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RESEARCH ARTICLE

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ANAPHORIC PROCESSING OF THE NULL PRONOUN IN BILINGUAL BRAZILIAN PORTUGUESE-SPEAKING (L1) LEARNERS OF SPANISH (L2)

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ABSTRACT

Studies on monolingualism and bilingualism have pointed to the fact that morphological information and the establishment of anaphoric co-references impact the establishment of co-referencing. Therefore, the aim of the present study was to investigate anaphoric co-referential processing of the null pronoun (*pro*) with regards to its disjointed reference in bilingual Brazilian Portuguese-speaking (L1) learners of Spanish (L2) to determine whether the morphological information inherent to the phi features of gender – according to the Feature Strength Hypothesis (Carminati, 2005) – exerts an impact on the establishment of the anaphoric co-reference in both ambiguous and non-ambiguous contexts. A further aim was to determine whether the processing of *pro* in bilingual speakers is also guided by the syntactic-structural position according to the Position of Antecedent Hypothesis (Carminati, 2002). The results of an online self-paced reading experiment revealed that neither morphological information related to the phi features of gender nor syntactic-structural function seem to exert an influence on the anaphoric co-referential processing of *pro* in the group of bilingual speakers analysed, who did not demonstrate in their processual course that they were guided by conforming resolutive mechanisms in line with the Feature Strength Hypothesis or Position of Antecedent Hypothesis.

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INTRODUCTION

Anaphoric co-referential processing has been the focus of interest in psycholinguistic research and has studies on this subject have increased in investigative volume ever since psycholinguistics was established as a science (KENNISON, S. M.; GORDON, P. C., 1997). In psycholinguistic studies, anaphoric co-referencing is the process by which anaphoric forms effect the assignment of antecedent elements allocated in the sentence that contribute to linguistic understanding. Several experimental studies have been conducted to understand the diverse factors that influence computational and cognitive processes in the human mind when processing anaphoric elements¹

(BADECKER; STRAUB, 2002) in different languages, such as English (CHAMBERS; SMYTH, 1998), Italian (FEDELE; KAISER, 2014), Spanish (ALONSO-OVALLE *et al.*, 2002), European Portuguese (FERNANDES *et al.*, 2018) and Brazilian Portuguese² (BARBOSA; LIMA, 2019; BEZERRA; LEITAO, 2013). Such studies have focused not only on monolingual processing, but also bilingual processing (BARBOSA, 2017), including that occurring in children (FERRARI-NETO; MARINHO, 2015). Such explorations are often directed at cross-linguistic comparisons³ (KIM, 2000). Studies on anaphoric co-referential processing have revealed the influence of different factors on anaphoric resolution, demonstrating the individuals with a greater working memory capacity are more

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¹For a comprehensive review of the different factors that influence anaphoric co-referential processing and its anaphoric resolution as well as knowledge on

studies that have pointed out these factors, see Almeida (2016, p. 228-231).

²Studies have been conducted on anaphoric co-referential processing in indigenous languages. For examples, see Oliveira & Maia (2011) and Christianson & Cho (2009).

³For an understanding of cross-linguistic comparisons, see Roberts (2019).

sensitive to structural ambiguity (Dwivedi and Goldhawk, 2009) and that working memory capacity directly affects the ability to override and void an initial interpretative processual analysis to enable the restructuring of this process in the face of new conflicting information ("garden-path" structures) (Novick, Trueswell and Thompson-Schill, 2005), although there is no clear relationship between sentential comprehension and working memory capacity (McElree, 2006). Regarding anaphoric co-reference achieved through a phonetically null pronoun (hereafter denominated *pro*), generative linguistic theory (CHOMSKY, 1981) characterises such pronouns as one of types of empty categories. Theoretical descriptions of *pro* have often focused on the distribution of these pronouns in the sentence (cf. RIZZI, 1986). In terms of processing, one of the most widely studied points is the referential ambiguity caused by null pronouns. This ambiguity entails procedural costs in the establishment of the co-reference. An example is shown in the sentence below (1) taken from Carminati (2005):

- (1) Quando Maria ha chiamato Mario, era contenta.

When Maria called Mario, *pro* was happy.

In this sentence, the precise establishment of the antecedent of the null pronoun is not possible. In other words, there is no way to know who was happy – Maria or Mario. Therefore, when one reaches the null pronoun in the processing of a such a sentence, a decision must be made regarding the establishment of the correct co-referent. There are indications in the sentence that lead to the choice of the proper antecedent. These indications, such as the marking of gender in adjectives, are taken into consideration when making the decision, as shown in sentences (2) and (3) below, which are also based on Carminati (2005):

- (2) Quando Maria ha chiamato Mario, era stanca
When Maria called Mario, *pro* was tired (adjective in the feminine)
- (3) Quando Maria ha chiamato Mario, era stanco
When Maria called Mario, *pro* was tired (adjective in the masculine)

In sentences (2) and (3), disambiguation is achieved by the morphological marking of gender in the adjective in the end position. In this structure, the antecedent could be the subject of the sentence, as in (2), or the object of the sentence, as in (3). Hence, the morphological gender feature of the antecedent is a factor that exerts an influence on the processing of the null pronoun, which merits investigation in an experimental study. In several online and offline studies involving data from Italian, Carminati (2005) found that, in the assignment through the anaphoric element *pro*, the subjects preferred to interpret this pronoun as having a referent introduced in the previous linguistic context in the subject position. For example, in a self-paced reading study, the author observed reading times of the main clause in sentences such as the following:

- (4) Dopo che Giovanni ha messo in imbarazzo Giorgio di fronte a tutti, Ø si è scusato ripetutamente.
After Giovanni had embarrassed Giorgio in front of everyone, *pro* apologised repeatedly.
- (5) Dopo che Giovanni ha messo in imbarazzo Giorgio di fronte a tutti, si è offeso tremendamente.
After Giovanni had embarrassed Giorgio in front of everyone, *pro* was tremendously offended.

The results showed that the reading time of sentences such as (4) was significantly faster than that of sentences such as (5). Thus, reading time diminished significantly when *pro* was pragmatically disambiguated for a previous subject and not a previous object. This *pro* bias to co-refer with an antecedent in the subject position found seminally in Italian by Carminati (2005) was addressed by the author in the Position of Antecedent Hypothesis. According to this hypothesis, null pronouns preferably assign antecedents in the structural position of subject or, more precisely, Spec-IP, which is a structural factor responsible for conferring prominence to the

antecedent. Considering sentences (4) and (5), we see that the null pronoun occupies the syntactic function of subject. Thus, we believe that it is relevant to also consider a possible influence of structural parallelism, since, according to Chambers and Smyth (1998), the co-reference process is facilitated when both the antecedent and assignment are structurally parallel, that is, when these elements have the same syntactic position and function. According to Carminati (2005), another factor that may influence the processing of the null pronoun is morphological information regarding phi (ϕ) features, such as gender, number and person. The author proposes that morphological features are organised hierarchically and encode conceptual features with different degrees of cognitive significance and relevance (see GREENBERG, 1963, p. 73-113), making clear predictions for the processing of sentences, particularly the processing of pronouns and features of pronouns, as a correlation is assumed to exist between the cognitive significance of a feature (relative to another) and its power of disambiguation, meaning that a more cognitively important feature would be better at disambiguating the pronoun that it carries (stronger power of disambiguation). The author denominated this the Feature Strength Hypothesis (CARMINATI, 2005). If this hypothesis is correct, the strength of the feature should interact with the pronoun resolution strategies used by the processor, such that, when considering a strategy based on the bias of *pro* for the assignment of the subject, the feature strength would imply two effects: (a) accelerating the antecedent assignment process when it is in agreement with the antecedent bias of *pro* for the subject and (b) reducing the cost of the penalty when the assignment goes against the bias of *pro* for the subject, that is, when the antecedent is the object.

With regards to bilingualism, studies on the process of the second language (L2) seek to understand how the processing of the additional language occurs in the mind of users of L2 and how the mother tongue (L1) affects the acquisition and computation process of L2. Some issues in this field regard how L1 and L2 are represented in the mind and how these two languages interact in processing, that is, whether L1 influences the processing of L2 and/or vice-versa in what is understood as linguistic attrition on the one hand or linguistic transference on the other. Some studies have investigated how L2 speakers use the grammar of L1 for aspects of external (discourse) and internal (grammar) systems. Thus, the processing of L2 can be seen in light of Interface Theory (SORACE; FILIACI, 2006), which proposes that there would be difficulty in integrating data that encompass the interface of the syntax with other linguistic competences or domains, especially on the pragmatic level. Therefore, this would influence the interpretation of the co-reference, as it could tend toward the use of the same mechanisms of L1 in L2. Given the scarcity of research on linguistic processing by bilingual speakers of Brazilian Portuguese (L1) and Spanish (L2), it is necessary to study the processing and interpretation of the null pronoun to determine the anaphoric processing mechanisms implemented by bilingual speakers. Therefore, the aim of the present study was to investigate anaphoric co-referential processing of the null pronoun (*pro*) in bilingual Brazilian Portuguese-speaking (L1) learners Spanish (L2) focusing on two types of information (morphological and syntactic-structural) within the theoretical-methodological precepts of experimental psycholinguistics and linguistic processing, which investigates computational, cognitive and mental processes involved in the processing and/or computation, comprehension and production of language (BALIEIRO Jr., 2006).

METHODS

A self-paced reading experiment was performed to observe factors that may exert an influence on the identification of the antecedent for the assignment of a null pronoun (*pro*). Among such factors, the gender feature and structural position of the antecedent can be used to guide the assignment of antecedents in the sentence.

Participants: Thirty-two bilingual Brazilian Portuguese-speaking (L1) learners of Spanish (L2) participated in the experiment voluntarily. All participants were students of different undergraduate

courses of *Universidade de Pernambuco* (UPE), *Universidade Federal de Pernambuco* (UFPE) and *Universidade Federal da Paraíba* (UFPB). Twenty were women (62.5%) and 12 were men (37.5%). Mean age was 24.75 years (range: 18 to 51 years).

MATERIALS AND DESIGN

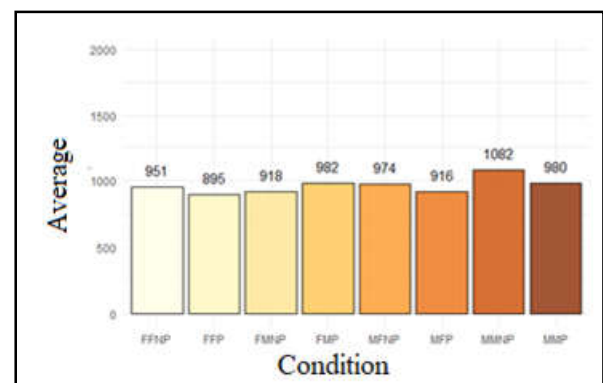
The experiment comprised a set of 32 sentences and 64 distractors, totalling 96 stimuli presented in Spanish. The items were distributed around eight conditions arranged in a within-subjects Latin Square Design, which enables each participant to be exposed to all conditions and all types of structures with no repetition of the sentences. A 4 x 2 design was used with the manipulation of the *gender feature* of the potential antecedents with which the null pronoun could or could not co-refer (masculine/feminine vs. feminine/masculine vs. masculine/masculine vs. feminine/feminine) and *syntactic position* of the potential antecedents with which the *pro* could establish or not establish co-reference within a parallel or non-parallel syntactic structure (subject vs. object). Thus, the experiment had four conditions (masculine/feminine and feminine/masculine – parallel and non-parallel) in which, when matching the gender with the potential antecedent in the subject position, *pro* automatically disagrees with the other concurrent antecedent in the object position. Likewise, when matching the potential antecedent in the object position, *pro* generically disagrees with the other concurrent antecedent in the subject position. Therefore, when the gender feature of the participle associated with *pro* is masculine (or feminine), its respective potential antecedent is also marked in the masculine (or feminine) form, whereas the concurrent antecedent is marked by the feminine (or masculine) form regardless of the assumed syntactic-structural position (subject or object). There are two other conditions (masculine/masculine and feminine/feminine – parallel) in which ambiguity is present for the establishment of the co-reference, as both antecedents could co-refer with *pro* by matching its gender. Lastly, there are two other conditions (masculine/masculine and feminine/feminine – non-parallel) in which neither of the two antecedents could co-refer with *pro* for not matching its gender, forcing the null pronoun to establish a disjointed co-reference and, possibly, a consequent exophoric co-referencing. The dependent variables consisted of the response time conferred to the reading of the sentences as experimental stimuli and the type of answer given to the comprehension question. The experimental sentences were composed of temporal adverbial subordinate clauses starting with the conjunction *when*. To avoid undue automatic, directed learning on the part of the participants, part of the distractor stimuli had similarities with the experimental items and was initiated by subordinate conjunctions while presenting other forms of co-referencing with other types of pronoun; and another part consisted of sentences with structures quite different from the experimental sentence, without the presence of co-reference pronouns and categorised as either coordinate or relative or were characterised as main clauses without any type of conjunctive or connective element.

Procedure: The experiment was conducted in study booths in public libraries. The volunteers were recruited randomly from within the limits of the universities. Screening was performed to ensure the bilingualism of the participants. For such, a vocabulary level test was used to measure the proficiency of each volunteer (SOUZA; SOARES-SILVA, 2015), with a maximum of ten minutes allotted to take the test. The test was composed of five levels and the respondent needed achieve at least 14 (78%) of the total of 18 points per section in order to advance to the next level (cf. NATION, 1990). Volunteers who were able to reach level 5 were selected for participation in the self-paced reading experiment. The experiment was designed and executed using the *Paradigm* (version 2.5.0) computational program and a *Samsung Essential E22* laptop computer with a 14-inch screen, 4GB DDR3L 1600 MHz memory and *Intel Pentium N3540* processor (2.16GHz up to 2.66GHz 2MB L2 Cache). The self-paced reading experiment was developed within the non-cumulative *moving-window* paradigm (JUST; CARPENTER; WOOLLEY, 1982). Prior to the experiment, the participants signed a statement of informed consent

that ensured confidentiality, anonymity and the voluntary nature of the study. In the experimental phase, the participant was placed in front of the laptop computer and assigned a number for subsequent identification. The numbers followed an increasing, non-redundant cardinal order. Based on the adopted experimental method, the stimuli were segmented in different portions. Once the activity had begun, instructions were given on the computer screen. After reading the instructions, the volunteer was instructed to press the space bar to give continuity to the task. With each new stimulus, the participant pressed the right arrow key (“>”) after concluding the reading to move on to a new segment of the sentence to be read and so on until completing the reading of all segments of the sentence. Prior to each new stimulus, the participant was instructed to gaze at the centre of the screen and then press “>” to continue the flow of the reading. When the “>” was pressed, the subsequent segment of the sentence emerged and the previous segment was covered by dashes to impede the participant from returning to this segment. At the end of reading the entire sentence composing the stimulus, the participant was shown an interpretative question to ensure the comprehension of the content of what had been read, induce the participant to pay attention to the task, avoiding mechanical, inattentive reading, and determine whether the participant was capable of adequately establishing the anaphoric co-reference on the interpretative and/or reflexive level of the processing. For each question, two direct response options were given, for which the participant had to answer either affirmatively or negatively (yes or no). To counterbalance and maintain the structure of the questions equilibrated in order to avoid undue directing or biasing, the questions were created such that the subject antecedent was addressed in four of the eight conditions of each stimulus and the object antecedent was addressed in the other four conditions of each stimulus. Prior to the experiment, all participants participated in a training session under the supervision of the researcher, who instructed each participant on how to perform the task. This stage served to familiarise the participants with the steps to be taken during the execution of the experiment and clarify any doubts the participants might have. In the training stage, sentences were presented with similar structures to those used in the experimental stage. After the understanding of the instructions and the conclusion of the training stage, the researcher left the room or booth the enable the participant to execute the task alone.

RESULTS AND DISCUSSION

For the statistical analysis of the results, the measure of interest was the reading time of the critical segment corresponding to the participle associated with *pro*. As the normality test revealed that the data presented non-normal asymmetrical distribution, the nonparametric Wilcoxon test was used for the pairwise comparisons between conditions. All calculations were performed with the aid of the Statistical Package for the Social Sciences (IBM SPSS). Figure 1 displays the distribution for the average reading time of the critical segment.



Source: The authors (2021)

Figure 1. Distribution of Average Reading Time of Critical Segment

The analysis followed two lines of investigation. The first sought to determine a possible effect of the gender feature of the antecedent on the establishment of the anaphoric co-reference and the second consisted of determining whether the syntactic-structural position of the antecedent (allocated to the function of subject or object) also exerted an influence on co-referencing. Therefore, the masculine-feminine-parallel (MFP) condition was compared to the feminine-masculine-parallel (FMP) condition (which assign subject antecedents) and the masculine-feminine-non-parallel (MFNP) condition was compared to the feminine-masculine-non-parallel (FMNP) condition (which assign object antecedents) to determine whether the gender feature affects co-referential processing. The MFP condition was also compared to the FMNP condition (respectively forcing co-reference with the subject and object antecedent) and the FMP condition was compared to the MFNP condition (respectively forcing co-reference with the subject and object antecedent) to determine whether the syntactic-structural position also exerts an influence on anaphoric co-referential processing. Likewise, the masculine-masculine-parallel (MMP) condition was compared to the feminine-feminine-parallel (FFP) condition (both ambiguous with regards to the antecedent) to determine whether there is a prevalence of one gender feature over the other (masculine over feminine or vice-versa) in ambiguous situations, and determine whether there is a syntactic appositional preference in choosing the antecedent with which to co-refer – that in the subject position or that in the object position when both are in competition and are equally valid as potential co-referents. Lastly, the masculine-masculine-non-parallel (MMNP) condition was compared to the feminine-feminine-non-parallel (FFNP) condition (which force a disjointed reference and/or exophoric co-referencing, as the gender feature of the participle associated with *pro* is incongruent with the gender features of both potential antecedents whether in the subject or object position) to determine whether the gender feature is also capable of impacting (depending on whether the feature is masculine or feminine) the processing of the disjointed reference when the computation of the anaphoric co-reference is frustrated. The analysis indicated a non-prevalence of the bilingual Brazilian Portuguese-speaking (L1) learners of Spanish (L2) to favor the establishment of the anaphoric co-reference of *pro* with the subject antecedent. Thus, the Position of Antecedent Hypothesis (PAH) appears not to constitute a mechanism for guiding anaphoric co-referential processing and anaphoric resolution in bilingual speakers (Carminati, 2002). The non-observation of PAH as guiding the anaphoric processing of *pro* replicates findings obtained for Brazilian Portuguese in a recent study by Melo et al. (2019) as well as a study conducted by Costa & Matos (2012), but is not in agreement with data reported in other studies conducted on the anaphoric processing of *pro* in Brazilian Portuguese (Fonseca & Guerreiro, 2012), Spanish (Alonso-Ovalle et al., 2002), Mexican Spanish (Keating, Jegerski & VanPatten, 2016) and Rioplatense Spanish (Gelormini-Lezama, 2008, 2010) as well as Spanish as a heritage language (Keating, Jegerski & VanPatten, 2016).

In the bilingual context of English as L1 and Spanish as L2 (Lozano, 2016), PAH was at least partially confirmed through the observation that *pro* tended to co-refer with the subject antecedent, whereas the overt pronoun proved more instable, at times conforming with the PAH by tending toward co-referring with the object antecedent and other times not exhibiting a defined tendency, indiscriminately either co-referring with the object antecedent or the subject antecedent. However, the present results are in line with those described in studies that investigated anaphoric co-referential processing in bilingual speakers of English (L1) and Spanish (L2) (Keating, VanPatten & Jegerski, 2011), in whom PAH was not confirmed, as *pro* tended to co-refer with the subject antecedent by chance, as found in the present study. The set of results from these studies and the present investigation suggest that bilingual speakers, even those in a more advanced stage of learning and/or acquisition of Spanish as L2, do not employ PAH as a resolutive mechanism used in their respective mother tongue (L1) in the co-referential resolution of L2. In terms of learning and processing in the context of bilingualism, the results of the present investigation align better with Interface Theory (Sorace &

Filiaci, 2006), as there seems to be a coexistence of distinct grammars in bilingual Brazilian Portuguese-speaking (L1) learners of Spanish (L2). Despite the advanced level of acquisition of L2 (Spanish), such speakers demonstrated the deactivation of the null pronoun processing pattern regarding pronominal specialisation guided by PAH in both the mother tongue (Brazilian Portuguese) and the target language that is the object of acquisition as the additional language (Spanish). As the processual protocol is the same in both languages, there would be no reason for these bilingual speakers to deactivate the implementation of the computational mechanism guided by PAH. This deactivation indicates that bilingual speakers in the acquisition process – most likely for not being aware of what standard resolutive mechanism is employed in the target language – opt for discarding the resolutive mechanics of their mother tongue in the expectation of abstracting another mechanism suspected to be different in the foreign language compared to that executed in L1. Thus, until the speakers have sufficient evidence regarding the *modus operandi* of the processual dynamics of L2 and perceive that the mechanism used in this additional language is identical or similar to that of the mother tongue so that they can reactivate this mechanism driven by PAH at least with regards to the processing of *pro*, they seem to immerse into an inter-language, which, as demonstrated by the experiment conducted in this investigation, does not draw upon the resolutive mechanism guided by PAH which is inherent either to L1 or L2 in the process of acquisition. Hence, as long as speakers have not yet assimilated all grammatical knowledge related to L2, remaining in the inter-language situation despite an advanced level of acquisition of the additional language, they seem to have difficulty integrating information that involves the interface between syntax and other domains, especially the semantic and pragmatic-discursive domains, in their inter-language, which compromises the capacity to implement standard mechanisms of L2 that are equal or similar to those of L1 until the *parser* of these speakers has full knowledge and complete access to the restrictions and mechanisms underlying L2 in the process of acquisition.⁴

FINAL CONSIDERATIONS

The results of the present study indicate that anaphoric co-referential processing in bilingual Brazilian Portuguese-speaking learners of Spanish is not guided by the operationalisation of the Feature Strength Hypothesis (Carminati, 2005), as neither the effect of disambiguation in ambiguous processing nor in non-ambiguous processes was clear in terms of the morphological marking of gender. Therefore, the gender feature is non-relevant information for the processing of null pronouns (*pro*) and is a linguistic factor that does not lead to the disambiguation of ambiguous anaphoric processing or non-ambiguous processing, as predicted by Feature Strength Theory. This suggests that morphological information of gender does not guide the anaphoric processing of *pro* by either facilitating or hindering the intended co-referential resolution. Likewise, the syntactic-structural position of the antecedent did not prove to be a relevant measure for the co-referential resolution inherent to the anaphoric co-referential processing of *pro*, indicating that the Position of Antecedent Hypothesis does not guide the anaphoric processing of the null pronoun in bilingual Brazilian Portuguese-speaking learners of Spanish, as the bilingual speakers analysed in the present study did not prioritise the co-referencing of *pro* with the subject antecedent, presenting a pronominal attribution for the null pronoun given by chance, which was capable of going in the direction of either the subject antecedent or object antecedent. This demonstrates a pronominal non-specialisation of *pro* within the linguistic-processual repertoire of the bilingual speakers considered in this investigation.

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⁴For a more in-depth discussion of the results, see MELO (2020).

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