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**The Influence of Conceptual Number in
Coreference Establishing: An ERP Study on
Brazilian and European Portuguese**

Juliana Andrade Feiden



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The work reported in this thesis has been carried out under the auspices of the Erasmus Mundus Joint International Doctorate for Experimental Approaches to Language and Brain (IDEALAB) of the Universities of Groningen (NL), Newcastle (UK), Potsdam (DE), Trento (IT) and Macquarie University, Sydney (AU), under Framework Partnership Agreement 2012-0025 – specific grant agreement number 2013-1458/001-001-EMII EMJD by the European Commission.

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UNIVERSITY OF TRENTO - Italy



MACQUARIE
University
SYDNEY AUSTRALIA



Newcastle
University

The Influence of Conceptual Number in Coreference Establishing: An ERP Study on Brazilian and European Portuguese

PhD Thesis

to obtain the joint degree of PhD at the
University of Groningen, the University of Potsdam, the University of Trento, Macquarie
University and Newcastle University

on the authority of the
Rector Magnificus of the University of Groningen, Prof. C. Wijmenga, the
President of the University of Potsdam, Prof. O. Günther, the Rector of the
University of Trento, Prof. P. Collini, the Deputy Vice Chancellor of Macquarie
University, Prof. S. Pretorius, and the Pro-Vice-Chancellor of Newcastle
University,
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and in accordance with
the decision by the College of Deans.

This thesis will be defended in public on

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Dedication

I would like to dedicate this PhD thesis to my grandfather,
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Chapter 1

GENERAL INTRODUCTION

1.1 CONCEPTUAL NUMBER IN COREFERENCE ESTABLISHING

Number is a diverse phenomenon which can manifest itself through different facets depending on the language in which it is being processed. Number is frequently considered just an opposition of singular versus plural (Corbett, 2000). In order for this opposition to occur, it should rely on two kinds of linguistic information –one of a grammatical nature and one of a conceptual nature; –in general, both converge (Bock, Eberhard, Cutting, Meyer, & Schriefers, 2001; Bock, Eberhard, & Cutting, 2004; Eberhard, Cutting, & Bock, 2005). Schweppe (2013) presented an example of such convergence: when we say ‘the book’, we are referring to one entity only, meaning that the noun ‘book’ should be in the singular form. However, when we say ‘the books’, we are referring to more than one entity, thus requiring the plural form of the noun.

However, some types of words do not present such convergence regarding number. Collective nouns are an example of such words because they present a grammatically singular form, but convey a conceptually plural idea of a group of individuals or things. An example of a collective noun is the grammatically singular noun ‘gang’. Despite its morphological singular form, the noun’s semantics denote a group of criminals, that is, it represents a plural concept. In order to process this noun, the word’s grammatical singular representation needs to be connected with its conceptual plural meaning.

Regarding coreference establishing and number processing, grammatical constraints should restrict the antecedent’s selection and retrieval, indicating that the antecedent and the anaphoric element share the same grammatical number, so that coreference can occur (Nicol & Swinney, 1989). However, when grammatical information does not sufficiently constrain the potential antecedent, conceptual information is taken into consideration. This is the case for collective nouns when they are part of anaphoric resolution, as these words present divergence in terms of grammatical and conceptual information:

- (1) The gang_{SG} terrifies_{SG} the neighborhood. They_{PL} are_{PL} very dangerous.

In example (1), the pronoun ‘they’ violates grammatical number by not agreeing with its grammatically singular antecedent ‘the gang’. The anaphoric relationship between the antecedent and the pronoun ‘they’ is, consequently, conceptual, since the plural pronoun agrees with the conceptual notion of plurality contained in the noun’s semantics, rather than its grammatically singular form. Therefore, to process this sentence pair, the individual needs to use conceptual number in order to establish the relationship between the antecedent and the pronoun, even if grammatical disagreement occurs.

The influence of conceptual number on coreference establishing has been explored in different languages, such as English (Gernsbacher, 1991), Spanish (Carreiras & Gernsbacher, 1992), German (Schweppe, 2013) and Brazilian Portuguese (Farias, Leitão, & Ferrari-Neto, 2012; Godoy, Françoço, & Ferreira, 2014; Silva, 2008). However, these studies present conflicting data regarding the processing of such sentences in which conceptual number is involved in coreference establishing.

For instance, Gernsbacher (1991), Carreiras and Gernsbacher (1992) and Godoy et al. (2014) showed that when a plural pronoun and a plural verb are referring to a singular collective noun during coreference establishing, it is more natural to process such sentences. The studies conducted by Gernsbacher (1991) and Carreiras and Gernsbacher (1992) were among the first to investigate the influence of conceptual number on coreference establishing. In both studies, it was observed that, when there was number disagreement (construction in the plural form) while referring to more general information or to generic items (multiple items and events, generic and collective types), both in the pronoun and in the verb, this disagreement did not impose processing problems. For instance, in a sentence pair such as ‘The substitute teacher begged the class to stop misbehaving. But they didn’t pay any attention to her.’, the pronoun ‘they’ is being used because a class represents a group of students, and not just one. In contrast, when both the antecedent and the pronoun were in the singular form and both agreed grammatically, the pronoun was processed more rapidly when referring to specific and unique items. In the sentence pair ‘The substitute teacher begged the student to stop misbehaving. But he didn’t pay any attention to her.’, the pronoun ‘he’ agrees in number with the noun ‘student’, because it is referring to one student only (Gernsbacher, 1991).

Godoy et al. (2014) designed an eye-tracking experiment that intended to disentangle the conflicting results found in previous studies conducted in Brazilian Portuguese on self-paced reading tasks (Leitão et al., 2012; Silva, 2008). Godoy et al. (2014) compared sentence pairs such as *O pelotão_{SG} dormiu antes de embarcar. Eles_{PL} agora estão_{PL} aptos a viajar.* (‘The platoon_{SG} slept before boarding. They_{PL} are_{PL} now able to travel.’) with *O pelotão_{SG} dormiu antes de embarcar. Ele_{SG} agora está_{SG} apto a viajar.* (‘The platoon_{SG} slept before boarding. It_{SG} is_{SG} now able to travel.’) and found that plural pronouns were read faster than singular pronouns. This finding means that conceptual interpretation of the collective noun as a group of individuals or things overruled its grammatical singular form.

Farias, et al. (2012) and Silva (2008) reported different results from the studies mentioned above. Based on a self-paced reading task, Farias et al. (2012) investigated the influence of conceptual number during anaphoric resolution. They used sentences such as:

O grupo_{SG} trabalhava na obra. Ele_{SG} terminou_{SG} a cozinha no sábado. ('The group_{SG} worked on the renovation. It_{SG} finished_{SG} the kitchen on Saturday.')

and: *O grupo_{SG} trabalhava na obra. Eles_{PL} terminaram_{PL} a cozinha no sábado.* ('The group_{SG} worked on the renovation. They_{PL} finished_{PL} the kitchen on Saturday.').

Farias et al. (2012) found that participants took longer to read sentences with conceptual number agreement than those sentences with grammatical number agreement even though they only observed a significant effect on the verb following the pronoun.

In a similar task, Silva (2008) presented sentences such as: *O jornalista acompanhou os times_{PL} ao estádio. Eles_{PL} fizeram_{PL} uma partida importante.* ('The journalist accompanied the teams_{PL} to the stadium. They_{PL} played_{PL} an important match.')

and: *O jornalista acompanhou o time_{SG} ao estádio. Eles_{PL} fizeram_{PL} uma partida importante.* ('The journalist accompanied the team_{SG} to the stadium. They_{PL} played_{PL} an important match.').

She showed that there was no difference in reading times between structures with conceptual and grammatical number. However, for those participants who presented differences in reading times between the two types of number agreements, reading times for sentences with conceptual number were longer compared to sentences with grammatical number.

Schweppe (2013) showed that the influence of conceptual and grammatical number on coreference establishing can be conditioned by the distance between the antecedent (collective noun) and its anaphor (pronoun). In a production task, participants were asked to fill two gaps with a pronoun and an inflected verb which should be referring to the collective noun present in the first sentence. An example of such a case would be: *Das Militär war noch immer preußisch organisiert. / ____ Wert auf eine kaisertreue Gesinnung. / Daran hatte sich nichts geändert.* ('The army was still organized in a Prussian way. / ____ a high value on loyalty to the emperor. / Nothing had changed.').

Two types of sentences were used, one in which the gapped pronoun was closer to the antecedent and one in which the pronoun was further from it. In the production task, distance proved to be a predictor of number agreement: when the pronoun and the verb were closer to its antecedent, in the short-distance condition, the participants used the pronoun's singular form, relying more on grammatical information. However, when the distance between the antecedent and the anaphor was longer, in the long-distance condition, participants used more forms of the plural pronoun, showing that the further the anaphor was from its antecedent, the more the individuals depended on the conceptual information. In the comprehension task, the author measured the reading times of (1) the pronoun (anaphor); (2) the verb that followed it; (3) the word following the verb, in sentences with short and long distances between the collective noun and the pronoun. It was observed that there was no effect of distance and

number on the reading times in relation to the pronouns and verbs, but a spillover effect was observed: distance and number agreement seemed to affect the word following the verb. Furthermore, in the short-distance condition, the critical word (post-verb) was read more quickly when it was preceded by a pronoun and a verb in the singular form, whereas in the long-distance condition, participants read the critical word more quickly when it was preceded by a pronoun and a verb in the plural form. In both the production task and the comprehension task, the same pattern was observed: the longer the distance, the more the individuals relied on conceptual information for anaphoric resolution.

Apart from finding conflicting results regarding the influence of conceptual number in coreference establishing, the studies mentioned above investigated coreference assignment between two separate sentences, in which the singular collective noun was located in the first sentence, and the pronoun was located at the beginning of the second sentence. It is possible that, depending on the sentence structure in which anaphoric resolution occurs, differences in terms of how conceptual number is processed can be observed. Additionally, not only could a distinct linguistic context have an impact on how conceptual number is processed, but the presence or absence of an overt pronoun could also play an important role.

In this introductory chapter, we will present a theoretical and experimental overview in order to address such issues. First, the differences concerning the occurrence of pro-drop and gapping will be discussed. Then, these differences will be addressed by comparing two variants of the same language: Brazilian Portuguese and European Portuguese. Subsequently, we speculate how we understand the influence of conceptual number in coreference establishing by using event-related potentials (ERPs). The introduction ends with the research questions which are a result of the issues we previously discussed, and with an overview of the thesis's structure.

1.2 COREFERENCE ESTABLISHING IN DIFFERENT LINGUISTIC CONTEXTS

1.2.1 Pro-drop

Languages present different characteristics regarding agreement and inflection. Due to these differences, the absence of a given element within sentence boundaries, such as a pronoun, could be allowed or not. Examples (2), in European Portuguese, and (3), in English, illustrate such a case:

(2)

∅	<i>Estudamos_{PL}</i>	<i>espanhol</i>	<i>aos</i>	<i>sábados.</i>
∅	Study _{PL}	Spanish	on	Saturdays.
We	study _{PL}	Spanish	on	Saturdays.

(3) We_{PL} study_{PL} Spanish on Saturdays.

In sentence (2), the first-person plural pronoun *nós* is absent, or it is dropped, because the morphosyntactic information the verb brings is sufficient for the sentence to be processed. In the case of example (3), however, the verb does not show such richness regarding verb inflection, so it is necessary to use the overt pronoun ‘we’.

According to Chomsky (1981), while these dropped elements are phonetically empty, they are still part of the sentence structure. When languages with tensed utterances present a null pronominal element, called ‘pro’, they are known as ‘pro-drop languages’. Chomsky (1981) also argued that it is possible to identify shared characteristics among pro-drop languages, such as a rich inflectional system, inversion of declarative sentences, violation of *that*-trace and the omission of a pronoun in expletive sentences.

Nonetheless, it is important to mention that the classification of a language as being pro-drop or not is not straightforward and it depends on the characteristics presented by each language in particular. For instance, the discussion regarding the presence or absence of an overt pronoun mainly involved the comparison between English and Romance languages, such as Italian and Spanish (Barbosa, 2011). However, how could one explain the existence of languages which do not have any inflection features but do present pro-drop, such as Chinese, and languages which have overt pronouns in very specific contexts, such as Brazilian Portuguese (Huang, 1984)?

According to Jaeggli and Safir (1989), what allows pro-drop is not a rich inflectional system per se, but the uniformity of verbal paradigms. If a language only has inflected forms, which includes number, person and tense, its identification as being a pro-drop language would rely on agreement markers, which is the case of European and Brazilian Portuguese. In contrast, in languages with non-derived forms, consisting only of the root, such as Chinese, the identification depends on the presence of a structural or discourse topic. In other words, the pronoun is allowed to be dropped because discourse/conceptual information is sufficient for anaphoric resolution to occur. Barbosa (2011) summarizes the four possibilities of classifying languages in relation to their dropping characteristics:

- (1) Languages with rich subject-agreement morphology, such as Italian, Spanish, European Portuguese, Hungarian, Greek, among many others. In these types of languages, subjects are freely dropped under the appropriate discourse conditions.
- (2) Languages that lack agreement, such as Chinese, Japanese and Korean. These have been described as topic-oriented languages and allow for any argument to be dropped, not just subjects.
- (3) Languages that have agreement and referential null subjects whose distribution is restricted (henceforth partial) such as Hebrew, Finnish, Marathi, Russian, and Brazilian Portuguese.
- (4) Languages where non-referential subjects are null/not realized (Yiddish, Icelandic, Faroese, a range of creole languages) are generally referred to as semi pro-drop languages.
- (5) In the case of Portuguese's two variants, Brazilian and European, which are the focus of this thesis, both display distinct classifications. Regarding Brazilian Portuguese, this variant is considered a partial pro-drop language, as it shows a preference for overt pronouns; however, in some contexts it allows the pronoun to be dropped. In contrast, European Portuguese is considered a pro-drop language, mainly due to its rich inflectional verb paradigm.

1.2.2 Gapping

Ellipsis could be defined as the lack of linguistic material that would normally occur in a given sentence, and the missing element is conceptually recoverable due to the grammatical and conceptual context (Sag, 1979; Sag & Hankamer, 1984; Williams, 1977b). Gapping, more specifically, is a type of ellipsis which occurs in coordination and the interpretation of the absent element depends on the element in the preceding clause (Sag & Hankamer, 1984; Ross, 1967). In the case of coreference establishing occurring in coordination, the antecedent's characteristics grammatically constrain the realization of the gapped anaphoric element and the elements following it.

Regarding pro-drop languages and gapping, the occurrence of ellipsis in a coordinated sentence is not an exclusive characteristic of these languages. In reality, it is a more general feature among most languages. Contrastingly, in partial pro-drop languages, the context of preference for omitted pronouns is correlated to the structural pattern in which they occur. In the case of coordination, the preference for gapped pronouns in Brazilian Portuguese is because the sentence structure grammatically constrains anaphoric resolution. If coreference establishing is occurring in a different context, such as two separate sentences,

then speakers of Brazilian Portuguese show a preference for the overt pronoun (Duarte & Varejão, 2013).

Pro-drop languages and partial pro-drop languages show different patterns regarding the presence or absence of overt pronouns in different types of sentence structures during coreference establishing. This is also the case with Brazilian Portuguese and European Portuguese. In the next section, some characteristics of both variants of Portuguese will be presented and discussed.

1.3 COREFERENCE ESTABLISHING IN BRAZILIAN PORTUGUESE AND EUROPEAN PORTUGUESE

As most Romance languages, European Portuguese is a pro-drop language. This characteristic is mainly due to the fact that European Portuguese has a rich inflectional verb system. In contrast, in the last century, Brazilian Portuguese has been undergoing a change from being a full pro-drop language to a partial pro-drop language (Almor, Carvalho Maia, Cunha Lima, Vernice, & Gelormini-Lezama, 2017; Cavalcante & Duarte, 2008; Duarte, 1995; 2000; 2003; Kato, 2000).

Different studies suggest that the reason why such a change is underway is that the use of overt subjects is closely related to the use of new subject pronominal forms and to an accelerated simplification of verbal morphology in Brazilian Portuguese. For instance, the second-person pronoun *você* has been used with increasing frequency, and, unlike the previous common second-person *tu*, it requires a third-person singular morphological marker on the agreeing verb. Another example is related to the expression *a gente*, meaning ‘we, the people’, which includes the speaker and the addressees and also requires a third-person singular marker on the agreeing verb. Also, the second-person pronoun *tu* presents syncretism with the second-person singular *você* and with the third-person singular *ele/ela*. Table 1.1 shows the comparison between the two variants of Portuguese and the change in the pronoun and verb paradigm

Table 1.1: Pronoun and verb paradigm in Brazilian and European Portuguese (verbo cantar – verb ‘to sing’).

	European Portuguese	Brazilian Portuguese
Singular	1. <i>Eu canto</i> (‘I sing’)	1. <i>Eu canto</i> (‘I sing’)
	2. <i>Tu cantas</i> (‘You sing’)	2. <i>Você canta</i> (‘You sing’)
		<i>Tu canta</i> (‘You sing’)
	3. <i>Ele canta</i> (‘He sings’)	3. <i>Ele canta</i> (‘He sings’)
	<i>Ela canta</i> (‘She sings’)	<i>Ela canta</i> (‘She sings’)
Plural	1. <i>Nós cantamos</i> (‘We sing’)	1. <i>Nós cantamos</i> (‘We sing’)
		<i>A gente canta</i> (‘We, the people sing’)
	2. <i>Vós cantais/Vocês cantam</i> (‘You sing’)	2. <i>Vós cantais/Vocês cantam</i> (‘You sing’)
	3. <i>Eles cantam</i> (‘They sing’ – masculine)	3. <i>Eles cantam</i> (‘They sing’ – masculine)
	<i>Elas cantam</i> (‘They sing’ – feminine)	<i>Elas cantam</i> (‘They sing’ – feminine)

These changes have resulted in an impoverished verbal morphology in modern Brazilian Portuguese, which does not distinguish between second-person singular, third-person singular and first-person plural, thus likely motivating the use of an overt pronoun with person and number features.

Although Brazilian Portuguese shows a preference for overt pronouns, there are some contexts in which the pronoun must be dropped. Consequently, the occurrence of a gapped pronoun in Brazilian Portuguese is conditioned by grammatical information, more specifically the sentence structure in which coreference establishing is occurring. In the case of coordination, the pronoun must be gapped. In other contexts, the presence of the overt pronoun is preferred. Contrastingly, in European Portuguese, grammatical information does not condition pronoun omission, as the pronoun is also dropped in other linguistic contexts.

Despite a substantial number of behavioral studies, some questions still remain: How does conceptual number influence coreference establishing? Additionally, the studies described above focused on coreference establishing occurring between two separate sentences. The research question is: are there differences regarding anaphoric resolution in inter and intra-sentential context? Additionally, the question is whether the same effects are observed in both full pro-drop and partial pro-drop languages. In order to answer such questions, we decided to investigate the influence of conceptual number in coreference establishing by using event-related potentials (ERPs), as ERPs have proved to be susceptible to processing differences regarding grammatical and conceptual information.

1.4 ERP STUDIES ON NUMBER AGREEMENT AND COREFERENCE ESTABLISHING

Event-related potentials (ERPs) are a neurocognitive technique which allows us to observe human brain activity in response to specific events or stimuli, for instance, linguistic tasks (Blackwood, St. Clair, & Muir, 1991; Luck, 2012). Therefore, language processing research has used ERPs as a way of understanding how conceptual and grammatical information are processed and how those information types interact. Furthermore, certain ERP components seemed to be sensitive to these types of information. One of the first language components identified was the N400 (Friederici, 1995; 2002; Kutas & Hillyard, 1980a; 1980b; 1980c; Kutas, Van Petten, & Besson, 1988), which is considered to reflect semantic integration cost, particularly in response to words that do not fit conceptually into the preceding context. Syntactic processes, however, correlate with two ERP components: a left-anterior negativity (LAN), which occurs during an early time window (between 300–500 ms) and a late centro-parietal positivity (P600), which occurs between 500–1000 ms (Friederici, 2002; Hagoort, Brown, & Groothusen, 1993; Holcomb, 1993; Osterhout & Holcomb, 1992). The LAN is believed to be elicited as an automatic response to morphosyntactic error detection, whereas the P600 is seen as a marker of repair and reanalysis processes.

Past studies on number processing indicated that grammatical number disagreement tends to elicit a P600 effect which is sometimes preceded by the LAN (e.g., Barber & Carreiras, 2005; Osterhout & Mobley, 1995). For instance, Osterhout and Mobley (1995) investigated agreement violations in relation to number and gender. They concluded that agreement violations during reading are syntactic in nature. Still, according to the authors, one can speculate that agreement is part of the form, rather than the language's meaning. The authors also emphasized that collective nouns represent a special category for which semantic and conceptual factors play a role in agreement phenomena. Based on this fact, they suggest that collective nouns should be investigated as antecedents, also through an ERP study.

1.5 AIMS OF THE STUDY AND RESEARCH QUESTIONS

Previous studies which investigated conceptual number processing presented conflicting data regarding how grammatical and conceptual information affect language processing, mainly when the number feature is involved in coreference establishing. Our study aimed

to investigate how grammatical and conceptual number influence coreference establishing when a collective noun is the sentence's antecedent and when a singular or a plural pronoun/verb refers to it. We also aimed to verify whether the linguistic context in which coreference establishing occurs (two separate sentences and coordination) would modulate how conceptual number is processed. In order to address these issues, we decided to use event-related potentials, as ERP studies have proved that conceptual and grammatical information show differences regarding electrophysiological activity. Thus, such a technique can help us understand how conceptual number influences coreference establishing.

Additionally, we studied the influence of conceptual number during coreference establishing in two variants of the same language (Brazilian and European Portuguese) to verify whether the pro-drop characteristic plays a role during coreference assignment on the presence of conceptual number.

In Chapter 2, we will present two ERP experiments which focused on the question of how conceptual number influences coreference establishing when two separate sentences are related to one another, in both Brazilian Portuguese (Experiment 1) and European Portuguese (Experiment 2). Based on Experiments 1 and 2, we will address the following questions:

1. *Are grammatical and conceptual agreement in coreference establishing processed in the same way, as measured behaviorally and with ERPs? For example, will we find differences when comparing sentence (4) to (5) and sentence (6) to (7)?*

(4) Brazilian Portuguese: singular collective noun + singular pronoun

Ontem, o elenco_{SG} leu a peça. Ele_{SG} aprovou_{SG} a obra escolhida.
 Yesterday, the cast_{SG} read the play. It_{SG} approved_{SG} the chosen piece.

(5) Brazilian Portuguese: singular non-collective noun + singular pronoun

Ontem, o ator_{SG} leu a peça. Ele_{SG} aprovou_{SG} a obra escolhida.
 Yesterday, the actor_{SG} read the play. He_{SG} approved_{SG} the chosen piece.

(6) Brazilian Portuguese: singular collective noun + plural pronoun

Ontem, o elenco_{SG} leu a peça. Eles_{PL} aprovaram_{PL} a obra escolhida.
 Yesterday, the cast_{SG} read the play. They_{PL} approved_{PL} the chosen piece.

(7) Brazilian Portuguese: plural non-collective noun plural pronoun

Ontem, os atores_{PL} leram a peça. Eles_{PL} aprovaram_{PL} a obra escolhida.
 Yesterday, the actors_{PL} read the play. They_{PL} approved_{PL} the chosen piece.

Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs? Will we find the same ERP effects in both variants, when presenting sentences like (8), in Brazilian Portuguese and (9), in European Portuguese?

(8) Brazilian Portuguese: singular collective noun + plural pronoun

Ontem, o elenco_{SG} leu a peça. Eles_{PL} aprovaram_{PL} a obra esc-olhida.
 Yesterday, the cast_{SG} read the play. They_{PL} approved_{PL} the chosen piece.

(9) European Portuguese: singular collective noun + plural verb

Ontem, o elenco_{SG} leu a peça. Ø Aprovaram_{PL} a obra escolhida.
 Yesterday, the cast_{SG} read the play. Ø Approved_{PL} the chosen piece.

In Chapter 3, we will describe two ERP experiments which focused on investigating how conceptual number influences coreference establishing in coordination, again, in both Brazilian Portuguese (Experiment 3) and European Portuguese (Experiment 4). Based on Experiments 3 and 4, we will address the following questions:

Are grammatical and conceptual agreement processed in the same way, when coreference establishing occurs in coordination, as measured behaviorally and with ERPs? For example, will we find differences when comparing sentence (10) to (11) and sentence (12) to (13)?

(10) Singular collective noun + singular verb

Ontem, o elenco_{SG} leu a peça e Ø aprovou_{SG} a obra escolhida.
 Yesterday, the cast_{SG} read the play and Ø approved_{SG} the chosen piece.

(11) Singular non-collective noun + singular verb

Ontem, o ator_{SG} leu a peça e Ø aprovou_{SG} a obra escolhida.
 Yesterday, the actor_{SG} read the play and Ø approved_{SG} the chosen piece.

(12) Singular collective noun + plural verb

Ontem, o elenco_{SG} leu a peça e Ø aprovaram_{PL} a obra escolhida.
 Yesterday, the cast_{SG} read the play and Ø approved_{PL} the chosen piece.

(13) Plural non-collective noun + plural verb

Ontem, os atores_{PL} leram a peça e Ø aprovaram_{PL} a obra escolhida.
 Yesterday, the actors_{PL} read the play and Ø approved_{PL} the chosen piece.

Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs, in the occurrence of gapping in coordination?

1.6 STRUCTURE OF THE THESIS

In Chapter 2, the first two experiments that we will present investigated the influence of conceptual number in coreference establishing, in both Brazilian Portuguese and European Portuguese. In Chapter 3, we will present the two experiments which were used to investigate the role of conceptual number in coreference establishing in a different linguistic context, in coordination, again in both variants of the Portuguese language. In Chapter 4, we will discuss the differences found within the language variants, in relation to the dissociation between different kinds of sentence structure and how they differently influence coreference establishing. The final chapter will discuss the results from the four experiments in relation to our research questions, along with comparing them with previous and current studies in the area.

Chapter 2

THE INFLUENCE OF CONCEPTUAL
NUMBER IN COREFERENCE ESTABLISHING:
AN ERP STUDY ON BRAZILIAN AND
EUROPEAN PORTUGUESE

2.1 INTRODUCTION

2.1.1 Conceptual Number and Coreference Establishing

Sentence comprehension involves the processing of different linguistic domains, such as morphology, syntax, and semantics. For instance, number processing encompasses two kinds of linguistic information: one of a grammatical nature and one of a conceptual nature (Bock, Eberhard, Cutting, Meyer, & Schriefers, 2001; Bock, Eberhard, & Cutting, 2004; Corbett, 2000; Eberhard, Cutting, & Bock, 2005). Generally, both types of information converge. Schweppe (2013) presented an example of such convergence: when we say ‘the book’, we are referring to one entity only (conceptual), which is conveyed by the noun’s singular form (null suffix; grammatical). However, when we say ‘the books’, we are referring to more than one entity, thus requiring the noun’s plural form (-s grammatical morpheme).

Nevertheless, it is important to emphasize that some linguistic elements, in certain contexts of occurrence, do not present such convergence in relation to number. This is the case for collective nouns, which are morphologically singular, but encompass a conceptual idea of a group of individuals. The word ‘team’, for example, is a collective noun in the singular form. However, the word has a plural meaning, as ‘team’ refers to a group of players/athletes. To process this word, the listener needs to reconcile the grammatically singular representation of the word with its conceptual plural meaning.

Regarding coreference assignment and number processing, Nicol and Swinney (1989) suggest that there are two issues at hand, namely when and how such relationships are established. Grammatical constraints usually restrict antecedent selection and retrieval, which means that the antecedent and the anaphoric element should share the same value of the grammatical features (e.g., gender and number) for coreference to occur. However, when grammatical information does not sufficiently constrain the potential antecedent, conceptual information is taken into consideration. This is the case for collective nouns when being part of anaphoric resolution, as these words present divergence in terms of grammatical and conceptual information, as in (1).

- (1) The team_{SG} is playing tonight. They_{PL} need_{PL} to win this match.

In example (1), the pronoun ‘they’ is in the plural form and it is the anaphor referring to the singular antecedent ‘the team’. Even though there is a grammatical number disagreement, in which the pronoun is not agreeing with its antecedent, the pronoun ‘they’ is agreeing in conceptual number with the collective noun. The anaphoric relationship between the

antecedent and the pronoun is, thus, conceptual, since the noun phrase ‘the team’ refers to the noun’s semantics which denote a group of individuals rather than the morphologically singular word form.

Previous studies presented conflicting results regarding the acceptance and processing of conceptual number in coreference establishing. For instance, Gernsbacher (1991) and Carreiras and Gernsbacher (1992) investigated the processing of conceptual number in English and Spanish. The authors observed that conceptual anaphors in number disagreement with either the pronoun and the verb did not impose processing problems when they referred to more general information or to generic items¹. For example, in a sentence such as ‘The substitute teacher begged the class_{SG} to stop misbehaving. But they_{PL} didn’t pay any attention to her.’, the pronoun ‘they’ is referring to the fact that the word ‘class’ represents a group of students, and not just one. In contrast, when both the antecedent and the pronoun were singular, meaning they both agreed grammatically, the pronoun was processed more rapidly when referring to specific and unique items, such as in ‘The substitute teacher begged the student_{SG} to stop misbehaving. But he_{SG} didn’t pay any attention to her.’ The pronoun ‘he’ agrees in number with the noun ‘student’, because it is referring to one student only (Gernsbacher, 1991).

Schweppe (2013) investigated the effect of distance between collective nouns and pronouns in the anaphoric resolution in German. In the production task, participants were asked to fill two gaps with a pronoun and a conjugated verb which should be a reference to the collective noun present in the first sentence. An example of such case would be *Das Militär war noch immer preußisch organisiert. / ____ Wert auf eine kaisertreue Gesinnung. / Daran hatte sich nichts geändert.* (‘The army was still organized in a Prussian way. / ____ a high value on loyalty to the emperor. / Nothing had changed.’). Two types of sentences were used, one in which the gapped pronoun was closer to the antecedent and one in which the pronoun was farther from it. For this production task, distance proved to be a predictor of number agreement: when the pronoun was closer to its antecedent, participants used the pronoun’s singular form, which relies more on grammatical information. However, when the distance between the antecedent and the anaphor was longer, participants more often used the plural pronoun, showing that the further the anaphor was from its antecedent, the more the individuals relied on conceptual information for anaphoric resolution. In the comprehension task, no effects of distance and number on reading times in relation to the pronouns and verbs were observed. However, a spillover effect was noted, in which

¹ According to Gernsbacher (1991), conceptual anaphors are plural pronouns which are referring to a singular word that conveys a plural meaning, e.g. collective nouns.

distance and number agreement seemed to affect the word following the verb. The pattern was the same in the production task; reading times were shorter for the singular form in the short-distance condition, and for the plural form in the long-distance condition. The study concluded that, when the distance between the antecedent and its anaphor was longer, the individuals relied more on conceptual information for anaphoric resolution.

Farias, Leitão and Ferrari-Neto (2012) and Silva (2008), used self-paced reading to investigate the influence of conceptual number during anaphoric resolution. They used sentences such as *O grupo_{SG} trabalhava na obra. Ele_{SG} terminou_{SG} a cozinha no sábado.* ('The group worked on the renovation. It finished the kitchen on Saturday.') and *O grupo_{SG} trabalhava na obra. Eles_{PL} terminaram_{PL} a cozinha no sábado.* ('The group worked on the renovation. They finished the kitchen on Saturday.'). Farias et al. (2012) found that participants took longer to read sentences with conceptual number agreement than those sentences with grammatical number agreement even though they only observed a significant effect on the verb following the pronoun.

Silva (2008), in a similar task presenting sentences such as *O jornalista acompanhou os times_{PL} ao estádio. Eles_{PL} fizeram_{PL} uma partida importante* ('The journalist accompanied the teams_{PL} to the stadium. They_{PL} played_{PL} an important match.'). and *O jornalista acompanhou o time_{SG} ao estádio. Eles_{PL} fizeram_{PL} uma partida importante* ('The journalist accompanied the team_{SG} to the stadium. They_{PL} played_{PL} an important match.')., showed that there was no difference in reading times between structures with conceptual and grammatical number. However, for those participants who presented differences in reading times between the two types of number agreements, reading times for sentences with conceptual number were longer compared to sentences with grammatical number.

Godoy et al. (2014) developed an eye-tracking experiment, aiming to disentangle the conflicting results found in the studies mentioned previously. According to the author, the results found by Farias et al. (2012) and Silva (2008) could be due to the plural verb having an extra morpheme in comparison to the singular verb, which could lead participants to take longer to read the sentence. Godoy et al. (2014) expected that sentences with plural pronouns would be read, and consequently processed, more easily than sentences containing singular pronouns. By comparing sentence pairs such as *O pelotão_{SG} dormiu antes de embarcar. Eles_{PL} agora estão_{PL} aptos a viajar.* ('The platoon_{SG} slept before boarding. They_{PL} are_{PL} now able to travel.')., with *O pelotão_{SG} dormiu antes de embarcar. Ele_{SG} agora está_{SG} apto a viajar.* ('The platoon_{SG} slept before boarding. It_{SG} is_{SG} now able to travel.')., the authors' hypothesis was supported: the conceptual interpretation of the collective noun as a

group of individuals or things overruled its grammatical singular form, meaning that plural pronouns were read faster than singular pronouns.

Even though there is an extensive number of behavioral studies, the question still remains: how does conceptual number influence coreference establishing between a collective noun and personal pronoun? Moreover, how does the interaction between grammatical and conceptual information affect sentence comprehension?

One possibility for investigating the influence of conceptual number in coreference establishing is by using an experimental method which could shed light on how the processing of these linguistic elements occurs. Event-related potentials (ERPs) are a good choice for investigating this phenomenon, since ERPs are differentially susceptible to grammatical and conceptual aspects of comprehension.

2.1.2 Event-Related Potentials and Coreference Establishing

When investigating language processing using ERPs, certain components are usually taken to represent a specific processing domain. The first language-related component identified was the N400 (Friederici, 1995; 2002; Kutas & Hillyard, 1980a; 1980b; 1980c; Kutas, Van Petten, & Besson 1988), a negative-going component peaking approximately 400 ms post-stimulus onset which is considered to reflect semantic integration costs, particularly in response to words that do not fit conceptually into the preceding context. Syntactic processes, however, correlate with two ERP components, a left-anterior negativity (LAN), which occurs during an early time window (between 300–500 ms) and a late centro-parietal positivity (P600), which occurs between 500–1000 ms (Friederici, 2002; Hagoort, Brown, & Groothusen, 1993; Osterhout & Holcomb, 1992). The LAN is believed to be elicited as an automatic response to morphosyntactic error detection, whereas the P600 is seen as a marker of repair and reanalysis processes.

Past studies on number processing indicated that grammatical number disagreement tends to elicit a P600 effect which is sometimes preceded by the LAN (e.g., Barber & Carreiras, 2005; Osterhout & Mobley, 1995). For instance, Osterhout and Mobley (1995), investigated agreement violations in relation to number and gender. They concluded that agreement violations while reading are syntactic in nature. According to the authors, one can speculate that agreement is part of the form, rather than the language's meaning. The authors also emphasized that collective nouns represent a special category for which semantic and conceptual factors play a role in agreement phenomena. Based on this fact, they suggest that collective nouns should be investigated as antecedents, through an ERP study.

Regarding coreference establishing and ERPs, Callahan (2008) conducted a review comparing different types of anaphoric resolution (movement, co-indexation and overt pronoun and co-indexation and null pronoun) and the ERP components which were elicited as a result of these different processes. In coreference assignment, once the anaphoric element is encountered, the search for a suitable antecedent in the previous context occurs. This search is guided by anaphoric element features, such as gender and number, and by the characteristics of the relationship between the antecedent and the anaphor, for example, the linguistic context in which coreference establishing is taking place as in, for instance, the sentence structure. Once selected based on these factors, the appropriate antecedent must be retrieved and integrated with the anaphor and the surrounding context. Thus, coreference establishing is affected by certain characteristics of the antecedent and the anaphor. For these reasons, the parser has three tasks in a coreference relationship: (a) process the anaphoric element, (b) select and retrieve the appropriate antecedent, and (c) integrate the antecedent information with the anaphor and the surrounding context. Table 2.1 illustrates which ERP components are usually elicited during each of these steps, according to Callahan (2008).

Table 2.1: Processes and ERP effects in co-indexation with the overt anaphor, adapted from Callahan, 2008, p. 254.

Processes	ERP Effects	Position Observed
– Processing anaphor	– Modulations of N400	– Around anaphor position
– Selecting/retrieving antecedent	– Phasic or sustained anterior negativity	– Around anaphor position
– Integrating antecedent at anaphor site	– Modulations of N400/P600	– Around anaphor position

We are interested in how conceptual number influences the selection and retrieval of the antecedent, a collective noun, as the anaphoric element may not agree in grammatical number with the ‘it.’ According to Callahan (2008), it seems that when there are processing difficulties while selecting and retrieving the antecedent, a phasic or sustained (late) anterior negativity is usually found.

Past studies showed that the manipulation of conceptual information can make antecedent selection and retrieval more difficult. Such contexts can be characterized, for example, as hypothetical information processing, (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006), referential ambiguity, (Nieuwland & Van Berkum, 2006; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003), nonparallel information processing, (Streb, Rösler,

& Hennighausen, 1999) and gender disagreement, (Hammer, Jansma, Lamers, & Münte, 2008). Dwivedi, Phillips, Lague-Beauvais, and Baum (2006), for example, investigated pronoun resolution when the antecedent was a hypothetical NP or an actual NP. The authors compared control sentences such as ‘John is reading a novel. It ends quite abruptly’ and ‘John is reading a novel. It might end quite abruptly’, to hypothetical sentences like ‘John is considering writing a novel. It ends quite abruptly’ and ‘John is considering writing a novel. It might end quite abruptly.’ A centro-parietal sustained late negativity was found, starting about 500 ms after the pronoun’s onset, for the hypothetical conditions only. According to the authors, the hypothetical sentences presented words such as ‘considering’ and ‘wondering’, adding an extra meaning to the sentence in which the antecedent was located. This extra information could represent an increase in working memory load, as the individual has to infer from the context the intentions of the sentence’s subject.

In relation to ambiguity in anaphoric resolution, several studies showed that ambiguity can also elicit a sustained negativity (Nieuwland & Van Berkum, 2006; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). Regarding the first study, the effect of ambiguity was investigated by presenting referentially ambiguous and non-ambiguous pronouns, in sentences such as ‘The chemist hit the historian while he was laughing hard’. The referentially ambiguous pronoun elicited a sustained, slightly lateralized, frontal negativity, when compared to the non-ambiguous pronoun, in the 400–1500 ms latency window. According to the authors, in this case, the pronoun does not contain enough linguistic features, such as gender and number, that can guarantee the retrieval of a unique antecedent, and the lack of linguistic context makes it difficult for selecting and retrieving the proper antecedent.

The second study investigated ambiguity when a noun is ambiguous in relation to the previous context (a girl being the anaphoric element when two girls were previously mentioned). Referentially ambiguous nouns elicited a frontal and sustained negativity between 300–400 ms after the pronoun’s onset. Once more, the authors suggest that this sustained negativity is related to working memory load.

The study conducted by Streb, Rösler, and Hennighausen (1999) investigated ERP effects on pronoun and proper name anaphors in both parallel and nonparallel discourse structures when working as anaphoric elements. Parallel structures were those in which the anaphor matches the antecedent and nonparallel those with a mismatch. The results show that pronouns evoked a more pronounced negativity than proper name anaphors between 270–420 ms over the frontal cortex, followed by another late negativity occurring between 510–600 ms over the parietal cortex. When the anaphor element is in a nonparallel position,

it triggers extra processing steps, due to search processes in working memory, which should integrate a previous linguistic context into its anaphoric representation. The nonparallel condition elicits a parietal scalp late negativity, for both pronouns (510–630 ms) and proper names (510–600 ms). Even though the data showed a relatively late negativity, the authors claim that the effects share characteristics of an N400 effect and, for this reason, they suggest that the N400 component does not only refer to the difficulty of integrating conceptual information to the previous context only, but may also represent extra processing steps forced by syntactic constraints.

Hammer, Jansma, Lamers, and Münte (2008) investigated the interaction between working memory and gender information during pronoun resolution, by manipulating the gender of animate (person) and inanimate nouns and the distance between the antecedent and the anaphoric element. Only in the short-distance condition, when referring to an animate antecedent, incongruent pronouns elicited a widespread negativity, around 200–400 ms after pronoun onset. When referring to an inanimate antecedent, however, the short-distance condition elicited a P600 effect. According to the authors, whenever it is necessary to link a pronoun to an animate antecedent, conceptual integration takes place (N400-like effect). However, when a pronoun has to be linked to an inanimate antecedent, syntactic integration is involved (P600). Also, in the animate condition, the lack of a P600 indicates that the direct mismatch between person antecedent and pronoun is associated with conceptual integration problems, which means that coreference establishing between an animate antecedent and a pronoun is conceptually driven rather than grammatically. In the case of the collective nouns used in our study, apart from the fact that they all refer to groups of people, they also carry extra conceptual information, the plurality represented by the group. These two factors combined could interfere with how collective nouns are processed during coreference establishing, with conceptual information playing an important role.

The studies discussed above investigated how linguistic context and conceptual information processing influence coreference establishing. Among the ERP effects found, one characteristic is consistent: the sustained (late) negativity found in relation to the incongruent conditions. Van Berkum, Brown, Hagoort and Zwieterlood (2003) discuss why this negativity is different from the N400, which is a component known for being involved in conceptual processing. According to the authors, distinct linguistic mechanisms are involved in comprehension when we have sentences such as ‘he saw her’, in which two different girls were presented in the previous context, when compared to sentences like ‘He sailed the girl’, in which the noun phrase ‘the girl’ is not the best conceptual fit for

this sentence. For the former type of sentence processing, a (late) sustained negativity is usually found. However, for the latter type, an N400 effect is usually elicited. Thus, the characteristics of the negativity are subject to the conceptual relationships developed during coreference establishing and depend on the context in which anaphoric resolution occurs.

Coreference establishing also occurs in languages in which the pronoun is omitted, as the sentence provides the necessary features for the antecedent to be connected to its anaphor. As Chomsky (1981) stated, these dropped elements are phonetically empty, but are part of the sentence structure. When languages with tensed utterances present a null pronominal element, called as ‘pro’, they are known as ‘pro-drop languages’.

According to Callahan (2008), when we have a null pronoun, the process of selecting and retrieving the antecedent becomes more difficult, as the linguistic features presented by the overt pronoun are not present. For this reason, it can be more demanding for an individual to search for the antecedent, as it is necessary to wait for extra information in order to connect the antecedent to its anaphor. However, how does conceptual number influence the processing of null pronouns during anaphoric resolution? One possibility of investigating such difference would be by comparing two variants of the same language which present different characteristics regarding the presence or absence of an overt pronoun. Brazilian Portuguese and European Portuguese are a good choice as European Portuguese is a pro-drop language, whereas Brazilian Portuguese is a partial pro-drop language.

2.1.3 Brazilian Portuguese and European Portuguese: Pro-Drop or no Pro-Drop?

The possibility of dropping an argument in a language is often related to its rich system of agreement morphology. European Portuguese, as most Romance languages, is a pro-drop language. In contrast, Brazilian Portuguese has been undergoing a change from a pro-drop language to partial pro-drop (Almor, Carvalho Maia, Cunha Lima, Vernice, & Gelormini-Lezama, 2017; Cavalcante & Duarte, 2008; Duarte, 1995; 2000; 2003; Kato, 2000). In the case of Brazilian Portuguese, such change is underway because overt pronouns are closely related to the use of new subject pronominal forms and to a rapid simplification of verbal morphology. For instance, there has been a wider use of the second-person pronoun *você*, which, unlike the previous common second-person *tu*, requires a third-person morphological marker on the agreeing verb. Another example is related to the expression *a gente*, meaning ‘the people’, which includes the speaker and the addressees and also requires

a third-person marker on the agreeing verb. Table 2.2 shows the comparison between the two varieties of Portuguese and the change in the pronoun and verb paradigm.

Table 2.2: *Pronoun and verb paradigm in Brazilian and European Portuguese (verbo cantar – verb ‘to sing’).*

	European Portuguese	Brazilian Portuguese
Singular	1. <i>Eu canto</i> (‘I sing’)	1. <i>Eu canto</i> (‘I sing’)
	2. <i>Tu cantas</i> (‘You sing’)	2. <i>Você canta</i> (‘You sing’)
		<i>Tu canta</i> (‘You sing’)
	3. <i>Ele canta</i> (‘He sings’)	3. <i>Ele canta</i> (‘He sings’)
	<i>Ela canta</i> (‘She sings’)	<i>Ela canta</i> (‘She sings’)
Plural	1. <i>Nós cantamos</i> (‘We sing’)	1. <i>Nós cantamos</i> (‘We sing’)
		<i>A gente canta</i> (‘We, the people sing’)
	2. <i>Vós cantais/Vocês cantam</i> (‘You sing’)	2. <i>Vós cantais/Vocês cantam</i> (‘You sing’)
	3. <i>Eles cantam</i> (‘They sing’ – masculine)	3. <i>Eles cantam</i> (‘They sing’ – masculine)
	<i>Elas cantam</i> (‘They sing’ – feminine)	<i>Elas cantam</i> (‘They sing’ – feminine)

These changes have resulted in an impoverished verbal morphology in modern Brazilian Portuguese, which does not distinguish between second-person singular, third-person singular and first-person plural, thus, likely motivating the use of an overt pronoun with person and number features. Almor, Carvalho Maia, Cunha Lima, Vernice, and Gelormini-Lezama (2017) investigated such a phenomenon by running a self-paced reading and an acceptability-judgment study, while also considering corpus analysis. Based on their results, the authors suggest that Brazilian Portuguese is undergoing a change, from a pro-drop language to a partial pro-drop language. However, in some contexts, omitting the pronoun is mandatory, for instance, in coordinate clauses, in which gapping occurs.

(2)

O	<i>time</i> _{SG}	<i>jogará</i>	<i>hoje</i>	<i>à</i>	<i>noite.</i>	<i>Eles</i> _{PL}	<i>precisam</i>	<i>vencer</i>	<i>esta</i>	<i>partida.</i>
The	team _{SG}	is playing	tonight.			They _{PL}	need	to win	this	match.

(3)

O *clubee*_{SG} *jogará* *hoje à noite.* Ø*Precisam*_{PL} *vencer* *esta partida.*
 The *club*_{SG} *is playing* *tonight.* Ø*Need*_{PL} *to win* *this match.*

Considering the fact that Brazilian Portuguese (2) and European Portuguese (3) present differences regarding the presence of an overt pronoun during anaphoric resolution, we aimed to investigate whether we would find processing differences between the two variants when coreference establishing is occurring and when conceptual number is involved.

2.1.4 Aims of the Study and Research Questions

Previous studies investigating coreference establishing with conceptual number have produced conflicting results. Our study aims to contribute to this body of research by investigating how grammatical and conceptual number influence coreference establishing when a collective noun is the antecedent of one sentence and when a singular or a plural pronoun/verb refers to it in the following sentence. More specifically, we have two questions we would like to address in Chapter 2:

1. *Are grammatical and conceptual agreement in coreference establishing processed in the same way, as measured behaviorally and with ERPs?*
2. *Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs?*

We decided to use ERPs because ERP components can be differently affected by conceptual and grammatical information. Studies on both number agreement and coreference establishing have shown different patterns. Most studies on number agreement found that the LAN and the P600 are elicited when there is number disagreement, characterizing this effect as reflecting a morphosyntactic difficulty. However, studies which investigated the influence of conceptual information in anaphoric resolution found a sustained (late) negativity, when a pronoun could not refer to a previous discourse context. Apart from suggesting that this negativity was related to conceptual anomalies, the studies suggested that this late negativity can be related to extra processing demands necessary to link the pronoun to its antecedent (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003; Streb, Rösler, & Hennighausen, 1999).

In addition to investigating the role of conceptual number in coreference establishing, we studied whether Brazilian and European Portuguese behave the same way in this respect. As Brazilian Portuguese is undergoing a change in its pronominal and verbal system, and European Portuguese is still a full pro-drop language, this difference enabled us to investigate the role of the overt and null pronouns in this particular type of coreference assignment. In Experiment 1, we investigated Brazilian Portuguese and in Experiment 2, European Portuguese.

2.2 METHOD EXPERIMENT 1

2.2.1 Participants

For the first experiment, 30 native speakers of Brazilian Portuguese (11 male, mean age 27, range 19–34) were tested. Seven participants were excluded due to an excessive number of artifacts, leaving 23 participants whose data were analyzed. They were all right handed, confirmed with the Edinburgh Handedness Questionnaire, adapted to Brazilian Portuguese (Oldfield, 1971). No participant reported any history of neurological or psychiatric disease. They all had normal or corrected-to-normal vision. The study was approved by the CETO (Research Ethics Review Committee – University of Groningen, project number 48111779) and before being part of our experiment, all participants read the information brochure which explained the whole procedure and signed a consent form.

2.2.2 Materials

The materials created for the first experiment consisted of 80 experimental sentence pairs. The experimental sentence pairs were divided into four different experimental conditions:

(1) Singular collective noun + singular pronoun:

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O time_{SG,M} perdeu_{SG} a competição_{SG,F}. Ele_{SG,M} enfrentou_{SG} críticas da imprensa.
 The team_{SG,M} lost_{SG} the competition_{SG,F}. It_{SG,M} faced_{SG} criticism from the press.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *time*_{SG,M} *jogou*_{SG} *na* *neve*_{SG,F} *Ele*_{SG,M} *sofreu*_{SG} *com* *o* *frio*.

The *team*_{SG,M} *played*_{SG} *in the* *snow*_{SG,F} *It*_{SG,M} *suffered*_{SG} *with* *the* *cold*.

(2) **Singular collective noun + plural pronoun:**

- (b) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O *time*_{SG,M} *perdeu*_{SG} *a* *competição*_{SG,F} *Eles*_{PL,M} *enfrentaram*_{PL} *críticas* *da* *imprensa*.

The *team*_{SG,M} *lost*_{SG} *the* *competition*_{SG,F} *They*_{PL,M} *faced*_{PL} *criticism* *from the* *press*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *time*_{SG,M} *jogou*_{SG} *na* *neve*_{SG,F} *Eles*_{PL,M} *sofreram*_{PL} *com* *o* *frio*.

The *team*_{SG,M} *played*_{SG} *in the* *snow*_{SG,F} *They*_{PL,M} *suffered*_{PL} *with* *the* *cold*.

(3) **Singular non-collective noun + singular pronoun:**

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O *jogador*_{SG,M} *perdeu*_{SG} *a* *cabeça*_{SG,F} *Ele*_{SG,M} *enfrentou*_{SG} *a* *rejeição* *pública*.

The *player*_{SG,M} *lost*_{SG} *his mind*_{SG,F} *He*_{SG,M} *faced*_{SG} *public* *rejection*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *jogador*_{SG,M} *jogou*_{SG} *na* *defesa*_{SG,F} *Ele*_{SG,M} *sofreu*_{SG} *na* *nova* *posição*.

*player*_{SG,M} *played*_{SG} *in the* *defense*_{SG,F} *He*_{SG,M} *suffered*_{SG} *in the* *new* *position*.

(4) **Plural non-collective noun + plural pronoun:**

- (b) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

Os *jogadores*_{PL,M} *perderam*_{PL} *a* *cabeça*_{SG,F} *Eles*_{PL,M} *enfrentaram*_{PL} *a* *rejeição* *pública*.

The *players*_{PL,M} *lost*_{PL} *their minds*_{PL,F} *They*_{PL,M} *faced*_{PL} *public* *rejection*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

Os jogadores_{PL,M} jogaram_{PL} na defesa_{SG,F}. Eles_{PL,M} sofreram_{PL} na nova posição.
 The players_{PL,M} played_{PL} in the defense_{SG,F}. They_{PL,M} suffered_{PL} in the new position.

In Conditions 1 and 2, the first noun phrase of the first sentence was a collective noun (*O time* – ‘the team’), used in the grammatically singular form. In Condition 3, the initial noun phrase of the first sentence contained a singular noun (*O rapaz* – ‘the guy’) and for Condition 4, the first sentence’s noun phrase was a plural noun (*Os rapazes* – ‘the guys’). The frequency of the two types of nouns was matched (log lemma frequency per million, $t(38) = 1.46$, $p = .6$). The conditions focusing on the processing of collective nouns as antecedents consisted of 40 sentence pairs (‘the team’– conceptual plural), as did the conditions focusing on the processing of non-collective nouns (‘the player’ – grammatically singular, ‘the players’ – grammatically plural).

When choosing the collective nouns for the present study, we took into consideration some factors that could influence the results. First, even though collective nouns are common in Brazilian Portuguese, the ones representing a group of individuals that are also high in frequency are not numerous. For instance, some collective nouns are also perceived as an institution (like ‘government’ and ‘church’) and not only as a group of individuals, therefore, they could be interpreted as singular words (Farias, Leitão, & Ferrari-Neto, 2012). For this reason, we controlled for the status of the collective noun, choosing those which represent a group of individuals.

Second, in a previous study conducted in Brazilian Portuguese by Farias, Leitão and Ferrari-Neto (2012), it was argued that the masculine gender, understood as morphologically unmarked, could represent generality in Brazilian Portuguese. Therefore, a sentence like *A banda_{SG,F} vai tocar hoje à noite. Elas_{PL,F} são muito talentosas.* (‘The band_{SG,F} is playing tonight. They_{PL,F} are very talented.’), in which the pronoun *Elas* is in the feminine form, was more difficult to process when compared to the form *A banda_{SG,F} vai tocar hoje à noite. Eles_{PL,M} são muito talentosos.* (‘The band_{SG,F} is playing today, they_{PL,M} are very talented.’) According to the authors, as the gender feature was also involved in coreference establishing, it may have had an influence on processing sentences with a feminine noun. In order to avoid such an effect, all collective nouns used in our study were masculine. Third, when designing the sentences for the experiment, all verbs were the same across the four conditions and the non-collective and collective nouns were semantically related (as shown

in the examples 1-4). All in all, we were left with 20 collective nouns. In order to have 20 sentences per condition, we created two types of sentence pairs:

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O time_{SG.M} perdeu_{SG} a competição_{SG.F}. Ele_{SG.M} enfrentou_{SG} críticas da imprensa.
 The team_{SG.M} lost_{SG} the competition_{SG.F}. It_{SG.M} faced_{SG} criticism from the press.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O time_{SG.M} jogou_{SG} na neve_{SG.F}. Ele_{SG.M} sofreu_{SG} com o frio.
 The team_{SG.M} played_{SG} in the snow_{SG.F}. It_{SG.M} suffered_{SG} with the cold.

As the goal of the present study was to analyze how coreference establishing takes place when conceptual number is being processed, the experimental materials consisted of sentence pairs, which were separated by a full stop. The first sentence of each pair started with an adverbial ('yesterday'; 'last week'; 'belatedly'), followed by a definite article, which was then followed by the antecedent noun. Depending on the number of the noun, the article took one of two forms: masculine singular (*o*) or masculine plural (*os*). In the first sentence, the noun phrase was the subject, therefore, the antecedent. In the second and following sentence, a personal pronoun was the subject and, consequently, the anaphor. In order to avoid ambiguity when the anaphoric element is looking for its antecedent, the object of the sentence where the antecedent was located was in the feminine form. Thus, only the antecedent and its anaphor presented masculine gender.

There were 80 fillers per list. Each filler sentence was presented once as a grammatical sentence and once as an ungrammatical sentence, depending on the list. The ungrammatical sentence lacked subject-verb agreement, having the verb in the infinitive form. Thus, each participant read 40 grammatical and 40 ungrammatical filler sentences in total.

- (a) Filler – grammatical sentence

O vizinho não varreu a calçada.
 The neighbor not sweeps the sidewalk.
 The neighbor did not sweep the sidewalk.

(b) Filler – ungrammatical sentence

*O	<i>vizinho</i>	<i>não</i>	<i>varrer</i>	<i>a</i>	<i>calçada.</i>
The	neighbor	not	to sweep	the	sidewalk.

2.2.3 Procedure

The participants were seated at a comfortable distance from the computer screen, while the EEG was being recorded. Their task was to read the presented sentences carefully. The presentation software used was E-prime 2.0 (Psychology Software Tools, Inc.). The experimenter explained the experiment in detail and provided a few examples. The instructions were presented on the screen, followed by six practice sentences. The participants were repeatedly asked if they needed additional clarification before the experiment started.

The sentence pairs were presented word by word, with white letters on a black background. The font used was Arial, and the size was 24 pt. Each stimulus started with a fixation cross (500 ms), followed by blank screen for 300 ms. Each constituent word was presented for 300 ms and was followed by a 300 ms break (blank screen). The last word of each sentence in a pair always appeared with a full stop. After every five sentence pairs on average, ranging from two to seven pairs, the screen remained blank for one second, and then a question mark was showed. The question mark was a cue for the participant to answer a question related to the previous sentence's content, in which participants should evaluate if the sentence was correct or not. The questions were always in relation to the filler sentences. To answer 'yes' or 'no', the participants had to press the appropriate button ('p' for yes or 'q' for no) and the order of the buttons was counterbalanced throughout the experiment. We decided to insert such tasks while participants were being recorded in order to help them keep their attention on the reading task. For each participant, the percentage of correct sentences was above 95% (average number of errors = 3.4, SD 2.2), so no participants were excluded due to low scores on this task. As these questions' only function was to assure the participants attentiveness during the experiment, these data were not considered during our analysis. The experiment consisted of four blocks, each containing 40 pairs of sentences and sentence fillers, with a break after each block. Recording and testing lasted 20 minutes on average.

2.2.4 EEG recording and Data Processing

The electroencephalogram was recorded from 32 Ag/AgCl scalp electrodes (WaveGuard) using the ASA-Lab system (ANT Neuro Inc, Enschede, The Netherlands). Additional bipolar electrodes were used to record horizontal (HEOG; at the outer canthus of each eye) and vertical (VEOG; above and below the left eye) eye movements. Impedances were kept below 10 k Ω . Data were acquired at 512 Hz sampling rate with the common average reference.

Data were pre-processed with Brain Vision Analyzer 2.04 (Brain Products, GmbH, Munich, Germany). The offline data were re-referenced to the average of the left and right mastoids. After that, automatic ocular correction was performed, data were filtered by applying a band-pass filter (0.1–40Hz). The data were segmented, starting 200 ms before the trigger marker (target pronoun onset). The automatic artifact rejection (± 100 threshold, minimal activity 0.1) was performed in the interval of -200 ms to 1000 ms for each epoch. Finally, the baseline correction was applied starting -200 ms until 0 ms after which the data were averaged per subject and per condition.

2.2.5 Analysis

Averaged values (in μV) were extracted per participant, per condition, and per region of interest. The scalp electrodes were divided into nine regions of interest (ROI), each containing either two or three electrodes: left anterior (F7, F3, FC5), midline anterior (Fz, FC1, FC2), right anterior (F4, F8, FC6), left central (C3, CP5), midline central (Cz, CP1, CP2), right central (C4, CP6), left posterior (P7, P3), midline posterior (Pz, POz), and right posterior (P4, P8). Five independent time windows were analyzed: the 300–500 ms window, the 500–700 ms window, the 700–900 ms window, the 900–1100 ms window and the 1100–1400 ms window.

For the statistical analysis, repeated measure ANOVAS were performed, with the following within subject factors: (1) condition (two levels: singular and plural); (2) number (two levels: conceptual number and grammatical number); (3) hemisphere (two levels: left and right); (4) anteriority (three levels: anterior, central and posterior). The global analysis for each time window was done through two separate ANOVAS. The first ANOVA analyzed the lateral regions only and it included all four factors. A second ANOVA analyzed the midline regions of interest, excluding the hemisphere factor. The significance level was set to $p < .05$. Follow-up ANOVAS were performed only when interactions were at least marginally significant ($p < .1$). When the assumption of sphericity was violated, the Geisser and Greenhouse (1959) correction was applied.

2.3 RESULTS EXPERIMENT 1

2.3.1 Behavioral Results

Before running the ERP experiment, all 80 experimental sentence pairs were evaluated, through a Survey Monkey questionnaire (www.surveymonkey.com). The written sentences pairs were presented and the individuals should answer 'yes' or 'no' to the question: "Is this pair of sentences acceptable or not?". Before starting the questionnaire, it was explained to the individuals that they should judge whether the second sentence of the pair was making a reference to the first sentence of the pair. Fifteen native speakers of Brazilian Portuguese, who did not participate in the EEG experiment, completed the questionnaire. When comparing the four experimental conditions, we observed a difference in terms of acceptability among them ($F(3,45) = 25.63, p < 0.001$). A follow up analysis was conducted and showed that the 'singular collective noun + singular pronoun' condition, when compared to the other three experimental conditions was considered significantly less acceptable by the participants ($p < .05$). According to the Brazilian participants, when a singular pronoun is referring to a collective noun in the previous sentence, such a sentence pair is not approved. Regarding the condition in which we have a grammatical number disagreement, when a plural pronoun is referring to a collective noun, no differences were found when compared to the 'non-collective noun + singular pronoun' and 'non-collective noun + plural pronoun' conditions, which means these sentences are possible in Brazilian Portuguese according to the participants' judgement.

2.3.2 ERP Results

For the EGG analysis, we compared the 'singular collective noun + singular pronoun' condition to the 'singular non-collective noun + singular pronoun' condition, and the 'singular collective noun + plural pronoun' condition to the 'plural noun-collective noun + plural pronoun' condition.

A visual inspection of the waveforms indicated a spread negative effect starting around 1100 ms after the onset of the target word (pronoun), mostly in the centro-parietal and posterior areas. The effect was found on the 'singular collective noun + singular pronoun' condition, when a singular pronoun was referring to a collective noun. The negativity started around 500 ms after the onset of the singular verb agreeing in number with the pronoun.

The time window (300–500 ms), which is related to the N400 effect or the LAN, did not show significant effects or interactions for the lateral regions. For the midline analysis, marginal interaction was observed between condition, number and anteriority

($F(2, 44) = 2.929, p < .1$). Post-hoc analysis indicated that the ‘singular collective noun + singular pronoun’ condition elicited a more negative waveform than the ‘singular non-collective noun + singular pronoun’ condition ($t(22) = -2, p < .1$).

The following time windows (500–700 ms), related to the onset and early P600 component and (700–900 ms), and also related to the P600 component, did not show significant effects or interactions for the lateral regions, as well as for the midline regions.

In the following time window (900–1100 ms), no significant effects or interactions were found for the midline regions. However, when analyzing the lateral regions, an interaction between condition, hemisphere and anteriority was found ($F(2, 44) = 3.822, p < .05$). In order to investigate the nature of such an interaction, follow-ups were performed, however, on the post-hoc analysis, no significant effects were found.

For the last time window (1100–1400 ms), in the lateral regions of interest, a marginal interaction between condition and number was found ($F(1, 22) = 4.258, p < .1$). After a post-hoc analysis, a main effect of number was found, in which the ‘singular collective noun + singular pronoun’ condition was more negative than the ‘singular non-collective noun + singular pronoun’ condition ($t(22) = -2.4, p < .05$). As for the midline regions, a marginal interaction of condition and number was also found ($F(1, 22) = 4.243, p < .1$). Again, a follow up analysis was conducted, which confirmed a main effect of number, in which the ‘singular collective noun + singular pronoun’ condition was again more negative than the ‘singular non-collective noun + singular pronoun’ condition ($p < .05$).

2.3.3 Summary of ERP Results

No effects were found in the first four time windows analyzed, in relation to the target word, which in our experiment was the pronoun. However, a negative effect was found around 1100 ms after the onset of the pronoun and around 500 ms after the onset of the word following the pronoun, which was a verb agreeing in number with it. Visual analysis of the waveform and the topographic maps suggests that this negative effect is related to the verb following the pronoun, and not to the pronoun itself. The effect has its peak around 1100 ms after the onset of the pronoun and it continues until the end of the analyzed time window. The topographical maps showed that the negative effect was more spread from 1200 ms to 1300 ms, however, this negativity was most prominent in the centro-parietal and posterior areas from 1300 ms until 1500 ms.

It is important to emphasize that the conditions containing singular pronouns and verbs referring to a conceptual plural noun in the first sentence were the ones showing an effect; no effects were found in the conditions in which there was a plural pronoun and verb.

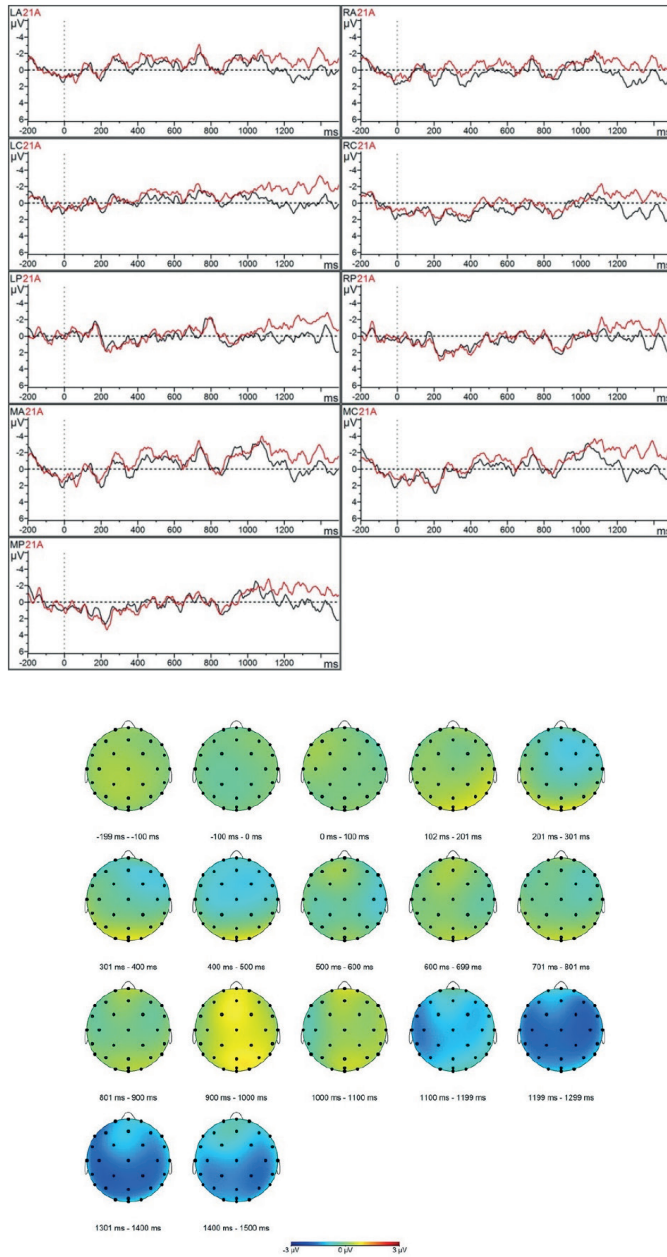


Figure 2.1: Grand average ERPs for the ‘singular collective noun + singular pronoun’ and ‘singular non-collective noun + singular pronoun (baseline 1) conditions across all 9 ROIs: the black line represents the ‘singular non-collective noun + singular pronoun’ (baseline 1) condition and the red line represents the ‘singular collective noun + singular pronoun condition’.

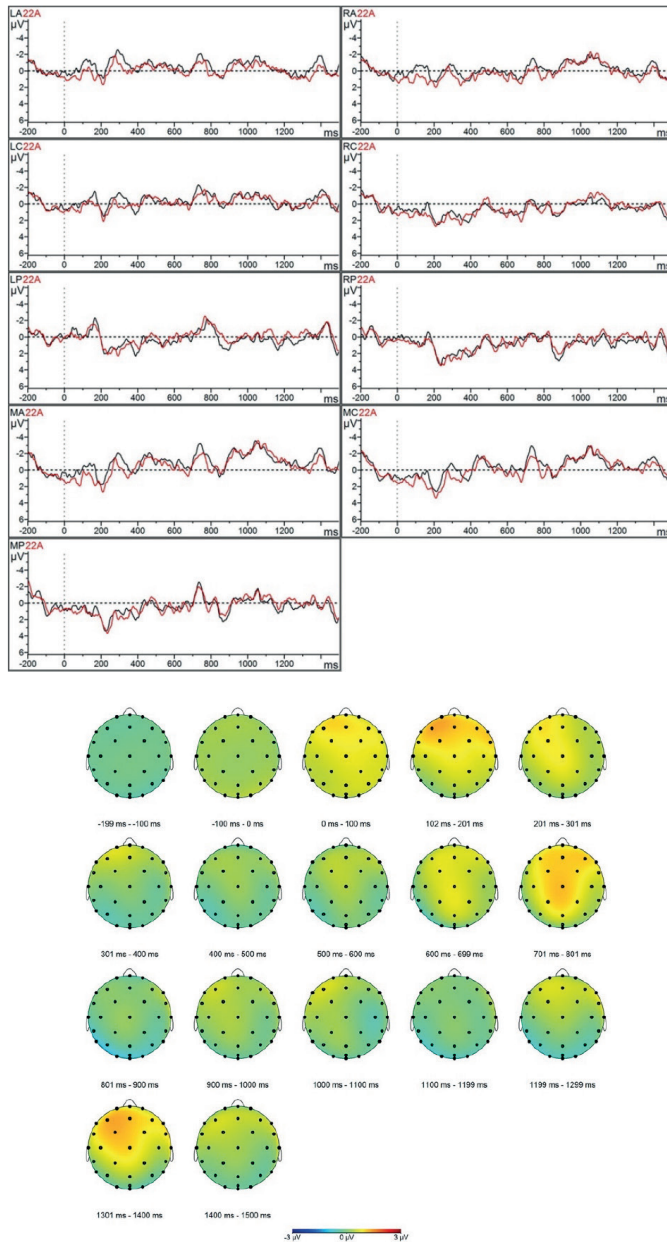


Figure 2.2: Grand average ERPs for the ‘singular collective noun + plural pronoun’ and ‘plural non-collective noun + plural pronoun’ (baseline 2) conditions across all 9 ROIs: the black line represents the ‘plural non-collective noun + plural pronoun’ (baseline 2) condition and the red line represents the ‘singular collective noun + plural pronoun’ condition.

2.3.4 Discussion Experiment 1

In our first experiment, we tested native Brazilian Portuguese speakers using a word-by-word reading task. The experimental condition in which a singular pronoun is referring to a collective noun elicited a late negative effect, starting around 1100 ms after the onset of the pronoun.

Our first interesting finding is related to the condition containing a conceptual number agreement and a grammatical number disagreement, as in *O time_{SG.M} perdeu_{SG} a competição. Eles_{PL.M} enfrentaram_{PL} críticas da imprensa.* ('The team_{SG.M} lost_{SG} the competition. They_{PL.M} faced_{PL} criticism from the press.'). This condition did not elicit any ERP effects when compared to the baseline (plural pronoun with a plural non-collective noun). ERP studies which investigated number-agreement processing suggested that when there is a grammatical number disagreement, a LAN followed by a P600 is elicited, reflecting syntactic complexity and difficulty in connecting an ungrammatical structure to the previous context (e.g., Barber & Carreiras, 2005; Osterhout & Mobley, 1995). Therefore, our finding suggests that when conceptual number is involved in the anaphoric processing, conceptual information is considered. In other words, the plural meaning of a collective noun, which represents a group of people, is salient enough to overrule the noun's singular form and to take part in anaphoric resolution.

Our second finding is related to the nature of the effect found. The condition in which a singular pronoun refers to a collective noun elicited a late negativity, when compared to its baseline condition (singular pronoun with singular non-collective noun). However, the negative effect starts at the verb following the pronoun, rather than at the pronoun. Earlier studies which investigated conceptual information in anaphoric resolution by using ERPs reported a (late) sustained negativity, when there was a difficulty in connecting an anaphoric element to its mismatching antecedent as well (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). This negativity reflects the difficulty in selecting and retrieving the proper antecedent to be connected to its anaphor. In the case of collective nouns as antecedents, the grammatical constraints alone are not enough for coreference to occur. Hence, there is a difficulty when linking the antecedent to a pronoun since the conceptual information carried by the collective noun is so salient that it overrules the grammatical information. Therefore, the anaphoric element will first search for a grammatically plural antecedent and, when it fails to do so, it elicits the late negativity.

Our third finding is related to the fact that we found the negativity effect on the verb following the singular pronoun. Garrod and Sanford (1994) and Garrod and Terras (2000) proposed that pronouns are not fully assigned to antecedents immediately. Instead, first, a search process occurs for possible antecedents and then actual integration occurs only when enough disambiguating information arrives. In the case of a collective noun working as the antecedent, there is not enough information at the pronoun position that could guarantee the selection and the retrieval of this collective noun. For this reason, the pronoun waits until it encounters the verb, which presents enough grammatical and conceptual information for coreference to be established. The study conducted by Farias, Leitão, and Ferrari-Neto (2012), in Brazilian Portuguese, also observed a significant effect on the verb following the pronoun, however, the condition in which a plural verb was referring to a collective noun was the most demanding condition during the self-paced reading task.

2.4 METHOD FOR EXPERIMENT 2

2.4.1 Participants

For the second experiment, 22 native speakers of European Portuguese (10 male, mean age 26.2, range 20–40) were tested. Only one participant was excluded due to an excessive number of artifacts, leaving 21 participants whose data were analyzed. All participants were right handed, which was confirmed with the Edinburgh Handedness Questionnaire that was adapted to European Portuguese (Oldfield, 1971). No participant reported any history of neurological or psychiatric disease. They all had normal or corrected-to-normal vision. The study was approved by the CETO (Research Ethics Review Committee – University of Groningen, project number 48111779) and before being part of our experiment, all participants read an information brochure which explained the whole procedure and signed a consent form.

2.4.2 Materials

The same materials and conditions from the Brazilian Experiment were used for Experiment 2. The only difference between the two experiments is that the second sentence of the sentence pair started with a verb, as European Portuguese is a pro-drop language. In comparison to Experiment 1, in the European Portuguese experiment one of the collective nouns was changed. In Brazilian Portuguese, we used the collective *time*, which means ‘team’. According to the suggestions made by the two native speakers of European Portuguese who

checked the sentences, we substituted the word team for the collective *clube*, which means ‘club’. The frequency of the two types of nouns was also matched for European Portuguese (log lemma frequency per million, $t(38) = 1.07$, $p = .29$). As in Experiment 1, only 20 collective nouns were used. In order to possibly have 20 sentences with collective nouns per condition, two types of sentences were developed.

As for Experiment 1, the experimental sentence pairs were divided into four different conditions, named as:

(1) **Singular collective noun + singular verb:**

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O *clube*_{SG.M} *perdeu*_{SG} *a* *competição*_{SG.F} Ø *Enfrentou*_{SG} *críticas* *da* *imprensa*.
 The *club*_{SG.M} *lost*_{SG} *the* *competition*_{SG.F} Ø *Faced*_{SG} *criticism* *from the* *press*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *clube*_{SG.M} *jogou*_{SG} *na* *neve*_{SG.F} Ø *Sofreu*_{SG} *com* *o* *frio*.
 The *club*_{SG.M} *played*_{SG} *in the* *snow*_{SG.F} Ø *Suffered*_{SG} *with* *the* *cold*.

(2) **Singular collective noun + plural verb:**

- (a) Noun Phrase_{MASC} + Transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O *clube*_{SG.M} *perdeu*_{SG} *a* *competição*_{SG.F} Ø *Enfrentaram*_{PL} *críticas* *da* *imprensa*.
 The *club*_{SG.M} *lost*_{SG} *the* *competition*_{SG.F} Ø *Faced*_{PL} *criticism* *from the* *press*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *clube*_{SG.M} *jogou*_{SG} *na* *neve*_{SG.F} Ø *Sofreram*_{PL} *com* *o* *frio*.
 The *club*_{SG.M} *played*_{SG} *in the* *snow*_{SG.F} Ø *Suffered*_{PL} *with* *the* *cold*.

(3) **Singular non-collective noun + singular verb:**

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

O *jogador*_{SG.M} *perdeu*_{SG} *a* *cabeça*_{SG.F} Ø *Enfrentou*_{SG} *a* *rejeição* *pública*.
 The *player*_{SG.M} *lost*_{SG} *his mind*_{SG.F} Ø *Faced*_{SG} *public* *rejection*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O *jogador*_{SG,M} *jogou*_{SG} *a* *defesa*_{SG,F} \emptyset *Sofreu*_{SG} *na* *nova* *posição*.

The *player*_{SG,M} *played*_{SG} *in the* *defense*_{SG,F} \emptyset *Suffered*_{SG} *in the* *new* *position*.

(4) **Plural non-collective noun + verb pronoun:**

- (a) Noun phrase_{MASC} + transitive verb + noun phrase_{FEM} – the object in a different gender from subject-noun phrase.

Os *jogadores*_{PL,M} *perderam*_{PL} *a* *cabeça*_{SG,F} \emptyset *Enfrentaram*_{PL} *a* *rejeição* *pública*.

The *players*_{PL,M} *lost*_{PL} *their minds*_{PL,F} \emptyset *Faced*_{PL} *public* *rejection*.

- (b) Noun phrase_{MASC} + intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase.

Os *jogadores*_{PL,M} *jogaram*_{PL} *a* *defesa*_{SG,F} \emptyset *Sofreram*_{PL} *na* *nova* *posição*.

The *players*_{PL,M} *played*_{PL} *in the* *defense*_{SG,F} \emptyset *Suffered*_{PL} *in the* *new* *position*.

As it was the case for the Brazilian experiment, after every five sentence pairs on average, ranging from two to seven, participants would evaluate if the previous sentence was correct or not. Again, the content questions were always in relation to the filler sentences. Each participant's percentage of correct answers was above 95%, (average number of errors 3.2, *SD* 2.3) so no participants were excluded due to low scores. As these questions were only inserted during the reading task to assure that participants were paying attention, these data were not analyzed.

2.4.3 Analysis

For the analysis, the only difference from Experiment 1 was the time windows evaluated. We decided to analyze different time windows for Experiment 2, when compared to Experiment 1, because the target word in this experiment was the verb, and not the pronoun, which could influence our final analysis. For this reason, the first analyzed time window starts earlier, at 200 ms, and not at 300 ms. In Experiment 2, four independent time windows were analyzed: the 200 to 400 ms window, the 400–600 ms window, the 600–800 ms window and the 800–1000 ms windows.

Again, for the statistical analysis, repeated measure ANOVAs were performed, with the following within subject factors: 1) condition (two levels: singular and plural); 2) number (two levels: conceptual number and grammatical number); hemisphere (two

levels: left and right); 4) anteriority (three levels: anterior, central and posterior). The global analysis for each time window was done through two separate ANOVAS. The first ANOVA analyzed the lateral regions only and it included all four factors. A second ANOVA analyzed the midline regions of interest, excluding the hemisphere factor. The significance level was set to $p < .05$. Follow up ANOVAS were performed only when interactions were at least marginally significant ($p < .1$). When the assumption of sphericity was violated, the Geisser and Greenhouse (1959) correction was applied.

For the statistical analysis, we compared the ‘singular collective noun + singular verb’ condition to the ‘singular non-collective noun + singular verb’ condition, and the ‘singular collective noun + plural verb’ condition to the ‘plural noun-collective noun + plural verb’ condition.

2.5 RESULTS EXPERIMENT 2

2.5.1 Behavioral Results

As with Brazilian Portuguese materials, all 80 experimental sentence pairs were evaluated, through a Survey Monkey questionnaire (www.surveymonkey.com) before the ERP experiment was conducted. The sentences were presented and the individuals would answer *yes* or *no* to the question: “Is this pair of sentences acceptable or not?”. Before starting the questionnaire, it was explained to the individuals that they should judge if the second sentence of the pair was making a reference to the first sentence of the pair. In total, 13 native European Portuguese speakers, who were not part of the ERP experiment, completed the questionnaire. When comparing the four experimental conditions, we observed a difference in terms of acceptability among them ($F(3,36) = 7.706, p = .035$). A follow up analysis showed that the ‘singular collective noun + plural verb’ condition was significantly less acceptable than the ‘plural non-collective noun + plural verb’ condition, ($p < .05$). This result shows that sentences with a plural verb referring to a singular collective noun are less acceptable than sentences with plural verb referring to a plural non-collective noun. However, it is important to mention that when comparing the ‘singular collective noun + singular verb’ condition to the ‘singular collective noun + plural verb’ condition, no differences were found. This fact shows that European Portuguese is equally sensitive to singular and plural verbs when referring to a collective noun.

2.5.2 ERP Results

The first time window (**200–400 ms**), which is related to the N400 effect and to the onset of the P600 effect, did not show any significant effects or interactions for both lateral and midline regions.

The following time window (**400–600 ms**), also related to the N400 and the LAN, did not show any significant effects or interactions for the lateral regions. However, for the midline regions, a marginal effect of condition was found ($F(1, 21) = 3.113, p < .1$). The conditions which contained a singular verb showed a trend of being more negative than those conditions in which the target verb was in the plural form.

For the third time window, which was from **600 to 800 ms**, no significant effects or interactions in relation to the midline regions were found. However, for the lateral region, a marginal main effect of number was found, with the conditions where the target verb was in the plural form tended to be more negative than those conditions where the target verb was in the singular form ($F(1, 21) = 3.597, p < .1$). In addition, a marginal four-way interaction between condition, number, hemisphere and anteriority was also found, ($F(2, 42) = 3.426, p < .1$). In a post hoc analysis, it was possible to observe that the condition in which a plural verb was referring to a collective noun was more negative, when compared to the condition in which a plural verb was making a reference to a non-collective noun ($t(21) = -2.4, p < .05$).

In the last time window analyzed (**800–1000 ms**), in the lateral regions, a main effect of number was found, in which the ‘singular collective noun + singular verb’ condition was more negative when compared to the ‘singular noun-collective noun + singular verb’ condition ($F(1, 21) = 5.197, p < .05$). A marginal four-way interaction between condition, number, hemisphere and anteriority was also found, ($F(2, 42) = 3.426, p < .1$). A post-hoc analysis showed that the ‘singular collective noun + singular verb’ condition was more negative in the right central region, when compared to its baseline condition (singular non-collective noun + singular verb; $t(21) = -2.22, p < .05$), and marginally more negative in the posterior right region ($t(21) = -1.81, p > .05$). In addition, the ‘singular collective noun + singular verb’ condition was marginally more negative compared to the ‘singular noun-collective noun + singular verb’ condition, in the left anterior region ($t(21) = -2.02, p < .1$).

In the midline regions, a main effect of condition was found, whereby the conditions with a singular verb were marginally more negative than the conditions in which the target verb was plural, ($F(1, 21) = 4.269, p < .1$).

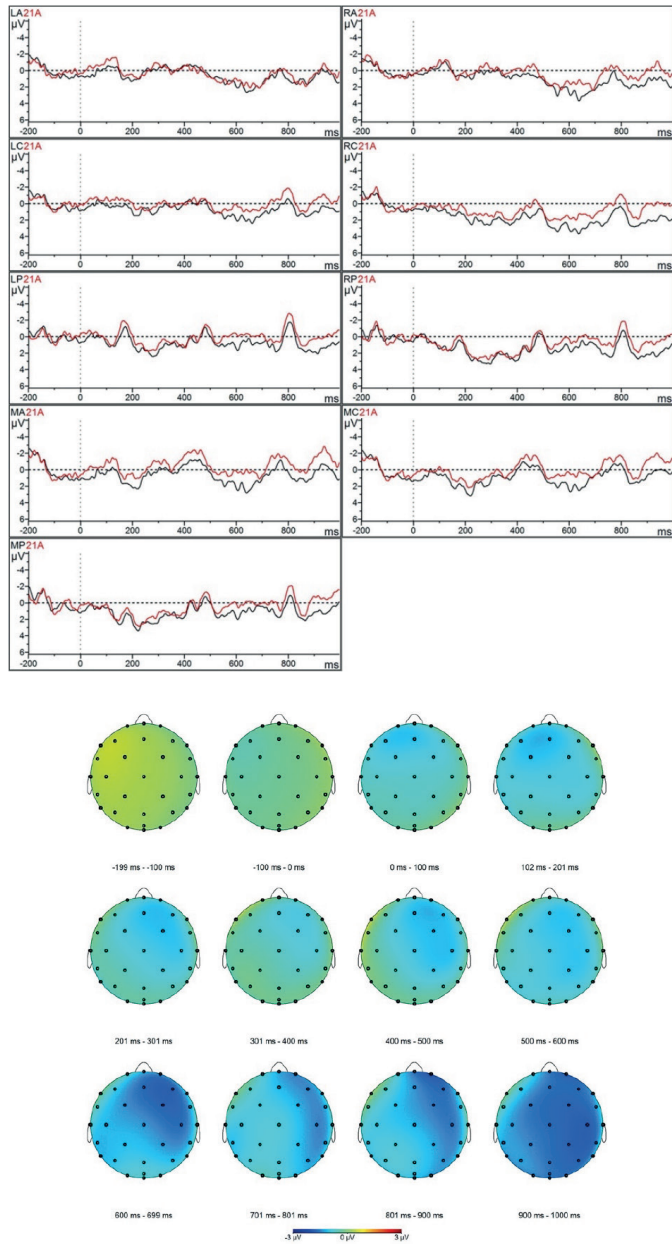


Figure 2.3: Grand average ERPs for the ‘singular collective noun + singular verb’ and ‘singular non-collective noun + singular verb’ (baseline 1) conditions across all 9 ROIs: the black line represents the ‘singular non-collective noun + singular verb’ (baseline 1) condition and the red line represents the ‘singular collective noun + singular verb’ condition.

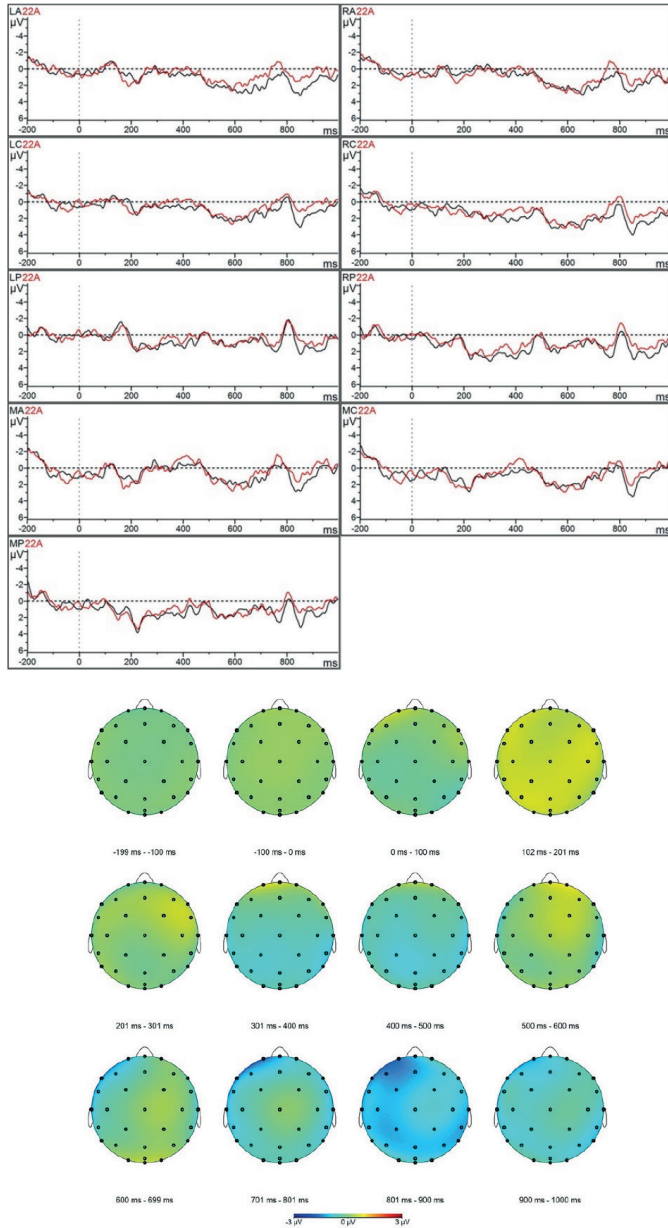


Figure 2.4: Grand average ERPs for the ‘singular collective noun + plural verb’ and ‘plural non-collective noun + plural verb’ (baseline 2) conditions across all 9 ROIs: the black line represents the ‘plural non-collective noun + plural verb’ (baseline 2) condition and the red line represents the ‘singular collective noun + plural verb condition’.

2.5.3 Summary ERP Results

The ERP study showed no effects in the first two time windows analyzed. The first effect found was in the 600-800 ms time window: a negativity in the left anterior region was found when a plural verb was referring to a singular collective noun, which was the antecedent of the previous sentence. Visual analysis of the wave patterns suggests that this negative effect has its peak around 600 ms and it is not sustained. In relation to the 800–1000 ms time window, a negative effect was found in relation to the condition in which a singular verb was referring to a singular collective noun. Visual analysis of the wave patterns suggests that this negativity has its peak around 750 ms and continues until the end of the time window analyzed. Again, as it was the case for Experiment 1, in Experiment 2 the conditions containing singular verbs referring to singular collective nouns were the ones showing a late sustained negative effect.

2.5.4 Discussion Experiment 2

For the second experiment, we tested native European Portuguese speakers using a word-by-word reading task. European Portuguese is a pro-drop language and, in comparison to Brazilian Portuguese, we aimed to investigate whether we would find the same effects in both varieties. The results showed that the condition in which a plural verb was referring to a singular collective noun was more negative when compared to the condition in which a plural verb was referring to a plural non-collective noun. Even though this effect resembled a left anterior negativity, it was recorded later than expected (600–800 ms) and was not followed by a P600.

In contrast, the condition in which a singular verb is referring to a collective noun elicited a late negativity effect after the onset of the verb in European Portuguese. As in Experiment 1, this late negativity starting around 750 ms after the onset of the verb and continued until the end of the analyzed time window, in the condition in which a singular verb was referring to a singular collective noun. According to these previous studies, this late negativity effect reflects an effort to select and retrieve the proper antecedent to an anaphor and, thus, it reflects the extra processing load when coreference establishing takes place.

2.6 GENERAL DISCUSSION

Studies conducted on different languages, such as Spanish (Carreiras & Gernsbacher, 1992), English (Gernsbacher, 1991), German (Schweppe, 2013) and Brazilian Portuguese (Farias, Leitão, & Ferrari-Neto, 2012; Godoy, Françaço, & Ferreira, 2014; Silva, 2008), investigated the influence of conceptual number in coreference establishing. These studies, however, had conflicting results regarding the ease or difficulty of processing such linguistic structures. In this chapter, we presented two experiments which aimed to investigate how conceptual number influences coreference establishing using ERPs.

Before discussing the research questions which this study aimed to answer, it is important to consider our behavioral data. Regarding European Portuguese, we have an interesting finding: the behavioral results showed that the sentences in which a plural verb was referring to a singular collective noun were significantly less acceptable than the sentences in which a plural verb was referring to a singular non-collective noun. However, it is important to emphasize that we did not find significant differences between the 'singular collective noun + singular verb' and 'singular collective noun + plural verb' conditions. These results suggest that European Portuguese speakers are sensitive to conceptual information, even when there is a grammatical disagreement, in the form of the 'singular collective noun + plural verb' condition. We can assume that when these participants were judging the sentences in terms of acceptability, both grammatical and conceptual information played a role during sentence comprehension.

In the case of Brazilian Portuguese, the behavioral results showed that when a singular pronoun and a singular verb are referring to a singular collective noun, these sentence pairs were significantly less acceptable, when compared to the other three experimental conditions. Therefore, it seems that for Brazilian Portuguese speakers, when coreference establishing is occurring and a collective noun is the antecedent, conceptual number overrules grammatical information and the condition in which a plural verb is referring to a collective noun is the acceptable one. Hence, both variants of the same language showed different patterns regarding acceptability. However, both European and Brazilian Portuguese consider conceptual information when coreference assignment is occurring.

2.6.1 The Influence of Conceptual Number Agreement in Coreference Establishing: ERP Results

Our first research question was as follows:

1. *Are grammatical and conceptual agreement in coreference establishing processed in the same way, as measured behaviorally and with ERPs?*

Regarding Research Question 1, the answer is: conceptual number and grammatical agreement are not processed in the same way. When a plural pronoun or a plural verb is referring to a collective noun, no ERP effects were elicited, which reflects that this grammatical number disagreement does not impose processing difficulties, thus these sentences are processed as acceptable. These findings are in line with the results of Gernsbacher (1991), Carreiras and Gernsbacher (1992), and Godoy, Françaço, and Ferreira (2014), in which sentences containing collective nouns and plural reference were considered natural and acceptable.

However, our findings are not in agreement with previous ERP studies which investigated number agreement (e.g., Barber & Carreiras, 2005; Osterhout & Mobley, 1995). Number violation, in which the plural pronoun/verb is not agreeing in grammatical number with its antecedent, should elicit a LAN followed by a P600 effect. Nonetheless, our data show that, when a collective noun has an antecedent function, grammatical information itself is not sufficient for coreference establishing to take place, demonstrating that conceptual information plays an even more important role in anaphoric resolution.

It is important to emphasize that previous studies which investigated the influence of discourse/conceptual context in coreference establishing, found a sustained (late) negativity when the anaphor is selecting and retrieving a conceptually incongruent antecedent (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). Even though the effects of our study do not resemble a classic N400, this late negativity reflects the difficulty of selecting and retrieving an antecedent that does not match in conceptual number with its anaphor.

Furthermore, sentences with such conceptual mismatches (singular collective noun + singular pronouns and singular verb) may put a heavier processing load, because there is difficulty in integrating word meaning into the preceding context, so second-pass semantic interpretation process is needed. The need for this conceptual reinterpretation may take the form of replacing the mismatching pronoun or verb with a plausible one based on the

context, which in the case of our experiment is the pronoun/verb referring to a singular collective noun.

2.6.2 The Influence of Conceptual Number Agreement on Coreference Establishing: A Comparison between Brazilian and European Portuguese

Our second research question was as follows:

2. *Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs?*

The reason for comparing the two variants of Portuguese is because Brazilian Portuguese is undergoing a change in its pronominal and verbal system, whereas European Portuguese is still a full pro-drop language. This difference enabled us to investigate how (conceptual) coreference is established when the pronoun is phonologically overt and when it is dropped (Almor, Carvalho Maia, Cunha Lima, Vernice, & Gelormini-Lezama, 2017; Cavalcante & Duarte, 2008; Duarte, 1995; 2000; 2003; Kato, 2000).

The answer to the second research question is: in this linguistic context, when a singular verb is referring to a singular collective noun, conceptual number influences coreference establishing in the same fashion for both variants of Portuguese. In both Brazilian and in European Portuguese, processing difficulties are found, reflected by a late sustained negative effect. Interestingly, the effect is at the same word (the verb), albeit at a different position in the sentence. In Brazilian Portuguese, the verb follows the pronoun, meaning that the effect is on the word after the target, whereas in European Portuguese the verb is the target word. The absence of an effect on the target word (pronoun) in the Brazilian Portuguese experiment may be due to the fact that the inflected verb, and not only the pronoun, is important to the help coreference establishing when conceptual number agreement is involved in sentence processing.

However, in European Portuguese, the condition in which a plural verb is referring to a collective noun elicited a non-sustained negativity, when compared to the condition in which a plural verb was referring to a plural non-collective noun. We assumed that the effect is not sustained due to the fact that the conflict is resolved, not demanding reanalysis, and the processing of the sentence can continue.

When comparing our behavioral and ERP data, it is possible to observe the same pattern in European Portuguese: in terms of acceptability, when a plural verb was referring

to a singular collective noun, these sentences were less acceptable when compared to the 'plural non-collective noun + plural verb' condition. However, no significant differences were found between the 'singular collective noun + singular verb' and 'singular collective noun + plural verb' conditions, which means that European Portuguese is more sensitive to conceptual information than Brazilian Portuguese.

The two experiments aimed to investigate the role of conceptual number during coreference establishing. Our findings show that in sentences in which a collective noun has an antecedent function, singular pronouns and singular verbs functioning as anaphoric elements elicit a late negative effect for both Brazilian and European Portuguese. In addition to that, it seems that European Portuguese speakers considered grammatical information when processing collective nouns and they are more sensitive to conceptual information.

Regarding the influence of conceptual number in coreference establishing, it is clear that words which do not present a convergence in terms of grammatical and conceptual information, such as collective nouns, are processed differently when compared to regular nouns. When a collective noun is the antecedent in coreference establishing, its conceptual plural meaning plays an important role in anaphoric resolution.

Chapter 3

THE INFLUENCE OF CONCEPTUAL
NUMBER IN COREFERENCE ESTABLISHING
IN COORDINATION: AN ERP STUDY ON
BRAZILIAN AND EUROPEAN PORTUGUESE

3.1 INTRODUCTION

3.1.1 Conceptual Number and Coreference Establishing

Sentence comprehension depends on processing at different linguistic levels and, depending on the interaction between distinct elements within sentence boundaries during sentence processing, grammatical features can play an important role. One example of a such feature is number. Number processing usually relies on two types of linguistic information, grammatical and conceptual information. Normally, both kinds of linguistic information match (Bock, Eberhard, Cutting, Meyer, & Schriefers, 2001; Bock, Eberhard, & Cutting, 2004; Corbett, 2002; Eberhard, Cutting, & Bock, 2005).

Still, there is an exception to the convergence between numerosity (conceptual level) and inflectional marking (grammatical level). For instance, in the noun phrase ‘the band’, the noun ‘band’ is in the singular form, despite the word conveying a plural meaning, as this collective represents a group of musicians. Hence the term *collective nouns* for this kind of nouns. For processing of such nouns to be possible, the individual needs to combine the plural conceptual meaning of the collective noun with its grammatically singular form.

The influence of conceptual number on language processing, more specifically coreference establishing, has been investigated before (Carreiras & Gernsbacher, 1992; Gernsbacher, 1991; Farias, Leitão, & Ferrari-Neto, 2012; Godoy, Françaço, & Ferreira, 2014; Schweppe, 2013; Silva, 2008). The studies conducted on English (Gernsbacher, 1991), Spanish (Carreiras & Gernsbacher, 1992) and Brazilian Portuguese (Godoy, Françaço, & Ferreira, 2014) showed that sentences in which a plural pronoun and plural verb are referring to a singular collective noun are easier to process when compared to sentences in which a singular pronoun and a singular verb are referring to the same collective noun. However, the studies conducted in Brazilian Portuguese (Farias, Leitão, & Ferrari-Neto, 2012; Silva, 2008) showed the opposite: when a plural pronoun and a plural verb were referring to a singular collective noun, individuals had more difficulty processing sentences with such elements. Interestingly, Schweppe (2013) showed that distance between the antecedent and the anaphor influenced how conceptual number affects coreference establishing: when the anaphoric element was closer to its antecedent, listeners relied more on grammatical number; however, when the anaphor was farther from the antecedent, they relied more on conceptual information.

The studies mentioned above investigated the influence of conceptual number in coreference establishing when the anaphoric element was a pronoun. Also, the experiments usually tested sentence pairs, that is, the antecedent (collective noun) was located in the first

sentence and the pronoun was located in a different sentence, separated by a full stop. It is important to consider the possibility that conceptual number will have a different influence in coreference establishing depending on the sentence structure in which it is occurring, for instance, in coordination.

3.1.2 Ellipsis in Coordination

Ellipsis is defined as the lack of linguistic material that would normally occur in a given sentence, and the missing element is conceptually recoverable because of the grammatical and conceptual context (Sag, 1976; Sag & Hankamer, 1984; Williams, 1977). Gapping, more specifically, is a type of ellipsis which occurs in coordination and the interpretation of the absent element depends on the element in the preceding clause. In other words, gapping can occur because the elided part presents redundant information, which can be retrieved from the previous clause (Sag & Hankamer, 1984; Ross, 1967). In the case of coreference establishing occurring in a coordinated sentence, the antecedent's characteristics constrain the realization of the gapped anaphoric element, as well as the elements following it.

Regarding pro-drop languages, the occurrence of ellipsis in a coordinated sentence is not an exclusive characteristic of these languages per se. In reality, it is a more general feature across languages. In the case of coordination, the linguistic context and more specifically the grammatical environment will constrain the usage of an overt pronoun and, as a result, both non-pro-drop and partial pro-drop languages can present gapping (Duarte & Varejão, 2013).

In relation to gapping and coreference establishing, when the pronoun is omitted, the process of selecting and retrieving the antecedent becomes more difficult, as the linguistic features presented by the anaphor are not present. Thus, it can be more demanding to search for the antecedent, as compared to when a pronoun is present, because one needs extra information in order to connect the antecedent to its anaphor (Callahan, 2008).

Event-related potentials are sensitive to the sentence structure in which coreference establishing occurs. Depending on the sentence structure (sentence pairs separated by a full stop or two clauses in coordination) or the type of anaphoric element (overt or null pronoun), differences in terms of processing may be observed. ERPs thus, can help us to understand how conceptual number influences coreference establishing in different linguistic contexts. Sentences (1) and (2) illustrate such distinct linguistic contexts:

- (1) The band is playing tonight. They are very talented.
- (2) *The band is playing tonight and are very talented.

3.1.3 ERP Studies on Coreference Establishing and Gapping

Investigating sentence processing by using ERPs usually relies on several ERP language-related components. The first language-related component to be identified was the N400 (Friederici, 1995; 2002, Kutas & Hillyard, 1980a; 1980b; 1980c; Kutas, Van Petten, & Besson, 1988), which is considered to reflect semantic integration costs, particularly in response to words that do not fit conceptually into the preceding context. Syntactic processes, however, correlate with two ERP components, a left-anterior negativity (LAN), which occurs in an early time window (between 300–500 ms) and a late centro-parietal positivity (P600), which occurs between 500–1000 ms (Friederici, 2002; Hagoort, Brown, & Groothusen, 1993; Holcomb, 1993; Osterhout & Holcomb, 1992). The LAN is supposed to be elicited as an automatic response to morphosyntactic error, whereas the P600 is seen as a marker of repair and reanalysis processes. Past studies on number processing indicate that grammatical number disagreement elicits a P600 effect which is sometimes preceded by the LAN (e.g., Barber & Carreiras, 2005; Osterhout & Mobley, 1995).

Regarding coreference establishing, ERP studies showed that the manipulation of conceptual context can make the selection and retrieval of the antecedent more complex (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). Among the ERP effects reported, one characteristic is constant: the sustained (late) negativity found when a given anaphoric element does not match the previous context. It has been suggested that sentences with such mismatches place a heavier load upon working memory, because integrating word meaning into the preceding context is more effortful and second-pass conceptual interpretation process is needed.

However, the studies mentioned above investigated the influence of conceptual context in relation to overt pronouns, usually when the anaphoric relationship is occurring between two separate sentences. In the case of two separate sentences, conceptual information plays an important role because the pronoun or the verb following a dropped pronoun are not bound to the sentence in which the antecedent is present and are not necessarily constrained by grammatical information, which means that the anaphor is matched to the most suitable antecedent at a conceptual level and not at a grammatical level. The question for the current study is whether the same mechanism is found when coreference assignment occurs in coordination.

Kaan, Wijnen, and Swaab (2004) studied the influence of conceptual information in gapping. A sentence such as ‘Ron took the planks for the bookcase, and Bill the hammer

with the big head,’ the verb ‘took’ is conceptually related to the gapped verb in the second clause. Whereas in the sentence ‘Ron sanded the planks for the bookcase, and Bill the hammer with the big head,’ it is not possible to integrate ‘sanded’ to the noun phrase ‘the hammer’. In the condition in which there was no conceptual match with the antecedent, a centro-parietal negativity between 300 and 500 ms post-onset of the object (N400), and a left posterior positivity between 600 and 900 ms post-onset (P600), were observed. The effects are due to the difficulty of conceptual integration and grammatical reanalysis in order to connect the verb to its noun phrase.

Hammer, Jansma, Lamers, and Münte (2008) also aimed to investigate whether gap and no-gap constructions alter the ERP pattern elicited by gender violations. In addition to that, the distance between the antecedent and the anaphoric element was manipulated (short-distance and long-distance). In the no-gap-long-distance condition, long-distance resulted in an N400-like effect, which indicates the involvement of conceptual integration, whereas for the gap-long-distance condition a P600 effect was found, which suggests the involvement of syntactic reanalysis. According to the authors, the P600 in the gap condition was due to the fact that in the gapping constructions, grammatical information was crucial for selecting and retrieving the antecedent related to the second clause.

The studies mentioned above are examples of how conceptual information can have a different impact depending on the linguistic context in which it occurs. When coreference establishing takes place during gapping, grammatical constraints are important for sentence processing. Nonetheless, it is important to stress that gapping is restricted to a very specific context, in which grammatical information is crucial. The omission of an anaphoric element, such as a pronoun, is only allowed when the antecedent and the anaphor share all grammatical features. Collective nouns present a conflicting number feature (grammatically singular, conceptually plural) which may influence processing of gapped anaphors. Here, we investigate whether the linguistic context (gapping in coordination) affects coreference establishing.

3.1.4 Gapping in Brazilian Portuguese and European Portuguese

In the last century, Brazilian Portuguese has been changing from being a pro-drop language to a partial pro-drop language (Almor, Carvalho Maia, Cunha Lima, Vernice, & Gelomini-Lezama, 2017; Duarte, 1995; 2000; 2003; Cavalcante & Duarte, 2008; Kato, 2000). European Portuguese, however, is a pro-drop language (see Chapter 2). In Brazilian Portuguese, the pronoun is required in coreference establishing between two separate sentences, which is not the case for European Portuguese (see Chapter 2). However, the pronoun’s omission

is required in some contexts in Brazilian Portuguese, for example, in coordinating clauses with coreferential elements (Almor, Carvalho Maia, Cunha Lima, Vernice, & Gelomini-Lezama, 2017). According to Duarte and Varejão (2013), the occurrence of null pronouns in partial pro-drop languages is correlated to the structure pattern in which they occur. In the case of coordination, pro-drop is required in Brazilian Portuguese because the sentence structure grammatically constrains anaphoric resolution. Hence, the antecedent's formal features are crucial and extra information in the form of a pronoun is not needed. The question is whether distinct sentence structures, such as two separate sentences and two clauses in coordination, are influenced differently by conceptual number.

Regarding the occurrence of gapping in coordination, Duarte and Varejão (2013) emphasize that this is not a unique property of pro-drop languages (European Portuguese), occurring in non-pro-drop languages as well. This means that, in European Portuguese, it is not the linguistic context which guarantees the elision of the pronoun.

For this reason, in case there is a difference of language processing between pro-drop and gapping contexts, we aimed to investigate whether gapping is processed differently in a partial pro-drop language (Brazilian Portuguese) when compared to a full pro-drop language (European Portuguese).

3.1.5 Aims of the Study and Research Questions

In Chapter 2, we described two ERP experiments which investigated the influence of conceptual number on anaphoric resolution, when a personal pronoun or an inflected verb is referring to a collective noun in a linguistic context in which two separate sentences are related to one another. The two variants of Portuguese elicited a late negativity effect on the verb, which is related to conceptual processing and the difficulty of selecting and retrieving the proper antecedent to its anaphor. In the current study, we investigated conceptual number processing in gapping under coordination. In addition, we also look into whether there is a difference between two variants of Portuguese regarding coreference establishing in coordination, more specifically between a partial pro-drop language (Brazilian Portuguese) and a full pro-drop language (European Portuguese).

The two experiments on Brazilian and European Portuguese aimed to answer the following research questions:

1. *Are grammatical and conceptual agreement processed in the same way, when coreference establishing occurs in coordination, as measured behaviorally and with ERPs?*
2. *Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European*

Portuguese), as measured behaviorally and with ERPs, in the occurrence of gapping in coordination?

In Experiment 3, we studied conceptual number processing in coreference establishing in coordination in Brazilian Portuguese and in Experiment 4, in European Portuguese.

3.2 METHOD EXPERIMENT 3

3.2.1 Participants

For Experiment 3, the same 30 native speakers of Brazilian Portuguese who participated in Experiment 1 were tested (11 male, mean age 27, range 19–34). From the total number, seven participants were excluded due to an excessive number of artifacts, leaving 23 participants whose data were analyzed. They were all right-handed, which was confirmed by the Edinburgh Handedness Questionnaire, that was adapted to Brazilian Portuguese (Oldfield, 1971). No participant reported any history of neurological or psychiatric disease. They all had normal or corrected-to-normal vision. The study was approved by the CETO (Research Ethics Review Committee – University of Groningen, project number 48111779) and before being part of our experiment, all participants read an information brochure which explained the whole procedure and signed a consent form.

3.2.2 Materials

The materials created for the third experiment consisted of 80 experimental sentence pairs and 80 fillers. The experimental sentences were divided into the following four conditions:

(1) **Singular collective noun (first clause) + singular verb (second clause):**

(a) Noun phrase_{MASC}+ transitive verb + noun phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O partido_{SG,M} interrompeu_{SG} a votação_{SG,F} e solicitou_{SG} um novo pleito.
The party_{SG,M} halted_{SG} the vote_{SG,F} and requested_{SG} a new voting.

(b) Noun phrase_{MASC}+ intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase:

O partido_{SG,M} optou_{SG} pela neutralidade_{SG,F} e condenou_{SG} os políticos indecisos.
The party_{SG,M} opted_{SG} for neutrality_{SG,F} and condemned_{SG} the undecided politicians.

(2) **Singular collective noun (first clause) + plural verb (second clause):**

- (a) Noun phrase
- _{MASC+}
- transitive verb + noun phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase.

O *partido*_{SG,M} *interrompeu*_{SG} *a* *votação*_{SG,F} *e* *solicitaram*_{PL} *um* *novo* *pleito*.
 The party_{SG,M} halted_{SG} the vote_{SG,F} and requested_{PL} a new voting.

- (b) Noun phrase
- _{MASC+}
- intransitive verb + prepositional phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase:

O *partido*_{SG,M} *optou*_{SG} *pela* *neutralidade*_{SG,F} *e* *condenaram*_{PL} *os* *políticos* *indecisos*.
 The party_{SG,M} opted_{SG} for neutrality_{SG,F} and condemned_{PL} the undecided politicians.

(3) **Singular non-collective noun (first clause) + singular verb (second clause):**

- (a) Noun phrase
- _{MASC+}
- transitive verb + noun phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase.

O *político*_{SG,M} *interrompeu*_{SG} *a* *colega*_{SG,F} *e* *solicitou*_{SG} *uma* *nova* *explicação*.
 The politician_{SG,M} interrupted_{SG} his colleague_{SG,F} and requested_{SG} for a new explanation.

- (b) Noun phrase
- _{MASC+}
- intransitive verb + prepositional phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase:

O *político*_{SG,M} *optou*_{SG} *pela* *investigação*_{SG,F} *e* *condenou*_{SG} *os* *colegas* *contrários*.
 The politician_{SG,M} opted_{SG} for the investigation_{SG,F} and condemned_{SG} the opposing colleagues.

(4) **Plural non-collective noun (first clause) + plural verb (second clause):**

- (a) Noun phrase
- _{MASC+}
- transitive verb + noun phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase.

Os *políticos*_{PL,M} *interromperam*_{PL} *a* *colega*_{SG,F} *e* *solicitaram*_{PL} *uma* *nova* *explicação*.
 The politicians_{PL,M} interrupted_{SG} their colleague_{SG,F} and requested_{PL} for a new explanation.

- (b) Noun phrase
- _{MASC+}
- intransitive verb + prepositional phrase
- _{FEM}
- the object in a different gender from the subject-noun phrase:

Os *políticos*_{PL,M} *optaram*_{PL} *pela* *investigação*_{SG,F} *e* *condenaram*_{PL} *os* *colegas* *contrários*.
 The politicians_{PL,M} opted_{PL} for the investigation_{SG,F} and condemned_{PL} the opposing colleagues.

We used the same 20 collective nouns as in Experiment 1. Since the number of collective nouns used is quite small, we decided to create two types of sentences, so we could use the

collective nouns twice during the task. The two kinds of sentences were distinct in terms of the structure of the first clause:

- (1) Noun phrase_{MASC}+ transitive verb + noun phrase_{FEM} – the object in a different gender from the subject-noun phrase.

O partido_{SG,M} interrompeu_{SG} a votação_{SG,F} e solicitou_{SG} um novo pleito.
 The party_{SG,M} halted_{SG} the vote_{SG,F} and requested_{SG} a new voting.

- (2) Noun phrase_{MASC}+ intransitive verb + prepositional phrase_{FEM} – the object in a different gender from the subject-noun phrase:

O partido_{SG,M} optou_{SG} pela neutralidade_{SG,F} e condenou_{SG} os políticos indecisos.
 The party_{SG,M} opted_{SG} for neutrality_{SG,F} and condemned_{SG} the undecided politicians.

In Conditions 1 and 2, the first noun phrase (NP) of the first clause was a singular collective noun, *o partido*, ‘the party’. In Condition 3, the initial NP of the first clause contained a singular noun, *o político*, ‘the politician’ and for Condition 4, the NP of the first clause was a plural noun, *os políticos*, ‘the politicians’. The frequency of the two types of nouns was matched (log lemma frequency per million, $t(38) = .46, p = .6$). The conditions focusing on the processing of collective nouns as antecedents consisted of 40 sentences pairs (‘the party’, conceptual plural), as did the conditions focusing on the processing of non-collective nouns (‘the politician’, grammatically singular, ‘the politicians’, grammatically plural).

Since our goal was to investigate conceptual number processing during coreference establishing in coordination, the experimental materials comprised one sentence consisting of two coordinated clauses, separated by the word *e*, meaning ‘and’. The sentence started with an adverbial (‘yesterday’, ‘last week’, ‘belatedly’), followed by a definite article, which was then followed by the noun. Depending on the number of the noun, the article took one of the two forms: masculine singular (*o*) or masculine plural (*os*). In the sentence, the noun phrase of the first clause was the subject (i.e., the antecedent), and the verb of the second clause was making a reference to the collective noun presented previously.

There were 80 fillers per list. Each filler sentence was presented once as a grammatical sentence and once as an ungrammatical sentence, depending on the list. The ungrammatical sentence lacked subject-verb agreement, and instead contained the verb in the infinitive form. Thus, each participant read 40 grammatical and 40 ungrammatical filler sentences in total.

(a) Filler – grammatical sentence:

O	<i>vizinho</i>	<i>não</i>	<i>varreu</i>	<i>a</i>	<i>calçada.</i>
The	neighbor	not	sweeps	the	sidewalk.
The	neighbor	did not	sweep	the	sidewalk.

(b) Filler – ungrammatical sentence:

*O	<i>vizinho</i>	<i>não</i>	<i>varrer</i>	<i>a</i>	<i>calçada.</i>
The	neighbor	not	to sweep	the	sidewalk.

3.2.3 Procedure

The procedure was the same as in Experiment 1. The participants were seated at a comfortable distance from the computer screen, while the EEG was being recorded. The presentation software used was E-prime 2.0 (Psychology Software Tools, Inc.). Before the experiment started, participants signed the consent form. Shortly after, the experimenter explained the task in detail and provided a few examples. The instructions were presented on the screen, followed by six practice sentences. The participants were repeatedly asked if they needed additional clarification before the experiment started.

The sentence pairs were presented word by word, with white letters on a black background. The font used was Arial, and the font size was 24 pt. Each stimulus started with a fixation cross (500 ms), followed by blank screen for 300 ms. Each word was presented for 300 ms and was followed by a 300 ms break (blank screen). The last word of each sentence always appeared with a full stop.

As it was the case for the experiments reported in Chapter 2, after every five sentences on average, ranging from two to seven, the screen remained blank for one second, and was followed by a question mark, which was the cue for the participants to answer whether the previous sentence was correct or not. The participants had to press the appropriate button ('p' for 'yes' or 'q' for 'no') and the order of the buttons was counterbalanced throughout the experiment. These content questions were always related to a filler sentence. All participants' percentage of correct answers was above 95% (average number of errors = 3.3, SD 2.1), so no participants were excluded due to low scores on this task. Since these questions' only function was to ensure participants' attention during the experiment, these data were not further considered during our analysis. The experiment consisted of four blocks, each

containing forty pairs of sentences and sentence fillers, with a break after each block. The experiment lasted 20 minutes on average.

3.2.4 EEG Recording and Data Processing

The electroencephalogram was recorded from 32 Ag/AgCl scalp electrodes (WaveGuard) using the ASA-Lab system (ANT Neuro Inc., Enschede, The Netherlands). Additional bipolar electrodes were used to record horizontal (HEOG; at the outer canthus of each eye) and vertical (VEOG; above and below the left eye) eye movements. Impedances were kept below 10 k Ω . Data were acquired at 512 Hz sampling rate with the common average reference.

Data were pre-processed with Brain Vision Analyzer 2.04 (Brain Products, GmbH, Munich, Germany). The offline data were re-referenced to the average of the left and right mastoids. Automatic ocular correction was subsequently performed by applying a band-pass filter (0.1–40Hz). The data were segmented, starting 200 ms before the trigger marker (target verb onset) until 1500 ms. The automatic artifact rejection ($\pm 100 \mu\text{V}$ threshold) was performed in the interval of -200 ms to 1500 ms for each epoch. Finally, the baseline correction was applied starting -200 ms until 0 ms after which the data were averaged per subject and per condition.

3.2.5 Analysis

Averaged values (in μV) were extracted per participant, per condition, and per region of interest. The scalp electrodes were divided into nine regions of interest (ROIs), each containing either two or three electrodes: left anterior (F7, F3, FC5), midline anterior (Fz, FC1, FC2), right anterior (F4, F8, FC6), left central (C3, CP5), midline central (Cz, CP1, CP2), right central (C4, CP6), left posterior (P7, P3), midline posterior (Pz, POz), and right posterior (P4, P8). Four independent time windows were analyzed: the 200–400 ms window, the 400–600 ms window, the 600–800 ms window, and the 800–1000 ms window.

For the statistical analysis, repeated measures ANOVAs were performed, with the following within-subject factors: (1) condition (two levels: singular and plural); (2) number (two levels: conceptual number and grammatical number); (3) hemisphere (two levels: left and right); (4) anteriority (three levels: anterior, central and posterior). The global analysis for each time window was performed through two separate ANOVAs. The first ANOVA encompassed the lateral regions only and it included all four factors. A second ANOVA analyzed the midline regions of interest, excluding the hemisphere factor. The significance level was set to $p < .05$. Follow-up ANOVAs were performed only when interactions were

at least marginally significant ($p < .1$). When the assumption of sphericity was violated, the Geisser and Greenhouse (1959) correction was applied.

3.3 RESULTS EXPERIMENT 3

3.3.1 Behavioral Results

All 80 experimental sentences were evaluated through a Survey Monkey questionnaire (www.surveymonkey.com). The sentences were presented to participants who should answer 'yes' or 'no' to the question: "Is this sentence acceptable or not?". Before starting the questionnaire, the participants were told that they should judge if the second part of the sentence, that is starting after the word *e*, which is 'and' in Portuguese, was making a reference to the noun phrase which was the subject of the sentence. In total, 20 native speakers of Brazilian Portuguese, who did not participate in the ERP experiment, completed the questionnaire. When comparing the four experimental conditions, there was a significant difference among them, in terms of acceptability ($F(3,60) = 68.91, p < .0001$). Follow-up analysis showed that, when compared to the other three conditions, the 'singular collective noun + plural verb' condition was significantly less acceptable by the participants ($p < .05$), which means that when a plural verb was referring to a singular collective noun, sentences were less acceptable for native Brazilian Portuguese speakers.

3.3.2 ERP Results

For the analysis, we compared the 'singular collective noun + singular verb' condition to the 'singular non-collective noun + singular verb' condition; and the 'singular collective noun + plural verb' condition to the 'plural non-collective noun + plural verb' condition. A visual inspection of the waveforms indicated a positivity effect starting around 600 ms after the onset of the target word (verb), mostly in the centro-parietal and posterior areas. The effect was caused by the 'singular collective noun + plural verb' condition, when a plural verb was making a reference to a collective noun.

The time window (200–400 ms), which is related to the LAN and to the N400 effects, did not show significant effects or interactions for the lateral regions, as well as for the midline regions.

The following time window (400–600 ms), related to the N400 effect and to the onset of the P600 component, show a marginally significant effects or interactions for the lateral regions. For the midline regions, an interaction between condition and anteriority was

found ($F(2, 48) = 4.137, p < .05$). In order to investigate the nature of such an interaction, a follow-up ANOVA was performed. However, in the post-hoc analysis, no significant effects were found.

For the third time window (**600–800 ms**), which was related to the P600 component, a marginal interaction between condition and number was found in the lateral regions of interest ($F(1, 24) = 4.059, p < .1$). After a post-hoc analysis, this interaction was confirmed by a main effect of number ($p < .05$), where the ‘singular collective noun + plural verb’ condition was more positive than the ‘plural non-collective noun + plural verb’ condition. As for the midline regions, no significant effects were found.

In the following time window (**800–1000 ms**), a marginally significant interaction between number and condition was found, ($F(1, 24) = 4.132, p < .1$). However, after the pot-hoc analysis, no significant effects were found. For the midline regions, no effects were found.

3.3.3 Summary of ERP Results

The ERP results showed that a positive effect was found around 600 ms after the onset of the target word, which in the case of our experiment was the verb in the second clause of the coordinated sentence. The effect was found for the condition in which a plural verb in the second clause is referring to a singular collective noun in the beginning of the coordinated sentence. The topographical maps showed that the positive effect was most prominent from 600 ms until 800 ms. Due to the effect’s characteristics, based on the waveforms and topographical maps, we interpret this effect as a P600 component.

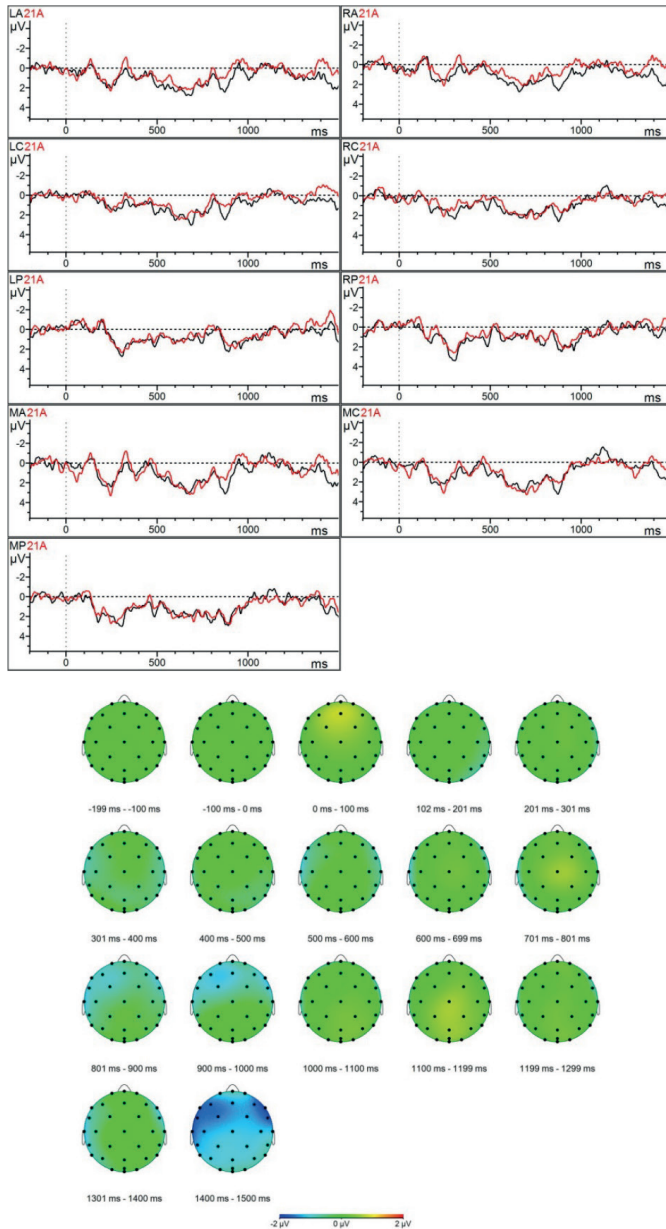


Figure 3.1: Grand average ERPs for the ‘singular collective noun + singular verb’ and ‘singular non-collective noun + singular verb’ (baseline 1) conditions across all 9 ROIs: the black line represents the ‘singular non-collective noun + singular verb’ (baseline 1) condition and the red line represents the ‘singular collective noun + singular verb condition’.

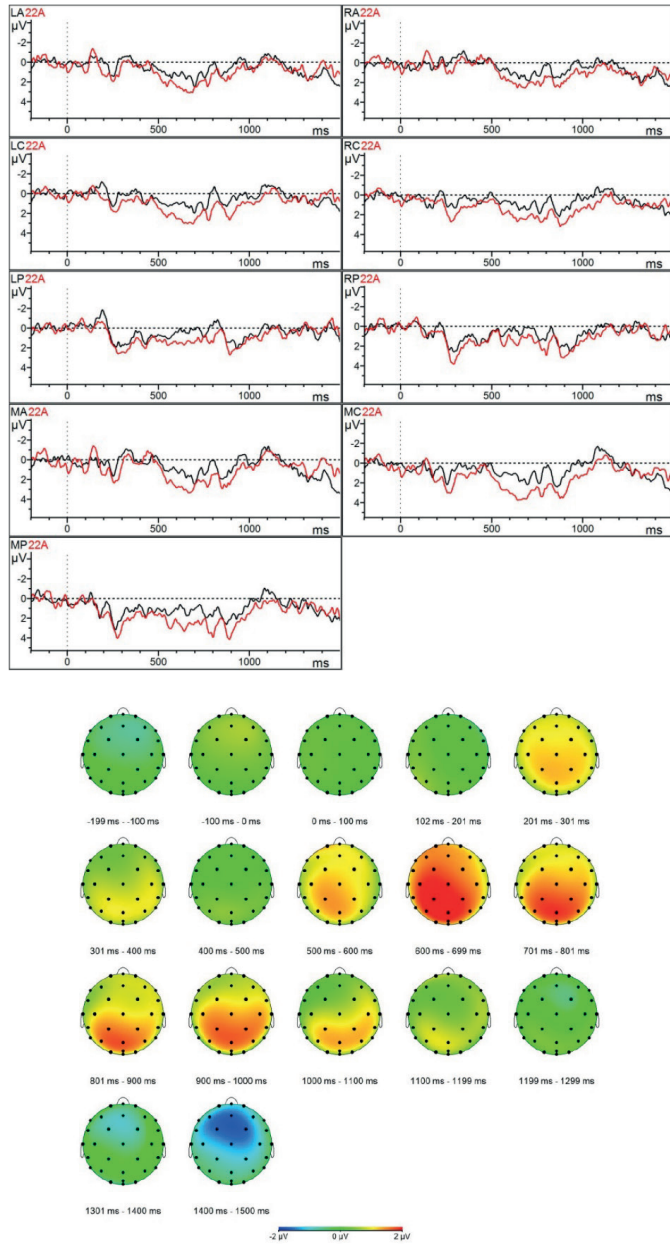


Figure 3.2: Grand average ERPs for the ‘singular collective noun + plural verb’ and ‘plural non-collective noun + plural verb’ (baseline 2) conditions across all 9 ROIs: the black line represents the ‘plural non-collective noun + plural verb’ (baseline 2) condition and the red line represents the ‘singular collective noun + plural verb’ condition.

3.3.4 Discussion Experiment 3

Previous studies which investigated conceptual and grammatical number in coreference establishing reported conflicting results. In our experiment, we tested native Brazilian Portuguese speakers using a reading task in which two clauses were in coordination and the anaphoric element was gapped. Our results showed that the condition in which a plural verb is referring to a collective noun elicited a positive effect, the P600 component, starting around 600 ms after the onset of the verb.

ERP studies which investigated the processing of conceptual information in gapping constructions typically elicited a P600 effect (Hammer, Jansma, Lamers, & Münte, 2008; Kaan, Wijnen & Swaab, 2004). Such an ERP effect reflects syntactic complexity and difficulty in connecting an ungrammatical structure to the previous context. Therefore, our findings in Brazilian Portuguese suggest grammatical information is crucial for coreference establishing in coordination, which means the conceptual plurality of the collective noun was not preferred.

Based on the results found on the Brazilian Portuguese gapping experiment, we wanted to investigate whether we could also observe the same results in a full pro-drop language such as European Portuguese (Experiment 4).

3.4 METHOD FOR EXPERIMENT 4

3.4.1 Participants

For Experiment 4, the same 23 native speakers of European Portuguese from Experiment 2 (10 male, mean age 26.2, range 20–40) were tested. From this group, one participant was excluded due to an excessive number of artifacts, leaving 22 participants whose data were analyzed. They were all right-handed, which was confirmed with the Edinburgh Handedness Questionnaire that was adapted to European Portuguese (Oldfield, 1971). No participant reported any history of neurological or psychiatric disease. They all had normal or corrected-to-normal vision. The study was approved by the CETO (Research Ethics Review Committee – University of Groningen, project number 48111779) and before being part of our experiment, all participants read an information brochure which explained the whole procedure and signed a consent form.

3.4.2 Materials

The same materials created for Experiment 3 were used for Experiment 4. Additionally, sentences were adapted to European Portuguese when needed, in terms of vocabulary and structure, and were checked by two native European Portuguese speakers.

The experimental sentence pairs were divided into four different experimental conditions, named as:

- (1) Singular collective noun + singular verb (second clause);
- (2) Singular collective noun + plural verb (second clause);
- (3) singular non-collective noun + singular verb (second clause);
- (4) plural non-collective noun + plural verb (second clause);

The conditions focusing on the processing of collective nouns as antecedents consisted of 40 sentences pairs ('the party' – conceptual plural), as did the conditions focusing on the processing of non-collective nouns ('the politician' – grammatically singular, 'the politicians' – grammatically plural). The frequency of the two types of nouns was also matched for European Portuguese (log lemma frequency per million, $t(38) = 1.07$, $p = .29$).

3.4.3 Procedure

The same procedure and EEG recording and data processing from Experiment 3 was applied for Experiment 4.

Regarding the content questions related to the filler sentences, as it was done for Experiments 1 and 2 (Chapter 2) and Experiment 3, participants were asked to answer whether these sentences were correct or not. The participants' percentage of correct answers was above 95% (average number of errors = 3.4, SD 2.3), so no participants were excluded due to low scores on this task. As these questions were only used to assure that participants were paying attention, these data were not explored and analyzed.

3.4.4 Analysis

Averaged values (in μV) were extracted per participant, per condition, and per region of interest. The scalp electrodes were divided into nine regions of interest (ROIs), each containing either two or three electrodes: left anterior (F7, F3, FC5), midline anterior (Fz, FC1, FC2), right anterior (F4, F8, FC6), left central (C3, CP5), midline central (Cz, CP1, P2), right central (C4, CP6), left posterior (P7, P3), midline posterior (Pz, POz), and right posterior (P4, P8). In this experiment, four independent time windows were analyzed: the 200–400 ms window, the 400–600 ms window, the 600–800 ms window and the 800–1000 ms windows.

Again, for the statistical analysis, repeated measures ANOVAs were performed, with the present within subject factors: (1) condition (two levels: singular and plural); (2) number (two levels: conceptual number and grammatical number); (3) hemisphere (two levels: left and right); (4) anteriority (three levels: anterior, central and posterior). The global analysis for each time window was performed through two separate ANOVAS. The first ANOVA analyzed the lateral regions only and it included all four factors. A second ANOVA analyzed the midline regions of interest, excluding the hemisphere factor. The significance level was set to $p < .05$. Follow-up ANOVAS were performed only when interactions were at least marginally significant ($p < .1$). When the assumption of sphericity was violated, the Geisser and Greenhouse (1959) correction was applied.

3.5 RESULTS EXPERIMENT 4

3.5.1 Behavioral Results

As was the case for the previous experiments, all 80 experimental sentences for Experiment 4 were evaluated through a Survey Monkey questionnaire (www.surveymoney.com). The sentences were presented and the individuals should answer 'yes' or 'no' to the question: "Is this sentence acceptable or not?". Before starting the questionnaire, it was explained to the individuals that they should judge if the second clause of the sentence was making a reference to the first clause. In total, 14 native speakers of European Portuguese completed the questionnaire. There was a significant difference between acceptability of the four conditions ($F(3,42) = 23.89, p < .001$). The 'singular collective noun + plural verb' condition was judged significantly less acceptable ($p < .05$), which means that when a plural verb is referring to a collective noun in coordination, this construction is not acceptable by native European Portuguese speakers.

3.5.2 ERP Results

For the analysis, we compared the 'singular collective noun + singular verb' condition to the 'singular non-collective noun + singular verb' condition; and the 'singular collective noun + plural verb' condition to the 'plural non-collective noun + plural verb' condition. After analyzing the four independent time windows, no statistical differences were found among the experimental conditions in relation to the midline and lateral areas of interest in the 200–400 ms time window, in the 400–600 ms window, in the 600–800 ms window and in the 800–1000 ms window.

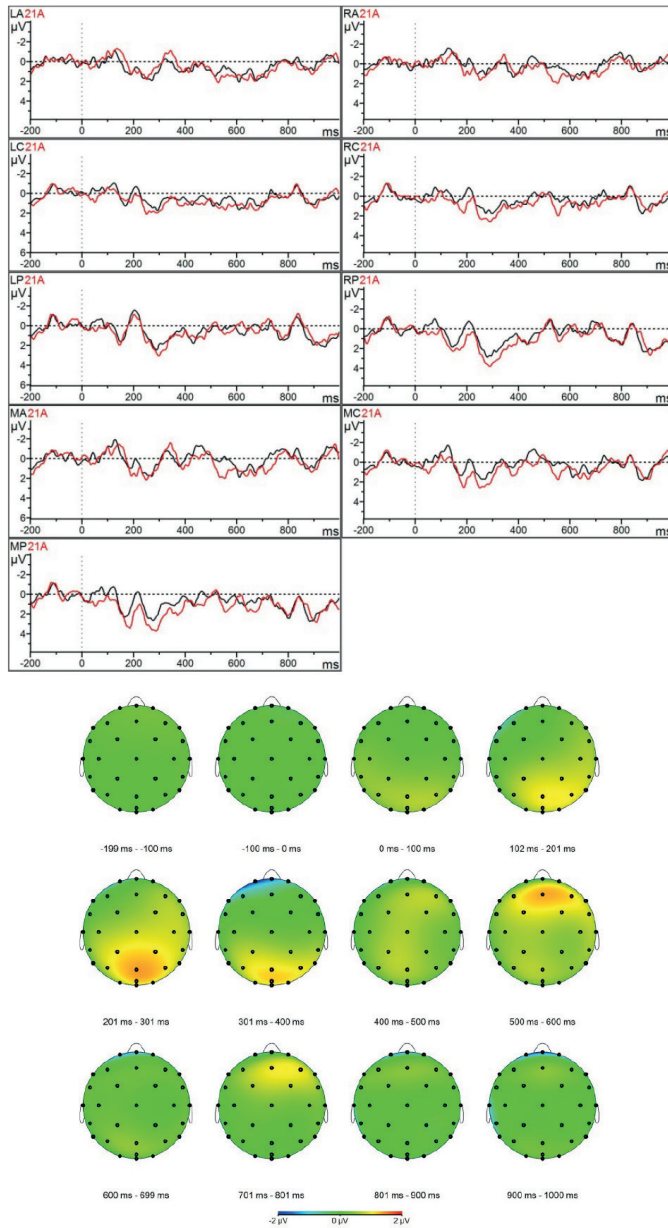


Figure 3.3: Grand average ERPs for the ‘singular collective noun + singular verb’ and ‘singular non-collective noun + singular verb’ (baseline 1) conditions across all 9 ROIs: the black line represents the ‘singular non-collective noun + singular verb’ (baseline 1) condition and the red line represents the ‘singular collective noun + singular verb’ condition.

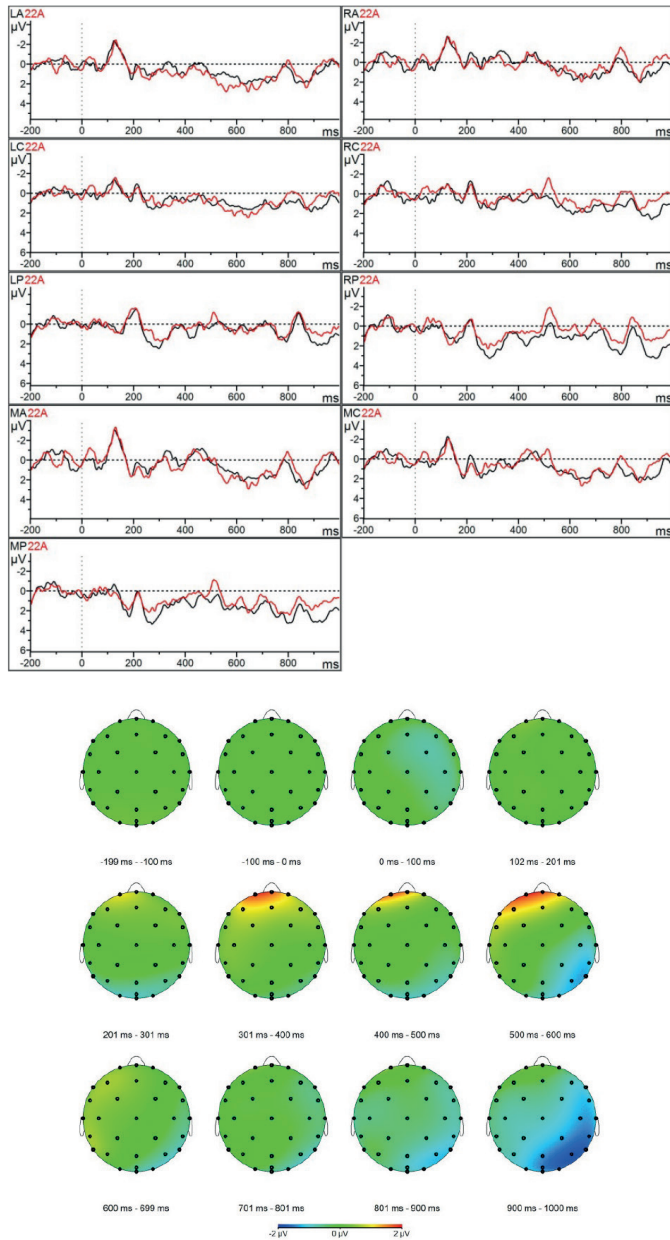


Figure 3.4: Grand average ERPs for the ‘singular collective noun + plural verb’ and ‘plural non-collective noun + plural verb’ conditions across all 9 ROIs: the black line represents the ‘plural non-collective noun + plural verb’ (baseline 2) condition and the red line represents the ‘singular collective noun + plural verb’ condition.

3.5.3 Discussion Experiment 4

In Experiment 4, we tested native European Portuguese speakers using a reading task. We decided to conduct such an experiment in order to verify whether differences in terms of sentence structure influence conceptual number processing in coreference establishing in a language that usually does not present overt pronouns.

According to previous studies on conceptual information processing during coreference assignment in coordination, a P600 is expected to be elicited, reflecting syntactic complexity and difficulty (Hammer, Jansma, Lamers, & Münte, 2008; Kaan, Wijnen & Swaab, 2004). However, this was not the case for the experiment in European Portuguese. No effects were found across the four experimental conditions, including the one in which a plural verb was referring to the singular collective noun.

3.6 GENERAL DISCUSSION

Grammatical and conceptual information seemed to influence coreference establishing differently, depending on the sentence structure in which coreference establishing occurs. In this chapter, we aimed to investigate whether conceptual number influences coreference establishing in a context in which two coordinated clauses are related to one another, and the anaphoric element which is referring to the first clause's antecedent is gapped. Also, we aimed to verify whether there is a difference between obligatory gapping in a partial pro-drop language (Brazilian Portuguese) and in a pro-drop language (European Portuguese).

Our first research question explored in Chapter 3 was as follows:

1. *Are grammatical and conceptual agreement processed in the same way, when coreference establishing occurs in coordination, as measured behaviorally and with ERPs?*

In order to answer this question, we need to address the two variants of Portuguese separately. In the Brazilian Portuguese experiment, we found a positive-going deflection around 600 ms after the onset of the target word for the 'singular collective noun+ plural verb' condition (i.e., *O partido_{SG} interrompeu a votação e solicitaram_{PL} um novo pleito.* – 'The party_{SG} halted the vote and asked_{PL} for a new voting.'). However, the 'singular collective noun+ singular verb' condition (i.e., *O partido_{SG} interrompeu a votação e solicitou_{SG} um novo pleito.* – 'The party_{SG} halted the vote and asked_{SG} for a new voting.'), did not elicit any ERP effects. In

the case of gapping, grammatical information is crucial for anaphoric resolution. Thus, our results show that conceptual and grammatical number on coreference establishing are processed differently in Brazilian Portuguese.

Nonetheless, for the European Portuguese experiment in relation to gapping, no ERP effects were found across all the experimental conditions. Thus, in the occurrence of gapping, European Portuguese speakers equally process grammatical and conceptual agreement during coreference establishing, which means that the collective noun's conceptual meaning is also considered, not only the grammatical constraints of the coordinated sentence.

The second research question explored in Chapter 3 was:

2. *Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs, in the occurrence of gapping in coordination?*

Regarding our behavioral data, both variants present the same pattern in relation to the influence of conceptual number in coreference establishing. When native speakers were asked to judge the experimental sentences through our Survey Monkey questionnaire, both Brazilian and European Portuguese speakers found the 'singular collective noun + plural verb' condition to be less acceptable when compared to the other three experimental conditions.

Even though the behavioral results are the same for both variants of Portuguese, this is not the case when measuring the same experimental sentences by using ERPs. Previous studies using ERPs showed that conceptual information can have a different impact on language processing depending on the linguistic context (e.g., Hammer, Jansma, Lamers, & Münte, 2008; Kaan, Wijnen, & Swaab, 2004). It seems that when coreference establishing is occurring during gapping, grammatical constraints are important for sentence comprehension. When the omitted anaphor and the anaphoric context do not agree grammatically with the antecedent, mainly a P600 is elicited.

Brazilian Portuguese is a partial pro-drop language due to the fact that its inflectional verb system is becoming poorer, so the pronoun comes as an extra information in order for anaphoric resolution to occur. However, the pronoun's omission occurs depending on the type of sentence in which coreference is occurring, which is the case in coordination. Therefore, for the pronoun to be omitted in Brazilian Portuguese, grammatical information

is crucial. This indicates that Brazilian Portuguese relies more on formal features during coreference establishing than European Portuguese. The fact that Brazilian Portuguese seems to rely more on grammatical information reflects the reason why, in coordination, when the plural verb is not agreeing in grammatical number with the collective noun, a P600 is elicited, which is an ERP component related to problems with syntactic integration.

In contrast, European Portuguese is a language which does not depend on extra formal features in order to omit the pronoun in inter (pro-drop) and intra (gapping) sentential processing, as in both cases the pronoun will be omitted. Because European Portuguese is not dependent on such formal/grammatical features, grammatical and conceptual number are equally considered during coreference establishing in coordination. For this reason, a sentence such as *O partido_{SG} interrompeu a votação e solicitaram_{PL} um novo pleito.* ('The party_{SG} halted the vote and asked_{PL} for a new voting.'). in which the plural verb of the second clause does not agree with its singular antecedent (a collective noun), did not elicit any ERP effects.

The two experiments described in this chapter aimed to investigate whether conceptual number influences coreference establishing in the occurrence of gapping. We also aimed to investigate whether we would find differences in terms of the influence of conceptual number between a partial pro-drop language (Brazilian Portuguese) and a full pro-drop language (European Portuguese). Based on our results, we observed that Brazilian Portuguese is more dependent on grammatical features in order to process a gapped pronoun, as pronouns occur in other linguistic contexts in Brazilian Portuguese. For this reason, when a plural verb was referring to a singular collective noun, a P600 effect was elicited. In European Portuguese, no significant results were found across the experimental conditions, as European Portuguese does not depend only on grammatical information in order to omit the pronoun in coordination, considering both grammatical and conceptual information during coreference establishing.

In Chapter 4, we will explore the results found in both Chapters 2 and 3, by contrasting the differences in terms of linguistic context in which coreference establishing is occurring, and by comparing the effects found within the two variants, Brazilian and European Portuguese.

Chapter 4

THE INFLUENCE OF CONCEPTUAL
NUMBER IN COREFERENCE ESTABLISHING:
COMPARISON OF BRAZILIAN AND
EUROPEAN PORTUGUESE RESULTS

4.1 INTRODUCTION

In the previous two chapters, we investigated the influence of conceptual number in coreference establishing, in both Brazilian and European Portuguese. Additionally, these experiments aimed to verify whether the sentence structure in which anaphoric resolution occurs have an impact on language processing, more specifically on coreference establishing between sentences or within sentences, that is, clauses in coordination.

Earlier studies in different languages focused on the influence of conceptual number on coreference establishing (Carreiras & Gernsbacher, 1992; Farias, Leitão, & Ferrari-Neto, 2012; Gernsbacher, 1991; Godoy, Françaço, & Ferreira, 2014; Schweppe, 2013; Silva, 2008). These studies reported different patterns regarding this type of number processing. It is important to emphasize that these studies tested conceptual number agreement mainly in self-paced reading and sentence-completion tasks. The novelty of our study is that we used event-related potentials to investigate this phenomenon. In addition, most of the previously mentioned studies focused on conceptual number processing during anaphoric resolution predominantly in a linguistic context in which two separate sentences were related to each other. Therefore, we investigated whether the effects found in sentence pairs would also be obtained when two clauses are part of the same sentence. Finally, our work is unique because two variants of one language have been studied that differ in one critical aspect.

In the following sections, we will discuss processing differences regarding coreference establishing, when occurring between two separate sentences, in comparison to one sentence with two clauses in coordination. Afterwards, based on these considerations, we will contrast the results found in Brazilian Portuguese and European Portuguese.

4.1.1 Processing Differences Regarding Sentence Structure

As discussed in our previous chapters, the internal sentence structure in which coreference establishing occurs affects how individuals process conceptual number. Therefore, the way a sentence is interpreted depends on the relationship between the antecedent and its anaphor, conditioned by the sentence structure (if coreference establishing occurs between two separate sentences or between two clauses in coordination).

The study by Frazier and Clifton (2005), for instance, demonstrates a difference between one-sentence and two-sentence processing. They compared one sentence, such as: 'John said that Fred went to Europe and Mary did too,' to two separated sentences, such as: 'John said that Fred went to Europe. Mary did too.' The results of a self-paced reading task and a questionnaire showed that in the one-sentence condition, individuals tended to relate

the phrase ‘Mary did too’ to the embedded clause ‘Fred went to Europe’. In the case of the two-sentence condition, individuals had the tendency to connect ‘Mary did too’ to ‘John said’, which is the salient antecedent of the previous sentence. According to the authors, the results show that linguistic context (i.e., one sentence or two separate sentences) can influence sentence comprehension.

Regarding coreference establishing, there is a difference in relation to number-agreement processing when occurring between two separate sentences and when occurring in one coordinated sentence. In the case of two sentences, the antecedent and pronoun appear in different clauses and resolution may, therefore, rely more on conceptual context rather than grammatical constraint (e.g.: Bock, Cutler, Eberhard, Butterfield, Cutting, & Humphreys 2006; Bock & Eberhard, 1993, Bock, Eberhard, & Cutting, 2004; Corbett, 2000). In the case of coordination, the elements within sentence boundaries are subject to different linguistic constraints. Gapping is a type of ellipsis which occurs in coordination and the interpretation of the absent element depends on the element in the precedent clause (Sag & Hankamer, 1984; Ross, 1967). In the case of coreference establishing occurring in coordination, the antecedent’s characteristics grammatically constrain the realization of the gapped anaphoric element and the elements following it.

The results found based on our four experiments show this dissociation: with two separate sentences, individuals tend to rely on conceptual information during coreference establishing. In the case of coordination, in Brazilian Portuguese grammatical information is crucial, whereas in European Portuguese both grammatical and conceptual information are involved in coreference establishing.

4.1.2 Differences between Brazilian and European Portuguese

As mentioned before, Brazilian Portuguese and European Portuguese present differences regarding the presence of an overt pronoun during coreference establishing. Studies have shown that Brazilian Portuguese has been considered a partial pro-drop language mainly because of an accelerated simplification of its verbal morphology. European Portuguese, however, is considered a full pro-drop language primarily due to its rich agreement verb system.

Even though Brazilian Portuguese shows a preference for overt pronouns, there are some contexts in which the pronoun must be omitted, and this is the case when two clauses are in coordination. Duarte and Varejão (2013) mention that the context for the occurrence of null pronouns is correlated to the structure pattern in which they occur. In case of

coordination, the necessity for null pronouns in Brazilian Portuguese in such context is the result of the sentence structure that grammatically constraints anaphoric resolution.

According to the same authors, pronoun gapping in coordination in pro-drop languages is not a characteristic of such languages per se, but a more general rule among languages. For this reason, it seems that the motivation for a null pronoun during coordination in both variants of Portuguese is different. Namely, on the one hand, what guarantees the occurrence of pronoun gapping in Brazilian Portuguese is the sentence structure in which coreference establishing occurs. Therefore, grammatical information is crucial when deciding if the pronoun should be elided or not, and, when the sentence is not in coordination, the pronoun should be overt. On the other hand, there is no such difference in European Portuguese, as the pronoun is omitted in both cases, meaning that the sentence structure is not crucial: it can be gapping or it can be pro-drop in a coordinating structure.

Regarding pro-drop languages, several authors have proposed that the generalization of the rule for pro-drop can be problematic, as languages such as Chinese allow the pronoun to be dropped, even though they lack a rich agreement paradigm (Huang, 1984). Rich agreement is still relevant when investigating the reason why some languages have dropped pronouns. However, some languages allow pro-drop because the discourse content or conceptual information is sufficient for the sentence to be comprehended. This means that not only a rich agreement paradigm is paramount for a language to be classified as pro-drop, but that conceptual information is essential as well. Regarding this issue, it is possible that European Portuguese is a pro-drop language, not only because its verb system is so rich in terms of agreement, but also because conceptual information allow the pronoun to be dropped.

4.2 PROCESSING DIFFERENCES REGARDING SENTENCE STRUCTURE IN BRAZILIAN AND EUROPEAN PORTUGUESE

4.2.1 Overall results

For the present thesis, we have conducted four ERP experiments, which aimed to investigate how conceptual number influences coreference establishing and whether the sentence structure in which coreference occurs modulates conceptual number processing. The experimental conditions for each of the four experiments are presented below, as well as the results we found across experiments:

Experiment 1: Two separate sentences – Brazilian Portuguese**Condition 1: singular collective noun + singular pronoun**

O *time*_{SG,M} *perdeu*_{SG} *a* *competição*_{SG,F} *Ele*_{SG,M} *enfrentou*_{SG} *críticas* *da* *imprensa*.
 The *team*_{SG,M} *lost*_{SG} *the* *competition*_{SG,F} *It*_{SG,M} *faced*_{SG} *criticism* *from the* *press*.

Condition 2: singular collective noun + plural pronoun

O *time*_{SG,M} *perdeu*_{SG} *a* *competição*_{SG,F} *Eles*_{PL,M} *enfrentaram*_{PL} *críticas* *da* *imprensa*.
 The *team*_{SG,M} *lost*_{SG} *the* *competition*_{SG,F} *They*_{PL,M} *faced*_{PL} *criticism* *from the* *press*.

Condition 3: singular non-collective noun + singular pronoun

O *jogador*_{SG,M} *perdeu*_{SG} *a* *cabeça*_{SG,F} *Ele*_{SG,M} *enfrentou*_{SG} *a* *rejeição* *pública*.
 The *player*_{SG,M} *lost*_{SG} *his mind*_{SG,F} *He*_{SG,M} *faced*_{SG} *public* *rejection*.

Condition 4: plural non-collective noun + plural pronoun

Os *jogadores*_{PL,M} *perderam*_{PL} *a* *cabeça*_{SG,F} *Eles*_{PL,M} *enfrentaram*_{PL} *a* *rejeição* *pública*.
 The *players*_{PL,M} *lost*_{PL} *their minds*_{PL,F} *They*_{PL,M} *faced*_{PL} *public* *rejection*.

Experiment 2: Two separate sentences – European Portuguese**Condition 1: singular collective noun + singular verb**

O *clube*_{SG,M} *perdeu*_{SG} *a* *competição*_{SG,F} \emptyset *Enfrentou*_{SG} *críticas* *da* *imprensa*.
 The *club*_{SG,M} *lost*_{SG} *the* *competition*_{SG,F} \emptyset *Faced*_{SG} *criticism* *from the* *press*.

Condition 2: singular collective noun + plural verb

O *clube*_{SG,M} *perdeu*_{SG} *a* *competição*_{SG,F} \emptyset *Enfrentaram*_{PL} *críticas* *da* *imprensa*.
 The *club*_{SG,M} *lost*_{SG} *the* *competition*_{SG,F} \emptyset *Faced*_{PL} *criticism* *from the* *press*.

Condition 3: singular non-collective noun + singular verb

O *jogador*_{SG,M} *perdeu*_{SG} *a* *cabeça*_{SG,F} \emptyset *Enfrentou*_{SG} *a* *rejeição* *pública*.
 The *player*_{SG,M} *lost*_{SG} *his mind*_{SG,F} \emptyset *Faced*_{SG} *public* *rejection*.

Condition 4: plural non-collective noun + verb pronoun

Os *jogadores*_{PL,M} *perderam*_{PL} *a* *cabeça*_{SG,F} \emptyset *Enfrentaram*_{PL} *a* *rejeição* *pública*.
 The *players*_{PL,M} *lost*_{PL} *their mind*_{PL,F} \emptyset *Faced*_{SG} *public* *rejection*.

Experiments 3 and 4: Gapping in Brazilian Portuguese and European Portuguese²

Condition 1: singular collective noun (first clause) + singular verb (second clause)

O *partido*_{SG,M} *interrompeu*_{SG} a *votação*_{SG,F} e *solicitou*_{SG} um novo pleito.
 The party_{SG,M} halted_{SG} the vote_{SG,F} and requested_{SG} a new voting.

Condition 2: singular collective noun (first clause) + plural verb (second clause)

O *partido*_{SG,M} *interrompeu*_{SG} a *votação*_{SG,F} e *solicitaram*_{PL} um novo pleito.
 The party_{SG,M} halted_{SG} the vote_{SG,F} and requested_{PL} a new voting.

Condition 3: Singular non-collective noun (first clause) + singular verb (second clause)

O *político*_{SG,M} *interrompeu*_{SG} a *colega*_{SG,F} e *solicitou*_{SG} uma nova explicação.
 The politician_{SG,M} interrupted_{SG} his colleague_{SG,F} and requested_{SG} for a new explanation.

Condition 4 – Plural non-collective noun (first clause) + plural verb (second clause)

Os *políticos*_{PL,M} *interromperam*_{PL} a *colega*_{SG,F} e *solicitaram*_{PL} uma nova explicação.
 The politicians_{PL,M} interrupted_{SG} their colleague_{PL,F} and requested_{PL} for a new explanation.

2 For the gapping experiments, the sentences for Brazilian and European Portuguese have the same structure and contain the same vocabulary. If necessary, adaptations have been made.

Table 4.1: Summary of Results

Brazilian Portuguese			
Overt Pronoun		Gapping	
Singular collective noun + singular pronoun	Singular collective noun + plural pronoun	Singular collective noun + singular verb	Singular collective noun + plural verb
Late Negativity	No ERP effects	No ERP effects	P600
1100 ms in central and posterior regions (pronoun) 500 ms (verb)		600 ms in the parietal and posterior regions (verb)	
European Portuguese			
Pro-drop		Gapping	
Singular collective noun + singular verb	Singular collective noun+ plural verb	Singular collective noun + singular verb	Singular collective noun+ plural verb
Late Negativity	No ERP effects	No ERP effects	No ERP effects
750 ms in central and posterior regions (verb)			

4.3 PROCESSING DIFFERENCES REGARDING SENTENCE STRUCTURE IN BRAZILIAN PORTUGUESE

In the first experiment in Brazilian Portuguese, in which we investigated conceptual number processing when two separate sentences are in coreference, the ‘singular collective noun + plural pronoun’ condition did not elicit ERP effects when compared to the ‘plural non-collective noun + plural pronoun’ condition. These findings are in line with the results found by Gernsbacher (1991), Carreiras and Gernsbacher (1992) and Godoy, Françaço, and Ferreira (2014), in which sentences presenting collective nouns and plural reference were considered natural and acceptable.

Our findings suggest that when conceptual number is involved in anaphoric processing, conceptual information is considered, which indicates that the plural meaning of a collective noun, which represents a group of people, is salient and helps during

anaphoric resolution. The condition in which the singular pronoun was referring to a singular collective noun elicited a late negativity compared to the ‘non-collective noun + singular pronoun’ condition, starting around 1100 ms after the onset of the pronoun, which is an effect related to the word following the pronoun, that is, the verb. This implies that a singular pronoun co-referring to a collective noun requires extra processing capacity and reanalysis, as the singular pronoun does not conceptually match with its antecedent.

Regarding our study, the findings are in line with studies in which conceptual congruencies were manipulated (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). Sentences with such mismatches may require a heavier processing load, such that there is a difficulty in selecting and retrieving the antecedent, so a second-pass, conceptual interpretation process is needed. The need for this semantic reinterpretation may take the form of replacing the mismatching pronoun or verb with a plausible one based on the context, which in case of our study would be a plural pronoun/verb referring to a singular collective noun. When conceptual information influenced coreference establishing, a sustained (late) negativity was found. The late negativity started around 1100 ms lasting until 1400 ms, which corresponds to approximately 500–800 ms after the onset of the word following the pronoun, the verb, in the condition in which a singular pronoun and a singular verb were referring to a singular collective noun. Therefore, before participants encounter the verb, they try to link the pronoun at the beginning of the second sentence to another antecedent. When this was not possible, a late negativity was elicited.

In the second experiment in Brazilian Portuguese, we investigated whether a different sentence structure (two clauses in coordination) would present the same ERP effects found in the first experiment. The late negativity found in the two sentences-experiment was not observed in the coordination experiment. In fact, when a singular verb was referring to a singular collective noun and agreeing in grammatical number with it, no effects were found. Moreover, for the condition in which a plural verb was referring to a singular collective noun, we observed a positive deflection starting around 600 ms after the onset of the target word, which was the plural verb located in the beginning of the second clause. Hence, this plural verb was not agreeing in grammatical number with its singular antecedent, thus eliciting a P600 effect.

As previously mentioned, ERP studies, which investigated how conceptual information influences coreference establishing in coordination (Kaan, Wijnen, & Swaab, 2004; Hammer, Jansma, Lamers, & Münte, 2008), also reported a P600 effect, reflecting

syntactic difficulty when integrating mismatching elements in the occurrence of gapping. Thus, our findings suggest that when coreference assignment is occurring in coordination, syntactic information is crucial, which means that the collective noun's plurality was not chosen as the best fit for this type of agreement.

According to Gouvea, Phillips, Kazanina, and Poeppel (2010), different latencies of the P600 reflect the time needed to complete the process, which triggers the positivity. In our case, the latency of our positivity is around 600–800 ms. This late onset as a reaction to agreement violation is consistent with the results from previous studies on agreement violation, in which the P600 reflects the reanalysis/repair process between the two clauses (e.g., Friederici, 2002; Friederici & Weissenborn, 2007; Hagoort, Brown, & Groothusen, 1993).

Regarding Brazilian Portuguese, our behavioral data corroborate our ERP findings. Regarding the two sentences experiment, the 'singular collective noun + singular pronoun' condition, when compared to the other three experimental conditions, was considered less acceptable by the participants. This means that native Brazilian Portuguese speakers actually consider acceptable the sentences in which a plural pronoun is referring to a collective noun. In the case of the coordination experiment, we found the opposite: when compared to the other three conditions, the 'singular collective noun + plural verb' condition was considerably less acceptable by the participants.

Study results on Brazilian Portuguese confirm that, depending on the type of sentence structure in which coreference assignment is occurring, grammatical and conceptual number information have different influences on language processing. In the case of two separate sentences, when a plural pronoun and a plural verb are referring to a singular collective noun, no effects were found. However, when a singular pronoun and singular verb are agreeing grammatically with the collective noun, a late negative effect is observed, related to difficulties in processing conceptual information. In the case of gapping, grammatical information produces a processing difference. In the second Brazilian experiment, the P600 effect was found on the plural verb, which was not agreeing in grammatical number with its antecedent, confirming that in coordination, the anaphoric element (gapped pronoun + verb) tends to rely more on grammatical information.

It is also important to emphasize that as Brazilian Portuguese is transitioning from being a pro-drop language to being a non-pro-drop language, this fact could explain the reason why we found distinct results in both Brazilian experiments. In Brazilian Portuguese, the sentence structure in which coreference establishing occurs conditions the preference for null pronouns. In different linguistic contexts, studies have shown that Brazilian

Portuguese speakers show a preference for the overt pronoun, and two separate sentences would be one of those contexts. Nonetheless, there is a context in which the overt pronoun is still not allowed, and this is the case when two clauses are in coordination. Thus, the sentence structure and, more specifically, grammatical information, are conditioning the possibility of omitting the pronoun in Brazilian Portuguese. Both our ERP experiments and our behavioral data show such a pattern: the pronoun will only be omitted when the sentence structure (coordination) permits such an action.

4.4 PROCESSING DIFFERENCES REGARDING SENTENCE STRUCTURE IN EUROPEAN PORTUGUESE

In European Portuguese, a processing dissociation in terms of conceptual number's influence in coreference establishing was also observed. For the first European Portuguese experiment (two separate sentences), a small, non-sustained negativity was elicited when a plural verb was referring to a singular collective noun. This effect was found due to the fact that European Portuguese speakers presented a difficulty when integrating the singular antecedent to its conceptual plural anaphor. However, as the negativity had its peak around 600 ms after the onset of the verb and did not present any further effects, the difficulty was presumably quickly resolved and the processing of the sentence continued its course without any additional costs. In contrast, when a singular verb was referring to a singular collective noun, a late sustained negativity was found. The effect found started around 750 ms after the onset of the target word (the second sentence's verb) and continued until the end of the analyzed time window. Once again, our findings are in line with studies which manipulated conceptual information (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003).

As in Brazilian Portuguese, we investigated the influence of conceptual number processing in coordination in European Portuguese. However, our motivation was different: we wanted to verify whether there are differences in processing null pronouns due to pro-drop and null pronouns due to gapping in ellipses.

In the second European Portuguese experiment, the effect of the first experiment was no longer present: in coordination, when a singular verb (second clause) was referring to a singular collective noun (first clause), the late negativity on the verb of the second clause was not elicited. Thus, again, pronoun resolution within a sentence elicits different

responses than pronoun resolution between sentences in European Portuguese, as it was the case in Brazilian Portuguese. However, the effects within and between sentences were not the same for Brazilian Portuguese and European Portuguese.

Duarte and Varejão (2013) emphasize that a gapped pronoun in coordination is not a characteristic of pro-drop languages, as it also occurs in non-pro-drop languages. However, in full pro-drop languages, the pronoun is omitted in several linguistic contexts, and not only in coordination. Therefore, concerning coreference establishing and gapping, European Portuguese does not show such dependency on the sentence structure and grammatical information necessary to omit the pronoun, as in Brazilian Portuguese. This could explain why we did not find any ERP effects in the gapping experiment: it seems that for this variant of Portuguese, conceptual and grammatical information interact during coreference establishing also in coordination.

Our behavioral data on European Portuguese partly corroborate our ERP results. In the case of our first European Portuguese experiment (two separate sentences), the ‘singular collective noun + plural verb’ condition was significantly less acceptable. However, no differences were found between sentence pairs in which a singular verb was referring to a singular collective noun and sentences pairs in which a plural verb was referring to a singular collective noun. In contrast, for the second European Portuguese experiment (coordination), the ‘singular collective noun + plural verb’ condition was less acceptable than the ‘singular collective noun + singular verb’ condition.

According to the behavioral data, when two separate sentences are related to one another, European Portuguese speakers rely on both grammatical and conceptual information. This is illustrated by the two conditions referring to a collective noun (singular verb and plural verb) not showing any differences in terms of acceptability. In the case of coordination, European Portuguese speakers consider the fact that a plural verb should not refer to a singular collective noun, meaning that conceptual number agreement is ungrammatical. Nonetheless, when these sentences are presented word-by-word during a reading task, these “ungrammatical” sentences do not impose any processing difficulties, suggesting that both grammatical and conceptual information are considered when coreference establishing is occurring in coordination. One possible explanation for such conflicting results between the behavioral and ERP data is the fact that, when participants are answering to a Survey Monkey questionnaire, they have time to re-read the sentences as many times they judge it is necessary before choosing a possible answer. This extra time for reading/processing the sentences could have influenced the way they considered the sentences as being acceptable or not.

The four experiments described in Chapters 2 and 3 aimed to investigate whether conceptual number has an impact on coreference establishing in two different linguistic contexts of occurrence (two separate sentences and coordination). Our findings for both Brazilian and European Portuguese present a dissociation between these two types of sentences. In sentence pairs in which a collective noun has an antecedent role, singular pronouns and singular verbs elicited a late negative effect in both Brazilian and European Portuguese. However, in the case of coordinated sentences, when the plural pronoun is referring to a singular collective noun, a P600 effect was found in Brazilian Portuguese and no significant ERP effects were elicited in European Portuguese across all the experimental sentences.

Based on our results, it is clear that the type of linguistic construction in which conceptual number agreement is occurring influences the processing of coreference establishing. When a singular collective noun is the antecedent in a given sentence and a singular pronoun in a second sentence is its anaphor, the individual tries to resolve this conceptual conflict by searching for a different antecedent, as it is not limited by sentence boundaries. When this is not possible, as the verb is conceptually related to the collective noun, a late negative effect is elicited. However, this is not the case in coordination. Additionally, we observed ERP differences depending on the language variant under investigation. For instance, in the Brazilian Portuguese experiment, a P600 was elicited when the anaphoric element was gapped, and a plural verb was referring to a singular collective noun. Conversely, we found no effects for the same construction in the European Portuguese experiment.

Chapter 5

GENERAL DISCUSSION AND CONCLUSION

5.1 OVERVIEW

Previous studies have investigated conceptual number processing and presented conflicting data regarding the ease and the difficulty of processing conceptual and grammatical information, mainly when number is a feature which is involved in coreference establishing. Our study aimed to investigate how grammatical and conceptual number influence coreference establishing when a collective noun is the antecedent and when a singular or a plural pronoun/verb refers to it. We also aimed to verify whether the linguistic context in which coreference establishing occurs (inter and intra sentential processing) modulates how conceptual number is processed. In order to address these issues, we used event-related potentials (ERPs), as they proved to be sensitive to processing differences between conceptual and grammatical information. For this reason, such a technique could help us understand how conceptual number influences coreference establishing and how different sentence types impact conceptual number agreement. In this chapter, we will address our four research questions and discuss the results we found based on them.

5.2 RESEARCH QUESTIONS

5.2.1 Research Question 1

Are grammatical and conceptual agreement in coreference establishing processed in the same way, as measured behaviorally and with ERPs?

Regarding Research Question 1, the answer is no. In relation to our behavioral data, the ‘singular collective noun + singular verb’ condition was less acceptable, when compared to the other three experimental conditions. The behavioral data show that Brazilian Portuguese speakers accept conceptual number agreement, in other words, it is natural for these individuals to process the plural form of the pronoun/verb when referring to a singular collective noun, even though there is a grammatical number disagreement.

Concerning our ERP data (see Chapter 2), when a plural pronoun/verb is referring to a collective noun, no ERP effects were elicited, which reflects that such grammatical number disagreement does not impose processing difficulties. These findings reflect what Gernsbacher (1991), Carreiras and Gernsbacher (1992), and Godoy, Françaço and Ferreira (2014) found: sentences containing collective nouns and plural reference were considered natural and acceptable. As no differences were found, we can conclude that conceptual

information is crucial for coreference establishing, when a plural pronoun is selecting and retrieving the conceptually plural antecedent.

The condition in which a singular pronoun was referring to a collective noun elicited a late negative effect, starting around 1100 ms after the onset of the pronoun and it continued until the end of the time window analyzed. The characteristics of the effect suggest that the component found is related to the verb following the pronoun. The negativity was elicited around 500 ms after the onset of the singular verb, and the effect is most prominent in the centro-parietal and posterior areas.

Past studies reported a sustained (late) negativity in relation to the incongruent conditions, when investigating how linguistic context and conceptual information influence coreference establishing (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, and Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). This effect is related to the difficulty of selecting and retrieving the proper antecedent which will conceptually match with the anaphor. In relation to our study, when a singular verb is referring to a singular collective noun, there is a difficulty in selecting and retrieving the proper antecedent, due to the conceptual information mismatch between the antecedent and the anaphor, and such complexity elicits a late negative effect. In conclusion, the parser is more sensitive to a conceptual mismatch, when a singular pronoun is referring to a collective noun, than to a grammatical mismatch, in which a plural pronoun/verb is referring to a collective noun.

In relation to the component onset in the Brazilian Portuguese experiment, the negative effect was found around 1100 ms after the onset of the pronoun, which was the first word we were measuring, and 500 ms after the onset of the conjugated verb following it. According to Garrod and Sanford (1994) and Garrod and Terras (2000) pronouns are not fully assigned antecedents immediately. First, a search process occurs for possible antecedents and then actual integration occurs only when enough disambiguating information arrives. In the case of a collective noun as the antecedent, there is not sufficient information at the pronoun site that guarantees the selection and retrieval of it. For this reason, the parser waits until it encounters the verb, which presents enough grammatical and conceptual information for coreference to be established. As we found late negativity, we conclude that when conceptual number is influencing coreference assignment, the more information the anaphoric structure provides, the better. In the case of personal pronouns, the features are not sufficient to connect it to its antecedent. Thus, the information carried

by the verb is crucial for coreference establishing between a collective noun and a plural anaphoric structure (verb).

5.2.2 Research Question 2

In contrast to Brazilian Portuguese, European Portuguese requires the pronoun to be dropped. Regarding these differences between Brazilian Portuguese and European Portuguese, our Research Question 2 was as follows:

Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs?

Regarding our behavioral data, when European Portuguese speakers judged the acceptability of our experimental sentences, the ‘singular collective noun + plural verb’ condition was considered less acceptable, when compared to the ‘plural noun-collective noun + plural verb’ condition. However, no differences were found when comparing the ‘singular collective noun + singular verb’ condition to the ‘singular collective noun + plural verb’ condition. Therefore, in European Portuguese, grammatical and conceptual information are both considered when involved in coreference establishing.

For the European Portuguese ERP experiment (see Chapter 2), a non-sustained negativity was found in the condition in which a plural verb was referring to a singular collective noun. We can conclude that when speakers of European Portuguese encounter sentences in which a plural verb is referring to a singular collective noun, grammatical and conceptual information are considered for coreference establishing to occur. Even though the negativity found reflects a conflict when assigning the anaphor (plural verb) to its antecedent (singular collective noun), individuals did not show any further processing difficulties, as the negative effect is not sustained during the time window analyzed.

Additionally, the European Portuguese experiment showed a similar late negative effect around 750 ms after the onset of the verb, when a singular verb was referring to a singular collective noun. Again, this effect is related to the fact that there is a difficulty in selecting and retrieving the proper antecedent which will conceptually match the anaphor. In addition, when there is a conceptual mismatch between an antecedent and its anaphoric element, extra processing load in conceptual processing is needed, which is not the case when there is a grammatical mismatch.

For both experiments, the late negativity is related to the verb. Past studies stated that this late negativity is related to the difficulty of integrating an antecedent to its anaphor, when there is a conceptual information mismatch (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2006; Hammer, Jansma, Lamers, & Münte, 2008; Nieuwland & Van Berkum, 2006; Streb, Rösler, & Hennighausen, 1999; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003). This sustained late negativity also represents the extra processing load needed when conceptual and grammatical information do not converge.

5.2.3 Research Question 3

For the past century, Brazilian Portuguese has been undergoing a process of becoming a non-null subject/null pronoun language. The overt pronoun is already preferred in some linguistic contexts, as the one explored in Chapter 2. However, in coordination, the pronoun is still omitted. The studies conducted by Kaan, Wijnen, and Swaab (2004) and Hammer, Jansma, Lamers, and Münte (2008) are examples of how conceptual information influences coreference establishing differently in coordination, with the occurrence of gapping, from different types of linguistic constructions. It seems that when coreference establishing is taking place during gapping, grammatical constraints are important for sentence comprehension.

Nonetheless, the occurrence of pronoun gapping is restricted to a very specific context, in which grammatical information is crucial. A given element is only omitted during coordination when there is sufficient information provided by the antecedent located in the preceding clause. For this reason, when the anaphoric element did not agree conceptually with the antecedent, an N400 but mainly a P600 was found, representing the grammatical reanalysis and repair in order to connect the verb to its noun phrase (Kaan, Wijnen, & Swaab, 2004; Hammer, Jansma, Lamers, & Münte, 2008). For this reason, Research Question 3 was as follows:

Are grammatical and conceptual agreement processed in the same way, when coreference establishing occurs in coordination, as measured behaviorally and with ERPs?

In our Brazilian Portuguese experiment (see Chapter 3), when the singular verb was referring to a collective noun, no ERP effects were found. As discussed before, in the occurrence of gapping, the element can be only omitted because it is possible to retrieve its grammatical and conceptual information from the antecedent located in the preceding clause. In coordination, when a collective noun is the sentence's antecedent, grammatical

information is crucial for anaphoric resolution. Thus, the effect found in the first Brazilian experiment is absent in the second: the singular verb referring to a collective noun did not elicit any ERP effects.

Conversely, when a plural verb was referring to a singular collective noun, in coordination, a P600 effect was found around 600 ms after the plural verb's onset. Unlike the first experiment on Brazilian Portuguese, the linguistic context of gapping does not allow conceptual information to have a central role. The antecedent, the collective noun, even though it represents a group of individuals, carries its singular grammatical feature and grammatical information plays a central role when coreference establishing occurs in coordination.

Our behavioral data supports the ERP results. Brazilian Portuguese speakers judged the 'singular collective noun + plural verb' condition less acceptable than the other three experimental conditions. Thus, our behavioral and ERP data show the same pattern in relation to the influence of conceptual number when coreference establishing occurs in coordination: the plural verb is considered a grammatical violation.

5.2.4 Research Question 4

We investigated conceptual number agreement in coordination in European Portuguese, as this variant is a pro-drop language. As stated by Duarte and Varejão (2013), the preference for an omitted pronoun in coordination is not a characteristic which only belongs to pro-drop language, but it is a more general property among languages. However, it is not the linguistic context which determines whether the pronoun will be dropped in European Portuguese, as for Brazilian Portuguese. In the Brazilian variant, the pronoun is only gapped in coordination constructions. In European Portuguese, the pronoun can be omitted in two separate sentences and in coordination. For this reason, if there is a processing difference between partial pro-drop languages and full pro-drop languages, differences in the ERP patterns should be observed. Research Question 4 was as follows:

Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs, in the occurrence of gapping in coordination?

We, indeed, observed different effects regarding the two variants of Portuguese: in the first European Portuguese experiment, a late negativity emerged related to the singular verb which was referring to a singular collective noun present in the first sentence. This late

negativity, as previously discussed, is related to the difficulty of selecting and retrieving the antecedent that does not conceptually match the verb. For the second European Portuguese experiment, no ERP effects were found. These results show that, in coordination, Brazilian and European Portuguese speakers process conceptual and grammatical number differently.

In case of Brazilian Portuguese, the preference for gapped pronouns in coordination is conditioned by the sentence structure and, for this reason, grammatical information is crucial for coreference establishing to occur. Thus, Brazilian Portuguese relies on grammatical information in order to gap the pronoun in coordination, indicating that formal features are crucial for the sentence to be processed. When there is a plural verb referring to a singular collective noun, this grammatical mismatch will reflect difficulty in terms of syntactic processing, which was the case, as we found a P600 effect.

However, for European Portuguese, the requirement of dropping the pronoun in different contexts, and not only in gapping, does not depend on the sentence structure and, therefore, on grammatical information only. The first Portuguese experiment, for instance, showed that European Portuguese speakers were susceptible to conceptual information, as both ‘singular collective noun + singular verb’ and ‘singular collective noun + plural verb’ conditions elicited a negative effect. In relation to plural verbs, a small non-sustained negativity was elicited, which reflected a conflict when connecting a conceptual plural antecedent (singular collective noun) to its anaphor (plural verb). Such conflict was resolved and did not impose any additional processing costs; and a late sustained negativity, when a singular verb was referring to a singular collective noun, which represents a difficulty when assigning the antecedent to its anaphor.

In contrast, in the second Portuguese experiment, it seems that both grammatical and conceptual information were equally considered, so the sentences did not show any differences in terms of processing.

5.3 CONCLUSION

We showed that there are differences in terms of electrophysiological brain activity when conceptual and grammatical number processing are involved in coreference establishing. In sentence pairs, a conceptual mismatch between a singular anaphor and a singular collective antecedent imposed extra load during sentence processing. A late negative effect, for both Brazilian Portuguese and European Portuguese represented this difficulty. Even though Brazilian and European Portuguese present differences in terms of overt and null pronouns, it was possible to observe the same ERP effect in the first two experiments.

We were also able to demonstrate that the ease or difficulty of processing conceptual number in coreference establishing cannot be generalized. The influence of conceptual number during anaphoric resolution seems to be conditioned by the type of sentence structure or linguistic context in which coreference establishing is occurring. In the case of sentence pairs separated by a full stop, conceptual information seems to play a vital role during anaphoric resolution, whereas in coordination, grammatical information is of more importance.

This dissociation illustrates that the type of linguistic construction in which conceptual number agreement is occurring influences the processing of anaphoric resolution. When a singular collective noun works as the antecedent and a singular pronoun in a second sentence is its anaphor, the individual will try to resolve this conceptual conflict by searching for a different antecedent. When this is not possible, as the verb following the pronoun is conceptually related to the collective noun, a late negative effect is elicited. This is not the case in coordination: when the verb in the second clause does not agree in grammatical number with the singular collective noun, elicits different effects: a P600 in the case of the Brazilian Portuguese experiment, or no effects at all, as in the European Portuguese experiment.

This thesis also showed that there are differences between Brazilian Portuguese and European Portuguese concerning coreference establishing and the presence or absence of an overt pronoun. Our study confirms that Brazilian Portuguese is undergoing a change, from being a pro-drop language to a partial pro-drop language. The results we found in the coordination experiment in Brazilian Portuguese illustrate this process: the fact that Brazilian Portuguese elicited a P600 effect, a component related to syntactic difficulty, shows that the pronoun is gapped because Brazilian Portuguese speakers rely on the sentence structure in order to omit the pronoun. In other contexts, in which such a grammatical constraint is not present, as coreference establishing between two separate sentences, native Brazilian Portuguese speakers show a preference for overt pronouns. This means that for Brazilian Portuguese, grammatical information is crucial when deciding whether the pronoun should be omitted or not.

In European Portuguese, which is a pro-drop language, grammatical information does not influence the preference for an omitted pronoun, as in both linguistic contexts the pronoun will be dropped. For European Portuguese, then, conceptual information is important for coreference, and our two experiments in European Portuguese illustrate this fact.

Appendix A

APPENDIX FOR THE BRAZILIAN PORTUGUESE MATERIALS CHAPTERS 2 AND 3

EXPERIMENTAL ITEMS – CHAPTER 2

1. COLLECTIVE NOUNS

O ELENCO

- O elenco leu a peça. Ele decorou todas as falas.
- O elenco estreou na novela. Ele mostrou um grande talento.
- O elenco leu a peça. Eles decoraram todas as falas.
- O elenco estreou na novela. Eles mostraram um grande talento.

O TIME

- O time perdeu a competição. Ele enfrentou críticas da imprensa.
- O time jogou na neve. Ele sofreu com o frio.
- O time perdeu a competição. Eles enfrentaram críticas da imprensa.
- O time jogou na neve. Eles sofreram com o frio.

O BANDO

- O bando assaltou a loja. Ele levou itens muito caros.
- O bando fugiu da prisão. Ele fez um túnel clandestino.
- O bando assaltou a loja. Eles levaram itens muito caros.
- O bando fugiu da prisão. Eles fizeram um túnel clandestino.

O CORO

- O coro estudou a partitura. Ele errou algumas notas musicais.
- O coro cantou na catedral. Ele emocionou as pessoas presentes.
- O coro estudou a partitura. Eles erraram algumas notas musicais.
- O coro cantou na catedral. Eles emocionaram as pessoas presentes.

O PARTIDO

- O partido interrompeu a votação. Ele solicitou um novo pleito.
- O partido optou pela neutralidade. Ele condenou os políticos indecisos.
- O partido interrompeu a votação. Eles solicitaram um novo pleito.
- O partido optou pela neutralidade. Eles condenaram os políticos indecisos.

O PELOTÃO

- O pelotão limpou as armas. Ele organizou todo o arsenal.
- O pelotão treinou na chuva. Ele correu por algumas horas.
- O pelotão limpou as armas. Eles organizaram todo o arsenal.
- O pelotão treinou na chuva. Eles correram por algumas horas.

O EXÉRCITO

- O exército agiu nas ruas. Ele garantiu a esperada paz.
- O exército protegeu a cidade. Ele impediu a crescente violência.
- O exército agiu nas ruas. Eles garantiram a esperada paz.
- O exército protegeu a cidade. Eles impediram a crescente violência.

O COMITÊ

- O comitê percebeu a falha. Ele refez o relatório final.
- O comitê aguardou pela análise. Ele aprovou os gastos previstos.
- O comitê percebeu a falha. Eles refizeram o relatório final.
- O comitê aguardou pela análise. Eles aprovaram os gastos previstos.

O QUARTETO

- O quarteto ensaiou na sala. Ele demonstrou um grande entrosamento.
- O quarteto repassou a melodia. Ele praticou durante muitas semanas.
- O quarteto repassou a melodia. Eles praticaram durante muitas semanas.
- O quarteto ensaiou na sala. Eles demonstraram um grande entrosamento.

O JÚRI

- O júri avaliou a situação. Ele julgou o réu reincidente.
- O júri trabalhou pela condenação. Ele analisou o caso cuidadosamente.
- O júri avaliou a situação. Eles julgaram o réu reincidente.
- O júri trabalhou pela condenação. Eles analisaram o caso cuidadosamente.

O CONSELHO

- O conselho questionou a aluna. Ele concordou com a resposta.
- O conselho mudou de posição. Ele reanalisou o documento oficial.
- O conselho questionou a aluna. Eles concordaram com a resposta.
- O conselho mudou de posição. Eles reanalisaram o documento oficial.

O PÚBLICO

- O público vaiou a performance. Ele prejudicou o grande espetáculo.
- O público aplaudiu das cadeiras. Ele adorou o musical inédito.
- O público vaiou a performance. Eles prejudicaram o grande espetáculo.
- O público aplaudiu das cadeiras. Eles adoraram o musical inédito.

O POVO

- O povo esperou a mudança. Ele acreditou que seria possível.
- O povo saiu às ruas. Ele reivindicou modificações no governo.
- O povo esperou a mudança. Eles acreditaram que seria possível.
- O povo saiu às ruas. Eles reivindicaram modificações no governo.

O BALÉ

- O balé executou a coreografia. Ele aprendeu os passos difíceis.
- O balé encantou na estreia. Ele apresentou um novo número.
- O balé executou a coreografia. Eles aprenderam os passos difíceis.
- O balé encantou na estreia. Eles apresentaram um novo número.

O SINDICATO

- O sindicato aceitou a greve. Ele tomou a decisão tardiamente.
- O sindicato protestou na avenida. Ele pediu melhorias na educação.
- O sindicato aceitou a greve. Eles tomaram a decisão tardiamente.
- O sindicato protestou na avenida. Eles pediram melhorias na educação.

O CASAL

- O casal preparou a bagagem. Ele viajou o dia inteiro.
- O casal gostou da festa. Ele ficou até ao final.
- O casal preparou a bagagem. Eles viajaram o dia inteiro.
- O casal gostou da festa. Eles ficaram até ao final.

O BATALHÃO

- O batalhão controlou a revolta. Ele deteve os presos exaltados.
- O batalhão chegou à vila. Ele conteve a briga generalizada.
- O batalhão controlou a revolta. Eles detiveram os presos exaltados.
- O batalhão chegou à vila. Eles contiveram a briga generalizada.

O PESSOAL

- O pessoal reorganizou a loja. Ele encontrou roupas pelo chão.
- O pessoal ansiou pela recompensa. Ele ganhou um bônus de natal.
- O pessoal reorganizou a loja. Eles encontraram roupas pelo chão.
- O pessoal ansiou pela recompensa. Eles ganharam um bônus de natal.

O CLERO

- O clero rezou pela paz. Ele reprovou o conflito armado.
- O clero autorizou a mudança. Ele discutiu por duas semanas.
- O clero autorizou a mudança. Eles discutiram por duas semanas.
- O clero rezou pela paz. Eles reprovaram o conflito armado.

O ESQUADRÃO

- O esquadrão sobrevoou a cidade. Ele monitorou o incêndio florestal.
- O esquadrão pousou na pista. Ele recebeu a autorização oficial.
- O esquadrão sobrevoou a cidade. Eles monitoraram o incêndio florestal.
- O esquadrão pousou na pista. Eles receberam a autorização oficial.

2. NON-COLLECTIVE NOUNS

O ATOR

- O ator leu a obra. Ele decorou o primeiro ato.
- O ator estreou na minissérie. Ele mostrou uma grande competência.

O JOGADOR

- O jogador perdeu a cabeça. Ele enfrentou a rejeição pública.
- O jogador jogou na defesa. Ele sofreu na nova posição.

O LADRÃO

- O ladrão assaltou a casa. Ele levou toda a comida.
- O ladrão fugiu da cela. Ele fez um policial refém.

O CANTOR

- O cantor estudou a letra. Ele errou todo o refrão.
- O cantor cantou na cerimônia. Ele emocionou com sua delicadeza.

O POLÍTICO

O político interrompeu a colega. Ele solicitou uma nova explicação.

O político optou pela investigação. Ele condenou os colegas contrários.

O SOLDADO

O soldado limpou as botas. Ele organizou os seus pertences.

O soldado treinou na pista. Ele correu por muitos quilômetros.

O SARGENTO

O sargento protegeu a região. Ele coibiu a ação criminosa.

O sargento agiu na desordem. Ele garantiu a segurança local.

O ORGANIZADOR

O organizador percebeu a imperfeição. Ele refez a linda decoração.

O organizador aguardou pela entrega. Ele aprovou os doces encomendados.

O MÚSICO

O músico repassou a composição. Ele praticou durante longos meses.

O músico ensaiou na praça. Ele demonstrou uma grande afinação.

O JUIZ

O juiz avaliou as provas. Ele julgou os deputados corruptos.

O juiz trabalhou nas férias. Ele analisou o importante processo.

O DIRETOR

O diretor questionou as conselheiras. Ele concordou com as opiniões.

O diretor mudou de opinião. Ele reanalisou o orçamento anual.

O ESPECTADOR

O espectador vaiou a encenação. Ele prejudicou o evento artístico.

O espectador aplaudiu das arquibancadas. Ele adorou o novo espetáculo.

O CIDADÃO

O cidadão esperou a oportunidade. Ele acreditou no seu potencial.

O cidadão saiu da empresa. Ele reivindicou salários mais justos.

O BAILARINO

O bailarino executou a dança. Ele aprendeu os saltos complicados.

O bailarino encantou na competição. Ele apresentou um passo inédito.

O TRABALHADOR

O trabalhador aceitou a proposta. Ele tomou uma atitude inesperada.

O trabalhador protestou na fábrica. Ele pediu horas de folga.

O VENDEDOR

O vendedor reorganizou as prateleiras. Ele encontrou alguns produtos estragados.

O vendedor ansiou pela promoção. Ele ganhou uma comissão extra.

O RAPAZ

O rapaz preparou a rota. Ele viajou para o interior.

O rapaz gostou da folia. Ele ficou até o amanhecer.

O PILOTO

O piloto sobrevoou a floresta. Ele monitorou o enorme desmatamento.

O piloto pousou na cidade. Ele recebeu flores na chegada.

O BISPO

O bispo autorizou a escolha. Ele discutiu cada perfil apresentado.

O bispo rezou pela união. Ele reprovou a atitude separatista.

O MILITAR

O militar controlou a rebelião. Ele deteve os traficantes perigosos.

O militar chegou na prisão. Ele conteve a fuga iminente.

OS ATORES

Os atores leram a obra. Eles decoraram o primeiro ato.

Os atores estrearam na minissérie. Eles mostraram uma grande competência.

OS JOGADORES

Os jogadores perderam a cabeça. Eles enfrentaram a rejeição pública.

Os jogadores jogaram na defesa. Eles sofreram na nova posição.

OS LADRÕES

Os ladrões assaltaram a casa. Eles levaram toda a comida.
Os ladrões fugiram da cela. Eles fizeram um policial refém.

OS CANTORES

Os cantores estudaram a letra. Eles erraram todo o refrão.
Os cantores cantaram na cerimônia. Eles emocionaram com sua delicadeza.

OS POLÍTICOS

Os políticos interromperam a colega. Eles solicitaram uma nova explicação.
Os políticos optaram pela investigação. Eles condenaram os colegas contrários.

OS SOLDADOS

Os soldados limparam as botas. Eles organizaram os seus pertences.
Os soldados treinaram na pista. Eles correram por muitos quilômetros.

OS SARGENTOS

Os sargentos protegeram a região. Eles coibiram a ação criminosa.
Os sargentos agiram na desordem. Eles garantiram a segurança local.

OS ORGANIZADORES

Os organizadores perceberam a imperfeição. Eles refizeram a linda decoração.
Os organizadores aguardaram pela entrega. Eles aprovaram os doces encomendados.

OS MÚSICOS

Os músicos repassaram a composição. Eles praticaram durante longos meses.
Os músicos ensaiaram na praça. Eles demonstraram uma grande afinação.

OS JUIZES

Os juízes avaliaram as provas. Eles julgaram os deputados corruptos.
Os juízes trabalharam nas férias. Eles analisaram o importante processo.

OS DIRETORES

Os diretores questionaram as conselheiras. Eles concordaram com as opiniões.
Os diretores mudaram de opinião. Eles reanalisaram o orçamento anual.

OS ESPECTADORES

Os espectadores vaiaram a encenação. Eles prejudicaram o evento artístico.
Os espectadores aplaudiram das arquibancadas. Eles adoraram o novo espetáculo.

OS CIDADÃOS

Os cidadãos esperaram a oportunidade. Eles acreditaram nos seus potenciais.
Os cidadãos saíram da empresa. Eles reivindicaram salários mais justos.

OS BAILARINOS

Os bailarinos executaram a dança. Eles aprenderam os saltos complicados.
Os bailarinos encantaram na competição. Eles apresentaram um passo inédito.

OS TRABALHADORES

Os trabalhadores aceitaram a proposta. Eles tomaram uma atitude inesperada.
Os trabalhadores protestaram na fábrica. Eles pediram horas de folga.

OS VENDEDORES

Os vendedores reorganizaram as prateleiras. Eles encontraram alguns produtos estragados.
Os vendedores ansiaram pela promoção. Eles ganharam uma comissão extra.

OS RAPAZES

Os rapazes prepararam a rota. Eles viajaram para o interior.
Os rapazes gostaram da folia. Eles ficaram até o amanhecer.

OS PILOTOS

Os pilotos sobrevoaram a floresta. Eles monitoraram o enorme desmatamento.
Os pilotos pousaram na cidade. Eles receberam flores na chegada.

OS BISPOS

Os bispos autorizaram a escolha. Eles discutiram cada perfil apresentado.
Os bispos rezaram pela união. Eles reprovaram a atitude separatista.

OS MILITARES

Os militares controlaram a rebelião. Eles detiveram os traficantes perigosos.
Os militares chegaram na prisão. Eles contiveram a fuga iminente.

EXPERIMENTAL ITEMS – CHAPTER 3

1. COLLECTIVE NOUNS

O ELENCO

- O elenco leu a peça e decorou todas as falas.
- O elenco estreou na novela e mostrou um grande talento.
- O elenco leu a peça e decoraram todas as falas.
- O elenco estreou na novela e mostraram um grande talento.

O TIME

- O time perdeu a competição e enfrentou críticas da imprensa.
- O time jogou na neve e enfrentou críticas da imprensa.
- O time perdeu a competição e enfrentaram críticas da imprensa.
- O time jogou na neve e sofreram com o frio.

O BANDO

- O bando assaltou a loja e levou itens muito caros.
- O bando fugiu da prisão e fez um túnel clandestino.
- O bando assaltou a loja e levaram itens muito caros.
- O bando fugiu da prisão e fizeram um túnel clandestino.

O CORO

- O coro estudou a partitura e errou algumas notas musicais.
- O coro cantou na catedral e emocionou as pessoas presentes.
- O coro estudou a partitura e erraram algumas notas musicais.
- O coro cantou na catedral e emocionaram as pessoas presentes.

O PARTIDO

- O partido interrompeu a votação e solicitou um novo pleito.
- O partido optou pela neutralidade e condenou os políticos indecisos.
- O partido interrompeu a votação e solicitaram um novo pleito.
- O partido optou pela neutralidade e condenaram os políticos indecisos.

O PELOTÃO

- O pelotão limpou as armas e organizou todo o arsenal.
- O pelotão treinou na chuva e correu por algumas horas.
- O pelotão limpou as armas e organizaram todo o arsenal.
- O pelotão treinou na chuva e correram por algumas horas.

O EXÉRCITO

- O exército agiu nas ruas e garantiu a esperada paz.
- O exército protegeu a cidade e impediu a crescente violência.
- O exército agiu nas ruas e garantiram a esperada paz.
- O exército protegeu a cidade e impediram a crescente violência.

O COMITÊ

- O comitê percebeu a falha e refez o relatório final.
- O comitê aguardou pela análise e aprovou os gastos previstos.
- O comitê percebeu a falha e refizeram o relatório final.
- O comitê aguardou pela análise e aprovaram os gastos previstos.

O QUARTETO

- O quarteto ensaiou na sala e demonstrou um grande entrosamento.
- O quarteto repassou a melodia e praticou durante muitas semanas.
- O quarteto repassou a melodia e praticaram durante muitas semanas.
- O quarteto ensaiou na sala e demonstraram um grande entrosamento.

O JÚRI

- O júri avaliou a situação e julgou o réu reincidente.
- O júri trabalhou pela condenação e analisou o caso cuidadosamente.
- O júri avaliou a situação e julgaram o réu reincidente
- O júri trabalhou pela condenação e analisaram o caso cuidadosamente.

O CONSELHO

- O conselho mudou de posição e reanalisou o documento oficial.
- O conselho questionou a aluna e concordou com a resposta.
- O conselho mudou de posição e reanalisaram o documento oficial.
- O conselho questionou a aluna e concordaram com a resposta.

O PÚBLICO

- O público aplaudiu das cadeiras e adorou o musical inédito.
- O público vaiou a performance e prejudicou o grande espetáculo.
- O público aplaudiu das cadeiras e adoraram o musical inédito.
- O público vaiou a performance e prejudicaram o grande espetáculo.

O POVO

- O povo saiu às ruas e reivindicou modificações no governo.
- O povo esperou a mudança e acreditou que seria possível.
- O povo saiu às ruas e reivindicaram modificações no governo.
- O povo esperou a mudança e acreditaram que seria possível.

O BALÉ

- O balé executou a coreografia e aprendeu os passos difíceis.
- O balé encantou na estreia e apresentou um novo número.
- O balé executou a coreografia e aprenderam os passos difíceis.
- O balé encantou na estreia e apresentaram um novo número.

O SINDICATO

- O sindicato aceitou a greve e tomou a decisão tardiamente.
- O sindicato protestou na avenida e pediu melhorias na educação.
- O sindicato aceitou a greve e tomaram a decisão tardiamente.
- O sindicato protestou na avenida e pediram melhorias na educação.

O CASAL

- O casal preparou a bagagem e viajou o dia inteiro.
- O casal gostou da festa e ficou até ao final.
- O casal preparou a bagagem e viajaram o dia inteiro.
- O casal gostou da festa e ficaram até ao final.

O BATALHÃO

- O batalhão controlou a revolta e deteve os presos exaltados.
- O batalhão chegou à vila e conteve a briga generalizada.
- O batalhão controlou a revolta e detiveram os presos exaltados.
- O batalhão chegou à vila e contiveram a briga generalizada.

O PESSOAL

- O pessoal reorganizou a loja e encontrou roupas pelo chão.
- O pessoal ansiou pela recompensa e ganhou um bônus de natal.
- O pessoal reorganizou a loja e encontraram roupas pelo chão.
- O pessoal ansiou pela recompensa e ganharam um bônus de natal.

O CLERO

- O clero rezou pela paz e reprovou o conflito armado.
- O clero autorizou a mudança e discutiu por duas semanas.
- O clero autorizou a mudança e discutiram por duas semanas.
- O clero rezou pela paz e reprovaram o conflito armado.

O ESQUADRÃO

- O esquadrão sobrevoou a cidade e monitorou o incêndio florestal.
- O esquadrão pousou na pista e recebeu a autorização oficial.
- O esquadrão sobrevoou a cidade e monitoraram o incêndio florestal.
- O esquadrão pousou na pista e receberam a autorização oficial.

2. NON COLLECTIVE NOUNS

O ATOR

- O ator leu a obra e decorou o primeiro ato.
- O ator estreou na minissérie e mostrou uma grande competência.

O JOGADOR

- O jogador perdeu a cabeça e enfrentou a rejeição pública.
- O jogador jogou na defesa e sofreu na nova posição.

O LADRÃO

- O ladrão assaltou a casa e levou toda a comida.
- O ladrão fugiu da cela e fez um policial refém.

O CANTOR

- O cantor estudou a letra e errou todo o refrão.
- O cantor cantou na cerimônia e emocionou com sua delicadeza.

O POLÍTICO

O político interrompeu a colega e solicitou uma nova explicação.

O político optou pela investigação e condenou os colegas contrários.

O SOLDADO

O soldado limpou as botas e organizou os seus pertences.

O soldado treinou na pista e correu por muitos quilômetros.

O SARGENTO

O sargento protegeu a região e coibiu a ação criminosa.

O sargento agiu na desordem e garantiu a segurança local.

O ORGANIZADOR

O organizador percebeu a imperfeição e refez a linda decoração.

O organizador aguardou pela entrega e aprovou os doces encomendados.

O MÚSICO

O músico repassou a composição e praticou durante longos meses.

O músico ensaiou na praça e demonstrou uma grande afinação.

O JUIZ

O juiz avaliou as provas e julgou os deputados corruptos.

O juiz trabalhou nas férias e analisou o importante processo.

O DIRETOR

O diretor questionou as conselheiras e concordou com as opiniões.

O diretor mudou de opinião e reanalisou o orçamento anual.

O ESPECTADOR

O espectador vaiou a encenação e prejudicou o evento artístico.

O espectador aplaudiu das arquibancadas e adorou o novo espetáculo.

O CIDADÃO

O cidadão esperou a oportunidade e acreditou no seu potencial.

O cidadão saiu da empresa e reivindicou salários mais justos.

O BAILARINO

- O bailarino executou a dança e aprendeu os saltos complicados.
- O bailarino encantou na competição e apresentou um passo inédito.

O TRABALHADOR

- O trabalhador aceitou a proposta e tomou uma atitude inesperada.
- O trabalhador protestou na fábrica e pediu horas de folga.

O VENDEDOR

- O vendedor reorganizou as prateleiras e encontrou alguns produtos estragados.
- O vendedor ansiou pela promoção e ganhou uma comissão extra.

O RAPAZ

- O rapaz preparou a rota e viajou para o interior.
- O rapaz gostou da folia e ficou até o amanhecer.

O PILOTO

- O piloto sobrevoou a floresta e monitorou o enorme desmatamento.
- O piloto pousou na cidade e recebeu flores na chegada.

O BISPO

- O bispo autorizou a escolha e discutiu cada perfil apresentado.
- O bispo rezou pela união e reprovou a atitude separatista.

O MILITAR

- O militar controlou a rebelião e deteve os traficantes perigosos.
- O militar chegou na prisão e conteve a fuga iminente.

FILLERS – GRAMMATICALLY CORRECT

- A mulher desesperada correu pela rua.
- O contrato de negócios foi escrito pelas diretoras.
- Eu gostaria de estar numa ilha tropical.
- Ninguém possui mais experiência do que o Carlos.
- O João nunca viu tulipas tão lindas.

De agora em diante você não pode mais fumar na minha sala.
Os dentes foram escovados pela criança.
Saltos tão altos podem machucar os seus pés.
Histórias são contadas em torno da fogueira.
Estas laranjas não dão muito suco.
A família inteira jogou cartas até tarde.
O meio ambiente é muito poluído pela sujeira das fábricas.
A pequena árvore foi plantada quando eu nasci.
A erva indestrutível cresce entre as pedras.
As empregadas estão arrumando a cama antes da chegada do presidente.
O milho foi colhido pelos fazendeiros.
A camisa enrugada foi passada pelo trabalhador.
Eu recebi a resposta correta dos professores.
O pão de centeio é assado todos os dias.
O osso foi colocado no lugar pelo médico.
As donas de casa abriram as latas de ervilha.
A famosa canção era cantada pelos trabalhadores da construção.
As crianças fizeram um grande castelo de areia.
Esta música foi composta por grandes mestres.
Esta opinião foi compartilhada por muitos outros.
Os criminosos violentos infringiram a lei.
A flauta foi tocada por um membro da orquestra.
O batom foi aplicado nos lábios rachados.
A mochila causou dor nas costas da menina.
O tempo seguirá firme no próximo mês.
As escadas lá em cima são muito íngremes para mim.
Espero que você não cause muito sofrimento à sua noiva.
Soa melhor do que realmente é porque você não está aqui.
Os italianos nunca bebem direto da garrafa, mas sempre de uma taça.
Há um lindo poema escrito no quadro negro.
Os turistas estão andando a cavalo antes de seguirem em frente.
O blusão de lã foi tricotado pela avó.
Este holandês claramente não tem bom gosto.
O açougueiro do bairro é um verdadeiro cavalheiro.
O programa é seguido por um público bastante jovem.

A empregada cozinha duas vezes por semana.
O jornalista escreveu sua coluna semanal.
O carnaval acontece todos os anos.
Os mexicanos gostam de beber tequila.
Esta estação de rádio não transmite a partida de futebol.
A alemã comprou a bicicleta da amiga.
As praias na Croácia são muito bonitas.
Este programa de doutorado é o mais prestigiado.
A professora corrigiu as provas das quatro turmas.
O seu vinho tinto favorito está em promoção.
A Maria chorou ao ver aquele filme.
Histórias em quadrinhos são um sucesso entre as crianças.
O Paulo leu os poemas durante as férias de verão.
A garota chorou ao perder o último trem.
Esta dieta é muito restritiva.
A falta de água prejudicou a limpeza.
A bolsa de valores fechou o dia desvalorizada.
A neve caiu durante toda a noite.
Este verão não está tão quente.
As árvores antigas foram podadas.
O José toma quatro xícaras de café por dia.
O cavalo ficou cansado por causa da corrida.
A pizza chegou fria e sem estar cortada.
A febre amarela ainda é um problema grave em alguns países.
O correspondente não conseguiu transmitir a notícia ao vivo.
O bilhete do trem está cada vez mais caro.
Ela ainda não recebeu o salário do mês.
O avô brincou com os netos durante toda a tarde.
A gasolina está dois reais mais cara.
A Joana gritou com os seus empregados.
O funcionário esqueceu do celular no trabalho.
O Rogério nunca tem tempo para os filhos.
O artigo foi publicado numa revista de prestígio.
Há muitos presos nas prisões brasileiras.
A garrafa de água está completamente vazia.

A academia estava muito cheia hoje pela manhã.
Nós não entendemos a pergunta feita pelo Filipe.
A conta foi paga no dia do seu vencimento.
O avião enfrentou uma terrível turbulência.
O treino foi muito intenso e longo.

FILLERS – GRAMMATICALLY INCORRECT

A mulher desesperada correr pela rua.
O contrato de negócios ser escrito pelas diretoras.
Eu gostar de estar numa ilha tropical.
Ninguém possuir mais experiência do que o Carlos.
O João nunca ver tulipas tão lindas.
De agora em diante você não poder mais fumar na minha sala.
Os dentes ser escovados pela criança.
Saltos tão altos poder machucar os seus pés.
Histórias ser contadas em torno da fogueira.
Estas laranjas não dar muito suco.
A família inteira jogar cartas até tarde.
O meio ambiente ser muito poluído pela sujeira das fábricas.
A pequena árvore ser plantada quando eu nasci.
A erva indestrutível crescer entre as pedras.
As empregadas estar arrumando a cama antes da chegada do presidente.
O milho ser colhido pelos fazendeiros.
A camisa enrugada ser passada pelo trabalhador.
Eu receber a resposta correta dos professores.
O pão de centeio ser assado todos os dias.
O osso ser colocado no lugar pelo médico.
As donas de casa abrir as latas de ervilha.
A famosa canção ser cantada pelos trabalhadores da construção.
As crianças fazer um grande castelo de areia.
Esta música ser composta por grandes mestres.
Esta opinião ser compartilhada por muitos outros.
Os criminosos violentos infringir a lei.
A flauta ser tocada por um membro da orquestra.

O batom ser aplicado nos lábios rachados.
A mochila causar dor nas costas da menina.
O tempo seguir firme no próximo mês.
As escadas lá em cima ser muito íngremes para mim.
Espero que você não causar muito sofrimento à sua noiva.
Soar melhor do que realmente ser porque você não está aqui.
Os italianos nunca beber direto da garrafa, mas sempre de uma taça.
Haver um lindo poema escrito no quadro negro.
Os turistas estar andar a cavalo antes de seguirem em frente.
O blusão de lã ser tricotado pela avó.
Este holandês claramente não ter bom gosto.
O açougueiro do bairro ser um verdadeiro cavaleiro.
O programa ser seguido por um público bastante jovem.
A empregada cozinhar duas vezes por semana.
O jornalista escrever sua coluna semanal.
O carnaval acontecer todos os anos.
Os mexicanos gostar de beber tequila.
Esta estação de rádio não transmitir a partida de futebol.
A alemã comprar a bicicleta da amiga.
As praias na Croácia ser muito bonitas.
Este programa de doutorado ser o mais prestigiado.
A professora corrigir as provas das quatro turmas.
O seu vinho tinto favorito estar em promoção.
A Maria chorar ao ver aquele filme.
Histórias em quadrinhos ser um sucesso entre as crianças.
O Paulo ler os poemas durante as férias de verão.
A garota chorar ao perder o último trem.
Esta dieta ser muito restritiva.
A falta de água prejudicar a limpeza.
A bolsa de valores fechar o dia desvalorizada.
A neve cair durante toda a noite.
Este verão não estar tão quente.
As árvores antigas ser podadas.
O José tomar quatro xícaras de café por dia.
O cavalo ficar cansado por causa da corrida.

A pizza chegar fria e sem estar cortada.
A febre amarela ainda ser um problema grave em alguns países.
O correspondente não conseguir transmitir a notícia ao vivo.
O bilhete do trem estar cada vez mais caro.
Ela ainda não receber o salário do mês.
O avô brincar com os netos durante toda a tarde.
A gasolina estar dois reais mais cara.
A Joana gritar com os seus empregados.
O funcionário esquecer do celular no trabalho.
O Rogério nunca ter tempo para os filhos.
O artigo ser publicado numa revista de prestígio.
Haver muitos presos nas prisões brasileiras.
A garrafa de água estar completamente vazia.
A academia estar muito cheia hoje pela manhã.
Nós não entender a pergunta feita pelo Filipe.
A conta ser paga no dia do seu vencimento.
O avião enfrentar uma terrível turbulência.
O treino ser muito intenso e longo.

Appendix B

APPENDIX FOR THE EUROPEAN
PORTUGUESE MATERIALS
CHAPTERS 2 AND 3

EXPERIMENTAL ITEMS – CHAPTER 2

1. COLLECTIVE NOUS

O ELENCO

- O elenco leu a peça. Decorou todas as falas.
- O elenco contracenou na novela. Mostrou um grande talento.
- O elenco leu a peça. Decoraram todas as falas.
- O elenco contracenou na novela. Mostraram um grande talento.

O CLUBE

- O clube perdeu a competição. Enfrentou críticas da imprensa.
- O clube jogou na neve. Sofreu com o frio.
- O clube perdeu a competição. Enfrentaram críticas da imprensa.
- O clube jogou na neve. Sofreram com o frio.

O BANDO

- O bando assaltou a loja. Levou itens muito caros.
- O bando fugiu da prisão. Fez um túnel clandestino.
- O bando assaltou a loja. Levaram itens muito caros.
- O bando fugiu da prisão. Fizeram um túnel clandestino.

O CORO

- O coro estudou a partitura. Errou algumas notas musicais.
- O coro cantou na catedral. Emocionou as pessoas presentes.
- O coro estudou a partitura. Erraram algumas notas musicais.
- O coro cantou na catedral. Emocionaram as pessoas presentes.

O PARTIDO

- O partido interrompeu a votação. Solicitou um novo plenário.
- O partido optou pela neutralidade. Condenou os políticos indecisos.
- O partido interrompeu a votação. Solicitaram um novo plenário.
- O partido optou pela neutralidade. Condenaram os políticos indecisos.

O PELOTÃO

- O pelotão limpou as armas. Organizou todo o arsenal.
- O pelotão treinou à chuva. Correu por algumas horas.
- O pelotão limpou as armas. Organizaram todo o arsenal.
- O pelotão treinou à chuva. Correram por algumas horas.

O EXÉRCITO

- O exército agiu nas ruas. Garantiu a esperada paz.
- O exército protegeu a cidade. Impediu a crescente violência.
- O exército agiu nas ruas. Garantiram a esperada paz.
- O exército protegeu a cidade. Impediram a crescente violência.

O COMITÉ

- O comité percebeu a falha. Refez o relatório final.
- O comité aguardou pela análise. Aprovou os gastos previstos.
- O comité percebeu a falha. Refizeram o relatório final.
- O comité aguardou pela análise. Aprovaram os gastos previstos.

O QUARTETO

- O quarteto ensaiou na sala. Demonstrou um grande entrosamento.
- O quarteto repassou a melodia. Praticou durante muitas semanas.
- O quarteto repassou a melodia. Praticaram durante muitas semanas.
- O quarteto ensaiou na sala. Demonstraram um grande entrosamento.

O JÚRI

- O júri avaliou a situação. Julgou o réu reincidente.
- O júri trabalhou pela condenação. Analisou o caso cuidadosamente.
- O júri avaliou a situação. Julgaram o réu reincidente.
- O júri trabalhou pela condenação. Analisaram o caso cuidadosamente.

O CONSELHO

- O conselho mudou de posição. Reanalisou o documento oficial.
- O conselho questionou a aluna. Concordou com a resposta.
- O conselho mudou de posição. Reanalisaram o documento oficial.
- O conselho questionou a aluna. Concordaram com a resposta.

O PÚBLICO

- O público aplaudiu da bancada. Adorou o musical inédito.
- O público vaiou a performance. Prejudicou o grande espetáculo.
- O público aplaudiu da bancada. Adoraram o musical inédito.
- O público vaiou a performance. Prejudicaram o grande espetáculo.

O POVO

- O povo saiu às ruas. Reivindicou modificações no governo.
- O povo esperou a mudança. Acreditou que era possível.
- O povo saiu às ruas. Reivindicaram modificações no governo.
- O povo esperou a mudança. Acreditaram que era possível.

O BALÉ

- O balé executou a coreografia. Aprendeu os passos difíceis.
- O balé encantou na estreia. Apresentou um novo número.
- O balé executou a coreografia. Aprenderam os passos difíceis.
- O balé encantou na estreia. Apresentaram um novo número.

O SINDICATO

- O sindicato aceitou a greve. Tomou a decisão tardiamente.
- O sindicato protestou na avenida. Pediu melhorias na educação.
- O sindicato aceitou a greve. Tomaram a decisão tardiamente.
- O sindicato protestou na avenida. Pediram melhorias na educação.

O CASAL

- O casal preparou a bagagem. Viajou o dia inteiro.
- O casal gostou da festa. Ficou até ao final.
- O casal preparou a bagagem. Viajaram o dia inteiro.
- O casal gostou da festa. Ficaram até ao final.

O BATALHÃO

- O batalhão controlou a revolta. Deteve os presos exaltados.
- O batalhão chegou à vila. Conteve a briga generalizada.
- O batalhão controlou a revolta. Detiveram os presos exaltados.
- O batalhão chegou à vila. Contiveram a briga generalizada.

O PESSOAL

- O pessoal reorganizou a loja. Encontrou roupas pelo chão.
- O pessoal ansiou pela recompensa. Ganhou um bónus de natal.
- O pessoal reorganizou a loja. Encontraram roupas pelo chão.
- O pessoal ansiou pela recompensa. Ganharam um bónus de natal.

O CLERO

- O clero rezou pela paz. Reprovou o conflito armado.
- O clero autorizou a mudança. Discutiu por duas semanas.
- O clero autorizou a mudança. Discutiram por duas semanas.
- O clero rezou pela paz. Reprovaram o conflito armado.

O ESQUADRÃO

- O esquadrão sobrevoou a cidade. Monitorizou o incêndio florestal.
- O esquadrão pousou na pista. Recebeu a autorização oficial.
- O esquadrão sobrevoou a cidade. Monitorizaram o incêndio florestal.
- O esquadrão pousou na pista. Receberam a autorização oficial.

2. NON-COLLECTIVE NOUNS**O ATOR**

- O ator leu a obra. Decorou o primeiro ato.
- O ator contracenou na minissérie. Mostrou uma grande competência.

O JOGADOR

- O jogador perdeu a cabeça. Enfrentou a rejeição pública.
- O jogador jogou à defesa. Sofreu na nova posição.

O LADRÃO

- O ladrão assaltou a casa. Levou toda a comida.
- O ladrão fugiu da cela. Fez um polícia refém.

O CANTOR

- O cantor estudou a letra. Errou todo o refrão.
- O cantor cantou na cerimónia. Emocionou com sua delicadeza.

O POLÍTICO

O político interrompeu a colega. Solicitou uma nova explicação.
O político optou pela investigação. Condenou os colegas contrários.

O SOLDADO

O soldado limpou as botas. Organizou os seus haveres.
O soldado treinou na pista. Correu por muitos quilómetros.

O SARGENTO

O sargento protegeu a região. Coibiu a ação criminosa.
O sargento agiu na desordem. Garantiu a segurança local.

O ORGANIZADOR

O organizador percebeu a imperfeição. Refez a linda decoração.
O organizador aguardou pela entrega. Aprovou os doces encomendados.

O MÚSICO

O músico repassou a composição. Praticou durante longos meses.
O músico ensaiou na praça. Demonstrou uma grande afinação.

O JUIZ

O juiz avaliou as provas. Julgou os deputados corruptos.
O juiz trabalhou nas férias. Analisou o processo importante.

O DIRETOR

O diretor questionou as conselheiras. Concordou com as opiniões.
O diretor mudou de opinião. Reanalisou o orçamento anual.

O ESPECTADOR

O espectador vaiou a encenação. Prejudicou o evento artístico.
O espectador aplaudiu das arquibancadas. Adorou o novo espetáculo.

O CIDADÃO

O cidadão esperou a oportunidade. Acreditou no seu potencial.
O cidadão saiu da empresa. Reivindicou salários mais justos.

O BAILARINO

O bailarino executou a dança. Aprendeu os saltos complicados.

O bailarino encantou na competição. Apresentou um passo inédito.

O TRABALHADOR

O trabalhador aceitou a proposta. Tomou uma atitude inesperada.

O trabalhador protestou na fábrica. Pediu horas de folga.

O VENDEDOR

O vendedor reorganizou as prateleiras. Encontrou alguns produtos estragados.

O vendedor ansiou pela promoção. Ganhou uma comissão extra.

O RAPAZ

O rapaz preparou a rota. Viajou para o interior.

O rapaz gostou da folia. Ficou até o amanhecer.

O PILOTO

O piloto sobrevoou a floresta. Monitorizou a enorme desfloração.

O piloto pousou na cidade. Recebeu flores na chegada.

O BISPO

O bispo autorizou a escolha. Discutiui cada perfil apresentado.

O bispo rezou pela união. Reprovou a atitude separatista.

O MILITAR

O militar controlou a rebelião. Deteve os traficantes perigosos.

O militar chegou na prisão. Conteve a fuga iminente.

OS ATORES

Os atores leram a obra. Decoraram o primeiro ato.

Os atores contracenaram na minissérie. Mostraram uma grande competência.

OS JOGADORES

Os jogadores perderam a cabeça. Enfrentaram a rejeição pública.

Os jogadores jogaram à defesa. Sofreram na nova posição.

OS LADRÕES

Os ladrões assaltaram a casa. Levaram toda a comida.
Os ladrões fugiram da cela. Fizeram um polícia refém.

OS CANTORES

Os cantores estudaram a letra. Erraram todo o refrão.
Os cantores cantaram na cerimónia. Emocionaram com sua delicadeza.

OS POLÍTICOS

Os políticos interromperam a colega. Solicitaram uma nova explicação.
Os políticos optaram pela investigação. Condenaram os colegas contrários.

OS SOLDADOS

Os soldados limparam as botas. Organizaram os seus haveres.
Os soldados treinaram na pista. Correram por muitos quilómetros.

OS SARGENTOS

Os sargentos protegeram a região. Coibiram a ação criminosa.
Os sargentos agiram na desordem. Garantiram a segurança local.

OS ORGANIZADORES

Os organizadores perceberam a imperfeição. Refizeram a linda decoração.
Os organizadores aguardaram pela entrega. Aprovaram os doces encomendados.

OS MÚSICOS

Os músicos repassaram a composição. Praticaram durante longos meses.
Os músicos ensaiaram na praça. Demonstraram uma grande afinação.

OS JUÍZES

Os juízes avaliaram as provas. Julgaram os deputados corruptos.
Os juízes trabalharam nas férias. Analisaram o processo importante.

OS DIRETORES

Os diretores questionaram as conselheiras. Concordaram com as opiniões.
Os diretores mudaram de opinião. Reanalisaram o orçamento anual.

OS ESPECTADORES

Os espectadores vaiaram a encenação. Prejudicaram o evento artístico.
Os espectadores aplaudiram das arquibancadas. Adoraram o novo espetáculo.

OS CIDADÃOS

Os cidadãos esperaram a oportunidade. Acreditaram nos seus potenciais.
Os cidadãos saíram da empresa. Reivindicaram salários mais justos.

OS BAILARINOS

Os bailarinos executaram a dança. Aprenderam os saltos complicados.
Os bailarinos encantaram na competição. Apresentaram um passo inédito.

OS TRABALHADORES

Os trabalhadores aceitaram a proposta. Tomaram uma atitude inesperada.
Os trabalhadores protestaram na fábrica. Pediram horas de folga.

OS VENDEDORES

Os vendedores reorganizaram as prateleiras. Encontraram alguns produtos estragados.
Os vendedores ansiaram pela promoção. Ganharam uma comissão extra.

OS RAPAZES

Os rapazes prepararam a rota. Viajaram para o interior.
Os rapazes gostaram da folia. Ficaram até o amanhecer.

OS PILOTOS

Os pilotos sobrevoaram a floresta. Monitorizaram a enorme desfloração.
Os pilotos pousaram na cidade. Receberam flores na chegada.

OS BISPOS

Os bispos autorizaram a escolha. Discutiram cada perfil apresentado.
Os bispos rezaram pela união. Reprovaram a atitude separatista.

OS MILITARES

Os militares controlaram a rebelião. Detiveram os traficantes perigosos.
Os militares chegaram na prisão. Eles contiveram a fuga iminente.

EXPERIMENTAL ITEMS – CHAPTER 3

1. COLLECTIVE NOUNS

O ELENCO

- O elenco leu a peça e decorou todas as falas.
- O elenco contracenou na novela e mostrou um grande talento.
- O elenco leu a peça e decoraram todas as falas.
- O elenco contracenou na novela e mostraram um grande talento.

O CLUBE

- O clube perdeu a competição e enfrentou críticas da imprensa.
- O clube jogou na neve e sofreu com o frio.
- O clube perdeu a competição e enfrentaram críticas da imprensa.
- O clube jogou na neve e sofreram com o frio.

O BANDO

- O bando assaltou a loja e levou itens muito caros.
- O bando fugiu da prisão e fez um túnel clandestino.
- O bando assaltou a loja e levaram itens muito caros.
- O bando fugiu da prisão e fizeram um túnel clandestino.

O CORO

- O coro estudou a partitura e errou algumas notas musicais.
- O coro cantou na catedral e emocionou as pessoas presentes.
- O coro estudou a partitura e erraram algumas notas musicais.
- O coro cantou na catedral e emocionaram as pessoas presentes.

O PARTIDO

- O partido interrompeu a votação e solicitou um novo plenário.
- O partido optou pela neutralidade e condenou os políticos indecisos.
- O partido interrompeu a votação e solicitaram um novo plenário.
- O partido optou pela neutralidade e condenaram os políticos indecisos.

O PELOTÃO

- O pelotão limpou as armas e organizou todo o arsenal.
- O pelotão treinou à chuva e correu por algumas horas.
- O pelotão limpou as armas e organizaram todo o arsenal.
- O pelotão treinou à chuva e correram por algumas horas.

O EXÉRCITO

- O exército protegeu a cidade e impediu a crescente violência.
- O exército agiu nas ruas e garantiu a esperada paz.
- O exército protegeu a cidade e impediram a crescente violência.
- O exército agiu nas ruas e garantiram a esperada paz.

O COMITÉ

- O comité percebeu a falha e refez o relatório final.
- O comité aguardou pela análise e aprovou os gastos previstos.
- O comité percebeu a falha e refizeram o relatório final.
- O comité aguardou pela análise e aprovaram os gastos previstos.

O QUARTETO

- O quarteto repassou a melodia e praticou durante muitas semanas.
- O quarteto ensaiou na sala e demonstrou um grande entrosamento.
- O quarteto repassou a melodia e praticaram durante muitas semanas.
- O quarteto ensaiou na sala e demonstraram um grande entrosamento.

O JÚRI

- O júri avaliou a situação e julgou o réu reincidente.
- O júri trabalhou pela condenação e analisou o caso cuidadosamente.
- O júri avaliou a situação e julgaram o réu reincidente.
- O júri trabalhou pela condenação e analisaram o caso cuidadosamente.

O CONSELHO

- O conselho questionou a aluna e concordaram com a resposta.
- O conselho mudou de posição e reanalisaram o documento oficial.
- O conselho questionou a aluna e concordou com a resposta.
- O conselho mudou de posição e reanalisou o documento oficial.

O PÚBLICO

O público vaiou a performance e prejudicaram o grande espetáculo.

O público aplaudiu da bancada e adoraram o musical inédito.

O público vaiou a performance e prejudicou o grande espetáculo.

O público aplaudiu da bancada e adorou o musical inédito.

O POVO

O povo esperou a mudança e acreditaram que era possível.

O povo saiu às ruas e reivindicaram modificações no governo.

O povo esperou a mudança e acreditou que era possível.

O povo saiu às ruas e reivindicou modificações no governo.

O BALÉ

O balé executou a coreografia e aprenderam os passos difíceis.

O balé encantou na estreia e apresentaram um novo número.

O balé executou a coreografia e aprendeu os passos difíceis.

O balé encantou na estreia e apresentou um novo número.

O SINDICATO

O sindicato aceitou a greve e tomaram a decisão tardiamente.

O sindicato protestou na avenida e pediram melhorias na educação.

O sindicato aceitou a greve e tomou a decisão tardiamente.

O sindicato protestou na avenida e pediu melhorias na educação.

O CASAL

O casal preparou a bagagem e viajaram o dia inteiro.

O casal gostou da festa e ficaram até ao final.

O casal preparou a bagagem e viajou o dia inteiro.

O casal gostou da festa e ficou até ao final.

O BATALHÃO

O batalhão controlou a revolta e detiveram os presos exaltados.

O batalhão chegou à vila e contiveram a briga generalizada.

O batalhão controlou a revolta e deteve os presos exaltados.

O batalhão chegou à vila e conteve a briga generalizada.

O PESSOAL

- O pessoal reorganizou a loja e encontraram roupas pelo chão.
- O pessoal ansiou pela recompensa e ganharam um bónus de natal.
- O pessoal reorganizou a loja e encontrou roupas pelo chão.
- O pessoal ansiou pela recompensa e ganhou um bónus de natal.

O CLERO

- O clero autorizou a mudança e discutiram por duas semanas.
- O clero rezou pela paz e reprovaram o conflito armado.
- O clero autorizou a mudança e discutiu por duas semanas.
- O clero rezou pela paz e reprovou o conflito armado.

O ESQUADRÃO

- O esquadrão sobrevoou a cidade e monitorizaram o incêndio florestal.
- O esquadrão pousou na pista e receberam a autorização oficial.
- O esquadrão sobrevoou a cidade e monitorizou o incêndio florestal.
- O esquadrão pousou na pista e recebeu a autorização oficial.

2. NON-COLLECTIVE NOUNS

O ATOR

- O ator leu a obra e decorou o primeiro ato.
- O ator contracenou na minissérie e mostrou uma grande competência.

O JOGADOR

- O jogador perdeu a cabeça e enfrentou a rejeição pública.
- O jogador jogou à defesa e sofreu na nova posição.

O LADRÃO

- O ladrão assaltou a casa e levou toda a comida.
- O ladrão fugiu da cela e fez um polícia refém.

O CANTOR

- O cantor estudou a letra e errou todo o refrão.
- O cantor cantou na cerimónia e emocionou com sua delicadeza.

O POLÍTICO

O político optou pela investigação e condenou os colegas contrários.

O político interrompeu a colega e solicitou uma nova explicação.

O SOLDADO

O soldado limpou as botas e organizou os seus haveres.

O soldado treinou na pista e correu por muitos quilómetros.

O SARGENTO

O sargento protegeu a região e coibiu a ação criminosa.

O sargento agiu na desordem e garantiu a segurança local.

O ORGANIZADOR

O organizador aguardou pela entrega e aprovou os doces encomendados.

O organizador percebeu a imperfeição e refez a linda decoração.

O JUIZ

O juiz avaliou as provas e julgou os deputados corruptos.

O juiz trabalhou nas férias e analisou o processo importante.

O MÚSICO

O músico repassou a composição e praticou durante longos meses.

O músico ensaiou na praça e demonstrou uma grande afinação.

O DIRETOR

O diretor questionou as conselheiras e concordou com as opiniões.

O diretor mudou de opinião e reanalisou o orçamento anual.

O ESPECTADOR

O espectador vaiou a encenação e prejudicou o evento artístico.

O espectador aplaudiu das arquibancadas e adorou o novo espetáculo.

O CIDADÃO

O cidadão esperou a oportunidade e acreditou no seu potencial.

O cidadão saiu da empresa e reivindicou salários mais justos.

O BAILARINO

O bailarino executou a dança e aprendeu os saltos complicados.

O bailarino encantou na competição e apresentou um passo inédito.

O TRABALHADOR

O trabalhador aceitou a proposta e tomou uma atitude inesperada.

O trabalhador protestou na fábrica e pediu horas de folga.

O VENDEDOR

O vendedor reorganizou as prateleiras e encontrou alguns produtos estragados.

O vendedor ansiou pela promoção e ganhou uma comissão extra.

O RAPAZ

O rapaz preparou a rota e viajou para o interior.

O rapaz gostou da folia e ficou até o amanhecer.

O PILOTO

O piloto sobrevoou a floresta e monitorizou a enorme desfloração.

O piloto pousou na cidade e recebeu flores na chegada.

O BISPO

O bispo autorizou a escolha e discutiu cada perfil apresentado.

O bispo rezou pela união e reprovou a atitude separatista.

O MILITAR

O militar controlou a rebelião e deteve os traficantes perigosos.

O militar chegou na prisão e conteve a fuga iminente.

OS ATORES

Os atores leram a obra e decoraram o primeiro ato.

Os atores contracenaram na minissérie e mostraram uma grande competência.

OS JOGADORES

Os jogadores perderam a cabeça e enfrentaram a rejeição pública.

Os jogadores jogaram à defesa e sofreram na nova posição.

OS LADRÕES

Os ladrões assaltaram a casa e levaram toda a comida.
Os ladrões fugiram da cela e fizeram um polícia refém.

OS CANTORES

Os cantores estudaram a letra e erraram todo o refrão.
Os cantores cantaram na cerimónia e emocionaram com sua delicadeza.

OS POLÍTICOS

Os políticos interromperam a colega e solicitaram uma nova explicação.
Os políticos optaram pela investigação e condenaram os colegas contrários.

OS SOLDADOS

Os soldados limparam as botas e organizaram os seus haveres.
Os soldados treinaram na pista e correram por muitos quilómetros.

OS SARGENTOS

Os sargentos protegeram a região e coibiram a ação criminosa.
Os sargentos agiram na desordem e garantiram a segurança local.

OS ORGANIZADORES

Os organizadores perceberam a imperfeição e refizeram a linda decoração.
Os organizadores aguardaram pela entrega e aprovaram os doces encomendados.

OS MÚSICOS

Os músicos repassaram a composição e praticaram durante longos meses.
Os músicos ensaiaram na praça e demonstraram uma grande afinação.

OS JUÍZES

Os juízes avaliaram as provas e julgaram os deputados corruptos.
Os juízes trabalharam nas férias e analisaram o processo importante.

OS DIRETORES

Os diretores questionaram as conselheiras e concordaram com as opiniões.
Os diretores mudaram de opinião e reanalisaram o orçamento anual.

OS ESPECTADORES

Os espectadores vaiaram a encenação e prejudicaram o evento artístico.

Os espectadores aplaudiram das arquibancadas e adoraram o novo espetáculo.

OS CIDADÃOS

Os cidadãos esperaram a oportunidade e acreditaram nos seus potenciais.

Os cidadãos saíram da empresa e reivindicaram salários mais justos.

OS BAILARINOS

Os bailarinos executaram a dança e aprenderam os saltos complicados.

Os bailarinos encantaram na competição e apresentaram um passo inédito.

OS TRABALHADORES

Os trabalhadores aceitaram a proposta e tomaram uma atitude inesperada.

Os trabalhadores protestaram na fábrica e pediram horas de folga.

OS VENDEDORES

Os vendedores reorganizaram as prateleiras e encontraram alguns produtos estragados.

Os vendedores ansiaram pela promoção e ganharam uma comissão extra.

OS RAPAZES

Os rapazes prepararam a rota e viajaram para o interior.

Os rapazes gostaram da folia e ficaram até o amanhecer.

OS PILOTOS

Os pilotos sobrevoaram a floresta e monitorizaram a enorme desfloresção.

Os pilotos pousaram na cidade e receberam flores na chegada.

OS BISPOS

Os bispos autorizaram a escolha e discutiram cada perfil apresentado.

Os bispos rezaram pela união e reprovaram a atitude separatista.

OS MILITARES

Os militares controlaram a rebelião e detiveram os traficantes perigosos.

Os militares chegaram na prisão e contiveram a fuga iminente.

FILLERS – GRAMMATICALLY CORRECT

A mulher desesperada correu pela rua.
O contrato de negócios foi escrito pelas diretoras.
Eu gostaria de estar numa ilha tropical.
Ninguém possui mais experiência do que o Carlos.
O João nunca viu tulipas tão lindas.
De agora em diante, não podes mais fumar na minha sala de estar.
Os dentes foram escovados pela criança.
Saltos tão altos podem machucar os seus pés.
Histórias são contadas em torno da fogueira.
Estas laranjas não dão muito sumo.
A família inteira jogou cartas até tarde.
O meio ambiente é muito poluído pela sujidade das fábricas.
A pequena árvore foi plantada quando eu nasci.
A erva indestrutível cresce entre as pedras.
As empregadas estão a arrumar a cama antes da chegada do presidente.
O milho foi colhido pelos fazendeiros.
A camisa enrugada foi passada pelo trabalhador.
Eu recebi a resposta correta dos professores.
O pão de centeio é assado todos os dias.
O osso foi colocado no lugar pelo cirurgião.
As donas de casa abriram as latas de ervilha.
A famosa canção era cantada pelos trabalhadores da construção.
As crianças fizeram um grande castelo de areia.
Esta música foi composta por grandes mestres.
Esta opinião foi compartilhada por muitos outros.
Os criminosos violentos infringiram a lei.
A flauta foi tocada por um membro da orquestra.
O batom foi aplicado nos lábios gretados.
A mochila causou dor nas costas da menina.
O tempo seguirá firme no próximo mês.
As escadas lá em cima são muito íngremes para mim.
Espero que não causes muito sofrimento à sua noiva.
Soa melhor do que realmente é porque tu não estás aqui.

Os italianos nunca bebem direto da garrafa, mas sempre de uma taça.

Há um lindo poema escrito no quadro negro.

Os turistas estão a andar a cavalo antes de seguirem em frente.

O blusão de lã foi tricotado pela avó.

Este holandês claramente não tem bom gosto.

O talhante do bairro é um verdadeiro cavalheiro.

O programa é seguido por um público bastante jovem.

A empregada cozinha duas vezes por semana.

O jornalista escreveu sua coluna semanal.

O carnaval acontece todos os anos.

Os mexicanos gostam de beber tequila.

Esta estação de rádio não transmite a partida de futebol.

A alemã comprou a bicicleta da amiga.

As praias na Croácia são muito bonitas.

Este programa de doutoramento é o mais prestigiado.

A professora corrigiu as provas das quatro turmas.

O seu vinho tinto favorito está em promoção.

A Maria chorou ao ver aquele filme.

Histórias aos quadrinhos são um sucesso entre as crianças.

O Paulo leu os poemas durante as férias de verão.

A rapariga chorou ao perder o último comboio.

Esta dieta é muito restritiva.

A falta de água prejudicou a limpeza.

A bolsa de valores fechou o dia desvalorizada.

A neve caiu durante toda a noite.

Este verão não está tão quente.

As árvores antigas foram podadas.

O José toma quatro chávenas de café por dia.

O cavalo ficou cansado por causa da corrida.

A pizza chegou fria e sem estar cortada.

A febre amarela ainda é um problema grave em alguns países.

O correspondente não conseguiu transmitir a notícia ao vivo.

O bilhete do comboio está cada vez mais caro.

Ela ainda não recebeu o salário do mês.

O avô brincou com os netos durante toda a tarde.

A gasolina está dois euros mais cara.
A Joana gritou com os seus empregados.
O funcionário esqueceu-se do telemóvel no trabalho.
O Rogério nunca tem tempo para os filhos.
O artigo foi publicado numa revista de prestígio.
Há muitos presos nas prisões brasileiras.
A garrafa de água está completamente vazia.
O ginásio estava muito cheio hoje pela manhã.
Nós não entendemos a pergunta feita pelo Filipe.
A conta foi paga no dia do seu vencimento.
O avião enfrentou uma terrível turbulência.
O treino foi muito intenso e longo.

FILLERS – UNGRAMMATICALLY CORRECT

A mulher desesperada correr pela rua.
O contrato de negócios ser escrito pelas diretoras.
Eu gostar de estar numa ilha tropical.
Ninguém possuir mais experiência do que o Carlos.
O João nunca ver tulipas tão lindas.
De agora em diante, não poder mais fumar na minha sala de estar.
Os dentes ser escovados pela criança.
Saltos tão altos poder machucar os seus pés.
Histórias ser contadas em torno da fogueira.
Estas laranjas não dar muito sumo.
A família inteira jogar cartas até tarde.
O meio ambiente ser muito poluído pela sujidade das fábricas.
A pequena árvore ser plantada quando eu nasci.
A erva indestrutível crescer entre as pedras.
As empregadas estar a arrumar a cama antes da chegada do presidente.
O milho ser colhido pelos fazendeiros.
A camisa enrugada ser passada pelo trabalhador.
Eu receber a resposta correta dos professores.
O pão de centeio ser assado todos os dias.
O osso ser colocado no lugar pelo cirurgião.

As donas de casa abrir as latas de ervilha.
A famosa canção ser cantada pelos trabalhadores da construção.
As crianças fazer um grande castelo de areia.
Esta música ser composta por grandes mestres.
Esta opinião ser compartilhada por muitos outros.
Os criminosos violentos infringir a lei.
A flauta ser tocada por um membro da orquestra.
O batom ser aplicado nos lábios gretados.
A mochila causar dor nas costas da menina.
O tempo seguir firme no próximo mês.
As escadas lá em cima ser muito íngremes para mim.
Espero que não causar muito sofrimento à sua noiva.
Soar melhor do que realmente ser porque tu não estás aqui.
Os italianos nunca beber direto da garrafa, mas sempre de uma taça.
Haver um lindo poema escrito no quadro negro.
Os turistas estar a andar a cavalo antes de seguirem em frente.
O blusão de lã ser tricotado pela avó.
Este holandês claramente não ter bom gosto.
O talhante do bairro ser um verdadeiro cavalheiro.
O programa ser seguido por um público bastante jovem.
A empregada cozinhar duas vezes por semana.
O jornalista escrever sua coluna semanal.
O carnaval acontecer todos os anos.
Os mexicanos gostar de beber tequila.
Esta estação de rádio não transmitir a partida de futebol.
A alemã comprar a bicicleta da amiga.
As praias na Croácia ser muito bonitas.
Este programa de doutoramento ser o mais prestigiado.
A professora corrigir as provas das quatro turmas.
O seu vinho tinto favorito estar em promoção.
A Maria chorar ao ver aquele filme.
Histórias aos quadrinhos ser um sucesso entre as crianças.
O Paulo ler os poemas durante as férias de verão.
A rapariga chorar ao perder o último comboio.
Esta dieta ser muito restritiva.

A falta de água prejudicar a limpeza.
A bolsa de valores fechar o dia desvalorizada.
A neve cair durante toda a noite.
Este verão não estar tão quente.
As árvores antigas ser podadas.
O José tomar quatro chávenas de café por dia.
O cavalo ficar cansado por causa da corrida.
A pizza chegar fria e sem estar cortada.
A febre amarela ainda ser um problema grave em alguns países.
O correspondente não conseguir transmitir a notícia ao vivo.
O bilhete do comboio estar cada vez mais caro.
Ela ainda não receber o salário do mês.
O avô brincar com os netos durante toda a tarde.
A gasolina estar dois euros mais cara.
A Joana gritar com os seus empregados.
O funcionário esquecer do telemóvel no trabalho.
O Rogério nunca ter tempo para os filhos.
O artigo ser publicado numa revista de prestígio.
Haver muitos presos nas prisões brasileiras.
A garrafa de água estar completamente vazia.
O ginásio estar muito cheio hoje pela manhã.
Nós não entender a pergunta feita pelo Filipe.
A conta ser paga no dia do seu vencimento.
O avião enfrentar uma terrível turbulência.
O treino ser muito intenso e longo.

REFERENCES

- Almor, A., De Carvalho Maia, J., Cunha Lima, M., Vernice, M., & Gelormini-Lezama, C. (2017). Language processing, acceptability, and statistical distribution: A study of null and overt subjects in Brazilian Portuguese. *Journal of Memory and Language*, 92, 98-113.
- Barber, H., & Carreiras, M. (2005). Grammatical gender and number agreement in Spanish: An ERP comparison. *Journal of Cognitive Neuroscience*, 17, 137- 153.
- Barbosa, P. (2011). Pro-drop and theories of pro in the minimalist program part 1: Consistent null subject languages and the pronominal-agreement hypothesis. *Language and Linguistics Compass*, 5(8), 551-570.
- Blackwood, D., St. Clair, D., & Muir, W. (1991). Auditory P300 and eye tracking dysfunction in schizophrenia pedigrees. *Archives of General Psychiatry*, 48(10), 899-909.
- Bock, K., Eberhard, K., Cutting, J., Meyer, A., & Schriefers, H. (2001). Some attractions of verb agreement. *Cognitive Psychology*, 43(2), 83-128.
- Bock, K., Eberhard, K., & Cutting, J. (2004). Producing number agreement: How pronouns equal verbs. *Journal of Memory and Language*, 51(2), 251-278.
- Callahan, S. (2008). Processing anaphoric constructions: Insights from electrophysiological studies. *Journal of Neurolinguistics*, 21(3), 231-266.
- Carreiras, M., & Gernsbacher, M. A. (1992). Comprehending conceptual anaphors in Spanish. *Language and Cognitive Processes*, 7, 281-299.
- Cavalcante, S. R., & Duarte, M. E. (2008). The subject position in Brazilian Portuguese: the embedding of a syntactic change. *University of Pennsylvania Working Papers in Linguistics*, 14 (2), 54-62.
- Chomsky, N. (1981). Lectures on government and binding: The pisa lectures (Studies in generative grammar, 9). Dordrecht: Foris Publications.
- Corbett, G. (2000). *Number* (Cambridge textbooks in linguistics). Cambridge, UK: Cambridge University Press. (2000).
- C.-T., Huang. (1984). On the Distribution and Reference of Empty Pronouns. *Linguistic Inquiry* 15(4), 531-74.
- Duarte, M. E. L. (1995). *A perda do princípio "Evite Pronome" no português brasileiro*. [Doctoral Dissertation, State University of Campinas].
- Duarte, M. E. L. (2000). The loss of the Avoid Pronoun Principle in Brazilian Portuguese. In M. Kato & E. V. Negrão (Eds.), *Brazilian Portuguese and the Null Subject Parameter* (pp. 17–36). Frankfurt: Vervuert- Iberoamericana.
- Duarte, M. E. L. (2003). A evolução na representação do sujeito pronominal em dois tempos. In Paiva, M. C. & M. E. L. Duarte (Eds.), *Mudança lingüística em tempo real* (pp.115–128). Rio de Janeiro: Contra-Capa/Faperj.
- Dwivedi, V., Phillips, N., Lague-Beauvais, M., & Baum, S. (2006). An electrophysiological study of mood, modal context, and anaphora. *Brain Research*, 1117(1), 135-153.
- Eberhard, K., Cutting, J., & Bock, K. (2005). Making syntax of sense: Number agreement in sentence production. *Psychological Review*, 112(3), 531-59.

- Edwin S. Williams. (1977). On Deep and Surface Anaphora. *Linguistic Inquiry* 8(4), 692-96.
- Farias, S.C.; Leitão, M.M.; Ferrari-Neto, J. (2012). Gênero e número no processamento da anáfora conceitual com nomes coletivos em português brasileiro. *ReVEL* 1(6), 82-109.
- Frazier, L., & Clifton, C. (2005). The syntax-discourse divide: Processing ellipsis. *Syntax*, 8(2), 121-174.
- Friederici, A. (1995). The time course of syntactic activation during language processing: A model based on neuropsychological and neurophysiological data. *Brain and Language*, 50(3), 259-81.
- Friederici, A. (2002). Towards a neural basis of auditory sentence processing. *Trends in Cognitive Sciences*, 6(2), 78-84.
- Friederici, A., & Weissenborn, J. (2007). Mapping sentence form onto meaning: The syntax-semantic interface. *Brain Research*, 1146, 50-58.
- Garrod, S. C., & Sanford, A. J. (1994). Resolving sentences in a discourse context: How discourse representation affects language understanding. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 675-698). San Diego, CA, US: Academic Press.
- Garrod, S., & Terras, M. (2000). The contribution of lexical and situational knowledge to resolving discourse roles: Bonding and resolution. *Journal of Memory and Language*, 42(4), 526-544.
- Gernsbacher, M. A. (1991). Comprehending conceptual anaphors. *Language and Cognitive Processes*, 6, 81-105.
- Godoy, M., Françaço, E., & Ferreira, A. (2014). Alternative methodological approaches for the investigation of conceptual anaphora. *Signum: Estudos Da Linguagem*, 16(2), 125-148.
- Gouvea, A., Phillips, C., Kazanina, N., & Poeppel, D. (2010). The linguistic processes underlying the p600. *Language and Cognitive Processes*, 25(2), 149-188.
- Hagoort, P.; Brown, C.M.; Groothusen, J. (1993). The Syntactic Positive Shift (SPS) as an ERP measure of syntactic processing. *Language and Cognitive Processes*, 8(4), 439-483.
- Hammer, A., Jansma, B., Lamers, M., & Münte, T. (2008). Interplay of meaning, syntax and working memory during pronoun resolution investigated by ERPs. *Brain Research*, 1230, 177-191.
- Holcomb, P. (1993). Semantic priming and stimulus degradation: Implications for the role of the n400 in language processing. *Psychophysiology*, 30(1), 47-61.
- Jaeggli, O., & Safir, K. (1989). The null subject parameter. *Studies in natural language and linguistic theory*, 15. Dordrecht: Kluwer Academic.
- Kaan, E., Wijnen, F., & Swaab, T. (2004). Gapping: Electrophysiological evidence for immediate processing of “missing” verbs in sentence comprehension. *Brain and Language*, 89(3), 584-592.
- Kato, M. A. (2000). The partial pro-drop nature and the restricted VS order in Brazilian Portuguese. In M. A. Kato & E. V. Negrão (Eds.), *Brazilian Portuguese and the Null Subject Parameter* (pp. 223-258). Frankfurt: Vervuert-Iberoamericana.
- Kutas, M., & Hillyard, S. (1980). Reading senseless sentences: Brain potentials reflect semantic incongruity. *Science*, 207(4427), 203-205.

- Kutas, M., & Hillyard, S. (1980). Event-related brain potentials to semantically inappropriate and surprisingly large words. *Biological Psychology*, 11(2), 99-116.
- Kutas, M., & Hillyard, S. (1980). Reading between the lines: Event-related brain potentials during natural sentence processing. *Brain and Language*, 11(2), 354-373.
- Kutas, M., Van Petten, C., & Besson, M. (1988). Event-related potential asymmetries during the reading of sentences. *Electroencephalography and Clinical Neurophysiology*, 69(3), 218-233.
- Luck, S. (2012). *An introduction to the event-related potential technique* (First ed.) [First edition.]. Cambridge, Massachusetts: MIT Press.
- Maria, E., & Filomena, V. (2013). Null subjects and agreement marks in european and brazilian portuguese. *Journal of Portuguese Linguistics*, 12(2), 101-123.
- Nieuwland, M., & Van Berkun, J. (2006). When peanuts fall in love: N400 evidence for the power of discourse. *Journal of Cognitive Neuroscience*, 18(7), 1098-111.
- Nicol, J., & Swinney, D. (1989). The role of structure in coreference assignment during sentence comprehension. *Journal of Psycholinguistic Research*, 18(1), 5-19.
- Oldfield, R. (1971). The assessment and analysis of handedness: The Edinburgh inventory. *Neuropsychologia*, 9(1), 97-113.
- Osterhout, L., & Holcomb, P. (1992). Event-related brain potentials elicited by syntactic anomaly. *Journal of Memory and Language*, 31(6), 785-806.
- Osterhout, L., & Mobley, L. (1995). Event-related brain potentials elicited by failure to agree. *Journal of Memory and Language*, 34(6), 739-773.
- Ross, J. (1967). *Constraints on variables in syntax*, [Doctoral dissertation, Massachusetts Institute of Technology].
- Sag, I., & Hankamer, J. (1984). Toward a theory of anaphoric processing. *Linguistics and Philosophy*, 7(3), 325-345.
- Silva, A (2008). A leitura e o processamento da anáfora conceitual. *Linguagem em (Dis)curso – LemD*, 8(2), 265- 287.
- Streb, J., Rösler, F., & Hennighausen, E. (1999). Event-related responses to pronoun and proper name anaphors in parallel and nonparallel discourse structures. *Brain and Language*, 70(2), 273-286.
- Schweppe, J. (2013). Distance effects in number agreement. *Discourse Processes: A Multidisciplinary Journal*, 50(8), 531-556.
- Van Berkum, J., Brown, C., Hagoort, P., & Zwitterlood, P. (2003). Event-related brain potentials reflect discourse-referential ambiguity in spoken language comprehension. *Psychophysiology*, 40(2), 235-48.

SUMMARY

This PhD thesis investigates how conceptual number influences coreference establishing, specifically in instances in which a collective noun is the antecedent and a singular or a plural pronoun/verb is referring to it ('The band_{SG} is very talented. It_{SG} is_{SG} performing tonight.' and 'The band_{SG} is very talented. They_{PL} are_{PL} performing tonight.'). In order to study coreference establishing with collective nouns, we decided to use event-related potentials (ERPs), as ERP studies have indicated that conceptual and grammatical information show differences regarding electrophysiological activity. Our investigation focused on two important issues regarding coreference establishing and conceptual number. The first issue was to verify whether the linguistic context in which coreference establishing occurs (two separate sentences or two phrases in coordination – gapping) modulates how conceptual number is processed ('The band_{SG} is very talented. They_{PL} are_{PL} performing tonight.' and 'The band_{SG} is very talented and are_{PL} performing tonight.'). Additionally, we investigated the influence of conceptual number during coreference establishing in two variants of the same language (Brazilian and European Portuguese) to verify whether the pro-drop characteristic plays a role during coreference assignment on the presence of conceptual number (Brazilian Portuguese: 'A banda_{SG} é muito talentosa. Eles_{PL} tocarão_{PL} hoje à noite.' 'The band_{SG} is very talented. They_{PL} are_{PL} performing tonight. '; European Portuguese: 'A banda_{SG} é muito talentosa. Ø Tocarão_{PL} hoje à noite.' 'The band_{SG} is very talented. Ø Are_{PL} performing tonight.').

Chapter 1 starts with a general introduction, delineating the two main issues addressed in the thesis. Regarding the influence of conceptual number in coreference establishing, different studies conducted in different languages, such as English, German, Spanish and Brazilian Portuguese, were discussed. After elaborating on the methodological problems in previous research, this chapter focused on how differences in terms of sentence structure can influence the role of conceptual number in coreference establishing. This section elaborates on how two separate sentences (sentence pairs) and two phrases in coordination (one sentence) are inversely dependent on grammatical and conceptual information. Afterward, the second issue is discussed, whether the presence or the absence of the anaphoric pronoun would influence how conceptual number is processed. To address such issue, we decided to use two variants of the same language, Brazilian Portuguese (partial pro-drop language) and European Portuguese (pro-drop language), as both presented differences in terms of the presence or the absence of an overt pronoun. The final part of the general discussion focused on the fact that past studies presented conflicting data regarding the acceptability of conceptual number, and most of these investigations focused on self-paced reading and completion tasks. Based on that, we proposed that event-

related potentials could help to disentangle how conceptual number is processed during anaphoric resolution, as ERPs proved to be differently susceptible to grammatical and conceptual information processing.

After the general discussion, Chapter 1 ended with outlining the aims and the four research questions of the thesis. Regarding the research questions, the first two were related to the first two experiments, which investigated conceptual number in coreference establishing in sentence pairs. The first question is: (1) Are grammatical and conceptual number agreement in coreference establishing processed in the same way, as measured behaviorally and with ERPs? The second question is related to the difference between Brazilian and European Portuguese: (2) Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs? The last two research questions focused on conceptual number processing in coordination: (3) Are grammatical and conceptual number agreement processed in the same way, when coreference establishing occurs in coordination, as measured behaviorally and with ERPs?; and (4) Does conceptual number play a different role in coreference establishing in a partial pro-drop language (Brazilian Portuguese) and a pro-drop language (European Portuguese), as measured behaviorally and with ERPs, in the occurrence of gapping in coordination?

In **Chapter 2**, we discussed how conceptual number influences coreference establishing and how two variants of the same language may present distinct results regarding conceptual number processing (Experiment 1: Brazilian Portuguese; and Experiment 2: European Portuguese). Our findings showed that in sentences in which a collective noun has an antecedent function, singular pronouns and singular verbs elicit a late negative effect for both Brazilian and European Portuguese (Brazilian Portuguese: ‘The band_{SG} is very talented. It_{SG} is_{SG} performing tonight.’ European Portuguese: ‘The band_{SG} is very talented. Ø Is_{SG} performing tonight.’). In addition, European Portuguese speakers considered both grammatical and conceptual information during anaphoric resolution. Regarding the influence of conceptual number in coreference establishing, when a collective noun is the antecedent in coreference establishing, its conceptual plural meaning plays an important role in anaphoric resolution.

In **Chapter 3** we presented the two experiments which aimed to investigate whether conceptual number influences coreference establishing in the occurrence of gapping. We also aimed to investigate whether we would find differences in terms of the influence of conceptual number between a partial pro-drop language (Brazilian Portuguese) and a full pro-drop language (European Portuguese). Based on our results, we observed that Brazilian

Portuguese is more dependent on grammatical features in order to process a gapped pronoun, ('The band_{SG} is very talented and are_{PL} performing tonight.'). For this reason, when a plural verb is referring to a singular collective noun, a P600 effect is elicited. In European Portuguese, no significant effects were found across the experimental conditions, as European Portuguese does not depend only on grammatical information in order to omit the pronoun in coordination, as it considers both grammatical and conceptual information during coreference establishing.

In **Chapter 4**, we first focused on the processing differences regarding sentence structure and, second, we focused on the processing differences between Brazilian and European Portuguese. Regarding difference in terms of sentence structure, we addressed the issue that, in coordination, grammatical constraints have an important role in the occurrence of anaphoric resolution. When coreference establishing occurs between two separate sentences, conceptual information plays an important role in coreference establishing. In relation to the differences observed between Brazilian and European Portuguese, the fact that one is a full pro-drop language (European Portuguese), and the other is partial pro-drop language (Brazilian Portuguese) can influence how conceptual number will be processed. Afterwards, we presented an overview of results obtained by the four ERP experiments and, based on what we found, we discussed the results within languages. First, we compared the results found in Brazilian Portuguese. In the sentence pairs experiment (two separate sentences), in which a collective noun has an antecedent role, singular pronouns and singular verbs elicited a late negative effect. However, in the experiment with coordinated sentences, when the plural verb is referring to a singular collective noun, a P600 effect was found in Brazilian Portuguese. It seems that Brazilian Portuguese is dependent on grammatical constraints in coordination. This is due to the fact that in coordination, the pronoun must be dropped and, in order to do so, the grammatical information of the subject of the sentence (antecedent) is crucial for coreference establishing to occur. Regarding European Portuguese, in the sentence pair experiment, a late sustained negativity was also found. However, no ERP effects were found in relation to the experiment which investigated coordinated sentences, which means that during coreference establishing in coordination, grammatical and conceptual information are considered.

In **Chapter 5**, the four research questions were presented and discussed, based on the results found by the four ERP experiments. Regarding research question 1, we can affirm that conceptual and grammatical information are not processed in the same way: the late sustained negativity represents that, when a collective noun is the antecedent, grammatical agreement/conceptual number mismatch imposes a processing difficulty,

reflected in the effort in matching the suitable anaphor to its antecedent. In relation to research question 2, both Brazilian and European Portuguese presented a late sustained negativity, in the occurrence of grammatical agreement. This shows that both Brazilian and European Portuguese considered conceptual information when coreference establishing is occurring between two separate sentences. Concerning research question 3, the results show that the late sustained negativity present in the sentence pair experiment was no longer present in the coordination experiment, which means that the structure of the sentence in which coreference establishing occurs influences sentence processing. Lastly, research question 4 focused on the difference between Brazilian and European Portuguese and the results found show that, in the occurrence of gapping, Brazilian Portuguese depends on grammatical constrains in order for anaphoric resolution to occur, and in the case of European Portuguese, both grammatical and conceptual information play a role during coreference establishing in coordination.

SAMENVATTING

Dit proefschrift beschrijft hoe conceptueel getal van invloed is op het vaststellen van de coreferentie. In dit proefschrift gaat het om een collectief zelfstandig naamwoord dat het antecedent van de zin is. De vraag is hoe co-referentie in dat geval verwerkt wordt wanneer de coreferent enkelvoudig is (*A banda_{SG} é muito talentosa. Ela_{SG} vai_{SG} se apresentar hoje à noite: ‘De band is erg getalenteerd. Ze treedt vanavond op.’*) en wanneer het meervoudig is (*A banda_{SG} é muito talentosa. Eles_{PL} vão_{PL} se apresentar hoje à noite: ‘De band is erg getalenteerd. Ze treden vanavond op.’*). Wij hebben dit onderzocht door middel van zogenaamde *event-related potentials* (ERPs). Voorgaande ERP-studies hebben reeds aangetoond dat conceptuele en grammaticale informatie kan leiden tot verschil in elektrofysiologische activiteit. Ons onderzoek richt zich op twee zaken die betrekking hebben op de vaststelling van coreferentie en conceptuele getal. Allereerst onderzoeken we of de taalkundige context waarin coreferentiebepaling plaatsvindt (i.e., in twee afzonderlijke zinnen of in twee zinnen in coördinatie), moduleert hoe conceptueel getal wordt verwerkt. Daartoe is coreferentie vergeleken in zinnen met als antecedent woorden als ‘de band’, zoals in het voorbeeld hierboven. De invloed van grammaticale en conceptuele informatie op de zinsverwerking kan verschillen, afhankelijk van de zinsstructuur waarin deze anaforische resolutie optreedt. Ook hebben we de invloed van conceptueel getal tijdens de coreferentiebepaling in twee varianten van dezelfde taal (Braziliaans- en Europees-Portugees) onderzocht om na te gaan of nul-subjecten van invloed zijn op de verwerking van het conceptueel getal tijdens de coreferentiebepaling.

Hoofdstuk 1 begint met een algemene inleiding, waarin de twee belangrijkste onderwerpen van het proefschrift worden beschreven. Op het gebied van de rol van conceptueel getal bij coreferentievorming worden verschillende studies besproken waarin verschillende talen zoals Engels, Duits, Spaans en Braziliaans-Portugees zijn onderzocht. Het blijkt dat er enkele methodologische problemen met voorgaand onderzoek zijn, reden om ons te richten op de vraag hoe verschillen in zinsbouw de rol van conceptueel getal bij het vaststellen van de coreferentie kunnen beïnvloeden. Dit hoofdstuk beschrijft hoe twee afzonderlijke zinnen (zinsparen) en twee zinnen in coördinatie (één zin) afhankelijk zijn van grammaticale en conceptuele informatie. De tweede vraag is of de aan- of afwezigheid van het anaforische voornaamwoord van invloed is op de verwerking van het conceptuele getal. Om deze vraag te beantwoorden hebben we besloten om twee varianten van dezelfde taal te gebruiken, het Braziliaans-Portugees (een gedeeltelijke pro-drop taal) en het Europees-Portugees (een volledige pro-drop taal), omdat beide varianten verschillen afwezigheid van een persoonlijk voornaamwoord toestaan. Het laatste deel van de algemene discussie richt zich op het feit dat eerder onderzoek tegenstrijdige resultaten liet zien met betrekking tot

de aanvaardbaarheid van conceptueel getal. Het merendeel van deze onderzoeken maakte gebruik van *self-paced-reading*-taken en *sentence-completion*-taken. Als aanvulling hierop stellen wij dat event-related potentials geschikt zijn om te onderzoeken hoe conceptueel getal wordt verwerkt tijdens anaforische resolutie aangezien ERP's gevoelig zijn voor grammaticale en conceptuele informatieverwerking.

Na de algemene discussie eindigt hoofdstuk 1 met de twee doelen van het proefschrift. Het eerste doel is te uit te vinden hoe grammaticaal en conceptueel getal coreferentie beïnvloeden, wanneer een collectief zelfstandig naamwoord het antecedent van de zin is en wanneer een enkelvoudig of een meervoudig voornaamwoord/werkwoord daarnaar verwijst. In het bijzonder willen wij nagaan of de linguïstische context waarin coreferentievaststelling plaatsvindt (twee afzonderlijke zinnen en coördinatie) de verwerking van conceptueel getal moduleert. Ons tweede doel is om de invloed van het conceptuele getal vast te stellen tijdens coreferentie bij twee varianten van dezelfde taal (Braziliaans- en Europees-Portugees) om na te gaan of pro-drop een rol speelt bij de aanwezigheid van conceptueel getal tijdens de coreferentievaststelling.

De eerste twee onderzoeksvragen hebben betrekking op de eerste twee experimenten, waarbij conceptueel getal in coreferentievaststelling werd onderzocht met zinsparen. De eerste vraag is: (1) Worden grammaticale en conceptuele overeenkomst in coreferentievaststelling op dezelfde manier verwerkt (gemeten met gedragstaken en ERPs)? De tweede vraag heeft betrekking op het verschil tussen Braziliaans- en Europees-Portugees: (2) Speelt conceptueel getal een verschillende rol bij het vaststellen van de coreferentie in een gedeeltelijke pro-drop taal (Braziliaans-Portugees) en een volledige pro-drop taal (Europees-Portugees) (gemeten met gedragstaken en ERPs)? De laatste twee onderzoeksvragen richten zich op verwerking van conceptueel getal in coördinatie: (3) Worden grammaticale en conceptuele afspraken op dezelfde manier verwerkt wanneer coreferentievaststelling plaatsvindt in coördinatie (gemeten met gedragstaken en ERPs); en (4) Speelt conceptueel getal een verschillende rol in coreferentievastlegging in een partiële pro-drop taal (Braziliaans-Portugees) en een volledige pro-drop taal (Europees-Portugees) bij het optreden van zogeheten *gapping* in coördinatie?

In **Hoofdstuk 2** bespreken we hoe conceptuele getallen van invloed zijn op het vaststellen van de coreferentie en hoe twee varianten van dezelfde taal verschillende resultaten opleveren met betrekking tot de verwerking van conceptueel getal (Experiment 1: Braziliaans-Portugees; en Experiment 2: Europees-Portugees). Onze bevindingen tonen aan dat in zinnen waarin een collectief zelfstandig naamwoord een antecedentfunctie heeft, enkelvoudige voornaamwoorden en enkelvoudige werkwoorden die functioneren als

anaforische elementen een laat-negatief effect veroorzaken voor zowel het Braziliaans als het Europees Portugees (Braziliaans-Portugees: *A banda_{SG} é muito talentosa. Ela_{SG} vai_{SG} se apresentar hoje à noite: ‘De band is erg getalenteerd. Ze treedt vanavond op.’; Europees-Portugees: ‘A banda_{SG} é muito talentosa. Ø Vai-se_{SG} apresentar hoje à noite, ‘De band is erg getalenteerd. Ø treedt vanavond op.’). Bovendien houden Europees-Portugese sprekers rekening met zowel grammaticale als conceptuele informatie tijdens anaforische resolutie. Wat betreft de invloed van conceptueel getal bij het vaststellen van coreferentie, wanneer een collectief zelfstandig naamwoord het antecedent is bij het vaststellen van coreferentie, speelt de conceptuele meervoudige betekenis ervan een belangrijke rol bij anaforische resolutie.*

In **Hoofdstuk 3** presenteren we twee experimenten die tot doel hadden te onderzoeken of conceptueel getal van invloed is op coreferentievorming bij *gapping*. We wilden ook onderzoeken of we verschillen zouden vinden in de invloed van conceptueel getal tussen een gedeeltelijke pro-drop taal (Braziliaans-Portugees) en een volledige pro-drop taal (Europees-Portugees). Op basis van onze resultaten kunnen we concluderen dat het Braziliaans-Portugees meer afhankelijk is van grammaticale kenmerken om een *gapped* voornaamwoord te verwerken, aangezien voornaamwoorden in andere taalkundige contexten in het Braziliaans-Portugees voorkomen. We vonden een P600-effect wanneer een meervoudig werkwoord verwijst naar een enkelvoudig collectief zelfstandig naamwoord. In het Europees-Portugees werden geen significante resultaten gevonden in de experimentele condities. Dit wordt verklaard door het feit dat het Europees-Portugees niet alleen afhankelijk is van grammaticale informatie om het voornaamwoord in de coördinatie weg te laten. Er wordt rekening gehouden met zowel grammaticale als conceptuele informatie bij het vaststellen van de coreferentie.

In **Hoofdstuk 4** presenteren we een algemene discussie. We richten ons ten eerste op de verwerkingsverschillen met betrekking tot de zinsbouw en ten tweede op de verwerkingsverschillen tussen Braziliaans- en Europees-Portugees. Op het gebied van zinsconstructie gaan we in op de kwestie dat, bij coördinatie, grammaticale beperkingen een belangrijke rol spelen bij het optreden van anaforische resolutie en dat wanneer een verband tussen twee afzonderlijke zinnen gelegd wordt, conceptuele informatie van belang is. Met betrekking tot de verschillen tussen het Braziliaans- en het Europees-Portugees kan het feit dat de ene een volledige pro-drop taal is (Europees Portugees) en de andere een gedeeltelijke pro-drop taal (Braziliaans Portugees), invloed hebben op de manier waarop conceptueel getal wordt verwerkt. We bespreken eerst de resultaten voor het Braziliaans-Portugees. In het experiment met zinsparen (twee afzonderlijke zinnen),

waarin een collectief zelfstandig naamwoord een antecedentrol had, lokten enkelvoudige voornaamwoorden en enkelvoudige werkwoorden een laat negatief effect uit. In het experiment met gecoördineerde zinnen, waarbij het meervoudig werkwoord verwees naar een enkelvoudig collectief zelfstandig naamwoord, werd een P600 effect gevonden in het Braziliaans-Portugees. Het lijkt erop dat verwerking van de zinnen in kwestie in het Braziliaans-Portugees afhankelijk is van de grammaticale beperkingen die optreden bij coördinatie: bij coördinatie moet het voornaamwoord worden weggelaten en daarvoor is de grammaticale informatie van het onderwerp van de zin cruciaal om de samenhang vast te stellen. Wat het Europees-Portugees betreft, werd in het zinspaarexperiment ook een late aangehouden negativiteit vastgesteld. Er werden echter geen ERP-effecten gevonden in het experiment met gecoördineerde zinnen, wat betekent dat bij het vaststellen van de coreferentie in de coördinatie, grammaticale en conceptuele informatie in overweging wordt genomen.

In **Hoofdstuk 5** worden de vier onderzoeksvragen gepresenteerd en besproken op basis van de resultaten van de vier ERP-experimenten. Als antwoord op onderzoeksvraag 1 kunnen we stellen dat conceptuele en grammaticale informatie niet op dezelfde manier worden verwerkt: de gevonden late, aangehouden negativiteit geeft aan dat, wanneer een collectief zelfstandig naamwoord het antecedent is, grammaticale overeenkomst/conceptuele getalsmismatch een verwerkingsprobleem opwekt, hetgeen tgeïnterpreteerd wordt als de moeite die het kost de anafoor te verbinden met het geschikte antecedent. Met betrekking tot onderzoeksvraag 2 lieten zowel de Braziliaans- als de Europees-Portugese sprekers een late aangehouden negativiteit zien bij grammaticale overeenkomst. Hieruit blijkt dat zowel de Braziliaans- als de Europees-Portugese sprekers rekening houden met conceptuele informatie wanneer het verband tussen twee afzonderlijke zinnen wordt vastgesteld. Met betrekking tot onderzoeksvraag 3 blijkt uit de resultaten dat de late aangehouden negativiteit in het zinspaarexperiment niet meer aanwezig was in het coördinatie-experiment, wat betekent dat de structuur van de zin waarin coreferentievaststelling plaatsvindt van invloed is op de zinsverwerking. Ten slotte richtte onderzoeksvraag 4 zich op het verschil tussen Braziliaans- en Europees – Portugees. De gevonden resultaten tonen aan dat bij het optreden van *gapping* verwerking in het Braziliaans-Portugees afhankelijk is van grammaticale restricties om anaforische resolutie te laten optreden en dat, in het geval van Europees-Portugees, zowel grammaticale als conceptuele informatie een rol speelt bij het vaststellen van coreferentie in coördinatie.

GRODIL

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