Case and Reanalysis¹

Markus Bader,^{2,3} Michael Meng,² and Josef Bayer²

In this paper we discuss an asymmetry in the Case system of German and its implications for human sentence processing: the asymmetry between nominative/accusative and dative case. Starting from the assumption that dative case has a distinct grammatical representation—dative DPs are embedded into an extra structural layer KP—the results of two experiments will be presented, which show that dative assignment during reanalysis is accompanied by additional processing operations that are not needed when accusative or nominative are assigned. In particular, we show that dative assignment during reanalysis triggers reaccess to the mental lexicon, giving rise to greater processing difficulty. We conclude with a discussion of empirical and theoretical consequences of our findings.

INTRODUCTION

Besides various differences at the level of syntax and semantics (Vogel & Steinbach, 1998), dative Case in German differs from both nominative and accusative in that it is subject to stricter morphological licensing conditions (Bayer, Bader, & Meng, 1999; Gallmann, 1996). First, dative is almost always associated with distinct morphology whereas the forms for nominative and accusative often coincide. Furthermore, expressions that do not inflect and that, therefore, lack Case morphology altogether (e.g., clausal arguments, pronominal elements like *nichts*, and *viel*) are barred from positions to which dative is assigned, but not from positions to which accusative or nominative is assigned. In sum, the evidence suggests that dative Case in German must be licensed by morphological means, a condition that does not apply to accusative or nominative Case.

¹ Names appear in arbitrary order.

² Universität Jena, Jena, Germany.

³ Part of the research reported here was supported by DFG grant # Ba 1178/4-1 # awarded to M. B. and J. B. Author to whom all correspondence should be addressed: Institut für Germanistische Sprachwissenschaft, Universität Jena, Ernst-Abbe-Platz 4, 07740 Jena, Germany. E-mail: Markus.Bader@rz.uni-jena.de.

To capture these and related differences, Bayer *et al.* (1999) have proposed that the phrase-structural representation of dative DPs differs from that of accusative and nominative DPs. In contrast to nominative and accusative DPs like *die Frau*, dative DPs like *der Frau* are embedded into an extra structural layer KP (for *Kase Phrase*) whose head must be identified by appropriate dative morphology (cf. Fig. 1).

In what follows, we will explore some processing consequences of the grammatical differences between dative Case and nominative/accusative Case. Case-related processing asymmetries from the domain of first-pass parsing have been reported in Hopf, Bayer, Bader, and Meng (1998). Consider object–object ambiguities like (1). Before the sentence-final thematic verb in (1a) or (1b) is reached, it is already evident that the sentence-initial DP *Menschen* (+ relative clause) will function as object of the sentence since it fails to agree in number with the finite verb *sollte*. However, it remains open which Case the object will bear. It turns out to be a dative object in the context of *helfen* (1a), but an accusative object in the context of *unterstützen* (1b) (ACC = accusative; DAT = dative).

- (1) a. Menschen_{DAT}, die in Not sind, sollte man helfen
 people who in distress are should one help
 b. Menschen_{ACC}, die in Not sind, sollte an unterstützen
 people who in distress are should one support

Hopf *et al.* (1998) have shown that in sentences like (1), disambiguation toward dative Case as in (1a) results in a garden-path effect, suggesting a first-pass parsing preference for accusative Case assignment. Under the KP analysis of dative DPs, this preference follows from parsing strategies like Minimal Attachment (Frazier, 1987). Note that the plural affix *-en* of *Menschen* is compatible with nominative, accusative, and dative alike. The affix can identify the head of KP, but since it provides no unambiguous evidence for the need to postulate a KP shell, the parser will attach nomi-

Fig. 1. Phrase structural representation for *die Frau* (nominative / accusative Case) and *der Frau* (dative Case). (KP = kase phrase; DP = determiner phrase; NP = noun phrase).

nal items as simple DPs, which are structurally simpler. In object position as in (1), such a DP can only be assigned accusative Case.

Furthermore, it has been shown that dative Case plays a special role in the so-called Case attraction phenomenon (Meng & Bader, 1998). Case attraction refers to the observation that a DP modified by a relative clause can inherit the Case feature from the relative pronoun. In the processing of subject–object ambiguities, this may have the consequence that the usual preference for subject–object structures reverses to an object–subject preference. In first-pass parsing, however, Case attraction can only be induced by a relative pronoun marked for dative Case and not, for example, by a relative pronoun marked for accusative Case, suggesting that only dative Case has the representational properties on which the mechanism that triggers Case attraction relies.

Here, our aim is to show that the grammatical differences between nominative/accusative and dative Case also lead to differential processing effects during second-pass parsing. Everything else being equal, the assignment of dative Case during reanalysis leads to greater processing difficulty because, as a consequence of the KP analysis for dative phrases, dative assignment necessitates additional operations which do not apply if, for example, accusative Case is assigned. In particular, we will argue for the Lexical Reaccess Hypothesis (Hopf *et al.*, 1998), which holds that in order to assign dative during reanalysis to a DP initially marked for nominative, the lexicon has to be reaccessed in order to make sure that the lexical items comprising this DP morphologically license dative Case. In the next section, we will introduce the Lexical Reaccess Hypothesis in more detail and provide some initial evidence for it. Afterward, the results of two experiments will be presented that examined specific predictions derived from the Lexical Reaccess Hypothesis.

THE LEXICAL REACCESS HYPOTHESIS

Consider the two locally ambiguous sentences in (2).

- (2) a. . . . daß Maria_{NOM} das Buch_{ACC} geliefert hat.
 that Maria the book delivered has
 “that Maria delivered the book”
 b. . . . daß Maria_{DAT} das Buch_{NOM} geliefert wurde.
 that Maria the book delivered was
 “that the book was delivered to Maria”

Because of the morphological ambiguity of the DPs *Maria* and *das Buch*, one cannot know which of these DPs is the subject and which is the

object before encountering the clause-final disambiguating auxiliary. Sentence (2a) ends with the auxiliary *hat*. Consequently, (2a) is an active sentence with *Maria* subject and *das Buch* accusative object. Sentence (2b), in contrast, ends with the passive auxiliary *wurde*. In this case, *das Buch* is the subject marked for nominative and *Maria* a dative object.

In several experiments, locally ambiguous passive sentences like (2b) have been shown to elicit a garden-path effect (Bader, in press; Meng & Bader, 1999), in line with what is known from subject–object ambiguities in other constructions (Hemforth, Konieczny, & Strube, 1993; Bader & Meng, 1999; Schlesewsky, Fanselow, Kliegl, & Krems, in press; also see Kaan, 1998). We conclude that for (2b), a subject–object structure is initially computed as well and that reanalysis becomes necessary once the sentence-final auxiliary *wurde* is received. Minimally, what the reanalysis procedures have to change in (2b) is the Case features on the DPs *Maria* and *das Buch*. *Maria* carries nominative but needs dative instead; *das Buch* has been initially assigned accusative, but should be assigned nominative.

If the KP analysis is correct, assigning dative during reanalysis should be connected with certain operations that are not necessary when only accusative or nominative are at stake. First, the assignment of dative Case to the DP *Maria* in (2b) requires that new structure has to be inserted: a KP shell into which the DP is embedded. Second the parser has to make sure that the lexical material contained in the DP has the appropriate means to properly identify the head of KP. Given that this information is not part of the phrase structural representation available to the parser, it has to be recovered from the lexicon. Consequently, lexical reaccess becomes necessary. In (2b), lexical reaccess would have to recover the information that *Maria* is a proper name which, although not overtly inflected for dative, is able to license the head of KP via N-to-D-to-K raising (see Bayer *et al.*, 1999, for discussion). In short, the KP analysis outlined above implies that dative Case should play a special role not only in first-pass parsing (where dative is avoided whenever possible), but also during reanalysis where it increases garden-path difficulty because of the additional operations it necessitates: KP insertion and, concomitant with it, lexical reaccess.

Note that ascribing garden-path difficulty to the need to reaccess the lexicon is not a new proposal. For example, Duffy, Morris, & Rayner (1988) have demonstrated a garden-path effect in sentences like (3), which contains the lexically ambiguous word *band*.

- (3) Of course the *band* was her favorite because it had such a beautiful engraving.

After reading *band*, the dominant reading “music group” is selected. When the disambiguating subordinate clause forces readers to revise their

initial selection, processing difficulties show up, suggesting that readers had to reaccess the lexicon in order to recover the nondominant meaning of *band*. (See also Ferreira & Henderson, 1991, for related discussion.)

Evidence for the assumption that lexical reaccess—as a consequence of the insertion of a KP—is an integral part of garden-path recovery in sentences like (2b) derives from the fact that it also sheds some light on performance variations in the processing of ungrammatical active and passive sentences like (4).

- (4) a. *. . . daß der Chefin das Buch geliefert hat.
 that the boss the book delivered has
 b. *. . . daß die Chefin das Buch geliefert wurde.
 that the boss the book delivered was

Instead of the morphologically ambiguous DP *Maria*, the two sentences (4a) and (4b) contain a definite DP/KP. In (4a), *der Chefin* is unambiguously marked for dative Case and, therefore, incompatible with the assignment of nominative as required in (4a). In (4b), the DP *die Chefin* is ambiguous between nominative and accusative, but incompatible with dative Case assignment as required in (4b). Consequently, both (4a) and (4b) are ungrammatical.

In a number of experiments using the method of speeded grammaticality judgments, we have found that ungrammatical active sentences like (4a) are judged as ungrammatical with high reliability whereas ungrammatical passive sentences like (4b) are often falsely accepted as grammatical. For example, in an experiment reported in Meng and Bader (1999), ungrammatical active sentences were correctly judged as ungrammatical at about 77% whereas the percentage of correct judgments for ungrammatical passive sentences was only at about 38%. In addition, ungrammatical passive sentences took much more time to be rejected as ungrammatical than ungrammatical active sentences (979 ms for ungrammatical passives versus 672 ms for ungrammatical actives).

If we assume that the parser is a serial mechanism, we can expect that the processing of garden-path sentences and the processing of corresponding ungrammatical sentences share certain properties. On encountering a local ungrammaticality, a serial parser has no way to tell whether this local ungrammaticality is a permanent one (ungrammatical sentence) or whether it is due to a prior misanalysis (GP sentences). Hence, there must be processes that determine the status of the local ungrammaticality. The simplest assumption is that the same processes occur in GP sentences and ungrammatical sentences: In both sentence types reanalysis is initiated, that is, attempts to assign a syntactic representation, which is in accordance with the grammar. In the case of GP sentences, reanalysis can be completed successfully, whereas in the case of ungrammatical sentences, it is eventually blocked at some point.

If reanalysis fails to be blocked, however, the sentence is perceived as grammatical, leading to performance errors in tasks like speeded grammaticality judgments.

For ungrammatical active sentences, it follows that the parser—in reaction to the local ungrammaticality—will try to assign nominative Case to the DP *der Chefin*, as required by the active auxiliary *hat*. Having been unambiguously marked for dative Case during first-pass parsing, the DP *der Chefin* is embedded in a KP. Since the parser will postulate a KP on first-pass parsing only if there is positive evidence for it, it can conclude that the DP *der Chefin* is morphologically unambiguous and thus incompatible with the assignment of nominative Case. Hence by looking at phrase structural information alone, namely the presence of a KP shell, the parser can derive immediately that reanalysis is impossible and the sentence therefore ungrammatical.

In ungrammatical passive sentences, dative has to be assigned to a DP (*die Chefin*), which received nominative Case during first-pass parsing. The situation is now quite different: While the mere presence of a KP blocks the assignment of nominative, the presence of a DP in itself does not rule out that reassignment of dative Case is possible. After all, the lack of KP might simply be a consequence of Minimal Attachment. Consequently, reanalysis will not already be disrupted at this point. Assigning dative to a DP, however, requires the postulation of a KP in which the DP is embedded. Furthermore, as argued above, lexical reaccess has to be performed in order to check whether *die Chefin* is morphologically compatible with dative.

We assume that this stage of lexical reaccess is responsible both for the prolonged reaction times and for the high rate of performance errors seen for ungrammatical passive sentences: False acceptances of (4b) as grammatical result if the lexical reaccess procedure delivers the wrong output, namely that *die Chefin* is compatible with dative although in fact it is not. One factor that could potentially mislead lexical reaccess pertains to the fact that *die Chefin* is partially ambiguous between nominative and accusative. DPs like *die Chefin* can thus be regarded as representing the default form, underspecified with respect to Case and used whenever a more specific form is missing. Consequently, its usage in syntactic positions to which dative Case is assigned would be blocked only by the fact that for dative, a specific form—*der Chefin*—indeed exists, prohibiting the insertion of the default form. However, if the lexical reaccess procedure fails to detect the existence of a specific form for dative, the default *die Chefin* will be treated on a par with proper names like *Maria* which may also be regarded as underspecified with respect to Case, but which indeed lack a specific form for dative, leading to the (wrong) conclusion that *die Chefin* can license KP and, consequently, that (4b) can be reanalyzed on a par with (2b).

In sum, resort to lexical reaccess does not only help to motivate why there should be garden-path difficulty in ambiguous passive sentences like (2b), but also explains why detecting the ungrammaticality of sentences like (4b) is a rather slow and error-prone process. In the remainder of this paper, we will provide experimental evidence for two predictions derived from the Lexical Reaccess Hypothesis. The first experiment investigates whether in processing subject–object ambiguities, the strength of garden path effects differs depending on the Case (dative or accusative) to be assigned during reanalysis. The second experiment will test whether performance on ungrammatical sentences varies depending on morphological properties of the DP to which dative Case is assigned during reanalysis and which, therefore, needs to be reaccessed according to our claims.

EXPERIMENT 1: CASE ASSIGNMENT IN REANALYSIS: DATIVE VERSUS ACCUSATIVE

The first experiment will compare the processing of the two types of locally ambiguous object–subject sentences shown in (5).

- (5) a. Wessen Anwalt_{DAT} denkst du, half der Lehrer_{NOM}
 whose lawyer think you helped the teacher
 “Whose lawyer do you think did the teacher help?”
- b. Wessen Anwalt_{ACC} denkst du, informierte der Lehrer_{NOM}
 whose lawyer think you informed the teacher
 “Whose lawyer do you think did the teacher inform?”

Both sentences consist of a matrix clause and an embedded clause from which the sentence-initial wh-phrase has been extracted. An ambiguity arises in these sentences because the phrase *wessen Anwalt* is morphologically compatible with nominative, accusative, and dative alike, leaving it open up to the sentence-final DP whether the wh-phrase will function as subject or object of the embedded clause. The sentence-final DP is unambiguously marked for nominative Case and thus takes the subject function, identifying the wh-phrase as the object of the embedded clause. The difference between (5a) and (5b) pertains to the Case, which the wh-phrase object will be assigned: *helfen* marks its object with dative Case while *informieren* assigns accusative Case.

Since in the processing of subject–object ambiguities, the assignment of a subject–object structure is generally preferred, we can expect a garden path in both (5a) and (5b). This also means that both in (5a) and (5b), the wh-phrase will be assigned nominative Case on first-pass parsing, but will receive dative Case in (5a) and accusative Case in (5b) during reanalysis.

For sentences identical to (5b), a fairly weak garden-path effect has already been established in prior work (Meng & Bader, in press). Given our assumptions about the representational difference between dative and accusative DPs and the Lexical Reaccess Hypothesis as a consequence of it, the garden-path effect in (5a) should be stronger because the assignment of dative during reanalysis—in contrast to the assignment of accusative—necessitates additional actions which do not have to be performed in (5a). Abstracting away from certain structural changes that are identical in (5a) and (5b), assigning dative to the *wh* phrase in (5a) requires postulating a KP shell for the DP *wessen Anwalt* and concomitant with it, lexical reaccess in order to check whether the lexical material contained in the *wh*-phrase is able to identify the head of the KP. Assigning accusative Case to the *wh*-phrase in (5a) does not necessitate these operations. No KP has to be postulated and, hence, lexical reaccess does not become necessary.

Method and Material

Twenty experimental sentences were constructed using structures as shown in (5) (see Meng, 1997, for a complete description). As in (5), all sentences contained a local subject–object ambiguity disambiguated by the Case marking of the sentence-final DP. Each sentence appeared in four conditions created by crossing structure (subject–object, object–subject) and verb type (dative, accusative). Sentences differed with respect to the Case, which the verb in the embedded clause assigns to its object: dative (*helfen*) or accusative (*informieren*). Furthermore, disambiguation was either toward an object–subject structure as in (5) or toward a subject–object structure as shown in (6). Whereas the sentence-final DP was unambiguously marked for nominative in object–subject sentences, it was marked for either dative (6a) or accusative Case (6b) in subject–object controls.

- (6) a. Wessen Anwalt_{NOM} denkst du, half dem Lehrer_{DAT}
 whose lawyer think you helped the teacher
 “Whose lawyer do you think helped the teacher?”
- b. Wessen Anwalt_{NOM} denkst du, informierte den Lehrer_{ACC}
 whose lawyer think you informed the teacher
 “Whose lawyer do you think informed the teacher?”

Four lists were created according to a latin square design. Experimental sentences were embedded in a list of 116 filler items and presented to 36 subjects in randomized order using the speeded grammaticality judgments procedure. Sentences were presented 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 224 ms plus an additional 14 ms for each

character to compensate for length effects. There was no interval between words. Grammaticality judgments were elicited immediately after the last word of the sentence. Subjects indicated their judgment by pressing a button box on the left-hand side for ungrammatical sentences and on the right-hand side for grammatical sentences. If subjects did not respond within 2000 ms, the trial finished automatically.

Results

Analyses were performed on both the percentages of correct answers and the reaction times for correct answers. Correct answers are all responses “grammatical” associated with a reaction time of less than 2000 ms. Reaction times were corrected for outliers individually for each subject. Data points more than 2 SD away from the subjects’ mean were replaced by the respective cut-off value. The resulting means are shown in Table I. On both dependent variables, separate two-way ANOVAS (2 structure $\times$ 2 verb type) were run, which included subjects (F_1) or items (F_2) as random effects.

The ANOVAs on percentages of correct answers revealed a main effect of structure [$F_1(1, 35) = 30.7$; $F_2(1, 19) = 17.7$, both $p < .01$], a main effect of verb type [$F_1(1, 35) = 37.6$; $F_2(1, 19) = 14.9$, both $p < .01$], and a significant structure $\times$ verb type interaction [$F_1(1, 35) = 24.2$, $p < .01$; $F_2(1, 19) = 8.23$, $p = .01$]. Subsequent analyses of simple main effects of structure on each level of verb type showed that the interaction can be reduced to the fact that structure had an effect only on dative sentences but not on accusative sentences. For dative sentences, object–subject sentences led to a significantly lower proportion of correct answers [$F_1(1, 35) = 43.9$; $F_2(1, 19) = 23.0$, both $p < .01$] whereas subject–object and object–subject sentences did not differ in accusative sentences [$F_1(1, 35) = 1.5$; $F_2(1, 19) = 0.5$, both n.s.].

For reaction times, the same pattern of effects was observed. Both main effects and interaction were significant [structure: $F_1(1, 33) = 12.2$; $F_2(1, 19) = 54.6$, both $p < .01$; verb type: $F_1(1, 33) = 6.54$; $F_2(1, 19) = 4.46$, both $p < .05$; structure $\times$ verb type: $F_1(1, 33) = 5.16$, $p < .05$; $F_2(1, 19) = 4.95$,

Table I. Experiment 1: Percentages of Correct Grammaticality Judgments and Reaction Times for Correct Responses (in Brackets) by Verb Type and Structure

Verb Type	Structure		Means
	Subject–Object	Object–Subject	
Dative	80% (790 ms)	47% (1011 ms)	64% (874 ms)
Accusative	87% (788 ms)	83% (833 ms)	85% (810 ms)
Means	84% (789 ms)	65% (900 ms)	74% (838 ms)

$p < .05$]. Subsequent analyses showed that for dative sentences, object–subject sentences elicited higher reaction times than subject–object sentences [$F_1(1, 33) = 18.0$; $F_2(1, 19) = 23.2$, both $p < .01$] whereas the effect of structure on accusative sentences—though going in the same direction—was not significant [$F_1(1, 33) = 0.7$; $F_2(1, 19) = 1.9$, both n.s.].

Discussion

Our results suggest that the strength of garden-path effects in processing local subject–object ambiguities varies depending on the Case to be assigned to the *wh* phrase during reanalysis: Whereas the assignment of dative results in a robust garden-path effect, the effect is weak at best for sentences in which the *wh*-phrase is assigned accusative Case. This asymmetry between dative and accusative sentences supports the assumption that dative and accusative Case differ in their underlying syntactic representations. Since dative phrases are structurally more complex than accusative phrases, assigning dative during reanalysis necessitates additional operations (KP insertion and lexical reaccess), which are not necessary for accusative assignment, explaining the greater processing difficulty observed for dative sentences.

EXPERIMENT 2: LEXICAL REACCESS AND MORPHOLOGICAL AMBIGUITY

Experiment 2 contrasts two types of ungrammatical active and passive sentences. In the sentences in (7) (repeated from above), the offending initial DP is a feminine DP. The sentences in (8) are identical to the sentences in (7), except that the initial feminine DP has been replaced by a corresponding masculine DP.

- (7) a. *Ich denke, daß der Chefin das Buch geliefert hat.
 I think that the boss the book delivered has
 b. *Ich denke, daß die Chefin das Buch geliefert wurde.
 I think that the boss the book delivered was
- (8) a. *Ich denke, daß dem Chef das Buch geliefert hat.
 I think that the boss the book delivered has
 b. *Ich denke, daß der Chef das Buch geliefert wurde.
 I think that the boss the book delivered was

The crucial difference between feminine and masculine DPs pertains to the fact that singular feminine determiners are Case-ambiguous whereas masculine determiners are not. There are only two feminine articles, which are both two-way ambiguous (*die*: nominative/accusative; *der*: dative/genitive).

The masculine paradigm, in contrast, contains four different articles, exactly one for each of the four Cases of German (*der*: nominative; *den*: accusative; *dem*: dative; *des*: genitive).

Above, we postulated that processing ungrammatical passive sentences but not processing ungrammatical active sentences involves lexical reaccess. If this is correct, manipulating the lexical items involved in the ungrammaticalities under discussion should have an effect on passive but not on active sentences. In particular, we expect that ungrammatical passive sentences with an initial masculine DP are less error-prone than corresponding sentences with a feminine DP. If, as suggested above, the two-way ambiguity of the feminine determiner *die* is responsible for the fact that sentences like (7) are often erroneously accepted as grammatical, eliminating this two-way ambiguity by using the masculine determiner *der* should reduce the error rate for ungrammatical passive sentences.

Method and Material

Twenty sentence quartets were constructed according to the model of sentences in (7) and (8). From these 20 sentence quartets, four lists were created according to a latin square design. The experimental sentences, individually randomized for each subject and embedded in a list of 78 filler items, were presented to 28 subjects in a speeded grammaticality judgments experiment. Sentence presentation followed the procedure described for Experiment 1.

Results

As in Experiment 1, separate two-way ANOVAS (2 structure $\times$ 2 gender) were performed on the percentage of correct answers and the reaction times for correct answers. Correct responses were all responses “ungrammatical” with reaction times of less than 2000 ms. Reaction times for correct responses were corrected for outliers following the procedure described for Experiment 1. The results of Experiment 2 are displayed in Table II.

Table II. Experiment 2: Percentages of Correct Grammaticality Judgments and Reaction Times for Correct Responses (in Brackets) by Gender and Structure

Structure	Gender		Means
	Feminine	Masculine	
Active	90% (719ms)	91% (737ms)	91% (728ms)
Passive	61% (926ms)	79% (906ms)	70% (916ms)
Means	76% (823ms)	85% (822ms)	81% (823ms)

The ANOVA on percentages of correct answers revealed a main effect of gender [$F_1(1, 27) = 7.25, p < .05$; $F_2(1, 19) = 15.55, p < .01$], a main effect of structure [$F_1(1, 27) = 24.20$; $F_2(1, 19) = 26.90$, both $p < .01$] and a significant interaction between these factors [$F_1(1, 27) = 5.79$; $F_2(1, 19) = 6.09$; $p < .05$]. The interaction was due to the fact that the manipulation of gender only had an effect on passive sentences but not on active sentences. An inspection of simple main effects of gender on each level of structure showed that passive sentence containing a feminine DP led to a higher proportion of judgment errors than passive sentences with masculine DP [$F_1(1, 27) = 12.43$; $F_2(1, 19) = 26.66$, both $p < .01$]. For active sentences, no such difference was observed ($F_1/F_2 < 1$).

ANOVAs on reaction times for correct judgments revealed a main effect of structure [$F_1(1, 27) = 19.69$; $F_2(1, 19) = 39.56$, both $p < .01$]. Passive sentences took more time to be judged as ungrammatical than active sentences. There was no effect of gender or an interaction between gender and structure.

Discussion

The results of Experiment 2 support the hypothesis that processing ungrammatical passive sentences involves a stage of lexical reaccess whereas the processing of ungrammatical active sentences does not. Sentences of the latter type were judged as ungrammatical rather quickly and with high reliability. Furthermore, morphological ambiguity of the initial DP had no effect on ungrammatical active sentences, as expected if ungrammatical active sentences can be rejected as ungrammatical by noting the mere presence of a KP shell. Ungrammatical passive sentences, in contrast, took a rather long time to be classified as ungrammatical and showed a clear dependence on the morphological ambiguity of the offending DP. Ungrammatical passive sentences with an ambiguous feminine DP were falsely accepted as grammatical more often than unambiguous masculine DPs.

GENERAL DISCUSSION

In this paper, we have presented results from two experiments investigating Case assignment during reanalysis. Starting from the assumption that dative Case has a distinct grammatical representation—dative DPs are embedded into the extra structural layer KP—we have shown that dative assignment during reanalysis is accompanied by additional processing operations which are not needed when accusative or nominative are assigned. In particular, we have shown that besides the insertion of a KP, dative assignment

during reanalysis triggers lexical reaccess, which is necessary in order to check whether the lexical items that make up the respective phrase license dative morphologically.

In Experiment 1, the concept of lexical reaccess led to a simple explanation of why assigning dative Case on second-pass parsing causes a much more pronounced garden-path effect than assigning accusative Case. In Experiment 2, resort to lexical reaccess provided an explanation for the fact that ungrammatical passive sentences are harder to classify as ungrammatical than ungrammatical active sentences and for the further finding that the processing of ungrammatical passive sentences but not the processing of ungrammatical active sentences is mediated by lexical properties of the offending DP.

Because of space limitations, we cannot discuss possible alternative accounts of our findings here, for example, in terms of the Diagnosis Model (Fodor & Inoue, 1994, 1998) or the monotonicity hypothesis (Sturt & Crocker, 1998). Instead, we would like to point out two important consequences of the analysis presented above. The first consequence pertains to the process of lexical reaccess itself. Although the nature of this process and its relation to initial lexical access during first-pass parsing remains to be made precise, a reasonable hypothesis seems to be that the computational effort associated with lexical reaccess is not fixed but instead varies considerably. For example, if we assume (following the reasoning in Ferreira & Henderson, 1991) that lexical elements accessed during first-pass parsing receive a certain amount of activation, which decays as the parse proceeds, we can expect the difficulty induced by lexical reaccess to vary as a function of the length of the ambiguous region, that is, the distance between the point of initial access and the point of lexical reaccess. If dative assignment during reanalysis turns out to be necessary immediately or shortly after the respective ambiguous DP has been processed, lexical reaccess should be easier in comparison with cases where more material intervenes.

Furthermore, we should expect that the effort associated with lexical reaccess varies depending on factors which exert influence on how effective lexical reaccess can be carried out. Such factors may include the overall syntactic complexity of the sentence to be processed and the complexity of the DP to which dative needs to be assigned during reanalysis and whose lexical items, therefore, have to be checked for morphological compatibility with dative Case. In both domains, an increase in complexity should increase the difficulty of lexical reaccess since fewer computational resources are available for lexical reaccess to be carried out. In summary, if dative assignment during reanalysis necessitates lexical reaccess and if lexical reaccess is the major determinant of garden-path strength in these cases, we would expect that the cost of assigning dative is not fixed, but varies depending on

factors such as the length of the ambiguous region, the syntactic complexity of the sentence, and the complexity of the DP to which dative needs to be assigned. In contrast, these factors should not affect the difficulty of accusative assignment during reanalysis where we claim lexical reaccess does not become necessary.

Although the specification of the actual influence these factors exert on garden-path strength is a matter of future research, some initial evidence supporting our hypothesis is already available. Recall from Experiment 1 that the garden-path effect for dative sentences is fairly robust, leading to a substantial drop in the percentage of correct answers in the speeded grammaticality judgment task. This contrasts with ambiguous passive sentences such as (9) (cf. 2b above) in which the DP *Maria* is assigned dative during reanalysis.

- (9) ... daß *Maria*_{DAT} das *Buch*_{NOM} geliefert wurde.
 that Maria the book delivered was
 “that the book was delivered to Maria”

As experimental investigations using the speeded grammaticality judgment task have shown, the garden path effect elicited by (9) is rather weak (Bader, in press; Meng & Bader, 1999). In comparison with the structures used in Experiment 1, the syntactic structure of (9) is arguably less complex, and so is the complexity of the DP to which dative needs to be assigned (*Maria* versus *wessen Anwalt*). Therefore, this contrast in garden-path strength is expected under an approach based on lexical reaccess. It is also expected that sentence complexity and DP complexity do not turn ambiguous accusative sentences as investigated in Experiment 1 into a strong garden path, as shown by our results. In the accusative sentences, no lexical reaccess has to be performed on the ambiguous DP *wessen Anwalt*. Consequently, these factors should not have the effect they have for dative sentences.

Furthermore, Scheepers, Hemforth, and Konieczny (1998) found a reliable garden-path effect associated with dative assignment during reanalysis only in sentences in which the critical object-DP is fronted, but not in sentences where the object remains in its canonical position inside the middle field. Again, this contrast is borne out under the lexical reaccess hypothesis, given that topicalization of the object increases the overall syntactic complexity of the sentence.

A second consequence of the approach advocated here pertains to our claim that lexical reaccess is not only involved in the processing of locally ambiguous sentences such as (9), but also in the processing of certain ungrammatical sentences, such as the ungrammatical passive sentences investigated in Experiment 2. This makes the prediction that factors that affect the ease of lexical reaccess and hence the strength of the garden-path effect in

ambiguous sentences should also influence the processing of ungrammatical sentences, determining how reliably the ungrammaticality is detected. Again, this is a matter that we have to leave for future investigation.

In sum, we conclude that the need to access the lexicon during reanalysis is a potential source of reanalysis difficulty. As a final remark, we would like to point out that our conclusion fits well with the widely held hypothesis that the HSPM has a modular architecture. Lexical reaccess is a process that transcends the parser proper. Therefore, the cost of lexical reaccess can be seen to primarily arise from the need to trespass a module boundary: The reanalysis procedures have to make recourse to information not stored within the parsing module but within the mental lexicon (see Bader, *in press*, for extensive discussion of this claim). Hence under a modular view of the HSPM, it does not have to be stipulated that lexical reaccess is potentially costly.

REFERENCES

- Bader, M. (*in press*). On reanalysis: evidence from German. In B. Hemforth & L. Konieczny (Eds.), *German sentence processing*. Dordrecht: Kluwer.
- Bader, M., & Meng, M. (1999). Subject-object ambiguities in German embedded clauses: an across-the-board comparison. *Journal of Psycholinguistic Research*, 28, 121–143.
- Bayer, J., Bader, M., & Meng, M. (1999). Morphological underspecification meets oblique Case: Syntactic and processing effects. Manuscript submitted for publication.
- Duffy, S. A., Morris, R. K., & Rayner, K. (1988). Lexical ambiguity and fixation times in reading. *Journal of Memory and Language*, 27, 429–446.
- Ferreira, F., & Henderson, J. (1991). Recovery from misanalysis of garden path sentences. *Journal of Memory and Language*, 30, 725–745.
- Fodor, J. D., & Inoue, A. (1994). The diagnosis and cure of garden paths. *Journal of Psycholinguistic Research*, 24, 407–434.
- Fodor, J. D., & Inoue, A. (1998). Attach Anyway. In J. Fodor & F. Ferreira (Eds.), *Reanalysis in sentence processing*. Dordrecht: Kluwer.
- Frazier, L. (1987). Sentence processing: A tutorial review. In M. Coltheart (Ed.), *Attention and performance XII: The psychology of reading*. Hillsdale, NJ: Lawrence Erlbaum.
- Gallmann, P. (1996). Die Steuerung der Flexion in der DP. *Linguistische Berichte*, 164, 283–314.
- Hemforth, B., Konieczny, L., & Strube, G. (1993). Incremental syntax processing and parsing strategies. In *Proceedings of the XVth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum.
- Hopf, J.-M., Bayer, J., Bader, M., & Meng, M. (1998). Event-related brain potentials and case information in syntactic ambiguities. *Journal of Cognitive Neuroscience*, 10, 264–280.
- Kaan, E. (1998). Sensitivity to NP-type: Processing subject–object ambiguities in Dutch. *Journal of Semantics*, 15, 335–354.
- Meng, M. (1997). Grammatik und Sprachverarbeitung: Psycholinguistische Untersuchungen zur Berechnung syntaktischer Strukturen beim Lesen. Doctoral dissertation, University of Jena.
- Meng, M., & Bader, M. (1998). The role of case and number features in syntactic ambiguity resolution. In M. de Vincenzi & V. Lombardo (Eds.), *Cross-linguistic perspectives on language processing*. Dordrecht: Kluwer, *in press*.

- Meng, M., & Bader, M. (1999). Ungrammaticality detection and garden path strength: evidence for serial parsing. Manuscript submitted for publication.
- Meng, M., & Bader, M. (in press). Mode of disambiguation and garden path strength: An investigation of subject-object ambiguities in German. *Language and Speech*, in press.
- Scheepers, C., Hemforth, B., & Konieczny, L. (1998). The impact of constituent ordering on Case assignment in German. Poster presentation, AMLaP-98; University of Freiburg.
- Schlesewsky, M., Fanselow, G., Kliegl, R., & Krems, J. (in press). Preferences for grammatical functions in the processing of locally ambiguous wh-questions in German. In B. Hemforth & L. Konieczny (Eds.), *German sentence processing*. Dordrecht: Kluwer, in press
- Sturt, P., & Crocker, M. (1998). Generalized monotonicity. In J. Fodor & F. Ferreira (Eds.), *Reanalysis in sentence processing*. Dordrecht: Kluwer.
- Vogel, F., & Steinbach, M. (1998). The dative in German: an oblique Case. *Linguistische Berichte*, 174, 3–28.