v. 34, n. 2, p. 246–266, 2026
ISSN: 2237-2083 · DOI: 10.17851/2237-2083.34.2.246–266
Submetido em: 14/01/2026 · Aprovado em: 11/06/2026

REVISTA DE ESTUDOS DA LINGUAGEM

Agreement Attraction in Children's Production: An Experimental Study in Brazilian Portuguese

Concordância por atração na produção de crianças: um estudo experimental no português brasileiro

Lilian Silva Scher
Universidade Estadual de Campinas (Unicamp) | Campinas | SP | BR
scherlilian@gmail.com
https://orcid.org/0000-0001-9717-5920

Pablo Faria
Universidade Estadual de Campinas (Unicamp) | Campinas | SP | BR
fariap@unicamp.br
https://orcid.org/0000-0002-4039-1769

Abstract: This study examines agreement attraction, a phenomenon in which a verb agrees in number with an intervening noun—the attractor—instead of the subject head (e.g., *The observation of the results show*...). Psycholinguistic research on adult speech has documented an asymmetry: attraction tends to occur when the subject head is singular and the attractor is plural. Here, we investigate whether Brazilian Portuguese-speaking children exhibit a similar pattern. We conducted a language production experiment using the referential communication paradigm (Nozari & Omaki, 2022). Children aged 5 to 7 participated in a game designed to elicit sentences with complex subjects (e.g., *The snake near the elephants*...), thereby inducing potential attraction effects. The number of the subject head and the attractor noun was manipulated between singular and plural. The dependent variable was the rate of agreement attraction in production. Results revealed that attraction was observed overall, whereas no clear attraction effect was found in the five-year-old group. Notably, children did not replicate the adult-like asymmetry: the singular-head/plural-attractor condition did not yield more errors than the reverse configuration. Our hypothesis is that variability of verb agreement in spoken Brazilian Portuguese may have influenced these results.

Keywords: agreement attraction; children's linguistic production; verbal number agreement; Brazilian Portuguese.

This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by/4.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

Resumo: Neste trabalho, a concordância por atração é caracterizada pela concordância de número entre o verbo de uma sentença e um nome atrator interveniente, o qual não corresponde ao núcleo do sujeito (p.ex., *a observação dos resultados mostram*...). A literatura psicolinguística atesta uma assimetria na fala de adultos, uma vez que os casos de atração geralmente acontecem quando o núcleo é singular e o atrator plural. Este estudo investiga a produção da concordância verbal por atração em crianças falantes do português brasileiro, para verificar se esta ocorre de forma semelhante à fala de adultos. Para tanto, conduziu-se um experimento de produção da linguagem através do paradigma de comunicação referencial (Nozari; Omaki, 2022). Nessa tarefa, as crianças, com idades entre 5 e 7 anos, participaram de um jogo elaborado para induzir a produção de sentenças com sujeitos complexos, tais como "A cobra perto dos elefantes..." e, consequentemente, a concordância por atração. Manipulou-se a informação de número do núcleo do sujeito e do nome atrator, que variava entre singular e plural. A variável dependente correspondeu ao índice de produção de concordância por atração. Foi encontrada a concordância por atração nas faixas etárias de 6 e 7 anos, mas não na faixa etária de 5 anos. Ademais, foi encontrado um padrão de produção da atração distinto do observado na fala de adultos, uma vez que a condição com núcleo singular e atrator plural não gerou mais erros em comparação com a configuração contrária (efeito de assimetria) em nenhuma das faixas etárias. Considera-se, ainda, a possibilidade de haver influência do caráter variável na concordância verbal do PB falado nos dados obtidos.

Palavras-chave: concordância por atração; produção linguística infantil; concordância verbal de número; português brasileiro.

1 Introduction

The linguistic phenomenon known as agreement can be defined as the sharing of features (Franck, 2011)—such as number, gender, and person—between elements within a sentence. Among the various types of agreement observed across the world's languages, verbal agreement stands out. It is typically established between a controlling element—such as the head noun of the subject—and a target element, such as the main verb or auxiliary. In this

process, certain grammatical features of the controller are reflected on the target. This study focuses specifically on number agreement in Brazilian Portuguese, wherein the verb reflects the number feature of the subject's head noun, as illustrated in the examples below:

(1) A moça compra pão na padaria.
the girl buys bread in the bakery

(2) A**s** moça**s** compra**m** pão na padaria.
*the.PL girl**s** buy.PL bread in the bakery*

In both sentences, the verb *comprar* (buy) agrees in number with the subject (*a moça* vs. *as moças*), in the singular and plural, respectively. It is important to note, however, that languages differ in how verbal number agreement is realized. These examples reflect standard Brazilian Portuguese (BP). In BP, both nominal and verbal number agreement have been consistently described in the sociolinguistic literature as variable phenomena (Naro, 1981; Guy, 1981; Mendes & Oushiro, 2015, among others). These studies have identified different agreement patterns, which vary according to the degree of overt number marking on the verb and within the noun phrase. In examples (1) and (2), we find what is called *redundant agreement*. In (3) and (4), we see two examples of *non-redundant agreement*, where the plural marker is omitted either in the noun phrase, the verb, or both.

(3) A**s** moça**s** compraØ pão na padaria.
*the.PL girl**s** buy.Ø bread in the bakery*

(4) A**s** moçaØ compraØ pão na padaria.
the.PL girl.Ø buy.Ø bread in the bakery

Sociolinguistic research has shown that this variation is systematic and influenced by both linguistic and social factors (see Mendes & Oushiro, 2015, for a review). Although this study does not aim to investigate the implementation or effects of variable agreement in BP, we acknowledge—especially in the conclusion—that it may have influenced our findings to some extent.

The phenomenon under investigation in this study is a specific type of verbal agreement known in the psycholinguistic literature as *agreement attraction*. In BP, this refers to instances in which number agreement is not established between the verb and the subject head, but rather with an intervening element—referred to as the *attractor*—whose grammatical features are mistakenly reflected on the verb. As defined by Franck, Vigliocco, and Nicol (2002, p. 373), the attractor is "a noun embedded in a prepositional phrase or in a clause that modifies the subject NP." Consider the following examples:

(5) A análise do**s** gráfico**s** sugere**m** um aumento no índice de poluição.
*the analysis of.the.PL graph**s** suggest.PL an increase in the pollution index*

(6) A**s** análise**s** do gráfico sugere um aumento no índice de poluição.
*the.PL analy**ses** of the graph suggests an increase in the pollution index*

In both sentences, the subject is a complex noun phrase in which the head (*a análise* / *as análises*) is modified by a prepositional phrase (*dos gráficos* / *do gráfico*). In both cases, the

verb *sugerir* agrees not with the head noun, but with the attractor. Thus, both are instances of agreement attraction. From a psycholinguistic perspective (Bock & Miller, 1991, among others), such cases are often described as *attraction errors*—failures in the online processing of linguistic information, not simply deviations from grammatical norms.

In (5), we have a classic case of agreement attraction, with a plural attractor inducing plural marking on the verb. In (6), a singular attractor seems to override the plural head. However, this second case may also be interpreted as an instance of variable agreement, as previously discussed. Scherre and Naro (2014), in a sociolinguistic analysis of adult speech in both written and oral BP, emphasize the variability of verbal agreement in complex subject constructions—verbs may agree with either the head noun or the attractor.

Agreement attraction has been widely studied in psycholinguistics, both in language production (Bock & Miller, 1991; Franck; Vigliocco & Nicol, 2002; Eberhard, 1997, 1999; Rodrigues, 2006; among others) and in comprehension (Nicol, Forster & Veres, 1997; Pearlmutter, Garnsey & Bock, 1999; Wagers, Lau & Phillips, 2009). These studies aim to uncover the mental processes involved in sentence planning and understanding, with attraction serving as a window into the dynamics of grammatical encoding and agreement.

Experimental research in this field has examined the effects of syntactic, semantic, and morphophonological factors on attraction. Although some findings appear contradictory—such as the influence of semantic features on a phenomenon traditionally viewed as purely syntactic—there is relative consensus on certain aspects. Chief among these is the asymmetry effect, whereby attraction is far more likely when the head noun is singular and the attractor plural, as in example (5).

A leading explanation for this asymmetry comes from Bock and Eberhard (1993), who proposed that the singular feature is a default, unmarked value, while the plural is marked. According to this view, only marked features (plural) can percolate upward in the syntactic structure to reach the agreement site, thereby inducing attraction. This effect of asymmetry is widely accepted in the literature on English. For Brazilian Portuguese, studies such as Rodrigues (2006) have replicated this asymmetry in adult speech, while also investigating other factors, including the linear and hierarchical position of elements, the semantic effects of subject phrase distributivity, and more.

It is worth noting, however, that most research on attraction has focused on adult speech. Consequently, there is a notable gap in the literature concerning children's speech, despite the broader body of work on verbal agreement in language acquisition. In the next section, we review studies that address verbal agreement in the speech of Brazilian Portuguese-speaking children, as well as those that have examined attraction in child language—primarily in English.

2 The phenomenon of agreement and attraction in child speech

As discussed in the previous section, agreement attraction arises in verbal number agreement when the subject noun phrase is structurally complex—that is, when a head noun is modified by a prepositional phrase containing another noun (e.g., *the analysis of the data*), which may function as an attractor. As Lorimor, Stephens-Hecker, and Miller (2019) note, agreement in complex-subject configurations has received relatively little attention, whereas research on the acquisition of agreement has largely focused on clauses with simple subjects. For example, English-speaking children as young as three are already able to produce verbal number agreement with considerable accuracy.

For Brazilian Portuguese (BP), acquisition findings point in the same direction. Studies on the development of verbal agreement in BP suggest that, early in acquisition, agreement marking—especially third-person plural—is still inconsistent and may take time to converge on adult-like patterns (Lopes, 2003; Lopes, Souza, & Zilli, 2005). By around age three, however, agreement largely stabilizes, albeit mostly in contexts involving simple subjects. With respect to plural verbal morphology, Rubino and Pine (1998), in a longitudinal analysis of one child between 3;2 and 3;4.8, report that plural verb forms are initially rare, but third-person plural morphology begins to appear in spontaneous speech around 3;3–3;4.

Taken together, these findings suggest that for older children—such as the participants in the present study (5–7 years old)—verbal agreement in BP should already be relatively stable. What remains less clear, however, is how children handle agreement when the subject is complex and how this relates to the emergence of attraction effects. Research on attraction has focused predominantly on adult production, leaving an important gap regarding attraction in child speech.

A small number of studies have examined agreement with complex subjects in children acquiring French, including Fayol, Hupet, and Largy (1999) in writing and Franck et al. (2004) in speech. These studies generally suggest that children begin to produce attraction effects around ages eight to nine; before that, they tend to default to singular verbal forms. Importantly, although attraction in adult production typically shows an asymmetry effect previously mentioned, this pattern was not observed in these studies of children's French production.

Lorimor, Stephens-Hecker, and Miller (2019) investigated agreement production in English-speaking preschoolers (3;9–5;11) and compared it directly with adult speech. They conducted two experimental tasks with children and adults and complemented these with two corpus analyses, examining the input available to children through transcripts of child-directed speech and children's picture books.

Across the corpus analyses, the authors found that children have limited exposure to sentences with complex subject noun phrases, especially cases in which the head noun and the attractor differ in number. As a result, children receive little positive evidence that the verb must agree with the subject head even when intervening modifiers are present.

In the experimental component, participants completed a memory-game task designed to elicit sentences with complex subjects and to assess agreement patterns. Participants viewed a scene with three distinct characters on a computer screen. In a short video sequence, each character was named twice and then disappeared; participants then indicated where each character had been located, producing utterances such as *The baby with the block is in bed*. This design placed an additional memory demand on participants, since responses were elicited after the characters vanished from the display.

The stimuli manipulated the number of the head noun and the local noun, yielding four conditions: SS (singular head–singular attractor), SP (singular head–plural attractor), PP (plural head–plural attractor), and PS (plural head–singular attractor). For instance, when one baby and one object appeared, an SS sentence was expected; when the baby held two objects, an SP sentence was expected. The child participants were preschoolers with a mean age of 4;8.

The results showed that children did produce attraction-like agreement. However, in adult production, more attraction was observed in the PS condition than in the SP condition. In other words, the asymmetry pattern was the reverse of what is typically reported for English, where SP tends to elicit more attraction than PS.

Lorimor et al. attribute this reversal to a possible effect of how the visual stimuli encoded a "singular unit" interpretation: because each character was spatially separated,

presented individually, and named separately, the task may have encouraged participants to conceptualize each referent as a single unit. Another important finding was the presence of response biases at the individual level: some children tended to use singular verbs across trials, whereas others tended to use plural verbs, largely independent of condition.

Insum, Lorimor, Stephens-Hecker, and Miller (2019) provide relevant evidence for understanding attraction in child speech. In particular, their findings suggest that children may have limited exposure to complex-subject structures in the input and, consequently, fewer opportunities to learn how agreement is typically established with the subject head in the presence of intervening modifiers.

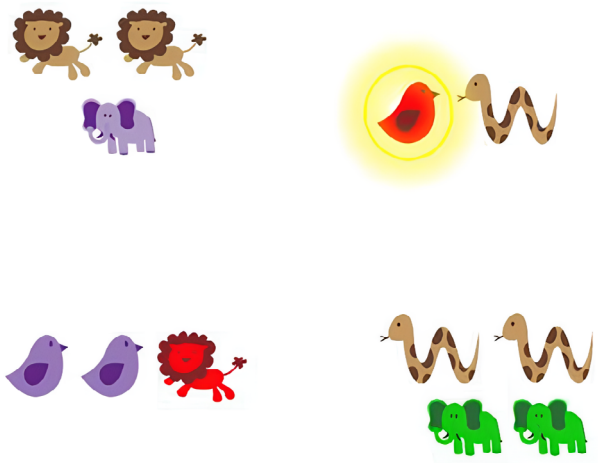
Comparing older children with preschool-aged children, the authors argue that younger children "have different strategies for how to produce verb agreement when the subject NP contains nouns with different number specifications" (Lorimor, Stephens-Hecker, & Miller, 2019, p. 313). Relative to adults, children did not show the same agreement–attraction profile; however, it is important to recall that, in that study, the asymmetry pattern went in the opposite direction of what is typically reported for adult speech.

A final point—also central to the motivation for the experimental task proposed by Nozari and Omaki (2022)—is that Lorimor et al.'s experiment imposed substantial memory demands, which may have directly affected participants' performance, as the authors themselves acknowledge. This consideration underscores the importance of examining attraction in tasks that more directly elicit sentence production while minimizing extraneous memory requirements.

Building on the French findings and on the results reviewed above from a high-memory-demand task, Nozari and Omaki (2022) developed two production experiments with English-speaking children, with the aim of comparing children's attraction patterns to those observed in adults. Importantly, they sought a task specifically tailored to language production while controlling memory load. To do so, they revisited an experimental method introduced in Nozari and Omaki (2018), termed the referential communication paradigm.

In this paradigm, children are presented with slides containing drawings whose colors vary. The child participates in an interactive game with the experimenter: the experimenter's slide serves as a model, and the child helps the experimenter color the corresponding drawings on a partially blank slide. Figure 1 illustrates an example of a stimulus slide used in the task.

Figure 1 – Example of a slide used in the referential communication paradigm



Source: Nozari and Omaki (2022, p. 410).

To indicate which drawing's color the experimenter should reproduce, a yellow highlight (a "flash") marks the relevant item. In the example in Figure 1, the child should instruct the experimenter to color the bird (the target figure) next to the brown snake (the cue figure) in red. Because many linguistic formulations could convey this information, the researchers explicitly instructed children to use a fixed structure, namely: "*The bird next to the brown snake is red*." This constraint was designed to elicit sentences with complex subjects in which the subject head (*the bird*) is modified by a prepositional phrase (*next to the brown snake*), whose noun may function as an attractor. For Brazilian Portuguese, although this structure also involves number and gender agreement on the adjective, our analysis focused exclusively on verbal number agreement.

As shown in Figure 1, number features were manipulated through the drawings themselves: targets and cues appeared either as singletons or as pairs. For instance, if a child saw one red bird next to two brown snakes, they would be prompted to produce "*The bird near the brown snakes...*", which could yield either singular verbal agreement (agreement with the head noun) or plural agreement (attraction to the local noun). The same logic applies when two red birds appear next to one brown snake.

This paradigm also enables a targeted investigation of the asymmetry effect, namely whether attraction is more likely in configurations with a singular head and a plural attractor than in the reverse configuration. For Nozari and Omaki (2022), testing asymmetry in children's production provides a way of assessing whether the mechanisms underlying attraction resemble those reported for adult production, which has been more extensively studied.

Because the referential communication task proved successful in eliciting attraction in the initial study (Nozari & Omaki, 2018), Nozari and Omaki (2022) conducted two further experiments. In Experiment 1, in addition to manipulating number features, they manipulated task difficulty by creating two conditions. In the target-flash condition, the target (i.e., the element occupying the subject-head position) blinked twice; in the cue-flash condition, the cue (i.e., the would-be attractor) blinked. The authors argue that the cue-flash condition increases cognitive demands because the most visually salient element is not the sentence-initial, structurally prominent head, but rather a modifier, which could increase agreement with the attractor.

Fifty-four native English-speaking children aged 5 to 7.5 years participated in Experiment 1. Children produced 336 attraction responses out of 1,472 utterances (22.8%). Notably, attraction was observed from age five, contrary to earlier findings from French. In addition, the cue-flash condition increased attraction rates, consistent with the authors' hypothesis. With respect to the asymmetry effect, it was only apparent under conditions of higher cognitive demand.

To test asymmetry under lower cognitive load, Experiment 2 used only the target-flash condition and included 20 children aged 6 to 8.5 years. Of 637 sentences, 179 exhibited attraction (28.10%). The results confirmed the asymmetry effect: configurations with a singular head and a plural attractor yielded higher attraction rates, aligning with the pattern widely reported in the literature.

Taken together, these findings support the view that English-speaking children show attraction patterns broadly similar to adults, unlike what had been reported for French—possibly due to differences in task design in earlier studies. Nozari and Omaki (2022) also highlight an age-related difference: the more adult-like pattern was observed in children older than six. For five-year-olds, they suggest that still-developing knowledge of agreement in complex-subject structures, combined with processing limitations, may underlie the absence of adult-like attraction patterns.

Turning to Brazilian Portuguese, research on attraction has so far focused exclusively on adult production. Rodrigues (2006) is particularly relevant, as it directly examined

attraction in Brazilian Portuguese. In a series of five production experiments, she investigated multiple variables that have been argued to affect attraction across languages such as English, French, and Dutch, including semantic factors (e.g., distributivity effects associated with certain complex subjects), syntactic factors (e.g., linear and hierarchical distance), and morphophonological factors (e.g., number marking within the complex subject).

All five experiments employed an error-elicitation production technique, widely used since Bock and Miller (1991). In this technique, participants are presented with a preamble consisting of a complex subject noun phrase and an infinitival verb. The task is to repeat the preamble and complete the sentence by inflecting the verb, allowing the researcher to observe the agreement form produced.

Among Rodrigues's (2006) findings, those related to morphophonological number marking are particularly relevant here. She reports an asymmetry effect consistent with other languages: attraction is more frequent when the head noun is singular and the attractor noun plural (e.g., *A análise dos dados... / the analysis of the.PL data*) than in the reverse configuration (e.g., *As análises do dado... / the.PL analyses of the datum*).

As the review above indicates, studies of attraction in children's production remain scarce and, to our knowledge, are still nonexistent for Brazilian Portuguese. Moreover, existing studies are exploratory and often aim to refine experimental techniques capable of reliably eliciting complex-subject structures—and thus attraction—in child speech.

To help address this gap, the present study experimentally investigates attraction in verbal number agreement in Brazilian Portuguese-speaking children, with the goal of determining whether children produce attraction at all. We further examine whether children's attraction patterns resemble those observed in adults, focusing on the linguistic conditions that favor agreement with the attractor, and in particular on the asymmetry effect involving singular versus plural attractors. This study also expands the cross-linguistic scope of the literature by providing empirical evidence from Brazilian Portuguese, enabling more direct comparison with findings from other languages.

Finally, given the scarcity of complex-subject structures and attraction patterns in children's input and in their spontaneous production (Lorimor, Stephens-Hecker, & Miller, 2019), the development of experimental methods that directly target production and successfully elicit these structures remains an ongoing challenge. Accordingly, a secondary objective of the present study is to assess whether the referential communication paradigm proposed by Nozari and Omaki (2018) is effective for the purposes outlined above.

3 Method

With the aim of eliciting a linguistic structure that is relatively infrequent in children's spontaneous speech, as noted by Lorimor, Stephens-Hecker and Miller (2019), we developed a language production experiment to investigate attraction in verbal number agreement in Brazilian Portuguese under controlled conditions. As the experimental task, we adopted the referential communication paradigm developed and validated by Nozari and Omaki (2018, 2022), which is designed to minimize memory demands and to target the production of specific sentence types more directly. As described in the previous section, the paradigm uses a playful activity to prompt participants to produce sentences with complex subjects, i.e.,

structures in which the subject head is modified by a prepositional phrase containing another noun that may function as an agreement attractor.

In this activity, participants play an interactive game with the experimenter. The goal is to help the experimenter by providing instructions on how to color specific figures displayed on two separate computer screens. On the participant's screen, a scene contains multiple figures already colored in distinct colors. On the experimenter's screen, the same scene is shown, but some figures appear in black and white while others match the participants' colored version. The participant is instructed to tell the experimenter which color should be used to fill in the black-and-white figures.

Stimuli were constructed by manipulating number information in the two nouns within the complex subject noun phrase—namely, the head noun and the local noun. Accordingly, some figures were presented as singletons (singular), whereas others appeared as pairs (plural), yielding systematic alternations in the number features of the subject head (the target figure) and the local noun (the cue figure). The independent variables were therefore (i) the number of the head noun (singular vs. plural) and (ii) the number of the local noun (singular vs. plural), resulting in four experimental conditions (Table 1).

Table 1 – Experimental conditions

Condition	Head number	Attractor number
A	Singular	Singular
B	Singular	Plural
C	Plural	Plural
D	Plural	Singular

Source: The authors

For example, stimuli were designed to elicit sentences of the following types:

(7) (a) Condition A: A cobra perto do elefante rosa É/SÃO verde(s).
The snake near the pink elephant IS/ARE green.

(b) Condition B: A cobra perto dos elefantes rosas É/SÃO verde(s).
The snake near the pink elephants IS/ARE green.

(c) Condition C: As cobras perto dos elefantes rosas É/SÃO verde(s).
The snakes near the pink elephants ARE/IS green.

(d) Condition D: As cobras perto do elefante rosa É/SÃO verde(s).
The snakes near the pink elephant ARE/IS green.

The dependent variable was the rate and direction of attraction observed in verbal agreement. For the present study, we adapted Nozari and Omaki's (2022) paradigm by using only the condition they term target-flash, in which the highlighted figure always corresponds to the element occupying the subject-head position (and therefore the sentence-initial position). We adopted this version because it is the lowest-demand condition and because

it successfully elicited attraction in the original study. Moreover, examining how increased cognitive load affects attraction is outside the scope of the present work.

Each participant was expected to produce 32 experimental sentences, distributed across four image slides presented as four "levels" of the game. Each level elicited eight sentences—two per experimental condition. All nouns were animal names, and the verb elicited was *be* in the present tense (*is* for singular; *are* for plural). In addition, two training slides were included (16 sentences total) to familiarize participants with the task and with the target sentence format.

3.1 Participants

Fifty-eight children participated in the experiment: 16 five-year-olds, 20 six-year-olds, and 22 seven-year-olds (mean age = 6.1 years; 30 girls). Data from 11 children were excluded: 10 because they did not produce the target structure—sentences with a complex subject noun phrase and a finite verb—and one because of technical problems during audio recording.

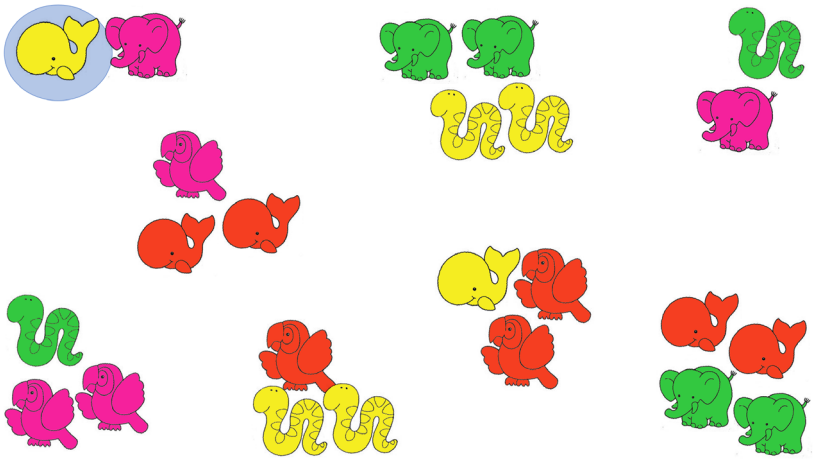
Participants were recruited from two schools in the municipality of Juiz de Fora – Minas Gerais: 20 children attended a private school and 38 attended a municipal public school, both located in the city's urban area. It was not possible to balance sample size across schools because the private school had fewer eligible students, and many potential participants could not be included due to the absence of signed parental informed consent.

Inclusion criteria were limited to the target age range. Exclusion criteria also included (i) failure to return a signed informed consent form and (ii) the presence of reported speech or language delay, which could affect the production of the phenomenon under investigation.

3.2 Materials

The experimental stimuli designed to elicit the target structure consisted of slides containing eight combinations of animal drawings (and, in the training phase, fruit drawings). Figures were presented either as singletons or pairs in order to manipulate the number features of the nouns produced in the elicited sentences. Figure 2 illustrates one of the experimental slides.

Figure 2 – Example of an experimental slide



Source: The authors.

Each slide was designed to elicit eight experimental sentences. To indicate which animal should serve as the basis for the instruction to the experimenter, the child saw the relevant drawing highlighted with a blue circle (e.g., the "yellow whale" in Figure 3).

Slides were created and presented using Microsoft PowerPoint (version 2022). Color editing of the drawings was performed in Clip Studio Paint (version 3.0). The task was administered on a Samsung GalaxyBook Go laptop (Monitor size: 14 inches). All sessions were audio-recorded with and subsequently transcribed for analysis.

3.3 Procedures

Prior to data collection, the study was submitted to the Research Ethics Committee of State University of Campinas and received approval for its methods and materials (CAAE: 79684924.2.0000.8142). Participating schools in the municipality of Juiz de Fora, Minas Gerais, were contacted to obtain authorization to conduct the experiment in the school setting. After approval, Informed Consent Forms (ICFs) were distributed to the children's legal guardians. Data collection began only after signed consent forms were returned, and only children whose participation had been authorized took part in the study. For children aged 6 and 7, an Informed Assent Form (IAF) was also obtained to ensure that the child wished to participate. After assent was provided, the session began.

At the start of each session, the researcher explained the goal and rules of the game. A key instruction concerned the sentence format participants were expected to use to tell the researcher which color to apply, following the fixed structure introduced earlier (e.g., *"The whale next to the pink elephant is yellow."*). In some sessions, this instruction had to be reiterated during the task, even after the initial training phase.

Participants then completed a two-slide training phase designed to familiarize them with the game mechanics and, crucially, with the target sentence format. After training, the child viewed a slide indicating the beginning of the game. While the child produced the sentences, the researcher colored the corresponding black-and-white figures on a second computer.

To preserve the interactive nature of the game, the child could not see the researcher's screen, and the researcher could not see the child's screen. At the end of each round, both checked whether the figures had been colored correctly and whether they matched the model displayed on the child's computer.

Each session was conducted individually in a quiet space provided by the schools, with only the researcher and the participant present. In one case, a teacher was present at the request of the child's guardians; this did not interfere with the task or the child's performance.

3.4 Hypotheses

Based on Nozari and Omaki (2022) and on prior work using the referential communication paradigm, we expected children to produce attraction in verbal number agreement in sentences with complex subject noun phrases containing a potential attractor noun. We further hypothesized that children's attraction patterns would resemble adult patterns, such that the singular–plural asymmetry effect would be observed. Specifically, we predicted that

Condition B (singular head + plural local noun) would yield more attraction responses than Condition D (plural head + singular local noun).

Finally, given the age range of our sample, we expected these effects to be more robust in older children than in five-year-olds. This prediction follows Nozari and Omaki's (2022) findings that adult-like attraction patterns characterized by singular–plural asymmetry were observed only from age six onwards.

4 Results

4.1 Data organization

As noted above, only 47 children were included in the analysis. In order to examine attraction in verbal number agreement, we required that each utterance instantiate the target configuration below:

(8) Subject head + attractor noun + verb
Example: *A(s) cobra(s) perto do elefante(s) rosa(s) é/são rosa(s)*
the(.PL) snake(s) near the pink elephant(s) is/are pink

Accordingly, utterances that did not conform to this structure were excluded. Importantly, in most cases children alternated between in-pattern and out-of-pattern productions. In total, we obtained 1,104 valid utterances. Of these, 197 were produced by five-year-olds, 411 by six-year-olds, and 496 by seven-year-olds.

To organize and analyze the dataset, we classified verbal agreement responses into three categories. In Type 1 responses, the verb matched the number feature of the subject head (singular in Conditions A and B; plural in Conditions C and D), regardless of the intervening attractor noun, as illustrated in (9):

(9) (a) A cobra perto do elefante é rosa. (Condition A)
the snake near the elephant is pink

(b) A cobra perto dos elefantes é rosa. (Condition B)
the snake near the elephants is pink

(c) As cobras perto dos elefantes são rosas. (Condition C)
the snakes near the elephants are pink

(d) As cobras perto do elefante são rosas. (Condition D)
the snakes near the elephant are pink

In Type 2 responses, the verb agreed with the number feature of the attractor noun—which, in these cases, differed from the head noun—as in (10):

(10) (a) A cobra perto dos elefantes são rosa(s). (Condition B)
the snake near the elephants are pink

(b) As cobras perto do elefante é rosa. (Condition D)
the snakes near the elephant is pink

Type 2 responses were only possible in Conditions B and D, because Conditions A and C served as controls in which head and attractor share the same number feature. Example (10a) represents the prototypical attraction configuration, with a singular head and a plural attractor. Example (10b) illustrates the reverse configuration, which is typically reported in the psycholinguistic literature as less likely to trigger attraction.

Finally, we classified as Type 3 those productions in which the verb mismatched the number feature of the subject head, but also did not match the number feature of the attractor noun. Such responses were only possible in the control conditions (A and C), as shown in (11):

(11) (a) A cobra perto do elefante são rosa(s). (Condition A)
the snake near the elephant are pink

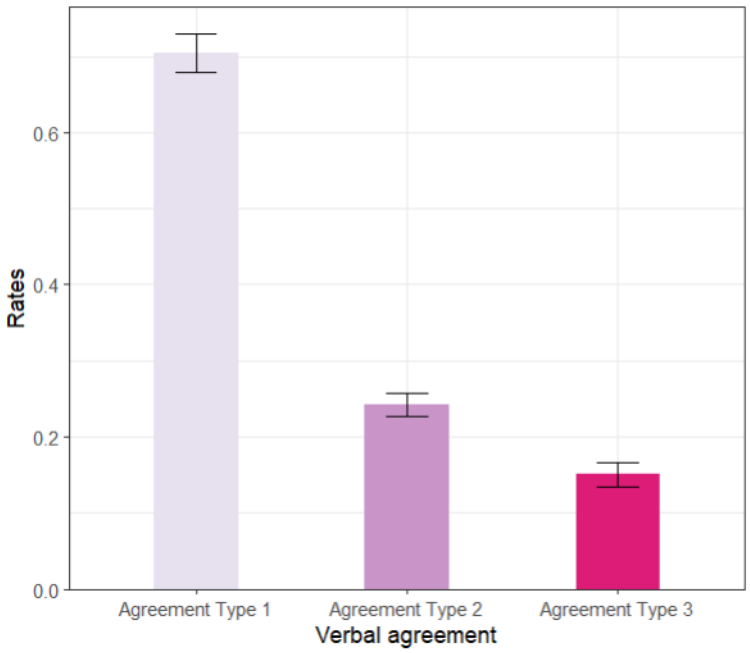
(b) As cobras perto dos elefantes é rosa. (Condition C)
the snakes near the elephants is pink

In sum, Type 1 responses reflect agreement with the subject head, whereas Types 2 and 3 correspond to non-head agreement patterns (i.e., verb forms that do not match the subject head), with Type 2 specifically indexing attraction errors and Type 3 indexing other head-inconsistent responses in the congruent conditions.

4.2 Data analysis

RStudio (version 2023.12.1) was used for data organization and statistical analyses. Across the 1,104 valid utterances, 765 instances corresponded to Type 1 (head-consistent agreement; 69.3%), 237 to Type 2 (attraction; 21.5%), and 102 to Type 3 (other head-inconsistent responses; 9.24%). Figure 3 shows mean per-participant proportions for each response type, along with standard errors.

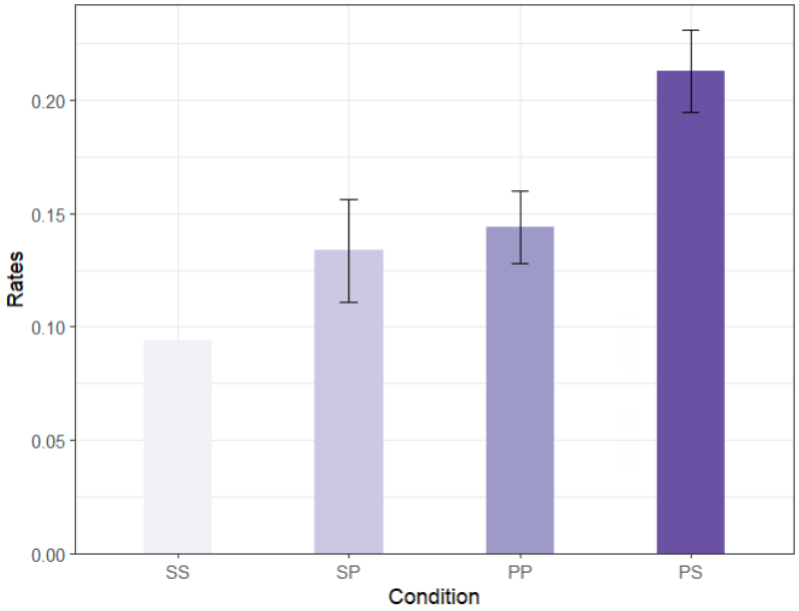
Figure 3 – Average proportions of the type of agreement produced



Source: The authors.

Figure 4 focuses specifically on responses in which the verb did not agree with the subject head (Types 2 and 3), broken down by experimental condition. It's important to recall that Type 2 (attraction) can only occur in Conditions B and D, where the attractor noun differs in number from the subject head. In the control conditions (A and C), in contrast, head-inconsistent responses can only take the form of Type 3, which does not constitute attraction.

Figure 4 – Average proportion of Types 2 and 3 agreement by experimental condition.



Source: The authors.

Comparing the two conditions that can yield attraction, Condition D (P+S) shows a higher mean attraction rate than Condition B (S+P). In the congruent conditions, Condition C (P+P) yielded more Type 3 responses than Condition A (S+S).

To analyze head-(in)consistent agreement patterns, we fit a mixed-effects logistic regression model (GLMM) using the *lme4* package (version 1.1-35.1). The model included Congruence (congruent: S+S, P+P; incongruent: S+P, P+S) and Verb Number (singular vs. plural) as fixed effects, and Participant and Lexical Item (Preamble) as random effects. Because the model is multivariate, the interaction between Congruence and Verb Number was also included in the model, following the predictor structure used by Nozari and Omaki (2022).

For interpretation, we collapsed the response categories into two outcome levels: agreement with the head (Type 1) versus non-agreement with the head (Types 2 and 3). Table 2 reports the model estimates.

Table 2 – Mixed-effects logistic regression model (GLMM)

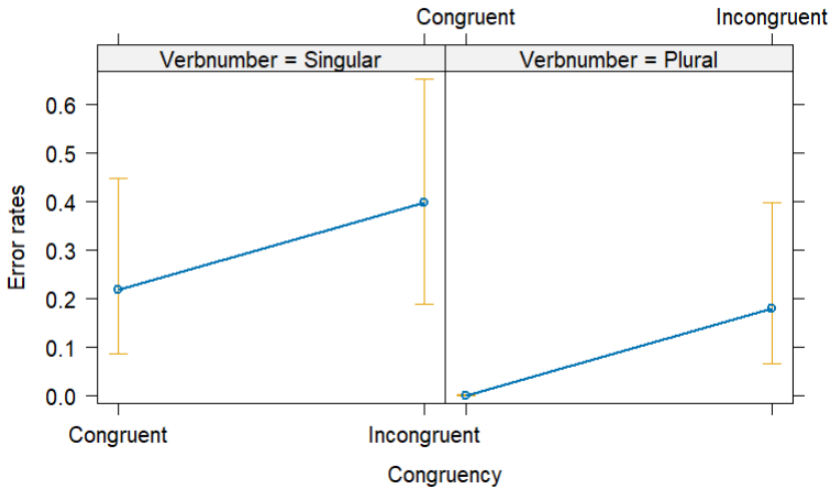
	Estimate (logOdds)	Standard Error	z-value	p-value
Intercept	-1.2825	0.5465	-2.347	0.0189
Congruence – Incongruence	0.8643	0.3575	2.418	0.0156
Nverb – Plural	-7.5390	1.1108	-6.787	1.14e-11
Congruence – Incongruence: Nverb – Plural	6.4285	1.1209	5.735	9.75e-09

Source: The authors.

Model results showed a main effect of Congruence: incongruent conditions (head and attractor mismatch) yielded higher rates of non-agreement with the head than congruent conditions. The model also returned a main effect of Verb Number, with higher rates of head-inconsistent responses when the verb was singular. That is, Conditions C (P+P) and D (P+S)—in which head-inconsistency corresponds to a singular verb form—showed higher rates of non-agreement with the head than Conditions A (S+S) and B (S+P).

The Congruence × Verb Number interaction was also statistically significant. In particular, Condition D (P+S) yielded a higher rate of head-inconsistent responses than Condition B (S+P). The effects plot in Figure 5 illustrates the estimated mean proportions of non-agreement with the head by condition.

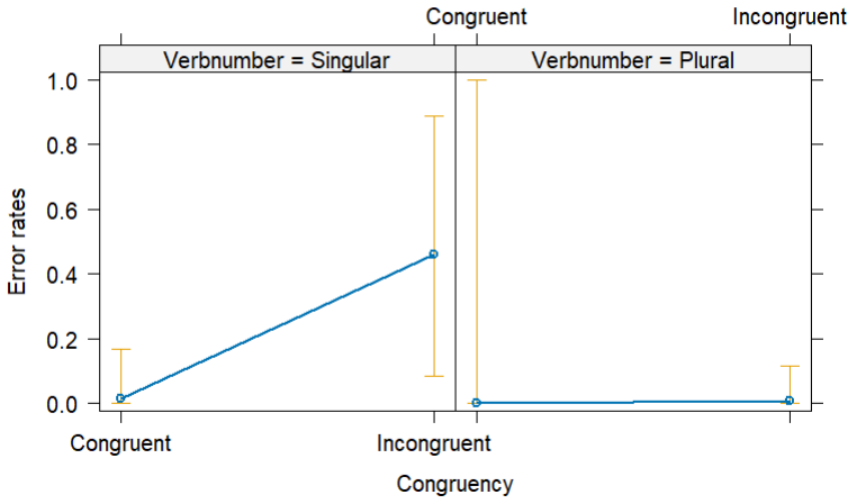
Figure 5 – Effects plot of the logistic regression model (complete data)



Source: The authors.

Finally, because Nozari and Omaki (2022) did not observe an asymmetry effect in younger children, we conducted an additional post hoc mixed-effects logistic regression restricted to the five-year-old group. The corresponding effects are shown in Figure 6. This model indicated that only the contrast between Condition C (P+P) and Condition D (P+S) was statistically significant, with higher rates of non-agreement with the head in Condition D. There was no evidence of an overall Congruence effect (beyond the C–D contrast) and no evidence of a Congruence × Verb Number interaction in this age group.

Figure 6 – Predicted effects from the mixed-effects logistic regression model for the 5-year-old group



Source: The authors.

5 Discussion

First, our results support the hypothesis that attraction affects agreement computation in children's speech. The incongruent conditions (B and D)—the only conditions in which the local noun differs in number from the subject head and can therefore act as an attractor—yielded a higher proportion of productions in which the verb did not agree with the subject head than the congruent conditions. In other words, the presence of a potential attractor increased the likelihood that agreement would be computed with an element other than the head, consistent with the effect reported by Nozari and Omaki (2022) for English.

In addition, our analyses revealed an effect of verb number, with higher rates of head-inconsistent responses when the verb was singular (i.e., in Conditions C and D). This effect was not reported by Nozari and Omaki (2022). One plausible interpretation is that the baseline singular default (Condition C, P+P)—although congruent—showed an unexpectedly high rate of head-inconsistent productions, which in turn inflated the overall rate of non-agreement in sentences with singular verbs. Notably, Condition C yielded substantially more head-inconsistent responses than the other congruent condition, Condition A (S+S). This pattern suggests that head-inconsistent verb forms were not restricted to contexts with a potential attractor; they also emerged in Condition C (P+P), where no attraction configuration is available.

Because number agreement is known to be variable in Brazilian Portuguese—including in child speech (e.g., Gomes et al., 2011; Molina, 2018)—one possibility is that variation contributed to the relatively high rate of head-inconsistent productions in Condition C. In these cases, both nouns were plural and no attractor mismatch was present, yet children frequently produced a singular verb form.

Molina (2018), for example, notes that although third-person plural marking is common in child speech, Brazilian Portuguese displays systematic variation in verbal agreement. Linguistic factors such as subject position relative to the verb, linear distance between subject

and verb, and phonetic salience have been shown to influence the alternation between overt plural marking and non-marking on the verb. Molina further argues that children become sensitive to these patterns early—around age three—which would make our participants, in principle, susceptible to such effects. Relatedly, Molina (2018) and Reis (2020) report that, relative to adults, children tend to produce more instances of what has been termed non-redundant agreement, i.e., structures in which plural is not overtly marked on the verb.

From a different perspective, Reis (2020), using an elicited production task with children aged 3 to 5, reports that children produced more utterances with singular-marked verbs (non-redundant agreement) than with plural-marked verbs (redundant agreement). However, because age was manipulated, Reis (2020) argues that these patterns reflect the developmental trajectory of acquiring verbal number agreement rather than the acquisition of stable sociolinguistic variation. By age five, children significantly reduce the production of the non-redundant pattern. On this view, nominal and verbal number agreement follow different developmental paths: whereas nominal agreement may be acquired through exposure to two possible surface patterns, non-redundant verbal agreement would tend to disappear with age as children converge on an adult grammar with redundant marking on the verb.

If this account is correct, non-redundant agreement should be less frequent in the age range investigated here. At the same time, it remains unclear whether the head-inconsistent productions observed in our data should be attributed to variable agreement. First, the form elicited in our task (e.g., *the snakes near the elephants is...*) does not correspond straightforwardly to the canonical non-redundant pattern described in the sociolinguistic literature, given that both noun phrases are plural while the verb is singular. Reis (2020), for instance, manipulated the relationship between agreement marking within the subject noun phrase and agreement marking on the verb, and found evidence for syntactic parallelism: non-redundant marking within the subject favors non-redundant marking on the verb. In our materials, however, subjects are complex: the head noun is modified by a prepositional phrase, which does not enter into agreement with the head. Thus, the relevant structural configuration differs from those typically investigated in studies of variable agreement, and this structural difference may be related to the singular-verb responses we observed even when both nouns within the subject were plural.

Second, because we did not directly manipulate sociolinguistic variation in our design, we cannot draw a strong conclusion about its role in shaping the observed patterns. Nevertheless, we consider it important to keep this possibility in view when investigating verbal number agreement in Brazilian Portuguese—especially because we did not observe the singular–plural asymmetry that is frequently reported in the attraction literature.

A further finding concerns the statistically significant interaction between the two fixed factors in our model, with Condition D (P+S) yielding more head-inconsistent responses than Condition B (S+P). Because these are precisely the two conditions that can give rise to attraction, an initial interpretation is that Condition D triggered higher attraction rates than Condition B. This result contrasts with Nozari and Omaki's (2022) findings and with the standard asymmetry reported for adult attraction, in which singular-head/plural-attractor configurations are typically more error-prone. Brazilian Portuguese adult data have also been claimed to show this asymmetry (Rodrigues, 2006). In our data, however, the reverse configuration appears more conducive to head-inconsistent agreement, which may suggest a divergence between children and adults in Brazilian Portuguese.

Again, the potential influence of variable agreement cannot be ruled out, particularly because the condition showing the highest rate of head-inconsistent productions is precisely one in which the subject noun phrase is plural while the verb is singular. More concretely, *As cobras perto do elefante* ("The snakes near the elephant") yielded more head-inconsistent agreement than *A cobra perto dos elefantes* ("The snake near the elephants"). Moreover, the former pattern more closely resembles structures attested in the Brazilian Portuguese variation literature.

On the other hand, given that attraction in Brazilian Portuguese has received relatively limited experimental attention—largely restricted to Rodrigues (2006)—it may be premature to conclude that the asymmetry effect is robust in Brazilian Portuguese to the same extent that it appears to be in English. Nozari and Omaki (2022) also note that previous French studies did not show asymmetry, although those studies relied on tasks with substantial memory demands (Fayol, Hupet, & Largy, 1999; Franck et al., 2004).

Another possibility for explaining the opposite asymmetry effect observed concerns the weakening of agreement features, a grammatical change attested in BP (Galves, 1993; Kato, 1999; Maia *et al.*, 2007). With the loss of the opposition between first and second person in the verbal inflectional paradigm in modern BP, only a binary opposition between first and third person related to the singular/plural distinction was maintained (Galves, 1993). Among other effects, as the preference for subject–verb (SV) order in sentence structure, there has been a weakening of the verbal inflection system in BP, which may be related to the preference for producing the verb in singular form. Nevertheless, further research is needed to investigate the status of the asymmetry effect in BP, both in adult speakers and in children, in order to deepen the discussion initiated here.

With respect to five-year-olds specifically, we did not observe an asymmetry effect, in line with Nozari and Omaki (2022). It is also worth noting that plural verb forms were relatively rare in this age group in our dataset, which may have affected statistical power and the stability of estimates.

Two additional points should be highlighted. First, some five-year-olds experienced greater difficulty with the task. Second, there was a lower willingness to participate and the amount of valid data from this group was substantially smaller than for the six- and seven-year-old groups.

6 Final considerations

This study investigated agreement attraction in the production of verbal number agreement by Brazilian Portuguese-speaking children aged 5 to 7. We adopted an experimental methodology because attraction typically arises in sentences with complex subject noun phrases, a construction that is relatively infrequent in the spontaneous speech of children in this age range. Our design was inspired by Nozari and Omaki (2022), who examined attraction in English-speaking children and adults and, crucially, proposed the referential communication paradigm as a method to elicit the relevant structures in child production.

With respect to the method, our findings align with Nozari and Omaki's (2022) conclusions regarding the paradigm's effectiveness: the task successfully elicited attraction-like responses from children even though the target construction is rare in spontaneous speech. At the same time, the task proved substantially more challenging for five-year-olds, as evidenced by the larger proportion of excluded utterances and by the absence of a clear attraction effect in this subgroup. Overall, however, the paradigm appears to be a useful tool for investigating attraction in child language.

Regarding the main results, although we observed attraction-related head-inconsistent agreement, the effect did not emerge in the expected direction. Specifically, we did not find the canonical singular–plural asymmetry commonly reported for adult attraction, whereby a singular head and a plural attractor yield higher attraction rates. Nozari and Omaki (2022) report this asymmetry for English, and Rodrigues (2006) reports it for adult Brazilian Portuguese. One possible interpretation is that attraction in child speech does not mirror adult patterns. A direct test of this possibility, however, requires applying the present paradigm to adult speakers of Brazilian Portuguese, which would allow a more controlled comparison using the same materials and procedure.

In this context, it is also important to note several differences between our Brazilian Portuguese implementation and the English study. First, the slides used in our experiment differed in visual layout and design features. Second, the elicited sentences were not identical across languages: in Brazilian Portuguese, the adjective's position relative to the local noun differed, and the target structure also involved predicative agreement with the adjective linked to the subject head. Such differences may have influenced processing and production, and they should be systematically assessed in future work.

A further issue that remained salient in our interpretation is the potential role of variable verbal agreement in Brazilian Portuguese, in both child and adult speech, as documented in the acquisition and sociolinguistic literature. One hypothesis for the absence of the asymmetry effect is that the variable status of verbal agreement may have increased the rate of head-inconsistent productions in sentences such as *As cobras perto do elefante é* ("The snakes near the elephant is"). Although the local noun (*o elefante*) could, in principle, attract singular agreement, this surface pattern is also compatible with a known option in Brazilian Portuguese variable agreement. As a result, for this subset of responses it is difficult to determine the relative contribution of attraction versus variable agreement.

Importantly, the primary goals of the present study were not to investigate the sociolinguistic conditioning of variable agreement in Brazilian Portuguese, but rather to determine whether children in this age range produce attraction at all and whether their production resembles adult patterns. For this reason, we did not manipulate or control for linguistic and social predictors that are typically examined in variationist work.

This constitutes a limitation of the present study and motivates future research. In Brazilian Portuguese, attraction and variable agreement may plausibly interact, and disentangling them will require designs that directly manipulate both factors in order to establish their respective contributions to verbal number marking. We also recommend applying the present experiment to adult speakers, using the same stimuli and procedure, to determine whether the canonical asymmetry emerges under these controlled conditions in adult Brazilian Portuguese production.

Statement of Authorship

We declare that the article was produced with contributions from both authors. The research presented was conceptualized by both authors, and the experiment was conducted by Lilian Scher. The initial draft of the article was written by Lilian Scher, with revision and translation into English by Pablo Faria. Data analysis was conducted by Lilian Scher, with review and contributions from Pablo Faria. Both authors contributed to the final revisions of the article.

References

BOCK, K; EBERHARD, K.M. Meaning, Sound and Syntax in English Number Agreement. *Language and Cognitive Processes*, v. 8, n. 1, p. 57-99, 1993.

BOCK, K.; MILLER, C.A. Broken Agreement. *Cognitive Psychology*, v. 23, n. 1, p. 45-93, 1991.

EBERHARD, K.M. The Marked Effect of Number on Subject-verb Agreement. *Journal of Memory and Language*, v. 36, n. 2, p. 147-164, 1997.

EBERHARD, K. M. The Accessibility of Conceptual Number to the Processes of Subject-verb Agreement in English. *Journal of Memory and Language*, v. 41, n. 4, p. 560-578, 1999.

FAYOL, M.; HUPET, M.; LARGY, P. The Acquisition of Subject-verb Agreement in Written French: From Novices to Experts' Errors. *Reading and Writing*, v. 11, n. 2, p. 153-174, 1999.

FRANCK, J.; VIGLIOCCO, G.; NICOL, J. Subject-verb Agreement Errors in French and English: The Role of Syntactic Hierarchy. *Language and Cognitive Processes*, v. 17, n. 4, p. 371-404, 2002.

FRANCK, J. *et al*. Normal and Pathological Development of Subject-verb Agreement in Speech Production: A Study on French Children. *Journal of Neurolinguistics*, v. 17, n. 2, p. 147-180, 2004.

FRANCK, J. Reaching Agreement as a Core Syntactic Process: Commentary of Bock & Middleton Reaching Agreement. *Natural Language & Linguistic Theory*, v. 29, p. 1071-1086, 2011.

GALVES, C. O enfraquecimento da concordância no Português Brasileiro. *In*: ROBERTS, I.; KATO, M. (org.). *Português brasileiro*: uma viagem diacrônica. Campinas: Unicamp, 1993. p. 387-408.

GOMES, C. A. *et al*. Variação e aquisição da flexão nominal e da flexão verbal. *Revista Gragoatá*. Niterói, n. 30, p. 39-54, 1. sem, 2011.

GUY, G. R. *Linguistic Variation in Brazilian Portuguese*: Aspects of the Phonology, Syntax, and Language History. 1981. 406 f. Tese (Doutorado em Linguística), Universidade da Pensilvânia, Pensilvânia, 1981.

KATO, M. Strong and Weak Pronominals in the Null Subject Parameter. *Probus*, v. 11, n. 1, p. 1-37, 1999.

LOPES, R.E.V. The Production of Subject and Object in Brazilian Portuguese by a Young Child. *Probus*, v. 15, n. 1, p. 121-144, 2003.

LOPES, R. E. V.; SOUZA, T. T.; ZILLI, A. S. Tempo e concordância e seus efeitos na aquisição do português brasileiro. *In*: ENCONTRO DO CELSUL, 6., 2004. *Anais* [...] Florianópolis: CELSUL, 2005, p. 1-10.

LORIMOR, H.; STEPHENS-HECKER, N.; MILLER, C. When It Comes to Complex NPs, Not All Preschoolers Agree. *Language Learning and Development*, v. 15, n. 4, p. 295-316, 2019.

MAIA, M., FERNANDÉZ, E., COSTA, A.; LOURENÇO-GOMES, M. Early and Late Preferences in Relative Clause Attachment in Portuguese and Spanish, *Journal of Portuguese Linguistics*. v. 6, n.1, p. 227-250, 2007.

MENDES, R.B.; OUSHIRO, L. Variable Number Agreement in Brazilian Portuguese: An Overview. *Language and Linguistics Compass*, v. 9, n. 9, p. 358-368, 2015.

MOLINA, D. *Aquisição da linguagem e variação linguística*: um estudo sobre a flexão verbal variável na aquisição do PB. 2018. 279 f. Tese (Doutorado em Linguística) – Universidade Federal de Juiz de Fora, Juiz de Fora, 2018.

NARO, A. J. The Social and the Structural Dimensions of a Syntactic Change. *Language*, n. 57, p. 63-98, 1981.

NICOL, J.L.; FORSTER, K. I.; VERES, C. Subject-verb Agreement Processes in Comprehension. *Journal of Memory and Language*, v. 36, n. 4, p. 569-587, 1997.

NOZARI, N.; OMAKI, A. Syntactic Production is Not Independent of Inhibitory Control: Evidence From Agreement Attraction Errors. *In*: ANNUAL CONFERENCE OF THE COGNITIVE SCIENCE SOCIETY, 40., 2018, Wisconsin. *Proceedings* [...]. Wisconsin: Cognitive Science Society, 2018. p.822- 827.

NOZARI, N.; OMAKI, A. Revisiting Agreement: Do Children and Adults Compute Subject-verb Agreement Differently? *In*: ANNUAL MEETING OF THE COGNITIVE SCIENCE SOCIETY, 44., 2022, Wisconsin. *Proceedings* [...]. Wisconsin: Cognitive Science Society, 2022. v. 44, n. 44, p. 409-415.

PEARLMUTTER, N. J.; GARNSEY, S.M.; BOCK, K. Agreement Processes in Sentence Comprehension. *Journal of Memory and Language*,1999. v. 41, n. 3, p. 427-456.

REIS, M. M. *Aquisição da variação e mudanças na(s) gramática(s) das crianças*: um olhar sobre a Concordância Variável no PB. 2020. 179 f. Dissertação (Mestrado em Linguística), Universidade Estadual de Campinas, Campinas, 2020.

RODRIGUES, E. D. S. *Processamento da concordância de número entre sujeito e verbo na produção de sentenças.* 2006. 203 f. Tese (Doutorado em Letras) – Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro, 2006.

RUBINO, R.; PINE, J. Subject-verb Agreement in Brazilian Portuguese: What Low Error Rates Hide. *Journal of Child Language*, v. 25, p. 35-59, 1998.

SCHERRE, M. M. P.; NARO, A. J. A variação da concordância verbal na escrita monitorada. *In*: PAIVA, M.C.; ABREU, C.G (org.). *Dinâmica da variação e da mudança na fala e na escrita*. Rio de Janeiro: Contracapa, 2014. p. 21-43.

WAGERS, M. W.; LAU, E. F.; PHILLIPS, C. Agreement Attraction in Comprehension: Representations and Processes. *Journal of Memory and Language*, v. 61, n. 2, p. 206-237, 2009.