INTERFERENCE DURING SUBJECT RETRIEVAL IN SENTENCE COMPREHENSION. AN INTERFERENCE-BASED CHECKING ACCOUNT FOR OBJECT ATTRACTION

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1. Introduction

The process of computing syntactic representations during language comprehension includes the checking of dependencies like subject-verb agreement. The rule for subject-verb agreement is as simple as this: If the subject has a certain phi-feature specification, the verb has to have the identical values for these features. In German, subject and verb have to agree in person and number.[1]

For the processing of subject-verb agreement it is useful to distinguish two phases. First, a phrase structure representation for the subject has to be built and integrated into the *current partial phrase marker* (CPPM) for the entire sentence. On encountering the verb, not only the verb has to be integrated into the CPPM, but also subject-verb agreement has to be checked by comparing the number specifications of the subject and the verb. In verb-final languages like German, subject and verb can be separated by several items. As a consequence, the subject has to be retrieved from memory in order to carry out the comparison. Both the subject integration phase and the agreement checking phase might be vulnerable to disruptions resulting in an agreement error.

In this paper, I will discuss a specific kind of agreement error, namely attraction errors which occur when the subject and verb are separated by a further noun phrase (NP) not matching the subject in number. This intervening NP can be a modifier or an object. I will show that attraction errors elicited by an object cannot be attributed to an erroneous subject representation but rather to an interference-based disruption during subject retrieval in the checking phase.

The paper is organized as follows: In section 2 attraction errors are introduced. Section 3 shows that similar agreement errors can be elicited by an object. Sections 4-6 present a series of three experiments investigating object attraction. Finally, section 7 presents an interference-based account for object attraction claiming that agreement errors elicited by an object can be attributed to interference during the checking phase.

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[1] Cf. Corbett (2006) for an overview of the typological diversity of agreement.

2. Attraction Errors

So-called attraction errors arise when a complex subject phrase contains a further noun phrase (which I call 'distractor') mismatching the head noun in number. A 'real life' example is given in (1) (from *The New Yorker*, quoted from Bock & Miller 1991: 46).

(1)   *The readiness of our conventional forces are at an all-time low.

In (1) the verb erroneously agrees with the plural modifier instead of agreeing with the actual agreement controller, the head noun of the subject NP. Attraction errors have first been observed for language production (starting with Bock & Miller 1991; cf. the overview in Bock et al., 2001) but have been attested for language comprehension as well (e.g. Branigan et al. 1995, Pearlmutter et al. 1995, 1999, Nicol et al. 1997).

Attraction errors can be used to investigate questions of representation and computation. The present paper focuses on the computation of subject-verb agreement. As we will see in section 3 the checking process can be disrupted by an intervening object. I will discuss whether attraction errors elicited by an object are due to an impaired subject representation or rather due to interference during subject retrieval. Beforehand I will briefly discuss the main results from prior research concerning attraction within a complex subject NP.

Attraction errors in modifier constructions exhibit a strict asymmetry: A plural NP modifying a singular subject NP can cause an attraction error, while a singular NP modifying a plural subject NP cannot. With a sentence completion task using sentence fragments like (2), Bock and Miller (1991) found more agreement errors in (2b) than in (2a), but no difference in error rates between (2c) and (2d).

(2)   a. the key to the cabinet ...
       b. the key to the cabinets ...
       c. the keys to the cabinet ...
       d. the keys to the cabinets ...

This asymmetry between singular and plural is firmly established for English, and has also been found in other languages including German (for German see Hartsuiker et al. 2003, Hemforth & Konieczny 2003, Hölscher & Hemforth 2000). This finding is taken as evidence for an asymmetric representation of number (cf. Eberhard 1997) and a feature percolation account for attraction errors (cf. Nicol et al. 1997). According to this account, attraction errors result from erroneous feature percolation during the integration of the second NP into the current syntactic representation. As a result, a singular subject NP turns into a plural NP on processing a plural NP. The asymmetry naturally follows under the assumption of an underlying plural specification for plural nouns and the absence of such a number specification for singular nouns (cf. Eberhard 1997). In this case only plural NPs would be represented by a number feature —a plural flag— which can cause attraction while singular NPs lack a corresponding singular feature or flag. With singular not being represented by a feature, singular modifiers cannot cause number attraction.

Further evidence for the percolation account comes from the finding, that the hierarchical distance between the head noun and the second noun is a main determinant of attraction. Although the verb is closer to the plural modifier in (3b) than in (3a), Nicol and Vigliocco (discussed in Nicol et al. 1997) found more attraction errors for (3a) than for (3b). Comparable results for language comprehension have been provided by Nicol et al. (1997).

(3) a. The telegram [to the *friends* [of the soldier]] …
     b. The telegram [to the friend [of the *soldiers*]] …

To sum up, the percolation account attributes attraction errors to erroneous feature percolation during the subject integration phase. The checking mechanism which is assumed to work basically flawlessly will later on retrieve a flawed subject representation and detect a seemingly agreement violation in actual ungrammatical sentences.

3. Object Attraction

Attraction errors are not restricted to complex subject NPs. For production, it has been shown that an object which does not match the subject in number can cause attraction as well (cf. Hartsuiker et al. 2001, Hemforth & Konieczny 2003). Sections 4-6 will present three experiments on German sentence comprehension showing that object attraction occurs in comprehension as well.

An obvious question that comes up at this point is whether attraction errors elicited by an object can be attributed to the same underlying mechanism as attraction errors elicited by a modifier. While percolation within a complex NP is conceivable, it is rather implausible from an object which is not part of the subject NP. When processing of the subject is completed, further material outside the subject NP should not affect its representation. As an alternative I will suggest that the checking process itself is disrupted by the presence of an object. The object interferes in the process of subject retrieval. Instead of retrieving the actual controller for agreement – the subject, the parser erroneously retrieves the object. If the object bears a number specification different from the subject's number specification a seeming agreement error will be detected.

The percolation account and the checking account make different predictions with respect to an asymmetry between singular and plural subjects and with regard to the role of case marking. Both dimensions have been tested experimentally using the method of speeded grammaticality judgments. Section 4 presents an experiment investigating whether the asymmetry observed for attraction in complex subject NPs shows up for object attraction as well. Sections 5 and 6 look at the role of morphological case marking.

4. Experiment 1

Experiment 1 compares attraction in simple subject-object sentences and attraction within a complex subject NP. Thirty-seven participants read forty sentences like (4) and judged their grammaticality. Each participant saw each sentence in one

of its eight versions. The versions result from a cross-factorial design including construction type, number specification of the subject and number specification of the second NP. All sentences contained an embedded clause with either a complex subject modified by genitive NP and an intransitive verb (cf. (4a-d)), or a simple subject followed by an object and transitive verb (cf. (4e-h)). The subject head noun of this embedded clause was always a feminine (and therefore case ambiguous) noun and either singular or plural. The modifier respective object was also a feminine noun and either matched or mismatched the subject in number.

(4) a. Ich habe gesehen, dass die Freundin der Schülerin gelacht hat.
       I   have seen   that the friend   the pupil.gen laughed has
    b. Ich habe gesehen, dass die Freundin der Schülerinnen gelacht hat.
       I   have seen   that the friend   the pupils.gen   laughed has
    c. Ich habe gesehen, dass die Freundinnen der Schülerinnen gelacht haben.
       I   have seen   that the friends   the pupils.gen   laughed have
    d. Ich habe gesehen, dass die Freundinnen der Schülerin gelacht haben.
       I   have seen   that the friends   the pupil.gen laughed have
       'I have seen that the friend(s) of the pupil(s) laughed'
    e. Ich habe gesehen, dass die Freundin die Schülerin ausgelacht hat.
       I   have seen   that the friend   the pupil.acc laughed-at has
    f. Ich habe gesehen, dass die Freundin die Schülerinnen ausgelacht hat.
       I   have seen   that the friend   the pupils.acc   laughed-at has
    g. Ich habe gesehen, dass die Freundinnen die Schülerinnen ausgelacht haben.
       I   have seen   that the friends   the pupils.acc   laughed-at have
    h. Ich habe gesehen, dass die Freundinnen die Schülerin ausgelacht haben.
       I   have seen   that the friends   the pupil.acc laughed-at have
       'I have seen that the friend(s) laughed at the pupil(s).'

Sentences were presented visually on a computer screen in a word by word fashion with each word appearing at the same position (mid-screen). Each word was presented for 225 ms plus additional 25 ms for each character to compensate for length effects. Participants made their judgment immediately after the clause-final by pressing one of two response buttons. They had to respond within a time window of 2,000 ms, otherwise the trial was finished.

The results of experiment 1 are given in Table 1. The first row presents results (in terms of percentage of correct judgments) for the modifier construction. The second row gives the results for sentences in which the distractor is the object. Attraction rates (measured in difference in correctness between the match and the corresponding mismatch condition) are shown in Figure 1.

Three-way ANOVAS revealed a main effect of sentence type ($F1 = 25.9$, $p < .0001$; $F2 = 59.4$, $p < .0001$). Sentences in the modifier construction received less correct judgments than sentences in the object-construction. A potential reason for this difference will be discussed below. Furthermore, a main effect of matching was observed. Participants produced more judgment errors when subject and distractor (modifier respective object) differed in number ($F1 = 6.8$, $p = .013$; $F2 = 9.8$, $p = .003$). Crucially, experiment 1 exhibits different attraction patterns for the two types of construction. While the modifier construction replicated the asymmetric at-

Table 1

Percentages of correct judgments in experiment 1

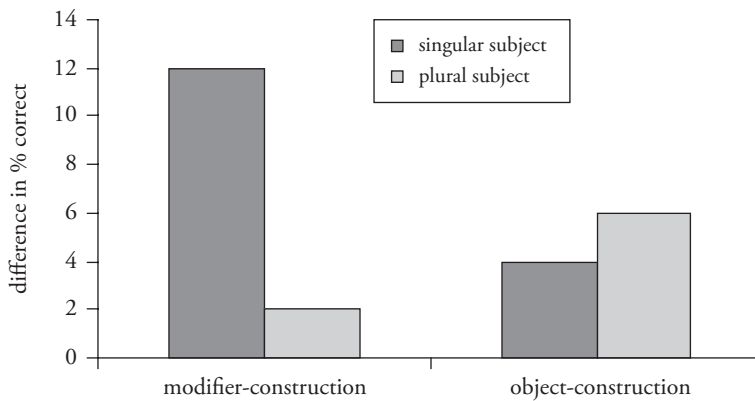|	singular subject		plural subject	
	Match	**Mismatch**	**Match**	**Mismatch**
modifier	76	68	81	79
object	96	92	91	85

Figure 1

Attraction rates in experiment 1

traction pattern known from prior research, object attraction occurred for both singular and plural subjects, with no asymmetry. The three-way interaction reached significance in the item-analysis (*F2 = 1.0, p < .05*), but failed significance in the subject analysis (*F1 = 1.0, p = .32*).

This difference in error pattern suggests that there is also a difference with regard to the processes which underlie the agreement error. Before discussing these processes, I will briefly refute a potential objection with regard to the modifier construction.

Note that the modifier construction contains a local ambiguity. When the modifier is a singular NP it is case ambiguous between genitive and dative. Therefore, it can either be a genitive modifier as in (5a), a genitive object as in (5b) or a dative object as in (5c). This local ambiguity is resolved on the verb participle.

(5)   a.   …, dass die Freundin der Schülerin gelacht hat
            that the friend   the pupil.gen laughed has
         'that the friend of the pupil laughed'
      b.   …, dass die Freundin der Schülerin gedacht   hat
            that the friend   the pupil.gen commemorated has
         'that the friend commemorated the pupil'

c. …, dass die Freundin der Schülerin geholfen hat
  that the friends the pupil.dat helped has
 'that the friend helped the pupil'

Since plural modifiers are only compatible with genitive, this ambiguity might produce a difference between match and mismatch conditions. However, while such an ambiguity-related mismatch effect can explain the overall low performance in the relevant conditions, it did not produce the observed asymmetry. Actually, it works against the asymmetry. With singular subjects the ambiguity occurs in the match condition (ambiguous singular modifier), but not in mismatch condition (unambiguous plural modifier). As a result the ambiguity might reduce the difference between the match and mismatch condition. With plural subjects, on the other hand, the ambiguity only occurs in the mismatch condition and therefore might increase the difference between the match and mismatch condition. Thus, although the observed asymmetry between singular and plural subjects might be modulated by the local ambiguity for singular modifiers, it is clearly produced by attraction.

In summary, experiment 1 has two main results. First, attraction errors can be elicited by modifiers and objects. Secondly, attraction errors elicited by a modifier are restricted to singular subjects, whereas attraction errors elicited by an object occur with both singular and plural subjects. As pointed out in section 2, an asymmetry between singular and plural is a crucial argument for percolation. Given that only plural is represented by an additional feature, only a plural modifier can elicit percolation. The absence of an asymmetry for object attraction argues against a percolation process in this configuration. The alternative is not to blame the subject representation but rather the checking process itself. For agreement checking, it is in principle conceivable that both singular and plural objects interfere with the retrieval of the subject. Retrieving the object instead of the actual agreement controller leads to a seeming agreement violation and a subsequent judgment error when subject and object differ in number.

It must be noted that although experiment 1 replicates findings from an prior experiment which only looked at object attraction (cf. Häussler et al. 2005), it stand in contrast to findings from sentence production. In a sentence-completion experiment, Hemforth and Konieczny (2003) found a reversed asymmetry. An attraction-like effect only occurred in sentences with a plural subject. For singular subjects Hemforth and Konieczny found no difference between sentences where the object was a singular NP and sentences in which the object was a plural NP. In addition to the attraction-like effect for plural subjects, a main effect of subject number was observed – participants produced more agreement errors for plural subjects than for singular subjects, even in the match condition. On the basis of this main effect, Hemforth and her colleagues (Hemforth & Konieczny 2003, Konieczny et al. 2004) offer an activation based account. The crucial assumption is that the observed difference for plural subjects is not due to an increased error rate in the mismatch condition, but rather due to a decreased error rate in the match condition. The authors claim that a plural object reactivates the plural representation of the subject which otherwise occasionally gets lost due to decay over time. The higher activation level of the plural specification in the match condition reduces the probability of an agreement error when the verb has to be pronounced. Under the assumption of an asymmetric rep-

resentation of number, no such effect is expected with singular subjects since there is nothing to reactivate.

The authors further claim that the described reactivation mechanism is restricted to co-arguments and does not occur for modifiers. They argue that an object unlike a modifier is integrated directly with the verb thereby giving the plural feature the opportunity to interfere with the plural feature of a co-argument. For modifiers, the only way to interfere with the head noun is via feature percolation. Note that this is not a necessary assumption since the modifier has to be integrated with the head noun and thereby might reactivate the plural specification.

However, this (re-)activation-based account can only partially explain the findings of the present comprehension experiment. Although sentences with a plural subject received less correct judgments than sentences with a singular subject, experiment 1 exhibits attraction effects for both sentence types. Crucially, experiment 1 exhibits no asymmetry between singular and plural subjects. Thus, decay and reactivation might play a role, but they are not the only source for agreement errors. Experiments 2 and 3 provide further evidence for the assumption that interference is the main source of attraction.

5. Experiment 2

Experiments 2 and 3 make use of the fact that German masculine and feminine determiners differ with regard to case marking. As can be seen in Table 2, the article has identical forms for nominative and accusative within the feminine and the neuter gender and the plural whereas these forms are different in the masculine gender.

Nouns show only little morphological case marking. If case is marked at all, it is mostly genitive or dative case. There is only one declinational class where nominative and accusative have distinct forms – masculine nouns like *Student* ('student'). How-

Table 2

Inflectional paradigm for the German definite article

Case	Gender		
	masculine	feminine	neuter
		singular	
nominative	der	die	das
genitive	des	der	des
dative	dem	der	dem
accusative	den	die	das
		plural	
nominative	die	die	die
genitive	der	der	der
dative	den	den	den
accusative	die	die	die

ever, these nouns have identical forms in all cells of the paradigm, except nominative singular (cf. Table 3).

Table 3

Inflectional paradigm for the noun *Student* ('student')

Case	Number	
	singular	plural
nominative	Student	Studenten
genitive	Studenten	Studenten
dative	Studenten	Studenten
accusative	Studenten	Studenten

Plural nouns are in general ambiguous with respect to case. A consequence of this syncretism is that a definite noun phrase can be case ambiguous depending on the number specification and gender. A singular masculine NP is unambiguous with respect to case,[2] feminine NPs, neuter NPs and plural NPs in general are indistinguishable in the nominative and accusative case.

Experiment 2 investigates forty embedded clauses like (6). The subject NP was in either case ambiguous or unambiguously marked for nominative. Unambiguous NPs had masculine gender, ambiguous NPs were the corresponding feminine counterparts. The object was always a feminine (i.e. case ambiguous) NP which either matched or mismatched the subject in number. Furthermore the embedded clause did or did not contain an adverbial between the object and the verb.

(6) a. …, dass die Studentin   die Professorin (gestern   öffentlich) kritisiert hat
           that the student$_{(fem)}$ the professor   yesterday in-public   criticized has
     b. …, dass die Studentin   die Professorinnen (gestern   öffentlich) kritisiert hat
           that the student$_{(fem)}$ the professors   yesterday in-public   criticized has
     c. …, dass der Student   die Professorin (gestern   öffentlich) kritisiert hat
           that the student$_{(masc)}$ the professor   yesterday in-public   criticized has
     d. …, dass der Student   die Professorinnen (gestern   öffentlich) kritisiert hat
           that the student$_{(masc)}$ the professors   yesterday in-public   criticized has
         'that the student criticized the professor(s) (yesterday in public)'

Forty participants took part in the experiment. The procedure of the experiment was the same as in experiment 1. The percentages of correct judgments are given in

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[2] However, masculine NPs are not always unambiguously marked for case. When introduced by a possessive NP the case of the NP is obscured.

 (i)   {Peters Lehrer / der Lehrer} hat angerufen.

Peter's teacher the teacher has called

 (ii) Ich kenne {Peters Lehrer / den Lehrer}.
       I   know   Peter's teacher the teacher

Table 4. Since the presence or absence of an adverbial did not affect correctness, Figure 2 presents attraction rates collapsed over sentences with and without an adverbial.

Table 4

Percentages of correct judgments in experiment 2

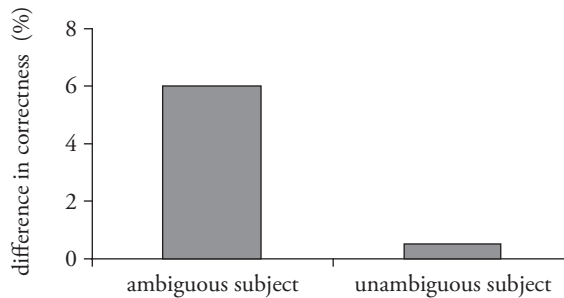|	ambiguous subject		unambiguous subject	
	Match	Mismatch	Match	Mismatch
with adverbial	96	89	95	94
without adverbial	94	89	96	96

Figure 2

Attraction rates in experiment 2

Three-way ANOVAS revealed main effects of match ($F1 = 9.0, p < .005$; $F2 = 7.7, p < .01$), case ambiguity ($F1 = 13.4, p < .001$; $F2 = 7.0, p < .05$) and an interaction of the two factors ($F1 = 5.4, p < .05$; $F2 = 6.6, p < .05$). Pairwise comparisons show that the mismatch effect is restricted to case ambiguous subjects ($t1 = 3.6$, $p < .005$; $t2 = 4.0, p < .001$) and did not occur with unambiguous subjects ($t1 < 1$; $t2 < 1$). The presence or absence of an adverbial had no effect at all (*both Fs < 1*).

The crucial finding of experiment 2 is that attraction errors only occurred with case ambiguous subjects. Note, however, that the case ambiguous determiner *die* is also number ambiguous (*die Professorin$_{SG}$, die Professorinnen$_{PL}$*). In a language production experiment investigating number attraction in the modifier construction, Hartsuiker et al. (2003) have found attraction effects for German feminine head nouns but not for head nouns which either had masculine and neuter gender. For the latter they found no errors when head noun and modifier matched in number and only few errors in the mismatch conditions. Crucially, the difference between match and mismatch conditions was not significant. Although the neuter definite article is case ambiguous, it is not ambiguous with respect to number (cf. Table 2). Therefore, Hartsuiker et al. (2003) attribute the attraction errors found for feminine

head nouns to the number ambiguity of the definite article and not to the case ambiguity.

In the current experiment it is rather unlikely that the case ambiguity effect is actually a number ambiguity effect. If so, we would expect more judgment errors in the match conditions, but participants did pretty well in these conditions.[3] Furthermore it is neither the article nor the noun per se which marks the NP unambiguously for case and number. While most German nouns lack any morphological case marking for nominative or accusative, the inflectional paradigm for the definite article has different forms for nominative and accusative case in the masculine gender. However, the inflectional paradigm also contains several identical forms. The definite article *der* is not only singular nominative masculine, but also singular genitive and dative feminine and genitive plural for all three genders. The form *den* is ambiguous as well (accusative singular masculine, dative plural). Due to this syncretism articles are often ambiguous with respect to case and number. It is the combination of determiner and noun which makes the noun phrase *der Student* ('the student') in (6c) and (6d) unambiguously marked for nominative singular. The feminine counterpart *die Studentin* is case ambiguous, but unambiguous with respect to number.

If we rule out an effect of number ambiguity, the observed case ambiguity effect is hard to reconcile with a percolation account. Why should an NP which is unambiguously marked for case resist feature overwriting with respect to number? A checking account, on the other hand, can easily cope with the effect of morphological case marking. In order to check subject-verb agreement at the verb the parser needs to retrieve the subject. The parser looks for a nominative NP. For unambiguous subjects this is an easy task, for ambiguous subjects the parser sometimes is misguided by an object if the object is case ambiguous and therefore morphologically compatible with nominative case. In sum, experiment 2 provides a challenge for the percolation account and evidence for the checking account.

6. Experiment 3

Experiment 3 investigated the role of case marking of the object. In a sentence production experiment in Dutch, Hartsuiker et al. (2001) found an attraction effect when the object was a full NP, but no attraction effect when the object was a pronoun. They attribute the lack of object attraction for pronouns to the fact that Dutch pronouns are overtly marked for case whereas non-pronominal NPs are not. In the present experiment, the object was either a case ambiguous feminine NP or the unambiguous masculine counterpart. Furthermore, the object either matched or mismatched the subject in number. The subject was a case ambiguous feminine NP and either singular or plural. Again, an adverbial did or did not intervene between object and verb. The experiment included forty sentences like (7).

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[3] Keep in mind that particpants had to read and judge sentences under time pressure. They had no possibility to look back at the subject. A mean error rate of 4% in the mismatch conditions is a perfect result in the paradigm of speeded-grammaticality judgments.

(7)   a. ..., dass die Studentin die Professorin (gestern   öffentlich) kritisiert hat
                 that the student   the professor(fem) (yesterday public   criticized has
      b. ..., dass die Studentinnen die Professorin (gestern   öffentlich) kritisiert haben
                 that the students   the professor(fem) yesterday public   criticized have
      c. ..., dass die Studentin den Professor   (gestern   öffentlich) kritisiert hat
                 that the student   the professor(masc) yesterday public   criticized has
      d. ..., dass die Studentinnen den Professor   (gestern   öffentlich) kritisiert haben
                 that the students   the professor(masc) yesterday public   criticized have
           'that the student(s) criticized the professor (yesterday in public)'

Forty-eight participants took part in experiment 2. The procedure of the experiment was the same as before. The percentages of correct judgments are shown in Table 5. Again the presence or absence of an adverbial did not affect correctness. Figure 3 presents attraction rates collapsed over sentences with and without an adverbial.

Table 5

Percentages of correct judgments in experiment 3

	ambiguous object		unambiguous object	
	Match	Mismatch	Match	Mismatch
with adverbial	97	85	97	93
without adverbial	96	86	97	94

ANOVAs revealed a main effect of match ($F1 = 21.0$, $p < .0001$; $F2 = 31.3$, $p < .0001$), ambiguity ($F1 = 11.5$, $p < .005$; $F2 = 13.3$, $p < .001$) and an interaction of the two factors ($F1 = 12.9$, p $.001$; $F2 = 16.6$, $p < .0005$). The adverbial had no effect (both Fs < 1). The remaining interactions failed significance (*all Fs < 1*).
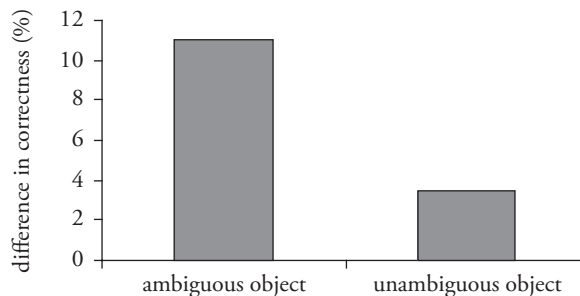

Figure 3

Attraction rates in experiment 3

Experiment 3 provides further evidence for the role of morphological case marking. Although attraction occurred for both ambiguous and unambiguous objects, the

attraction rate is higher for ambiguous objects and only marginally for unambiguous objects. This is in line with findings from sentence production. The present results show that the lack of attraction for Dutch object pronouns found in Hartsuiker et al. (2001) is nothing specific for pronouns but rather has to do with case marking. We take this as evidence for an interference scenario, in which unambiguous case marking reduces the probability of mistaking an object as the subject.[4]

7. Conclusions

The present experiments provide evidence for attraction errors elicited by an object which does not match the subject in number. Before discussing further findings and an interference-based checking account for object attraction, I have to mention a potential objection. Since subject and object were always case ambiguous – compatible with both nominative and accusative case, it might be the case that participants occasionally analyze the first NP of the embedded clause as the object and the second NP as the subject. For object-before-subject (OS) readings agreement with the second NP would be correct. Thus, what looks like a judgment error due to a seeming agreement violation in the mismatch condition could rather be a sign of a (possible) OS reading with an actual agreement violation. However, given the strong evidence for a SO-preference (e.g. Bader & Meng 1999), this is a rather unlikely scenario. Further evidence for attraction as the cause of judgment errors comes from experiment 3 which shows that the same type of errors can be observed with unambiguous objects (for details see section 6). Finally, object attraction has been attested for Dutch as well (cf. Hartsuiker et al. 2001), a language which does not allow to scramble an object in front of the subject, except a focused object (cf. DeHoop & Kosmeijer 1995).

The experiments revealed two further effects. First, object attraction does not exhibit the same asymmetry observed in the modifier construction. Secondly, experiments 2 and 3 establish effects of morphophonological ambiguity. Object attraction is restricted to case ambiguous subjects and only marginally occurs with unambiguous objects. These findings are taken as evidence against a percolation scenario and for a scenario in which the checking process itself is disrupted due to interference by the object.

Percolation accounts assume that for attraction errors the representation of the subject NP is flawed while the checking process itself works correctly. Such accounts are challenged by the results presented above for three reasons: (i) when processing of the subject is completed, further material outside the subject NP should not affect its representation, (ii) percolation should result in an asymmetry between singular and plurals, (iii) percolation should not be sensitive to case ambiguity.

As an alternative, I would like to suggest that during the checking process which includes subject retrieval the object causes interference and occasionally is misretrieved as the controller for agreement. Such an interference-based checking account

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[4] Hartsuiker et al. explicitly reject the idea that the effect of case ambiguity might be due to a misidentification of syntactic functions in the comprehension part of the sentence completion task.

offers a solution for all three challenges raised above. First, it is possible for an NP outside the subject to interfere in the process of subject retrieval, as long as it at least partially matches the retrieval cue. Secondly, interference is possible for both singular and plural objects. Thus, no asymmetry is expected. Third, unambiguous case marking should reduce interference.

Note that the interference-based checking account does not assume a linear, backward-search through the sentence conceived of as a string of words. As McElree (2000) and McElree et al. (2003) have shown, retrieval during sentence comprehension is mediated by a direct access mechanism, not by a search process. Direct access is achieved via retrieval cues. A further element can interfere when it (partially) matches the retrieval cues. Interference has a chance to apply whenever the parser needs to retrieve some earlier information from the CPPM, either to integrate the current word or to revise an initial analysis. For example, Gordon and his colleagues have shown that interference contributes to the increased complexity of object-extracted relative clauses in contrast to subject-extracted relative clauses (cf. Gordon, Hendrick & Johnson 2001, Gordon, Hendrick & Levine 2002). For interference during reanalysis van Dyke and Lewis (2003) have shown that recovery from a garden-path can become particularly difficult when the ambiguous region contains interfering items.

The present study provides evidence for interference during subject retrieval. Since the retrieval cues include nominative case, the object is always at a disadvantage and therefore only rarely considered to be the retrieval target. Ambiguity of case marking increases the probability of interference. Number does not seem to be among the retrieval cues, indicated by the fact that both singular and plural objects cause interference leading to attraction errors.

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