

PROSODY IN THE INTERPRETATION OF AMBIGUITY

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Abstract: *The present paper aims to analyze the role of prosody in the resolution of global ambiguity in sentences of the type NP1 - Verb - NP2 - Adverb of place - Adverb of intensity (very) - Attribute, e.g., "The guitarist received the drummer at the room very drugged" (O guitarrista recebeu o baterista no quarto bastante drogado), in Brazilian Portuguese (BP). We consider the hypothesis that prosodic cues, such as stress and pause, assist in the process of disambiguation, both in isolation and in conjunction. The experimental paradigm of the present study used an off-line method of linguistic processing through a questionnaire with Likert scale questions. The results revealed a predominance of non-local apposition judgments in all analyzed conditions. However, the choice of assigning the adjective to the first nominal phrase increased, in a statistically significant way, in the conditions in which there was prosodic manipulation for that purpose, confirming our hypothesis.*

Keywords: prosody; prosodic stress; prosodic pause; syntactic ambiguity.

1 Introduction

Linguistic issues that involve ambiguity, especially how the linguistic processing of different types of ambiguity occurs, have been studied by researchers from different areas in order to better understand and/or explain this phenomenon that is inherent in the language. Based on the previous literature on prosody and its interface with the linguistic processing of ambiguities, we assumed that prosodic cues, such as stress and pause, assist in linguistic processing of disambiguation (Nespor and Vogel, 2007 [1986]; Fonseca, 2008; Traxler, 2012; Prieto, 2012).

Most of the researches carried out for BP, however, investigated the processing of ambiguous relative clauses using the reading paradigm and, for this reason, did not analyze the role of explicit prosodic cues in the auditory interpretation process of ambiguous sentences (Maia et al, 2007; Ribeiro, 2005; Fodor, 2005). The present study intends to minimize this gap using an offline processing methodology and ambiguous structures that have not been explored extensively in previous literature.

Considering the importance of prosody in the syntactic and semantic interpretation of sentences, this study aims to analyze the role of prosody in resolving ambiguity in BP (Traxler, 2012; Prieto, 2012). For that, we use sentences that present a global ambiguity in relation to the referent of attribute, as in the example “The healer led the rubber tapper at the jungle very hungry”¹ (O curandeiro conduziu o seringueiro na selva bastante faminto). In the example, there is an ambiguity that is not undone at the end of the utterance, regarding who was hungry, whether that is the first noun phrase (NP1 - o curandeiro “the healer”) or the second noun phrase (NP2 - o seringueiro “the rubber tapper”).

2 Background

Our theoretical support is based on the theory of Prosodic Phonology, proposed by Nespor and Vogel (2007 [1986]), which is a theory of interactions between the various components of grammar and phonology. According to the authors, in addition to delimiting the units of speech production, prosodic constituents also play a role in speech perception, since it is the result of the application of the various phonetic and phonological phenomena that allows listeners to identify the internal structure in the sounds sequence of speech they hear. In other words, the prosodic theory also contributes to a theory of perception (understanding) of language, since the components of the prosodic hierarchy also provide relevant structures for the first level of processing in speech perception.

It is important to point out that, during the processes of production and perception of language, in addition to prosody, there are structural factors, such as late closure, subjecthood and first-mention, which also play an important role in the interpretation of utterances.

The structural factor of proximity, evidenced in previous researches, refers to the late closure principle, predicted in the Garden-Path Theory (GPT) by Frazier (1979), that is, in case of ambiguity, the preference should be for the referent closest to the critical word (Frazier, 1979; Frazier and Rayner, 1982; Pickering and Traxler, 1998). So, in the example “The healer led the rubber tapper at the jungle very hungry” (O curandeiro conduziu o seringueiro na selva bastante faminto), the preferred referent would be the NP2 (o seringueiro, “the rubber tapper”) because it is closer to the attribute (critical word).

However, other studies have also provided evidences that another, semantic, factor has a strong influence on the resolution of referential expressions in ambiguous sentences, i.e., first-mention, indicating that the preference is for the first referent mentioned, regardless of its syntactic role in the sentence (Cuetos and Mitchell, 1988; Gernsbacher and Hargreaves, 1988; Cozijn et al, 2011; Kaiser, 2011). So, in the example mentioned, the preference would be to assign the adjective (faminto,

¹ In our opinion, this type of ambiguity is not possible in English because the attribute must be put on the left of the referent to which it is assigned. For this reason, the translation of the sentences in this paper is between double quotes, indicating a literal translation.

“hungry”) to the NP1 (o curandeiro, “the healer”), because it is the first mentioned referent in the sentence.

Yet another factor is subjecthood (Cozijn et al., 2011; Gernsbacher and Hargreaves, 1988). It indicates that the syntactic subject has a prominent role in the sentence, and as such is a very accessible referent for a subsequent pronoun in the discourse. Of course, subjecthood and first-mention very often coincide, so it is hard to tease apart their influences, but they do originate from different sources. Subjecthood follows from syntax, whereas first-mention follows from semantics. In some languages such as English and Dutch, the first protagonist mentioned in a sentence is also often the subject of that sentence, so a preference for the first mention often accompanies a preference for the subject. Although we know that in Brazilian Portuguese the subject of the clause is not always the first protagonist mentioned, in all sentences used in our experiment, the subject of the clause coincided with the first-mention position, and because of this, these two structural factors will be called first mention throughout this paper.

Fonseca (2008) developed a study that presents how prosodic cues assist in the disambiguation process in Brazilian Portuguese. In this research, the author analyzed how prosodic cues can direct listeners to a non-local apposition (adjective assigned to NP1) in processing ambiguous utterances like: NP1-Verb-NP2-Attribute (for example, “The mother found the daughter angry”, *A mãe encontrou a filha irritada*). The author found, from offline experiments, that the increase in fundamental frequency (f0) in the NP1 and in the adjective, jointly, was the most significant cue in order to direct listeners to assign the adjective to the NP1. However, in her research, the author did not carry out such detailed control over the acoustic manipulations and the number of syllables of the sentences, in order to control the size of the elements that make up the sentence, which makes it difficult to draw conclusions about the prosodic parameters. Therefore, in the present study, we made sure to control the materials, so that, when comparing the adjective assignment to noun phrases under the analyzed conditions: i) neutral, ii) stress, iii) pause, and iv) stress and pause, all other constant factors remained constant. Thus, finding differences between conditions shows the influence of stress and/or pause in the interpretation of this type of ambiguity.

Angelo (2016) also studied the processing of sentences with the same structure as used by Fonseca (2008) for Brazilian Portuguese, however without focusing on the processing of an ambiguity in the *parser*. So, although our sentences are similar to those used by Magalhães and Maia (2006), Fonseca (2008), and Angelo (2016), we made sure to control the acoustic data. The aim of our study was to verify the influence of prosody on the interpretation of referentially ambiguous sentences of the type: NP1 - Verb - NP2 - Adverb of place (PP) - Adverb of intensity (bastante, “very”) - Attribute (adjective).

3 Methods

The experimental paradigm of this study uses off-line measurements resulting from a questionnaire with auditory stimuli whose response options were presented on a Likert scale. In order to reach the proposed objectives, firstly, we created the ambiguous experimental sentences, as well as unambiguous sentences to verify the participants’ referent choices.

We created 48 ambiguous experimental sentences like “The drummer received the guitarist at the room very drugged” (*O baterista recebeu o guitarrista no quarto bastante drogado*) without repeating nouns, verbs, adverbs of place and adjectives, in order to prevent participants from finding anything strange during the experiments that would be carried out. And to control for the noun phrase positions which could interfere with the disambiguation process, we included 48 sentences with their positions reversed (NP2-NP1), like “The guitarist received the drummer at the room very drugged” (*O guitarrista recebeu o baterista no quarto bastante drogado*). Besides that, we created 22 unambiguous

sentences, like “The priest found the thief stealing at the sacristy” (O padre encontrou o marginal roubando na sacristia), in order to check whether participants performed the task the experiment well. All sentences were recorded by a professional male broadcaster in an appropriate acoustic environment and with accurate recording equipments.

The sentences appeared three times, randomly, so that the broadcaster could read as naturally and neutrally as possible, stopping between sentences to avoid a list effect. After that, we asked the broadcaster to read the experimental sentences with stress, such that the listener would be guided to interpret the adjective as qualifying the NP1 (non-local apposition), since the default interpretation would be for the NP2 (local apposition), according to the previous literature about similar sentences as discussed above (Magalhães and Maia, 2006; Fonseca, 2008).

In view of this, we defined the conditions as follows: i) neutral (N), that is, no prosodic cues that could disambiguate the sentence; ii) focus on the subject and the adverb of intensity (F), following the strategy used by the broadcaster when trying to disambiguate the utterances to the NP1, in accordance with the findings of Fernandes (2007) to focus on the subject, and of Fonseca (2008) who used focus on the adjective in similar utterances (NP1-Verb-NP2-Attribute); iii) pause (P), 200 ms of silent pause before the adverb of intensity (“very”, bastante), similar to Fonseca (2008) who used the pause before the adjective; iv) conditions (ii) and (iii) simultaneously (FP).

The recordings were then acoustically manipulated in Praat (Boersma and Weenink, 2017). All utterances were stylized in 2 semitones, including neutral ones, to avoid comparing natural stimuli with acoustically manipulated stimuli, following the criteria adopted in Wellmann et al. (2012). After stylization of the pitch contour, some manual adjustments at the pitch points were necessary in order to make the stylized recording as close as possible to the original.

The auditory stimuli were distributed over 8 lists for the questionnaire, such that the participants who were administered to one of these lists would listen to all sentences, however, in different conditions, (12 experimental sentences in each condition plus 22 verification utterances), following the experimental design shown in Table 1.

Table 1: Experimental design of the judgment test

NP1-NP2	List1	List2	List3	List4	NP2-NP1	List5	List6	List7	List8
E1-E12	N	FP	P	F	E49-E60	N	FP	P	F
E13-E24	F	N	FP	P	E61-E72	F	N	FP	P
E25-E36	P	F	N	FP	E73-E84	P	F	N	FP
E37-E48	FP	P	F	N	E85-E96	FP	P	F	N
V1-V22	N	N	N	N	V1-V22	N	N	N	N

For this perception test, we used Qualtrics, a research platform that allows making questionnaires available on the internet, including inserting texts, audios, or links from another platform, such as SoundCloud, which was used to store the audio files. The participants’ task was to listen to the auditory stimulus, as often as was necessary, and to choose, on a gradual scale (from 1, not probable, up to 5, highly probable) their judgment regarding whom the adjective referred to, for each of the two alternatives offered (NP1 and NP2). If they failed to give a judgment on one or both scales, an error message was presented. Hence, after listening to an utterance like “The fencer pointed the racquetball player on the podium very vibrant” (O esgrimista apontou o raquetista no pódio

bastante vibrante), the participants replied to the question: “Who was vibrant?” on two Likert scales, one for each referent (NP1 and NP2).

According to Schütze and Sprouse (2013) and Norman (2010), Likert scales are appropriate for perceptual judgment tests of this kind. They assert that data from tests which use Likert scale may be analyzed statistically using parametric tests, since the results provided by the Likert scale are treated as a gradation and not as categorical variables. For this reason, we used the Analysis of Variance statistical test (ANOVA) to compare the results between the conditions analyzed, followed by the Bonferroni multiple comparison statistical test. And, in order to compare the choices from participants for NP1 and NP2 in each condition, we have used the t-test of comparison between means, following orientations from Winter and Dodou (2010). The dependent variable analyzed has been the judgments average scores for the protagonists (NP1 and NP2), indicating the probability of these noun phrases to be referent of the adjective.

4 Results and discussions

We excluded the data of 34 out of 178 survey participants, either because they did not complete the questionnaire (20 cases) or for lack of attention (14 cases), resulting in the data of 144 respondents for analysis. The cases of lack of attention were recognized due to the excessive number of wrong replies to the questions with unambiguous verification utterances, that is, even though the correct reply was evident, the participant replied: i) with the same score on the scale for both protagonists; ii) with the same scores for all questions; or iii) with incorrect judgements of several of these verification utterances. Therefore, the judgments of these participants were not included in the final analysis.

The results of the judgments were exported from Qualtrics in XLSX format, which was later opened in SPSS (IBM Corp.) to proceed to statistical analysis. After performing an ANOVA test, we found that there was no statistically significant difference in the results presented in the 8 lists, $F(7,136)=0,63$, $p>0,05$, showing that there was a certain degree of consensus among all survey participants regarding the judgments of the utterances. Figure 1 shows, in general, the influence of each condition in the participants’ judgments.

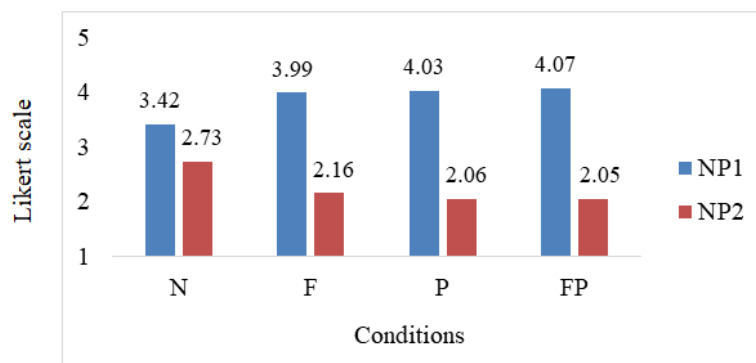


Figure 1: Graph representing the effects of conditions on judgments

Figure 1 illustrates the predominance of judgments by non-local apposition (assigning the adjective to NP1) compared to local apposition (assigning the adjective to NP2), in all conditions. This is probably due to the strong influence of the first-mention structural factor in the processing, even though it is a judgment test with results from offline measurements (after interpretation), and not from online measurements (during processing). However, it is also evident in our results that this predominance was higher in the conditions where there were prosodic cues (F, P, FP), which guided the listeners in their choices.

We found evidence for the influence of late closure (Garden-Path Theory) in the judgment test only in the analysis of the behavior of the judgments for the NP2 in isolation, since there was a preference for local apposition in the neutral condition compared to the manipulated conditions, as predicted by this theory of language processing.

Then, we carried out a more detailed analysis considering the difference between the judgments (NP1 - NP2), that exposed which utterances were judged as ambiguous by the participants, and also the possible effects were of the prosodic cues that were inserted in the auditory stimuli (F, P, FP). In addition, we performed a statistical comparison between the judgments for NP1 and NP2 in each condition, considering all utterances exposed to judgments.

When analyzing the difference between the judgments (NP1 - NP2), we noted that, in general, the listeners have considered the utterances as ambiguous in the neutral condition, based on the results presented in Table 2, since the mean difference judgments score was lower than 1.0, which indicated that participants doubted regarding the assignment of the attribute.

Table 2: Mean difference judgment scores (NP1 – NP2) in the conditions

Conditions	Mean	Standard error
N	0.69	0.090
F	1.83	0.088
P	1.98	0.080
FP	2.02	0.090

Under conditions where there were prosodic cues to lead the listeners to assigning the attribute to the NP1, the values of the mean: i) were close to 2.0, suggesting that the adjective refers unambiguously to the NP1 because of prosody, and ii) were positive, indicating that more judgments were made for the non-local apposition (NP1 > NP2), as predicted. The results also show that, in general, the combined prosodic cues proved to be more productive in eliciting a preference for non-local apposition than the cues in isolation.

The values in Table 3 indicate that, despite the fact that most of the choices were made for a non-local apposition (NP1) in all conditions, this number increased significantly when the stimuli presented were the acoustically manipulated utterances (F, P, FP). So, the prosodic cues significantly increased participants' preference for the NP1 when compared to the neutral condition (N), as evidenced in a Bonferroni test.

Table 3: Pairwise statistical comparison, judgments for NP1 - NP2 (Bonferroni test)

Conditions	Conditions	Mean NP1 - NP2	Standard error	<i>p</i> value
N	F	-1.160*	0.095	~0.000
	P	-1.310*	0.099	~0.000
	FP	-1.344*	0.105	~0.000
F	P	0.149	0.069	0.200
	FP	0.184*	0.067	0.039
P	FP	-0.035	0.066	~1.000

In addition, the results shown in Table 3 reveal that, among the manipulated conditions (in the fourth, fifth and sixth rows of Table 3), there is a statistically significant difference only when comparing the FP and F conditions (in the fifth row of Table 3), although the combined condition (FP) has shown to be the most productive cue for an interpretation by non-local apposition (Table 2).

The results showed that the means of the differences between NP1 and NP2 were lower than 1.0 for the stimuli presented in the neutral condition (N), and that in the other conditions (F, P, and FP), there was a significant increase in judgments for a non-local apposition. Based on the findings one might conclude that all utterances were ambiguous. However, we checked this conjecture by investigating: i) whether the difference between the means of the judgments for NP1 and NP2 was lower than 1.0 in an utterance, separately, in both orders (NP1-NP2 and NP2-NP1) and; ii) whether the influence of the noun phrase position influenced the preference for one or the other NP, calculating the difference scores. When the difference was lower than 1.0, it can be concluded that the NP position in the utterance did not interfere with the judgments given by the participants. So, when the utterance fulfilled these criteria, it was considered ambiguous.

As an example, Table 4 shows the differences between the means of the judgments for NP1 and NP2 in the utterances “The engineer grassed the dump truck driver at the mine very agitated” (O engenheiro dedurou o caçambeiro na mina bastante afoito, E1) and the reversed order version “The dump truck driver grassed the engineer at the mine very agitated” (O caçambeiro dedurou o engenheiro na mina bastante afoito, E49), as well as the difference score.

Table 4: Example of an utterance that is considered to be ambiguous

Mean NP1 – Mean NP2		Influence of the NP position
E1	E49	Difference
0,63	0,79	0,16

Verifying the influence of noun phrases in the judgments allowed us to identify if there were any semantic problems that, perhaps, we did not notice while drafting the sentences, as we can note in the examples in Table 5.

Table 5: Examples of utterances in which the NP position influenced judgments

Mean NP1 – Mean NP2		Influence of the NP position
E7	E55	Dif.
-0,31	1,29	1,60
E11	E59	Dif.
-0,31	1,79	2,10
E22	E70	Dif.
-0,73	1,07	1,80

In the sentences E7 “The guard captured the cangaceiro at the square very angry” (O vigilante capturou o cangaceiro na praça bastante irado), E11 “The linesman repressed the forward at the field very reluctant” (O bandeirinha reprimiu o atacante no campo bastante arisco) and E22 “The canoeist won the triathlete at the court very sweaty” (O canoísta superou o triatleta na quadra bastante suado), the negative values resulting from the difference between the means of the judgments for NP1 and NP2 indicated that most of the judgments assigned the attribute to the NP2 (“the cangaceiro”, “the forward” and “the triathlete”), while in their corresponding condition with an inverted order of nominal phrases, the positive values revealed that the participants preferred that the attribute be assigned to NP1 (“the cangaceiro”, “the forward”, and “the triathlete”), that is, the same protagonists. Perhaps, this pattern is due to some strong semantic association that the participants may have made between these nouns and the corresponding adjectives in BP, “cangaceiro” and “angry”, “forward” and “reluctant”, “triathlete” and “sweaty”, as compared to the other nouns that filled the position of the other NP.

The offline test with the utterances also made it possible to check for possible biases caused by the verbs, which in some way may have influenced the referential choices so that the utterance was not judged as ambiguous by the participants. For example, in the sentences “the gunman held the police chief at the small farm very brave” (o pistoleiro dominou o delegado na roça bastante valente), “the mountaineer confronted the messenger at the track very nervous” (o alpinista afrontou o mensageiro na pista bastante retado), and “the terrorist faced the marine at the tank very possessed” (o terrorista enfrentou o fuzileiro no tanque bastante possesso), the participants judged that the first noun phrases (agents of the verbal action) were the appropriate referents to the attributes, regardless of the noun that represented this NP1, that is, even when the noun phrase positions were inverted, most of the participants opted for the protagonist that filled the position of subject (NP1).

This was probably due to the fact that, in these cases, there is a strong relationship between those which practice the actions of “holding”, “confronting”, “facing” and the attributes (“brave”, “nervous” and “possessed”), in BP. The same also seems to have happened for the NP2 (patient of the verbal action), as for example in “the jeweler found the gold digger at the bank very distrustful”, which presented a bias for the second nominal phrase (regardless of which of the protagonists filled this position).

In view of the results, we already know that prosodic cues led people to choose the NP1 (non-local apposition) more often than the NP2, as we had predicted. In other words, we have shown that the manipulation of stress and pause in fact increased the choice for NP1 and decreased the choice for NP2, and that the increases and decreases in the judgments differed between the neutral condition and each of the other three conditions (F, P, FP) significantly. However, the results do not report whether the judgments for NP1 and NP2 differed significantly. For this, we decided to perform t-tests and statistically compare the judgments for NP1 and NP2 in each condition.

Results from the t-tests showed that there was a statistically significant difference between the judgments for NP1 and NP2 in all conditions, as shown in Table 6.

Table 6: Results from t-tests comparing judgments for NP1 and NP2 in all conditions

Conditions	Mean NP1	Mean NP2	t-test
N	3,42	2,73	$t(1727) = 11,989, p < 0,05$
F	3,99	2,16	$t(1727) = 35,124, p < 0,05$
P	4,03	2,06	$t(1727) = 39,667, p < 0,05$
FP	4,07	2,05	$t(1727) = 41,037, p < 0,05$

The results in Table 6 show that the judgments for NP1 were significantly higher than for NP2, even in the neutral condition. However, such a difference may not exactly mean that there was a preference for non-local apposition, but rather problems in stimuli, resulting from the influence of the noun phrase position or from some bias caused by the verb, as we have explained above. It is worth remembering that the statistical tests were carried out with all utterances that we submitted to judgment by participants in order to check if they would be considered ambiguous.

Out of 96 utterances, we identified 44 which fulfilled the defined criteria. From these, 22 were selected according to the order of noun phrases for which the difference between the means was closest to zero, that is, the order in which the participants showed more doubt, these utterances were more ambiguous. This procedure was important to making sure that the materials are valid.

So, by discarding the utterances in which there were semantic problems that led the listeners to not consider them as ambiguous, we verified that the remaining utterances were really judged as ambiguous (in the neutral condition), from the t-test. The result [$t(342) = 1,598, p > 0,05$] showed that there was no significant difference between the judgments for NP1 and NP2 in the neutral condition and, therefore, such stimuli were judged as ambiguous, since this result demonstrates the indecision of the participants to choose one or the other noun phrase when interpreting the analyzed ambiguity. In the other conditions (manipulated), the judgments for these stimuli showed significant differences between NP1 and NP2, which reveals an important role of prosody for the preference of participants for NP1.

Our findings corroborate those of Fonseca (2008), with similar sentences, ratifying the role of prosody in the syntactic and semantic interpretation of ambiguous utterances. That is, we have shown that the manipulation of stress and pause in fact increased the choice for the NP1 and decreased the choice for the NP2, and that the increases and decreases in the judgments significantly differed between the neutral condition and the other three conditions (F, P, FP). Furthermore, the combined prosodic cues (FP) appear to be more consistent than in isolation (F and P) and, in this case, when analyzed separately, the pause was more relevant than the stress in interpreting this type of ambiguity, as shown in Table 6 ($FP > P > F$).

On the other hand, with regard to which prosodic cue was most salient to assist in the ambiguity interpretation, our findings diverge somewhat from those of Fonseca (2008), who found as the most relevant prosodic cue for the processing of utterance, with non-local apposition of the attribute, the increase of the fundamental frequency in the subject (NP1) and in the attribute. Perhaps this is explained by the prosodic phrasing (Nespor and Vogel, 2007 [1986]). That is, an attribute that is not combined with a determiner or an intensifier, as in “The father hugged the son sweaty” (O pai abraçou o filho suado), does not have enough phonetic material to generate a phonological phrase alone, or to generate an intonational phrase, and a pause may sound strange to the listeners, because there is little phonetic material to generate a pause (Fonseca, 2010). This is different in the present study, since the structure we have used does have the potential of prosodic phrasing because there is an intensifier for the attribute. Thus, the two elements together, “very drugged” (bastante drogado), have the potential to form a phonological phrase and even an intonational phrase, in order to provide an ideal boundary to pause.

5 Conclusions

The offline judgment test results reported here revealed a predominance of judgments for non-local apposition, in all conditions analyzed, which seems to be evidence of the strong influence of the structural factor of first mention in the interpretation of the referential ambiguity studied here. However, as we highlighted, this difference may also have been due to some preferred interpretation

based on semantic association, influence of the noun phrase position, or even some bias caused by the verb, as we verified in some utterances, and not necessarily because the participants interpreted the ambiguity by means of choosing for the NP1 based on first mention.

Our findings are in line with previous studies (Finger and Zimmer, 2005; Fodor, 2005) that also found, based on offline measures, that the late closure principle (GPT) does not seem to apply to Brazilian Portuguese, as in relative clauses. The Construal model (Frazier and Clifton Jr, 1996) explains that the principles of the Garden-Path Theory only apply in the argumental system in which argument positions are at stake, concatenating a nucleus to its complement (Maia, 2009), and not in cases where the argumental system is filled with adjuncts, as is the case with the materials tested in the present study, in which the model proposes that there is no rapid syntactic apposition, but rather an association. Magalhães and Maia (2006) and Fonseca (2008) proved, in their offline experiments, the strength of the late closure principle in choosing a referent in the disambiguation of short sentences like NP1-Verb-NP2-Attribute, in BP.

However, the results presented in our offline experiment demonstrated that the choice of assigning the adjective to the first noun phrase (NP1) increased, in a statistically significant way, in the conditions in which there were prosodic cues (F, P, FP) to lead the listener to a non-local apposition, contrary to what late closure dictates. The FP condition, a strategy of focusing on the subject and the adverb “very” (bastante) combined with the pause before the adverb, proved to be the most productive cue to lead an interpretation for non-local apposition, followed by the P condition (pause before adverb), and the least productive seems to be the F condition (focusing on the subject and the adverb).

Based on these results, our hypothesis seems to be confirmed, at least with regard to offline judgments. However, it is worth noting that preferences during processing can only be verified in an online experiment with, for instance, eye tracking. It then would be possible i) to test our hypothesis in real time, with regard to the online processing of this type of utterance; ii) to control the number of times participants hear the utterances; and iii) to determine at what point during the processing of the sentence disambiguation occurs, in anticipation of the adverb or just at the end of the sentence. We are planning an online experiment with eye tracking in our lab, using a subset of the utterances used in this study, in order to investigate at what moment during processing cues like stress and pause influence referent selection.

In view of our findings, we believe that not only prosodic and syntactic factors, but also lexical, morphological, semantic, pragmatic, and world-knowledge factors interact during language processing. However, perhaps our results are not enough to defend interactive theories in sentence processing, since the findings could also be explained within the Construal model (Frazier and Clifton Jr, 1996). According to the Construal model, which is not an interactive theory, there is no automatic (direct) apposition but an association when there are argumental system constructions with adjuncts, as is the case with our sentences and there may be rapid access to information that is not strictly syntactic, and that it is possible that the comprehension of adjuncts may be affected by non-syntactic factors.

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