

**RESEARCH**

# Bilingualism effects on L1 representation and processing of argument structure

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This study aims to investigate L2-to-L1 cross-linguistic influence on bilinguals' representation and processing with three psycholinguistics tasks. The interest in this type of effect lies in its possible association with cognitive control development. Our study focuses on possible influences of the non-dominant language on the dominant language: we analyzed whether highly proficient Brazilian Portuguese-English late bilinguals immersed in the L1 context behaved differently from Brazilian Portuguese monolinguals in regards to sentences in the L1 that simulated an L2-specific construction (true resultative). We conducted a maze task in order to analyze the speakers' linguistic processing and a speeded acceptability judgment task in order to analyze their linguistic representation. We also observed participants' behavior towards a construction available in both languages (depictive). The overall results indicate that bilinguals processed both constructions faster than monolinguals, but the difference between the groups was significantly larger towards the true resultative construction. However, there was no significant difference between the groups in relation to how they perceived the acceptability of both constructions. We interpret the results as evidence that the L2 influence on the L1 occurs during real time sentence processing, but it does not result in changes in the overall L1 representation.

**Keywords:** L2 influence on L1; True resultative; Bilingualism; Language processing; Language representation

## 1. Introduction

Second language research is a discipline in which debates and controversies abound. Nevertheless, it is probably consensual for this research community that the linguistic representations and the language processing routines of the languages spoken by bilinguals and multilinguals interact. As argued by Grosjean (2008), viewing contact of bilinguals' languages as anomalous or accidental is a standpoint derived from the perspective that language knowledge resides in encapsulated memory repositories in the bilingual mind. However, this perspective has not survived empirical testing, at least in some domains of language such as lexical knowledge, for which complex cross-linguistic interactions have been demonstrated to be actually the norm (see Heredia, 2008, for a review).

In fact, present-day second-language research strives to propose and test models that seek to account for cross-linguistic effects on bilingual language representation

and processing. Such models include perspectives that attempt to accommodate second-language acquisition and bilingualism within overarching architectures of linguistic competence (Sharwood, Smith & Truscott, 2014; Amaral & Roeper, 2014). They also include models that challenge assumptions of essentially distinct mechanisms for first- and second-language acquisition, emphasizing that usage-driven language entrenchment and cross-linguistic competition are at the core of attainment variability in successive language acquisition (MacWhinney, 2012; Li, 2015). What these proposals have in common is their incompatibility with any view of a second or subsequent language as isolated from the overall linguistic cognition and memory repositories of individuals.

In recent years there has been an intense debate about possible cognitive effects of bilingualism across the lifespan, with studies that report that bilinguals tend to display superior performance in both linguistic and non-linguistic tasks involving cognitive control (Bialystok et al., 2009; Adesope et al., 2010; among others). Although it is not uncontroversial that such effects are indeed real (de Bruin et al., 2015; Paap et al., 2015; Valian, 2015), proponents of the bilingual advantage in cognitive control usually interpret it as deriving from the notion that bilingualism systematically imposes especially strict demands on executive functions as bilinguals exercise the

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selection of a given wanted language and the inhibition of the unwanted language to attain communicative goals. This interpretation clearly stems from the assumption that at least some aspects of a multilingual speaker's two or more languages are simultaneously activated over the course of bilingual language processing.

Much of the literature on language co-activation in bilingual language processing examines populations of early and simultaneous bilinguals. Notwithstanding, a few recent studies have reported findings that suggest that even late L2 acquirers may demonstrate the type of cognitive effects of bilingualism reported in the literature (Bak et al., 2014, Vega-Mendoza et al., 2015). If the bilingual advantage is a result of the enhanced demands on executive functions caused by constant exercise of language activation and inhibition, what the studies by Bak et al. (2014) and Vega-Mendoza et al. (2015) are ultimately suggesting is that bilinguals whose L2 learning took place after early childhood are also pressed for selection of linguistic representations as they process language.

A factor that may play a role in how languages and language processing routines interact is the degree of a bilingual's immersion in an L2, and therefore the amount of L2 usage he or she has experienced. The role of immersion in the L2 is highlighted in a study by Dussias and Sagarra (2007), in which a study investigating possible changes in relative clause attachment preferences among Spanish-English bilinguals is reported. The authors compared a group of bilinguals who had been immersed in the L2 environment for some time with bilinguals with comparable proficiency in the L2, but who remained immersed in the L1 environment. The results reported by Dussias and Sagarra (2007) suggest that convergence with the L2 pattern of relative clause attachment preference when processing L1 sentences – which is evidence for cross-linguistic interactions in the bilingual's language-processing architecture – were only found among bilinguals who had been immersed in the L2 environment.

Oliveira (2016) discusses several studies on cross-linguistic influence (L1-to-L2 and L2-to-L1) both at the lexical and at the syntactic level. The author shows that only a few of them report data of L2 influence on the L1 in bilinguals whose L1 is dominant. Furthermore, most of these studies use only offline methods and their findings

seem to be inconclusive. Cook et al. (2003) and Balcom (2003), for example, show results that indicate changes in L1 representation, but they disagree in respect to how predictable by L2 those changes are.

Our study aims to provide evidence of possible L2 influence on the L1, which is still not robust in the literature: we have data from both online and offline tasks, our bilingual participants were immersed in the L1 environment and they were L1-dominant. We investigate, specifically, how bilinguals of Brazilian Portuguese (BP) and English respond to sentences whose surface structure would link to an argument realization construction not present in their L1, but productive in their L2: the English true resultative construction (henceforth resultative construction). This construction is especially interesting because its overt configuration is identical to other constructions (such as the depictive construction) that are licensed in both English and BP. However, the overt configuration in question never has a resultative meaning in BP.

In the next section we discuss the English resultative construction and contrast it with constraints on the expression of resultativeness in BP. We then describe a set of three experiments conducted to explore whether there would be cross-linguistic effects on the representation and processing of such construction in BP-English bilinguals who are late L2 acquirers and who are immersed in the L1 environment. We conclude with considerations about the implications of our findings.

## 2. The Resultative and the Depictive Construction

Our aim is to analyze how BP-English bilinguals represent and process the resultative construction in comparison to monolinguals and in comparison to how they process the depictive construction.<sup>1</sup> Both constructions have a similar syntactic structure (NP-VP-NP-AP), but their APs are mapped onto different meanings. Furthermore, the two constructions vary in relation to their availability and licensing in BP. The depictive construction, on the one hand, is licensed in both English (1) and BP (2). The resultative construction, on the other hand, is licensed in English (3), but not in BP (4); language in which the resultative syntactic structure tends to be mapped onto a depictive reading (5).

- (1) He ate the salmon raw.
- (2) *Ele comeu o salmão cru.*  
He eat.PAST DET salmon raw  
"He ate the salmon raw."
- (3) He wiped the table clean.
- (4) *\*Ele esfregou a mesa limpa.* (resultative reading)  
He wipe.PAST DET table clean  
"He wiped the table clean."
- (5) *Ele esfregou a mesa limpa.* (depictive reading)  
He wipe.PAST DET table clean  
"He wiped the clean table."

The depictive construction has the same features in both BP and English. As pointed out by Pykkänen and McElree (2006), this construction has no causal relation. Thus, in (1) and in (2) the state of the salmon *raw* was not caused by the agent *he*. The AP in the depictive construction only describes a property that one of the entities involved had during the action. The depictive construction is also considered assertive since it expresses certainty about state of the NP described by the AP.

The resultative construction found in the English language has a peculiar set of characteristics (Goldberg & Jackendoff, 2004; Oliveira, 2016). This construction is formed by an atelic verb. However, the sentence has telicity due to the presence of an AP that indicates the result/limit of the verbal action. In (3), for example, the verb *clean* is the limit and result of the action *wipe*. This construction, as opposed to the depictive construction, has a causal relation since the subject NP is the agent of the changing undergone by the patient NP. Also, this construction is assertive since it expresses certainty concerning the property of the object NP.

The resultative construction seems to be very peculiar to the English language. Kratzer (2005) argues that Romance languages, for example, do not license this construction in their repertoire due to the impossibility of having a secondary predicate in the position it occurs in the resultative construction. Only bare adjectives can incorporate causativity, according to the author, and Romance languages do not have bare adjectives as English does. A bare adjective is formed only by its root and adjectives in Romance languages are inflected. Notice that most adjectives that form resultative sentences in English are indeed bare (e.g. flat, clean, dry, straight, open, empty, full, smooth and shut). Therefore, this proposal suggests that the unproductivity of the resultative construction in Romance language is related to morphological restrictions in the resultative predicate. Recent studies (Oliveira, 2013; 2016) provide theoretical and empirical evidence that corroborates the argument that BP does not license the resultative construction.

The next section describes the experiments that composed this study about the manner in which BP-English bilinguals and BP monolinguals represent and process the resultative construction in L1 in comparison to the depictive construction. Previous studies provided empirical evidence that BP-English bilinguals with high L2 proficiency, but not those with low L2 proficiency, acquire the resultative construction in English (Oliveira, 2013). Therefore, we only tested bilinguals with high levels of proficiency.

Overall, we predicted that the bilingual group would process the resultative predicate in BP faster than the monolingual group, but they would not exhibit higher acceptability towards the resultative construction in BP as compared to the monolingual group. We expected to observe these results, as we discuss in the next sections, due to a possible L2-to-L1 influence effect that is limited to bilinguals' processing routines. In order to measure the processing cost of the resultative predicate we will utilize a maze task. The acceptability of the resultative construction will be measured with two speeded

acceptability judgment tasks. The maze-task and the two speeded acceptability judgment tasks are presented in detail in the following section.

### 3. The Experiments

#### 3.1. Experiment one

We designed experiment one with the aim of examining whether bilinguals would have extended tolerance to the expression of a construction in their L1 that does not belong to that language's repertoire. The assumption we had in mind is that this heightened tolerance to an intrusive linguistic structure might make it come to integrate the bilinguals' L1 language representations as a consequence of repeated and recurrent instances of processing.

In order to observe this possible L2 influence on the L1, we contrasted the RTs exhibited by BP-English bilinguals and BP monolinguals for the APs in both the resultative and the depictive constructions in BP. Differences in RTs are commonly used as a measure of processing cost: the harder a structure is to be processed, the longer the participants' RTs will be. Thus, our prediction was that bilinguals would exhibit shorter RTs for the APs in the resultative construction – but not for the APs in the depictive construction – as compared to monolinguals, if it is indeed the case that L2 influences L1 processing. We also predicted that the two groups of speakers would exhibit shorter RTs for the depictive construction as compared to the resultative construction since the latter is not part of BP grammar and, in turn, is less frequent than the former in both bilinguals' and monolinguals' grammars. However, we expect this difference to be smaller among bilinguals due to the aforementioned L2 effect.

Since the task focused on the processing of a specific word, we selected a paradigm that forces an incremental processing and is capable of revealing processing costs for specific parts of a sentence without spillover effects: the maze task (Forster et al., 2009; Witzel et al., 2012). The independent variables for this experiment are the constructions (resultative and depictive) and the linguistic profile (monolinguals and bilinguals), whereas the dependent variable is the RTs for the APs in the depictive and in the resultative constructions.

#### 3.1.1 Method

##### 3.1.1.1 Participants

In total, there were 53 participants, 27 bilinguals and 26 monolinguals. They were all residents of the Belo Horizonte metropolitan area, where BP is the predominant language for social interaction. In this region, bilinguals are typically late learners whose first contact with English occurs in primary schools (6–8 years old), but such contact is usually limited to learning basic words. The bilingual participants were mostly undergraduate or graduate students at the Federal University of Minas Gerais (UFMG) and their mean age was 28 (SD = 5) ranging from 22 to 34. The monolingual participants had a similar profile: they were mostly undergraduate or graduate students at UFMG and their mean age was 27 (SD = 4) ranging from 20 to 32.

In order to measure the bilinguals' proficiency, we utilized the Vocabulary Levels Test (Nation, 1990). We have selected this test because it has been validated, and it has proved to be very efficient in separating bilinguals with high L2 proficiency from those with low L2 proficiency (Souza & Silva, 2015). Also, this test was used in previous studies that demonstrated that bilinguals with high L2 proficiency, as opposed to those with low L2 proficiency, acquire the resultative construction (Oliveira, 2013; Souza & Oliveira, 2014). Furthermore, the test is practical and it can be taken in few minutes.

(6) A águia pegou o peixe e o comeu vivo.  
 DET eagle catch.PST DET fish and it.ACC ate.PST alive  
 "The eagle caught the fish and ate it alive."

(7) A motorista molhou o carro e o esfregou limpo.  
 DET driver water.PST DET car and it.ACC wipe.PST clean  
 "The driver watered the car and wiped it clean."

The sentences were pseudo-randomized so that they were always exhibited in a different order. Furthermore, the items were organized in a manner that the resultative and depictive sentences were unlikely to appear in sequence. The DMDX software was utilized to present the sentences, manage their randomization and register the RTs. The participants used the same portable computer to perform the task.

### 3.1.1.3. Procedures

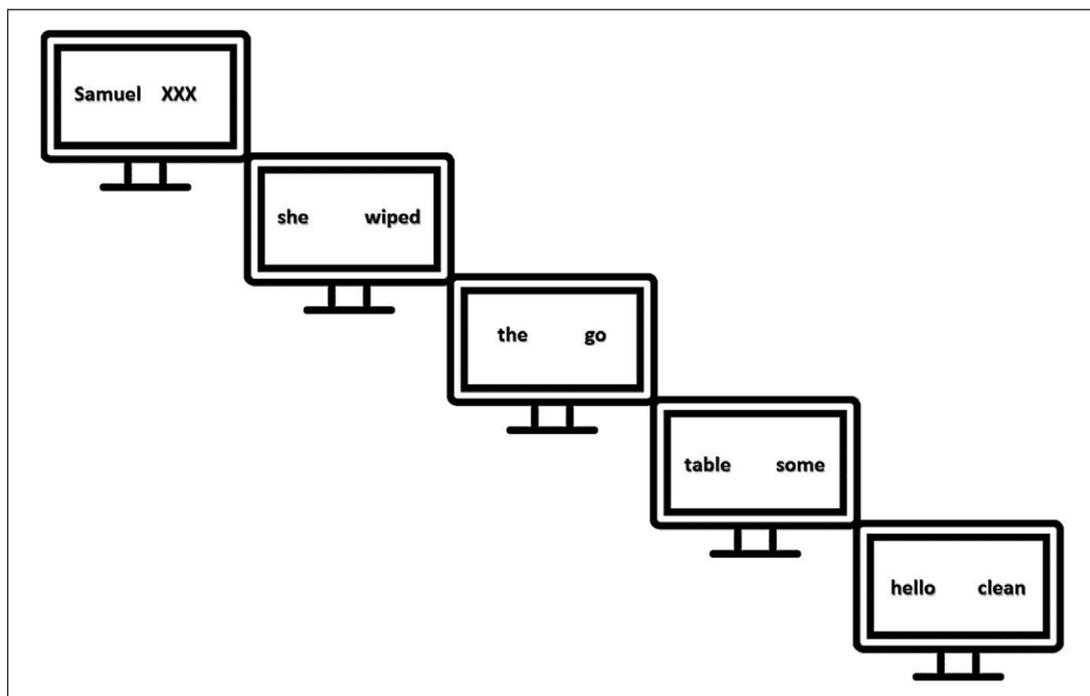
Before starting the task, the participants performed a training session. Participants were informed that in the maze task they should form sentences word by word. Participants were given the first word of the sentence and

### 3.1.1.2. Materials

All the 58 items in maze task were in BP. The task had a training session with ten sentences and an experimental corpus formed by 48 sentences. Eight sentences were instances of the depictive construction, similar to (6), and eight sentences simulated the resultative construction, as in (7). The structure utilized in these sentences, previously used by Oliveira (2013) and validated by Oliveira & Machado Rosa (in press), aimed to mitigate any possibility of ambiguous reading. The 32 distractor items were all grammatical sentences unrelated to the target structure.

after that, they moved forward selecting, as quickly and accurately as possible, the next word out of two options – one grammatical and one ungrammatical – until the end of the sentence, as illustrated in **Figure 1**. To make their choice, the participants had to use the shift keys, which were highlighted with colored stickers. The shift key on the left was used to choose the word on the left, and the shift key on the right for the word on the right. After the instructions, the participants were introduced to some examples and to a training session.

The presentation was continuous and randomized. Each pair of words remained visible for four seconds, which was the time ceiling for the participants to make their decision. When they made their choice, the next pair was presented



**Figure 1:** A sample maze task sentence, frame by frame (Oliveira, 2016).

automatically, and if they violated the time ceiling they were automatically taken to the next sentence. In order to diminish possible fatigue effects, participants could take a break halfway through the task. The experiment was totally conducted in BP so that the participants were as close as possible to a monolingual mode (Grosjean, 2013).

### 3.1.2. Results

Our hypothesis for experiment one was that highly proficient BP-English bilinguals would show shorter RTs for the APs in the resultative construction as compared to BP monolinguals due to a possible L2 influence on the L1 processing routine. Also, we hypothesized that such difference would not exist in relation to the depictive construction since this structure is available in both languages. Moreover, we predicted that the two groups would process the AP in the depictive sentence faster than they processed the AP in the resultative construction due to a frequency effect. The results from the maze task are summarized in **Figure 2**.

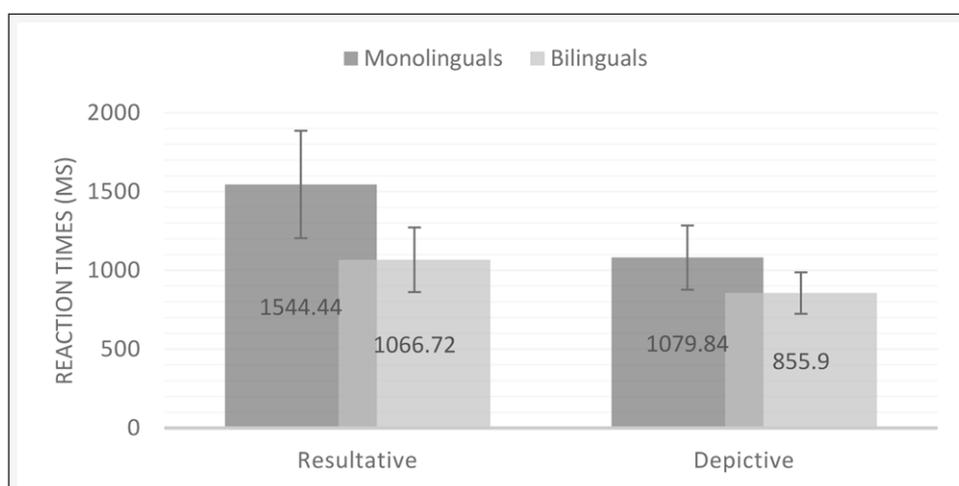
The Shapiro-Wilk test attested the normality of the distributions. In order to compare bilinguals' and monolinguals' RTs for the APs in the resultative and depictive construction, Student's t-tests were conducted. The Pairwise t-test indicated that there was a significant difference between the monolinguals' scores for the resultative and for the depictive constructions ( $t_1 = -7.552$  ( $df = 24$ ),  $p < 0.001$ ;  $t_2 = -8.321$  ( $df = 7$ ),  $p < 0.001$ ). There was also a significant difference between the bilinguals' scores for the resultative and for the depictive constructions ( $t_1 = -8.478$  ( $df = 23$ ),  $p < 0.001$ ;  $t_2 = -3.230$  ( $df = 7$ ),  $p < .01$ ). The independent-samples t-test indicated that monolinguals' and bilinguals' scores for the resultative construction yielded a significant difference ( $t_1 = -5.802$  ( $df = 47$ ),  $p < 0.001$ ;  $t_2 = -6.393$  ( $df = 14$ ),  $p < 0.001$ ). Monolinguals' and bilinguals' scores for the depictive construction also yielded a significant difference ( $t_1 = -4.513$  ( $df = 47$ ),  $p < 0.001$ ;  $t_2 = -4.472$  ( $df = 14$ ),  $p < 0.001$ ). Therefore, our results suggest that the AP in the depictive construction was processed faster than the one in the resultative construction by both groups, and that bilinguals processed both APs faster than

monolinguals did. Our hypothesis predicted that only the resultative construction would be processed faster. In order to further scrutinize these results, we analyzed if the differences between bilinguals and monolinguals were similar in regards to both constructions.

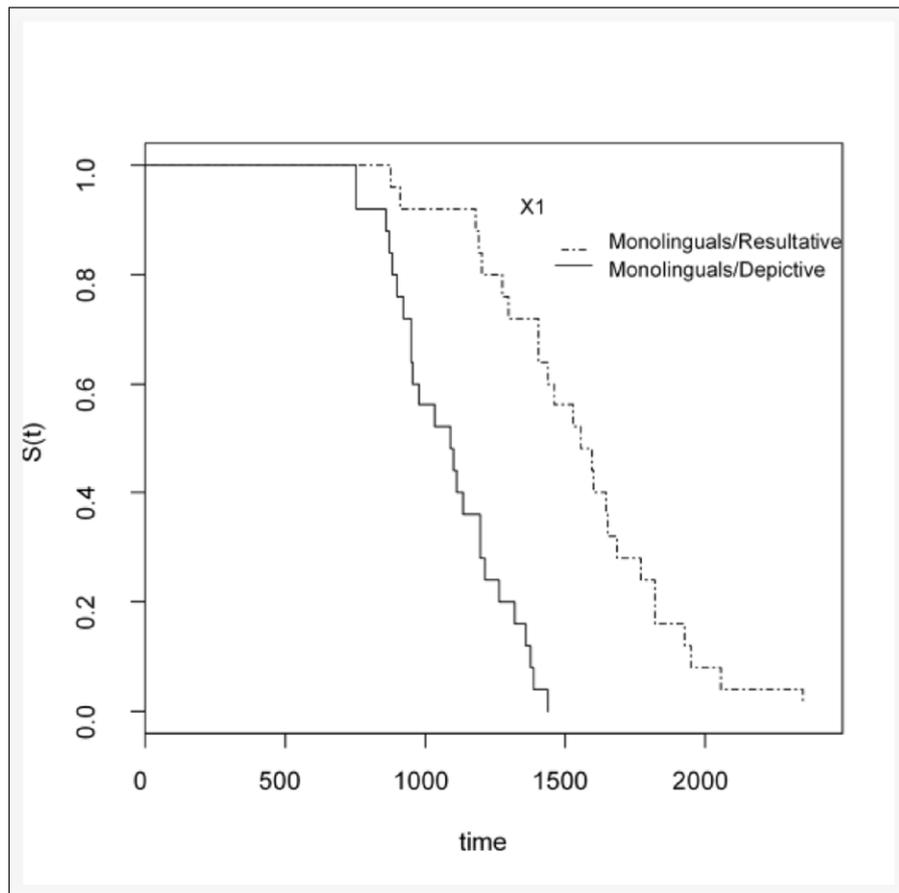
In order to reach this aim, we estimated the median RTs of each group in the aforementioned experiment with Survival Analysis techniques. First, the curves of survival were generated for each covariate with the non-parametric method of Kaplan-Meier (1958). Two curves were generated within each covariate and we used the log-rank test to compare if there were differences between the estimated curves. After, we set a parametric model to the data. The best model was selected using graphic techniques as well as the likelihood-ratio test (LRT) based on the generalized gamma distribution. Cox-Snell residues were analyzed in each case to check the quality of the adjustments of the selected model. For all tests, the significance level established was 0.05.

The results illustrated in **Figure 3** shows that the median time for monolinguals to process the APs in the resultative construction was 1.42 times longer than the median time they took to process the APs in the depictive construction. The results in **Figure 4** show that the median time for bilinguals to process the APs in the resultative construction was 1.23 times longer than the median time they took to process the APs in the depictive construction. Therefore, the processing difference between the resultative and the depictive construction was larger in the monolingual group, as we had predicted, since bilinguals could have their RTs reduced due to a possible L2 influence. We also compared the differences between bilinguals and monolinguals in relation to each construction.

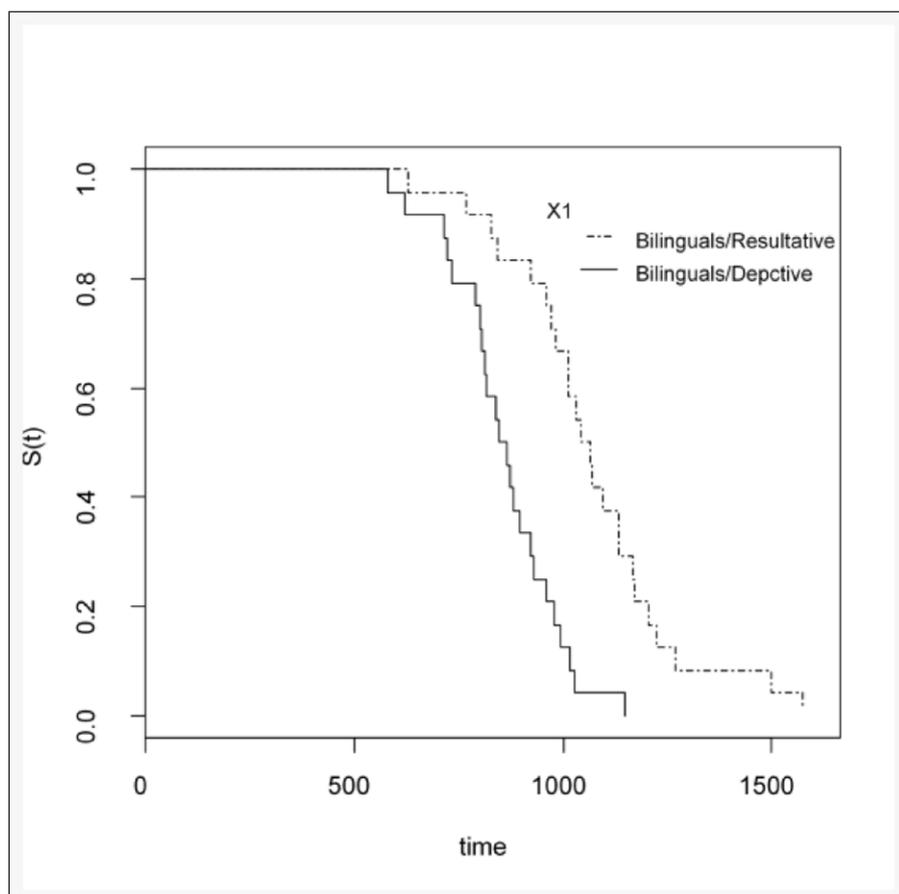
The results exhibited in **Figure 5** indicate that the median time for the monolingual group to process the APs in the depictive construction was 1.25 longer than the median time the bilingual group took to process the same APs. The results in **Figure 6** indicate that the median time for the monolingual group to process the APs in the resultative construction was 1.44 longer than the median time the bilingual group took to process these APs. Thus,



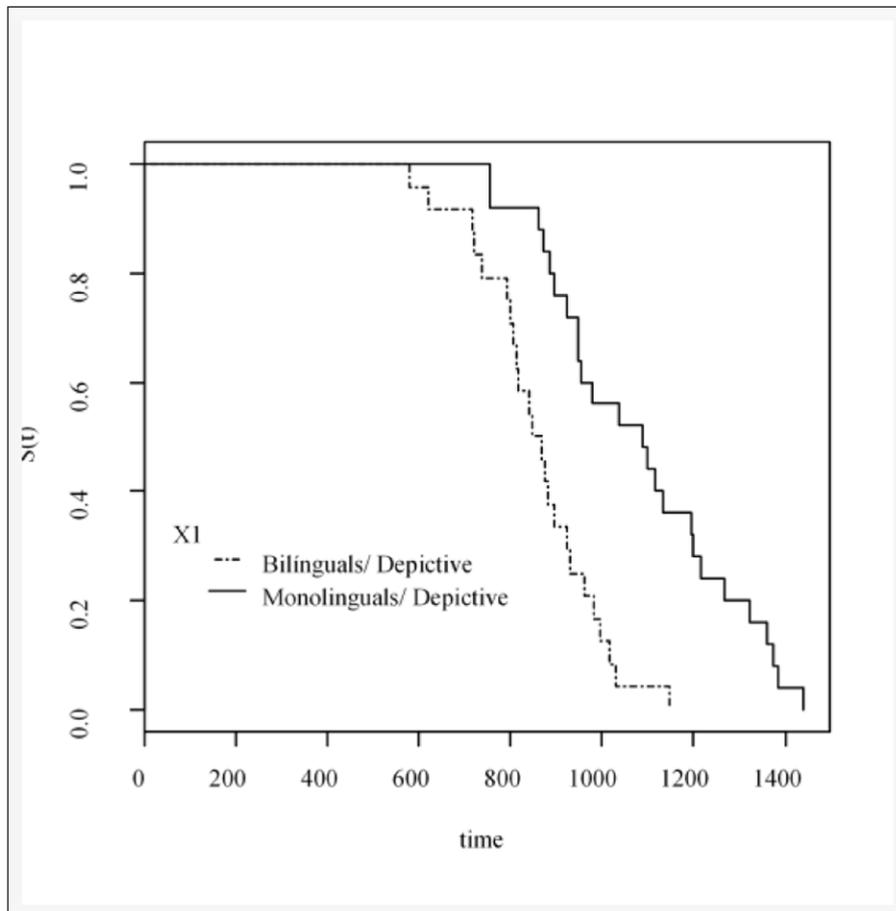
**Figure 2:** Monolinguals' and bilinguals' mean RTs for the AP in the resultative and in the depictive constructions.



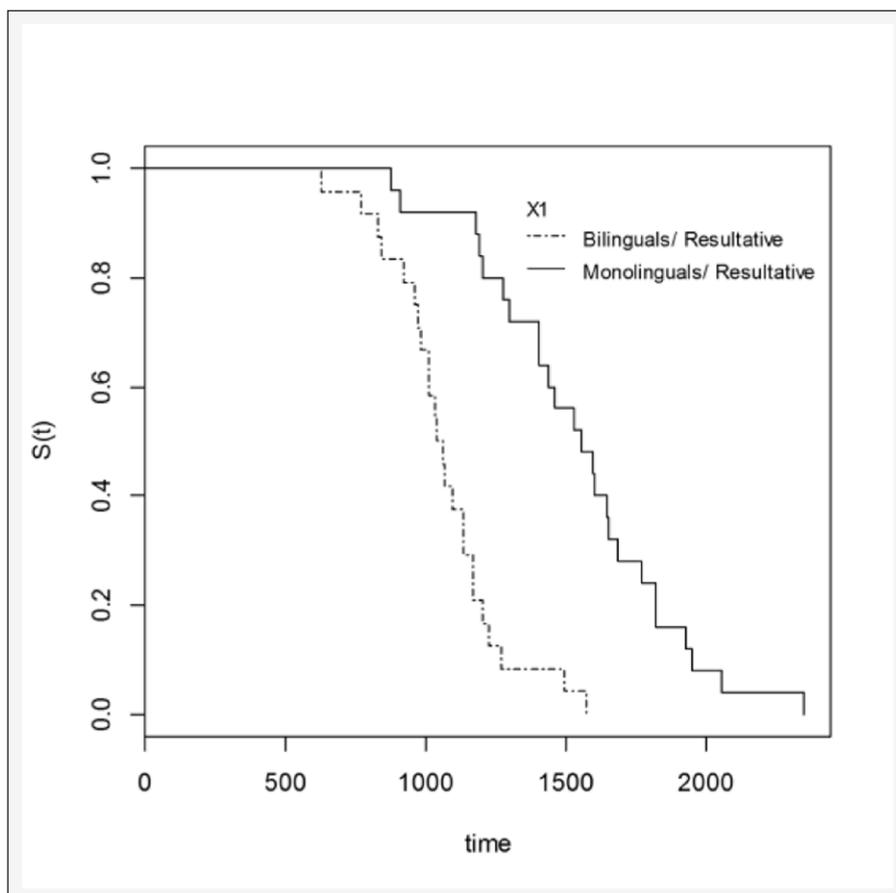
**Figure 3:** Monolinguals' survival curves estimated by the Kaplan-Meier method for the covariant X1.



**Figure 4:** Bilinguals' survival curves estimated by the Kaplan-Meier method for the covariant X1.



**Figure 5:** Depictive's survival curves estimated by the Kaplan-Meier method for the covariant X1.



**Figure 6:** Resultative's survival curves estimated by the Kaplan-Meier method for the covariant X1.

the processing cost difference between monolinguals and bilinguals is larger for the resultative construction, as we expected because of the possible L2 influence on bilinguals' RTs.

### 3.1.3. Discussion

At odds with our prediction, bilinguals processed the depictive construction faster than monolinguals. It is possible that these results reflect a kind of bilingual advantage that results in a general tendency of bilinguals being faster than monolinguals in the maze task or the fact that the use of two languages made bilinguals use these constructions more often than monolinguals. Considering this, we expected that the difference between bilinguals and monolinguals in RTs for the resultative construction would be significantly larger than their difference in RTs for the depictive construction. In other words, when processing the AP in the resultative construction, the two groups would present the same difference observed in relation to the AP in the depictive construction plus an L2 influence effect by the bilingual group, which would increase the groups' difference.

Our results corroborated this prediction. On the one hand, as illustrated in **Figure 2**, the resultative construction imposed a high processing cost to the monolingual participants, which was expected due the fact that this construction is not licensed in BP. On the other hand, as demonstrated with the Survival Analysis technique, this construction did not impose such high processing cost to the bilingual participants, possibly due to an L2 facilitation effect on the L1.

The resultative construction per se is not part of BP grammar, but its surface form overlaps with the depictive construction, which is available in the L1 grammar of our participants. However, because the experimental manipulation we implemented coerced the target sentences into a resultative reading, they certainly sounded odd to participants who did not have access to this construction. This is the reason why we interpret the lower RTs for the bilingual group when reading the target sentence as an effect of access to the L2-only construction.

These findings are in line with the findings reported in Souza (2014), Fernández et al. (2016) and Fernández & Souza (2017). These studies document observations of BP-English bilinguals with high L2 proficiency exhibiting higher tolerance in L1, as compared to BP monolinguals, for an L2-specific argument structure, namely the induced movement alternation (ex: the researcher ran the mouse through the maze). More specifically, the aforementioned studies report experiments that suggest that these bilinguals not only process the induced movement alternation faster than monolinguals do, but they also produce this construction more often than monolinguals do, notwithstanding its ungrammaticality in BP. Due to the fact that this cross-linguistic influence was observed both in processing and in production, Fernández & Souza (2017) hypothesized that this phenomenon might not be restricted to a temporary and highly localized processing gap. We will test this hypothesis in our next experiments.

In the following experiments, we will analyze if these effects observed in bilinguals' but not in monolinguals' processing routines extend to the representational level. If it does, we expect this effect to generate a difference between the two groups in regards to the manner they perceive the acceptability of sentences in a speeded acceptability judgment task. This paradigm can also provide us with extra evidence on linguistic processing, since it is possible to observe which constructions tend to be left unjudged due to time ceiling violations, which can be associated with difficulty in processing (Souza et al., 2015).

### 3.2. Experiment two

Experiment two focused on how BP-English bilinguals and BP monolinguals represent the resultative and the depictive construction. For that purpose, we conducted a speeded acceptability judgment task with a four-second time ceiling. The imposition of a time limit is exactly what qualifies the speeded version of the acceptability judgment paradigm. This strategy aimed at restricting their use of explicit metalinguistic knowledge (Souza et al., 2015). It is important to note that recent studies (Souza & Oliveira, 2017) show that the imposition of a time ceiling does not change the tasks' offline nature.

As we mentioned in the previous section, Fernández et al. (2017) predicted that L2-to-L1 influence is probably not restricted to a temporary and highly localized processing gap. This prediction is based on the fact that this phenomenon was observed both in comprehension and in production of the induced movement alternation. However, Souza et al. (2016) tested this hypothesis and did not encounter significant differences between monolinguals and bilinguals as for the acceptability of the same construction. The authors suggest that the influence of the non-dominant language on the dominant language is evanescent, not lasting enough to generate changes in the L1 representation. Oliveira (2013) conducted an untimed acceptability judgment task with the magnitude estimation paradigm and found out that bilinguals and monolinguals exhibited only small differences concerning their perception of the resultative construction. Bilinguals' acceptability means was 0.36 and monolinguals' acceptability means was 0.28 in 0-to-1 scale. Therefore, our prediction is that we will not find differences between bilinguals and monolinguals as for the acceptability ratings given to the resultative construction, but we will find differences between these two groups as to the frequency they violate the time ceiling due to their differences in processing cost observed in the maze task.

The independent variables for this experiment were also the constructions (depictive and resultative) and the linguistic profile (monolinguals and bilinguals). The dependent variables were the acceptability ratings given by the participants to the instances of the depictive and the resultative constructions. We also measured the ratio of time-ceiling violations to judge each of these constructions in order to analyze possible further information on linguistic processing.

### 3.2.1. Methodology

#### 3.2.1.1. Participants

The same 56 participants took part in experiment two after they performed the maze task in experiment one. The task was conducted with a within-subject design and, hence, all participants were exposed to both the resultative and the depictive construction. The procedure to group the participants as monolinguals and bilinguals was the same utilized in experiment one.

#### 3.2.1.2. Materials

There were 111 sentences in BP in experiment two. Fifteen of these items constituted the training session and the other 96 were presented during the task. These

sentences were balanced in terms of grammaticality (50% grammatical and 50% ungrammatical). The structure of the target and the control sentences was similar to the one in experiment one, but the sentences were not the same. There were eight instances of the resultative construction (8) and eight instances of the depictive construction (9). The sentences had approximately 35 characters, which is a size compatible with the time ceiling imposed in the task (Souza et al., 2015). The grammatical distractors were sentences with a basic structure such as (10) and the ungrammatical distractor were sentences whose words were out of order (11) or sentences with an unlicensed argument structure (12).

- (8) *A gata pegou o rato e o comeu vivo.*  
 DET cat catch.PAST DET mouse and it.ACC eat.PAST alive  
 "The cat caught the mouse and ate it alive."
- (9) *O garçom arrumou a mesa e a esfregou limpa.*  
 DET waiter set.PAST DET table and it.ACC wipe.PAST clean  
 "The waiter set the table and wiped it clean."
- (10) *A mulher usou o seu cartão de crédito.*  
 DET woman USE.PST DET her card of credit  
 "The woman used her credit card."
- (11) *\*Hudson bem falaram Alemão muito.*  
 Hudson well speak.PST.PLU German very  
 "Hudson well speak German very."
- (12) *\*Meu carro dirige facilmente.*  
 My car drives easily  
 "My car drives easily."

As in experiment one, the items were pseudo-randomized in order to mitigate possible effects concerning their order of presentation. Besides being displayed in a different order for each participant, the items were organized to prevent the resultative and the depictive items to appear in sequence. The DMDX software was utilized to exhibit the sentences, manage their randomization and register the acceptability ratings, accuracy and RTs. The software was run in the same computer used in experiment one.

#### 3.2.1.3. Procedures

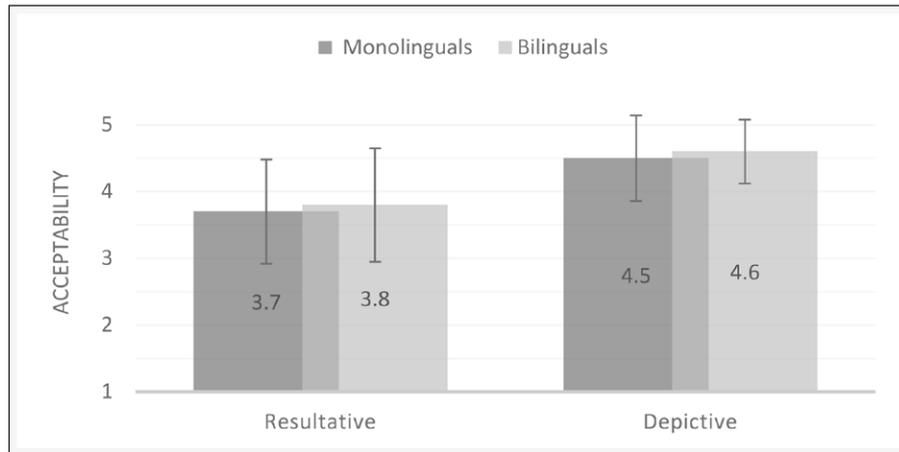
Participants were instructed to analyze the acceptability of the sentences focusing on the structure of the sentences and trying to ignore their pragmatic content. The instructions also pointed out that the judgments were to be made with the numerical keys 1, 2, 3, 4 and 5. 1 represented the lowest level of acceptability, 5 the highest level, and the other numbers intermediate levels. This Likert scale has been argued to be the most suitable scale for acceptability judgment tasks (Souza & Oliveira, 2014).

After reading the instructions, the participants started the training session judging the acceptability of 15

sentences. During the task, the experimental items were exhibited continuously and in a random order. Each sentence remained visible for four seconds, which was the time ceiling for the participants to judge each sentence. This time limit was based on the study conducted by Souza et al. (2015). The next sentence was presented right after the acceptability judgment was given or after four seconds. The task was also conducted thoroughly in BP (monolingual mode) so that participants were not encouraged to activate their L2.

### 3.2.2. Results

Our hypothesis was that bilinguals and monolinguals would give similar acceptability ratings to the sentences that simulated the resultative construction into BP and they would also give similar acceptability ratings to the sentences that instantiated the depictive construction. Furthermore, we hypothesized that monolinguals, towards the resultative, but not the depictive construction, would tend to violate the acceptability judgment time ceiling more than bilinguals, due to the difficulty in processing observed in experiment one. The mean acceptability ratings results are illustrated in **Figure 7**.



**Figure 7:** Bilinguals' and monolinguals' mean acceptability ratings for the resultative and the depictive constructions.

The Shapiro-Wilk test indicated that the distributions of bilinguals' and monolinguals' acceptability ratings to both the resultative and depictive construction differed from the normal distribution. We utilized the Mann-Whitney test to compare the acceptability ratings given to the two constructions by each group and the acceptability ratings given to each construction by both groups of speakers. The monolinguals' acceptability ratings yielded a significant difference between the resultative and the depictive construction by subjects ( $U = 115.5$ ,  $W = 466.5$ ,  $Z = -4.084$ ,  $p < 0.001$ ) and by items ( $U = 3$ ,  $W = 39$ ,  $Z = -3.046$ ,  $p < 0.01$ ). The bilinguals' acceptability ratings also yielded a significant difference between the resultative construction and the depictive construction by subjects ( $U = 150$ ,  $W = 528$ ,  $Z = -3.731$ ,  $p < 0.001$ ) and by items ( $U = 0$ ,  $W = 36$ ,  $Z = -3.366$ ,  $p < 0.001$ ). The two groups of speakers did not differ significantly from each other in relation to the acceptability of the resultative construction neither by subjects ( $U = 344.5$ ,  $W = 722.5$ ,  $Z = -.346$ ,  $p = 0.729$ ) nor by items ( $U = 31$ ,  $W = 67$ ,  $Z = -.105$ ,  $p = .916$ ). Similarly, the two groups did not differ significantly from each other in regards to the acceptability of the depictive construction neither by subjects ( $U = 349$ ,  $W = 727$ ,  $Z = -.273$ ,  $p = 0.785$ ) nor by items ( $U = 25$ ,  $W = 61$ ,  $Z = -0.736$ ,  $p = 0.462$ ).

Our results indicate that there was not a significant difference between the behavior of monolinguals and bilinguals concerning the acceptability of the resultative and the depictive construction. The null hypothesis of undifferentiated mean acceptability judgment ratings between the two groups of speakers was not rejected. These results suggest that the bilingualism effects encountered in the maze task did not extend to the bilinguals' L1 representation. However, we cannot rule out the hypothesis that the behavior of the participants was influenced by the fact that they had just taken part in experiment one. We will address this issue in experiment three.

We also compared the frequency each group violated the four-second time limit imposed in the task. The percentage of violations can also be seen as evidence of

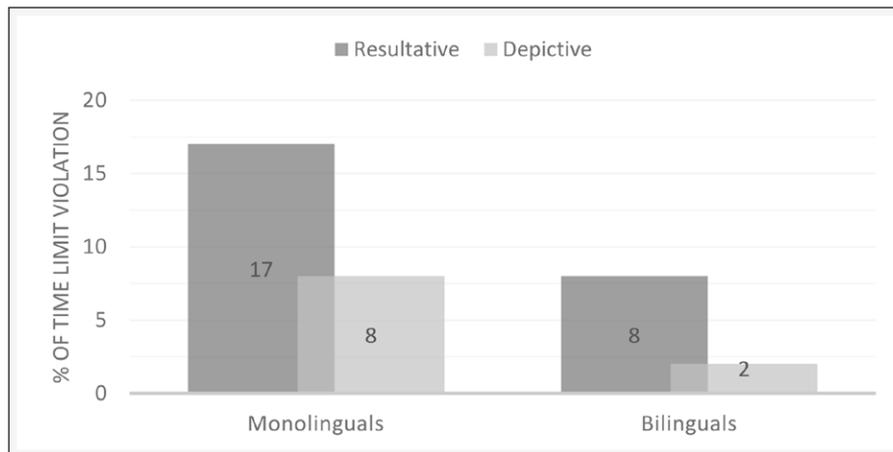
difficulty to process the constructions under scrutiny (Souza et al., 2015). Monolinguals violated the time ceiling in 17% of the resultative sentences and 8% of the depictive sentences. Bilinguals violated the time ceiling in 8% of the resultative sentences and 2% of the depictive sentences. Therefore, monolinguals violated the time ceiling more than bilinguals in relation to both constructions, as illustrated in **Figure 8**. These results have the same pattern encountered in experiment one, in which bilinguals tended to be significantly faster than monolinguals in regards to both constructions, but the difference was more evident when analyzing the resultative construction.

### 3.2.3. Discussion

As previously mentioned, the participants took experiment two after performing the maze task in experiment one, which may have influenced their behavior since the same constructions – but not the same sentences – were present in these experiments. Therefore, before discussing the corollaries of these findings, we will analyze, with experiment three, whether experiment one influenced the participants' performance in experiment two.

### 3.3. Experiment three

The participants of experiment two performed the speeded acceptability judgment task after doing the maze task in experiment one. Even though the sentences were different, the fact that the same constructions were present in both experiments may have biased the participants' performance. Hence, in the speeded acceptability judgment task in experiment three, the participants had not taken any tests beforehand. We did not expect the maze task to have biased the participants' behavior in experiment two because we used a considerable number of distractors so that the target sentences did not stand out. In turn, we predicted that bilinguals and monolinguals would also exhibit similar acceptability ratings in experiment three, and monolinguals would violate the time ceiling more than bilinguals when reading the resultative sentences.



**Figure 8:** Percentage of bilinguals' and monolinguals' time ceiling violation in the speeded acceptability judgment task for the resultative and the depictive constructions.

### 3.3.1. Methodology

#### 3.3.1.1. Participants

Thirty-two participants performed the task in experiment three, 20 in the bilingual group and 12 in the monolingual group. These participants had not taken any of our previous tasks and they were also undergraduate or graduate students at UFMG. Bilinguals' mean age was 23 (SD = 4), ranging from 18 to 30, and monolinguals' mean age was 25 (SD = 4), ranging from 20 to 30. Thus, these participants were similar to those who took part in experiment one and experiment two.

#### 3.3.1.2. Materials

Among the distractor items of experiment two, there were sentences that had a completely abnormal order. We suspected that they may have increased the acceptability of the other sentences. In experiment three we substituted these sentences for items with agreement errors. More specifically, we utilized sentences with a singular subject and a plural verb, as in (13), which is a very odd combination in BP. All the other materials were the same utilized in experiment two.

- (13) \**O cachorro vieram para casa rapidamente.*  
 DET dog come.PST.PLU to house quickly  
 "The dog came home quickly."

#### 3.3.1.3. Procedures

In order to gather more acceptability ratings, we changed the time limit to judge each sentence since the four seconds used in experiment two resulted in a large number of violations, especially by monolinguals. Thus, we extended the time ceiling so that participants had six seconds to judge the sentences in experiment three. All the other procedures were the similar to those in experiment two.

### 3.3.2. Results

Our hypothesis was that the aforementioned changes applied to experiment three would not change the overall results found in experiment two. **Figure 9** illustrates the mean acceptability ratings obtained in experiment three speeded acceptability judgment task.

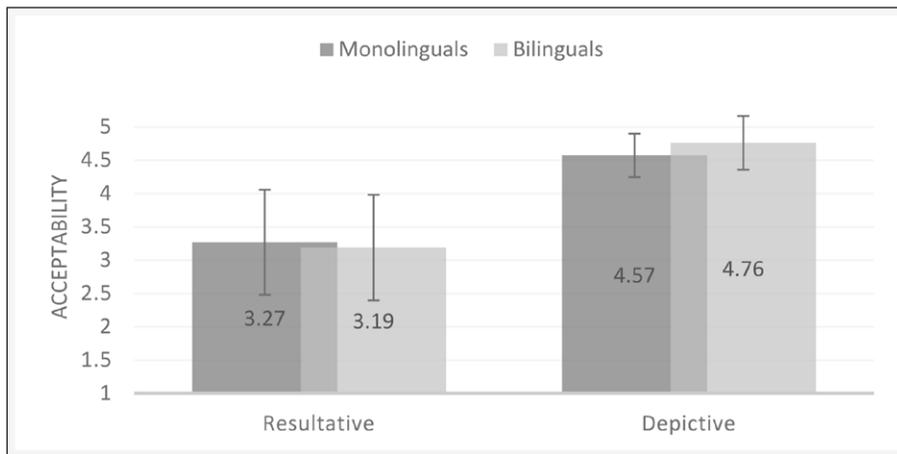
As in experiment two, the Shapiro-Wilk test indicated the non-normality of the distribution. The Mann-Whitney Test showed a significant effect of construction among the monolinguals by subjects ( $U = 11.5$ ,  $W = 89.5$ ,  $Z = -3.506$ ,  $p < 0.001$ ) and by items ( $U = 0$ ,  $W = 36$ ,  $Z = -3.363$ ,  $p < 0.001$ ). There was also an effect of construction among the bilinguals by subjects ( $U = 15.5$ ,  $W = 225.5$ ,  $Z = -5.029$ ,  $p < 0.001$ ) and by items ( $U = 0$ ,  $W = 36$ ,  $Z = -3.363$ ,  $p < 0.001$ ). There was not any effect of speakers'

profile for the resultative construction neither by subjects ( $U = 116$ ,  $W = 194$ ,  $Z = -.156$ ,  $p = 0.88$ ) nor by items ( $U = 30.5$ ,  $W = 66.5$ ,  $Z = -0.158$ ,  $p < 0.88$ ). In relation to the depictive construction, dissimilarly, there was an effect of speakers' profile by subjects ( $U = 67$ ,  $W = 145$ ,  $Z = -2.115$ ,  $p < 0.04$ ), but there was not any in the analysis by items ( $U = 16$ ,  $W = 52$ ,  $Z = -1.683$ ,  $p = 0.10$ ).

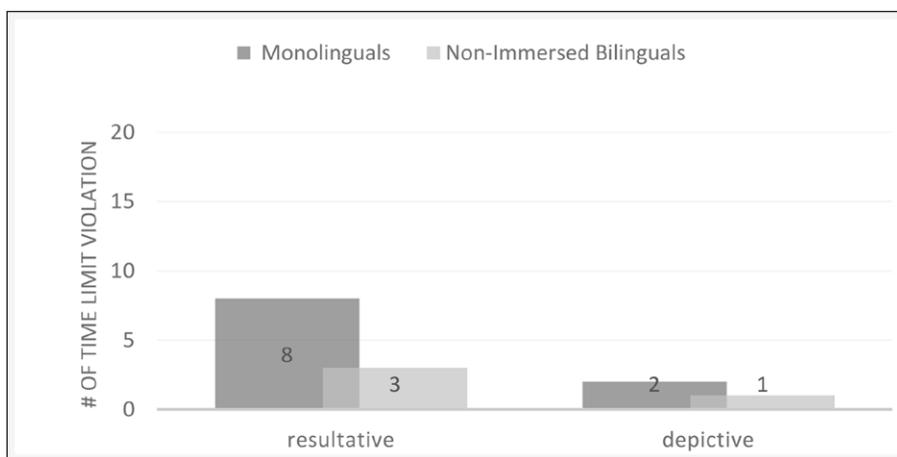
We also compared the two groups of speakers in relation to the percentage of violations of the six-second time ceiling imposed in the task. As illustrated in **Figure 10**, the monolingual group monolingual group violated the time ceiling in 8% of the resultative sentences and 2% of depictive sentences. The bilingual group violated the time ceiling in 3% of the resultative sentences and 1% of the resultative sentences. The fact that in experiment three the time limit was two seconds longer than in experiment two diminished the number of violations considerably. However, again monolinguals took longer than bilinguals did to judge the resultative construction.

### 3.3.3. Discussion

Overall, the speeded acceptability judgment results in experiment three were similar to the results in experiment two. They indicated that there was not



**Figure 9:** Bilinguals' and monolinguals' mean acceptability judgments for the resultative and the depictive constructions.



**Figure 10:** Percentage of bilinguals' and monolinguals' time ceiling violation in the speeded acceptability judgment task for the resultative and the depictive constructions.

a significant difference between monolinguals and bilinguals in relation to the acceptability of the resultative construction and that both groups of speakers judged the depictive construction to be significantly more acceptable than the resultative construction. Also, both experiments indicated that monolinguals tend to violate the time limit of the task more often than bilinguals when reading resultative sentences. The only point that diverged in the two tasks was that in experiment three, as opposed to experiment two, the difference between bilinguals and monolinguals in regards to the depictive construction was marginally significant in the analysis of subjects as random factor, but they did not differ in the analysis of items as random factor. Therefore, we consider that both experiment two and experiment three point to the fact that bilinguals and monolinguals behave similarly in relation to the acceptability of the resultative and the depictive construction.

In order to better understand the acceptability ratings given to the resultative construction, we have also measured the mean acceptability rating of the sentences with an abnormal word order in experiment two and those with odd agreement errors in experiment three. Monolinguals' mean acceptability ratings for the

sentences with an abnormal order in experiment two was 1.69 and bilinguals' was 1.16. Monolinguals' mean acceptability rating for the sentences with agreement mistake in experiment three was 2.34 and bilinguals' was 2.33. These results suggest that ungrammatical sentences can exhibit low or intermediate acceptability ratings. Furthermore, we can notice that in experiment three monolinguals' and bilinguals' mean acceptability rating was closer to the sentences with agreement mistakes than it was to the depictive sentences. The fact that only the last word is ungrammatical in the resultative sentences may be the reason why it receives intermediate and not low acceptability ratings.

Both experiment two and experiment three corroborate the idea that the bilingualism effects found in the maze task do not extend to the bilinguals' overall L1 representation. The studies are in line with the acceptability judgment results encountered by Oliveira (2013) and Souza et al. (2016), discussed in section 3.2. These results suggest that the L2 influence on the L1 plays a role during online processing, but it is inhibited afterwards during the process of judging the sentences. Thus, during a task that taps metalinguistic awareness on the form of L1 sentences, bilinguals exhibit a considerable level of

cognitive control by blocking the influence exerted by the ease on processing demonstrated in experiment one. Not only do these results suggest that L2 does not play a major role in L1 acceptability judgment, but they also suggest that timed and untimed acceptability judgments tap into similar kinds of knowledge.

Therefore, the results yielded by the maze task and the two speeded acceptability judgment tasks corroborate Souza et al. (2016) and Souza & Oliveira (2017). Both studies claim that these two tasks tap into different psycholinguistic mechanisms. Whereas the maze task yields data related to localized, temporary and implicit access to language representation, the speeded acceptability judgment task yields data related to attention-driven inspection of information that is maintained in the working memory after linguistic processing.

#### 4. Conclusions

This study aimed at analyzing possible bilingualism effects from the non-dominant L2 on the dominant L1 in both linguistic processing and linguistic representation. A maze task was conducted in order to analyze bilinguals' linguistic processing, and it indicated a tolerance to an unlicensed argument structure construction, as compared to monolinguals, possibly due to L2 influence. A speeded acceptability judgment task was conducted to shed light on bilinguals' linguistic representation, and it indicated that bilinguals do not perceive, in the L1, the aforementioned L2-specific argument structure construction as more acceptable than monolinguals do.

We understand that the results reported in this study provide important information about languages' co-activation in the bilingual mind. First, they suggest that the knowledge of argument structure construction in the L2 may play a role in the L1 processing routines of highly proficient late bilinguals. Second, the results suggest that L2 influence on the L1 is not restricted to bilinguals immersed in an L2 context, since all the participants lived in an environment that favored the use of their L1. Third, the results indicate that these bilingualism effects on processing do not seem to affect linguistic representation, since bilinguals perceived the grammatical restrictions of their L1 as well as monolinguals.

As we have discussed in the introduction, the intercommunication of languages has been associated with some cognitive control enhancement presented by bilinguals. Hence, this kind of cognitive development is possibly not restricted to bilinguals who acquired the L2 early in life or who are immersed in the L2. Furthermore, the fact that these bilinguals can quickly overrule representations of the unintended language suggests that they have a considerable level of language control, at least in their L1.

Our study has limitations that deserve special attention. The results we found may have been biased by the frequency of the resultative construction. More specifically, it is possible that we find different L2 effects on the L1 if we investigate argument structure constructions that are more frequent. Also, since we did not test the behavior of

bilinguals of languages that do not have the resultative construction, we cannot exclude the possibility that the effects encountered in the maze task is simply a general bilingualism effect instead of an effect generated specifically by the L2. We intend to address these issues in follow-up studies. Furthermore, we would like to replicate the experiments described here with bilinguals immersed in the L2 in order to observe possible effects of immersion and dominance inversion.

#### Note

<sup>1</sup> See Oliveira (2016) for a deeper analysis of these constructions in both English and Brazilian Portuguese.

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