not obtain a significant effect in this experiment ($p = 0.144$).

These findings suggest that the notion of c-command is indeed a significant factor in the interpretation of the reflexive anaphor "a si mesmo" (a). When the sentences had as an antecedent a DP that was c-commanding and agreeing in gender, as in the FMRF, MFRM, and FFRF conditions, processing was faster than in sentences where the anaphor matched in gender but did not have a c-command relationship with the nearest antecedent, as in the FMRM, MFRF, and MMRM conditions.

This indicates that, as postulated by Chomsky (1981), the c-command domain of the subject to a DP or PP seems to be an active factor since faster reading times were found in sentences where the anaphor could only have a possible link with a DP that c-commanded it than in sentences where this could not occur, confirming the initial hypothesis of this study. We can visually observe these results in Figure 2 below, examining the reading times in milliseconds of the critical segment in each experimental condition. Let's see:
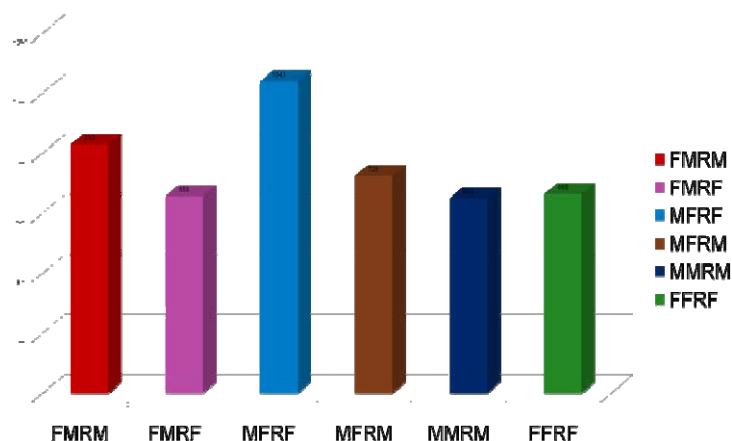
Figure 2. Reading times of the critical segment (anaphora) under experimental conditions

Source: Research data.

Finally, this first experiment aimed to verify whether the reflexive anaphor "a si mesmo" (a) is subject to c-command regardless of gender feature agreement between the anaphor and its antecedent. This question was identified, through the experiment's results, as a factor that distinguishes processing among the experimental conditions analyzed here.

The second test conducted in this research aimed to determine whether structures with the logophoric anaphor "ele mesmo" (a) are acceptable in Brazilian Portuguese (BP), based on the structures in English presented by Reinhart and Reuland (1993). We hypothesized that structures with logophoric anaphora would be considered acceptable by BP speakers.

3.3 Experiment 2

The second experiment led in this research aimed to determine if structures with the logophoric anaphor "ele mesmo" and the logophoric pronoun "ele" are acceptable in BP, based on the structures in English presented by Reinhart and Reuland (1993). Our hypothesis is that structures with logophoric anaphora and logophoric pronouns will be considered acceptable by BP speakers and that, in contexts where there is a logophoric anaphor, there can also be a logophoric pronoun, as indicated by Reinhart and Reuland (1993).

3.3.1 Method and Procedure

We designed an offline experiment of judgment acceptability using the *Psyscope* program on an Apple MacBook. In this experiment, participants read the sentences while guiding their own reading in front of the computer screen and keyboard. The experiment sentences were presented one by one, at natural speed, each time the participant pressed the "L" key on the keyboard in front of them. Each time this key was pressed, the sentence disappeared, and automatically, the sequence of numbers "1 2 3 4 5" appeared, indicating that they should choose one of these options to proceed to the next sentence. In other words, after finishing reading the sentence, the numerical sequence appeared for the participant to judge the acceptability of the sentence. Participants were asked to read the sentences naturally and

choose the option they found acceptable according to their intuition. Each subject was presented with 12 experimental sentences and 24 distractor sentences, and for each of them, five options: (1) Not acceptable; (2) Less acceptable; (3) Slightly acceptable; (4) Acceptable; (5) More acceptable.

All volunteers who participated were individually subjected to the experiment in the LAPROL-UFPB room. Before starting to read the sentences, they were orally instructed on how to proceed, and the instructions on the computer were also read to them. A practice, similar to the experimental task, was conducted before starting the reading to familiarize them with the task.

3.3.2 Participants and Material

There were 48 undergraduate students from different courses at UFPB, Campus I, João Pessoa, aged between 21 and 35 years, all native speakers of Brazilian Portuguese, volunteering participating in the experiment.

The material created for this experiment consists of 24 experimental sentences divided into 2 sets: one set with 12 sentences with logophoric anaphora and another set with 12 sentences with logophoric pronouns. For each sentence, there were 5 options, with the participant selecting only one for each sentence. An additional 48 distractor sentences were added to the experiment.

The design was elaborated so that each subject was tested in only one condition to avoid potential biases. Thus, each subject was exposed to one experimental set, i.e., one of the experimental conditions.

The experiment had the dependent variable as the type of judgment (1-5) made for each condition and the time taken for this judgment, and the independent variable was the type of logophor (anaphora and pronoun). The experimental conditions were: logophoric pronoun continuation (LP) and logophoric anaphora continuation (LA). Gender agreement between the antecedent and the logophor was controlled in the experiment to facilitate coreference with the DP proposed in this study. Below are the instructions given to the to the participants and examples of the experimental conditions.

Table 2. Example of experimental sentences of the acceptability judgment

INSTRUCTIONS	
Observe the sentences below and rate the acceptability from 1 to 5 according to the caption below:	
1 Not acceptable 2 Less acceptable 3 Slightly acceptable 4 Acceptable 5 More acceptable	
There are no right or wrong answers. We just want to check your intuitions about the phrases.	
TYPE OF SENTENCE	SENTENCES
Logophoric anaphora	O genro de Karla cortou Joana e ele mesmo com a faca na cozinha.
LA	O primo de Luiza barbeou Amanda e ele mesmo com o barbeador nobanheiro.
	O colega de Vitória penteou Lucia e ele mesmo com a escova noquarto.
	O amigo de Flávia feriu Thaís e ele mesmo com o brinquedo noparque.
Logophoric pronoun	O genro de Karla cortou Joana e ele com a faca na cozinha.
LP	O primo de Luiza barbeou Amanda e ele com o barbeador no banheiro.
	O colega de Vitória penteou Lucia e ele com a escova no quarto.
	O amigo de Flávia feriu Thaís e ele com o brinquedo no parque.

Source: Data research.

3.3.3 Results and Discussion: Experiment 2

The results found in this acceptability judgment, presented in the table below, evidenced an acceptance of both structures, corroborating the initially formulated hypothesis that the structures with the logophoric anaphora "ele mesmo" and with the logophoric pronoun "ele" observed in this study are accepted in BP, as in English.

We obtained a higher number of acceptable judgments in both conditions. To clarify, let's see the table below, which presents the number and total of responses given for each option:

Table 3. Number of judgments given to the experimental conditions

	AL	PL	TOTAL
1 (Not acceptable)	0	2	2
2 (Less acceptable)	0	4	4
3 (Slightly acceptable)	39	41	80
4 (Acceptable)	208	177	385
5 (More acceptable)	41	64	105
TOTAL	288	288	576

Source: Research Data.

When comparing the responses of the two conditions, judgment 4 had the highest number of choices compared to the others. We also observed that participants maintained their choices in the LA condition among options 3–5, and in the LP condition, most judgments also were within options 3–5, with only 2 judgments in option 1 and 4 judgments in option 2. Thus, the

sentences were considered acceptable by the majority of the participants. Regarding the total number of judgments in both conditions, judgment 4 also had the majority of choices. Therefore, in both conditions, we have a similar distribution of judgments.

As we can see in the sum of judgments made for the AL and PL conditions, the condition with the highest number of acceptable responses was AL, with 208 acceptable responses, and the one with the highest number of more acceptable responses was PL, with 64 responses. It is also noteworthy that the AL condition had no unacceptable and less acceptable judgments. In contrast, in the PL condition, there were judgments across all scales.

When comparing only the "acceptable" responses with the other responses, we obtained significant differences for logophoric anaphora ($p < 0.05$) and logophoric pronoun ($p < 0.001$) using the chi-square test for proportion of a sample. When comparing the judgments between the two conditions, we found a significant effect between the AL and PL conditions ($p < 0.008$). In the AL condition, there was a higher level of acceptability compared to the PL condition, as can be seen in the following graph:
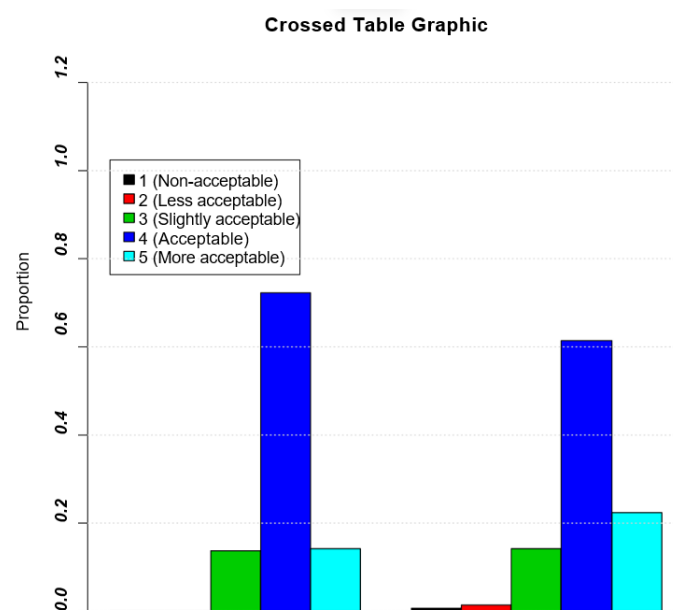

Figure 3. Crossed table graphic

Source: Research Data.

When we compare the answers presented in graph form, we realize that the structures were judged in a similar way, with greater acceptability for the anaphoras. Given the acceptability of the two structures, we can infer that both are acceptable for BP speakers.

Analyzing the response times of the two experimental conditions, we observed that the participants judged acceptability faster in the LP condition compared to the LA condition. Although in both conditions we found acceptability as a general standard and LA was judged

more acceptable, we noticed that, in terms of response time, LA was judged faster than LA. We then observed that there was a significant effect when comparing them ($p < 0.05$).

4. General Discussion

In the first experiment described earlier, as well as in the results obtained by Oliveira, Leitão, and Henrique (2012), we can perceive the relevance of syntax and Chomsky's Binding Theory Principle A in resolving logophoric anaphora. Thus, it was possible to find evidence that logophoric anaphora is constrained by Principle A, especially the notion of c-command, as the antecedent that c-commanded the anaphora was processed more quickly than the one that did not c-command it, despite gender agreement with the anaphora. Therefore, in the absence of an antecedent that c-commands the anaphora, participants took longer in coreferential resolution.

The data obtained in experiment 2, based on acceptability judgments, demonstrated that sentence structures with logophoric anaphora and logophoric pronouns are considered acceptable by native speakers of Brazilian Portuguese (BP). We can consider, as Reinhart and Reuland (1993) suggested, that this type of structure is grammatical. The data points to this possibility, as we obtained significant values for the acceptability of these logophoric structures.

In the logophoric anaphora experimental condition, participants judged it to be acceptable; in the logophoric pronoun condition, participants judged it to be acceptable but less so than the logophoric anaphora. In the second experiment, there were 208 acceptable judgments for logophoric anaphora and 177 acceptable judgments for logophoric pronouns. However, the judgment time for the latter was faster compared to logophoric anaphora. As suggested by Reinhart and Reuland (1993), logophoric pronouns can probably replace logophoric anaphora without altering the meaning. It remains to be investigated, in a new experiment, whether the meaning attributed to logophoric pronouns is always the same as that attributed to logophoric anaphora.

These data align with the results of the self-paced reading experiment conducted by Foraker (2003), where the same processing pattern was found for logophoric anaphora and pronouns, as participants in the second experiment judged both types of sentences as acceptable.

It is noteworthy that the Theory of Reflexivity predicts that logophoric anaphora is not guided by Binding Theory. Thus, based on the experimental technique used and the data obtained, it is possible to assert that this type of structure is present in the grammar of BP speakers. However, it is not possible to gauge whether they are restricted to syntactic binding relations or at what point in processing semantic-discourse factors, as mentioned by the authors, come into play.

It is important to mention that the control of logophoric reading will be improved in the next stages of the research in order to confirm the reference assumed by anaphors and pronouns. Additionally, further investigation is needed to understand how the processing of these semantic-discourse factors occurs in logophoric structures. We will also seek to comprehend whether processing a logophoric element incurs a greater operational cost.

5. Final Considerations

The data obtained from the experimental tests in this research demonstrated that the notion of c-command proposed by Chomsky has psychological reality, and that syntax is relevant in resolving logophoric anaphora. On the first study described here, it was possible to find evidence that logophoric anaphora is constrained by Principle A, especially the notion of c-command, as the antecedent that c-commanded the anaphora was processed more quickly than the one that did not c-command it, despite gender agreement with the anaphora. Therefore, in the absence of an antecedent that c-commands the anaphora, participants took longer in coreferential resolution.

On the second test, however, sentences containing anaphora that were not arguments by themselves were considered acceptable by native speakers of Brazilian Portuguese. Thus, we confirm our hypothesis as Reinhart and Reuland (1993) suggested, that this type of structure is grammatical both in BP and English.

In conclusion, the data analyzed here show that the notion of c-command is relevant during language processing, and logophoric anaphora, based on the perception of participants in the experiments, is acceptable, indicating that such structures likely constitute the grammar of Brazilian speakers.

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Notes

Note 1. Flavio praised himself at the party yesterday.

Note 2. Flavio said that Carla would like to invite Maria and himself for the party yesterday.

Note 3. Flavio said that Carla would like to invite Maria and him for the party yesterday.

Note 4. Maria said that she and Daniel ate the sandwich.

Note 5. The brothers fought one with each other yesterday.

Note 6. Jose cut himself today.

Note 7. Jose told Carla that he had already run in the park today.

Note 8. She said that Maria was completely drunk.

Note 9. Mateus knew that nobody liked João and himself/ him because of their personalities.

Note 10. Luiza hurt herself with a knife.

Note 11. Technically, coreference can only be obtained when the pronoun or anaphora is not coindexed with the antecedent (when the pronoun or anaphora is syntactically linked, the allowed interpretation is only that of linked variable).

Note 12. Luiza hurt Joana and herself with a knife.

Note 13. Vitor loves jokes about himself.

Note 14. Vitor loves jokes about him.

Note 15. Translation: Beto's granddaughter painted herself in the atelier. Did Beto's granddaughter paint herself?

Note 16. Translation: Beto's granddaughter painted himself in the atelier. Did Beto paint himself?

Note 17. Translation: Marcia's grandson painted himself in the atelier. Did Marcia's grandson paint himself?

Note 18. Translation: Marcia's grandson painted herself in the atelier. Did Marcia paint herself?

Note 19. Translation: Marcia's granddaughter painted herself in the atelier. Did Marcia paint herself?

Note 20. Translation: Beto's grandson painted himself in the atelier. Did Beto paint himself?

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