Syntactic features and reanalysis in near-native processing

Holger Hopp

Second Language Research 22,3 (2006); pp. 369–397

Syntactic features and reanalysis in near-native processing

Holger Hopp *University of Groningen*

Received July 2005; revised February 2006; accepted February 2006

In order to investigate second language (L2) processing at ultimate attainment, 20 first language (L1) English and 20 L1 Dutch advanced to near-native speakers of German as well as 20 native Germans were tested in two experiments on subject–object ambiguities in German. The results from a self-paced reading task and a speeded acceptability judgement task show that the lower-proficient advanced learners in this study display the same processing preferences as natives in reading accuracy yet fail to demonstrate differential response latencies associated with native syntactic reanalysis. By contrast, near-native speakers of either L1 converge on incremental native reanalysis patterns. Together, the findings highlight the role of proficiency for processing the target language since it is only at near-native levels of proficiency that non-natives converge on native-like parsing. The results support the view that endstate non-native processing and native processing are qualitatively identical.

I Introduction

Research on ultimate attainment in the L2 has hitherto investigated whether endstate L2 speakers attain levels of grammatical knowledge comparable to that of native speakers (e.g. Hyltenstam and Abrahamsson, 2003; Sorace, 2003). By contrast, little or no research on endstate L2 learners has addressed the real-time processing of the target language, in spite of the potentially far-reaching implications. After all, the psycholinguistic mechanisms and processes involved in L2

Address for correspondence: Holger Hopp, Department of General Linguistics, University of Groningen, Postbus 716, 9700 AS Groningen, The Netherlands; email: hopp@let.rug.nl

 10.1191/0267658306sr272oa

comprehension could be a barrier to attaining native-like proficiency and competence in a second language.

A large body of psycholinguistic research on native-language sentence comprehension attests that parsing involves, amongst other things, the incremental computation of phrase structure according to grammatical rules and parsing preferences (e.g. Frazier, 1987). Not least, sentence comprehension implicates the rapid coordination of syntactic, morphological, lexical, semantic and pragmatic information. Faced with this task, non-native processing might be subject to delays, inefficiencies or qualitative differences compared to native processing that potentially persist up to and including ultimate attainment. Some psycholinguistic studies on intermediate to advanced L2 learners indeed claim that L2 learners in general show a reduced sensitivity to syntactic information in non-native parsing (e.g. Felser and Roberts, to appear) compared to native speakers, while several off-line studies on fossilized endstate learners suggest that the computational demands of coordinating different types of morphological and syntactic information in real time leads to non-convergence at the L2 endstate (Lardiere, 2000; White, 2003; see also Sorace, 2005).

This study explores the on-line use of parsing principles and syntactic features in the L2 processing by English and Dutch advanced to near-native speakers of German. Two psycholinguistic experiments on local subject–object ambiguities in German were run to investigate, first, the extent to which non-natives employ syntactic information in parsing similar to native speakers and, second, the extent to which such sensitivity varies as a function of proficiency or L1. The article is structured as follows: Section II reviews previous research on non-native processing of syntactic ambiguities. Section III outlines the native processing of subject–object ambiguities in German. The two experiments are reported in Section IV, and Section V offers a general discussion of the findings.

II L2 Processing of syntactic ambiguities

Psycholinguistic research often studies the processing of sentences that are (temporarily) syntactically ambiguous in order to explore preferences and strategies in parsing. Research on syntactic ambiguity

resolution in L2 processing has focused on relative clause attachment and filler-gap ambiguities in *wh*-movement. Considering first relative clauses such as 'He thanked the secretary of the professor who never drank wine', cross-linguistic studies find that relative clauses preferentially attach to the second NP in English (i.e. low attachment), yet to the first NP in Greek, Spanish, German and French (i.e. high attachment). Attachment preferences have been argued to reflect parameterized syntactic processing principles (Gibson *et al.*, 1996). Testing advanced learners of English and Greek of various L1 backgrounds on self-paced reading, Felser *et al.* (2003) and Papadopoulou and Clahsen (2003), respectively, conclude that non-natives do not show any attachment preference in on-line reading in the L2, irrespective of L1 background. These authors suggest that the lack of attachment preferences is owing to the learners' failure to apply native-like syntactic parsing principles in the L2 (see also Papadopoulou, 2005). Other studies, however, find robust preferences in on-line reading. Dussias (2003) reports that Spanish learners of English show native-like preferences in reading the L2; however, these learners, unlike Spanish monolinguals, also show a low attachment preference in their native Spanish (see also Fernandez, 2003). Using eye-tracking, Frenck-Mestre (2002; 2005) finds that highly proficient English speakers of French show a native-like high attachment preference in the L2, while a less proficient group demonstrates a low attachment preference as in the L1 (see also Frenck-Mestre and Pynte, 1997).

Reading-time studies on gap-filling effects in *wh*-movement by Juffs and Harrington (1996), Williams *et al.* (2001) and Juffs (2005) demonstrate that, like natives, non-natives attempt to integrate a displaced constituent as early as possible with a potential subcategorizer, thus showing evidence of the application of economy-based parsing principles like the Active Filler Strategy (Clifton and Frazier, 1989). These results suggest native-like processing in the L2. However, using cross-modal priming, Marinis *et al.* (2005) and Felser and Roberts (to appear) find no evidence of native-like reactivation of the filler at intermediate trace positions in *wh*-chains. They suggest that the non-natives relate the filler directly to the verb by means of its thematic structure. In a similar vein to Felser *et al.* (2003) and Papadopoulou and Clahsen (2003), they argue that non-natives underuse syntactic information in parsing and over-rely

on lexical-semantic and pragmatic information to compensate for their relatively 'shallower' syntactic processing. Clahsen and Felser (2006) dub this approach, which postulates a qualitative difference between native and non-native parsing, the 'Shallow Structure Hypothesis'.

All of the studies reported above were conducted with intermediate to advanced L2 learner groups and did not include proficiency as a potential variable for parsing behaviour in the L2. Even though the findings by Frenck-Mestre (2002) suggest that degree of proficiency affects the degree to which syntactic processing in the L2 proceeds in native-like fashion, there have been no studies to date on processing syntactic ambiguities at ultimate attainment in the L2.

III Word order, syntactic features and native processing in German

In German, which has base SOV order, the object can optionally precede the subject in embedded clauses, such as in (1b).[1]

1) a. Maria glaubt, dass der Vater den Onkel schlägt.
Maria thinks that the$_{NOM}$ father the$_{ACC}$ uncle beats
'Maria thinks that the father beats the uncle.'

b. Maria glaubt, dass [den Onkel]$_1$ der Vater t_1 schlägt.

Syntactic reordering as in (1b), so-called scrambling, is usually analysed as movement of the dislocated object targeting an adjoined position higher than the subject (e.g. Haider and Rosengren, 1998). The syntactic function of NPs in German is overtly expressed by case marking as in (1) where the definite determiners disambiguate the sentence. Due to syncretistic case morphology, however, the syntactic status of NPs can also remain locally ambiguous up to the clause-final verb as in (2), in which the order of NPs is disambiguated by virtue of number agreement between the verb and the subject.

2) a. Er sagt, dass die Kellnerin$_{SG}$ die Kollegen$_{PL}$ gesehen hat$_{SG}$.
He says that the$_{NOM/ACC}$ waitress the$_{NOM/ACC}$ colleagues seen has
'He says that the waitress saw the colleagues.'

b. Er sagt, dass die Kellnerin$_{SG}$ die Kollegen$_{PL}$ gesehen haben$_{PL}$.
He says that the$_{NOM/ACC}$ waitress the$_{NOM/ACC}$ colleagues seen have
'He says that the colleagues saw the waitress.'

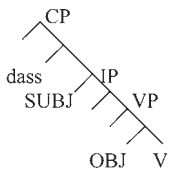
[1]I use embedded clauses in order to avoid the interference of additional reordering to verb-second in German main clauses.

A large set of processing studies has exploited the different syntactic ordering options in German. Native speakers of German show a robust subject-initial preference when reading clauses with multiple animate arguments (e.g. Bader and Meng, 1999; Hemforth and Konieczny, 2000). Such a preference has been viewed as the result of universal parsing principles dictating the serial parser to construct as economical a well-formed grammatical structure as possible (3).

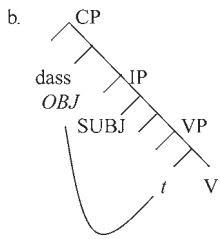
3) Minimal Chain Principle (de Vincenzi, 1991: 13; see also Frazier, 1987; Gorrell, 1995); 'Avoid postulating unnecessary chain members at S-structure, but do not delay required chain members.'

In accordance with (3), the parser incrementally constructs the default subject-initial phrase structure in (4a) upon encountering the first NP. However, when morphosyntactic information disabuses the parser of its subject-initial preference (e.g. case marking on determiners in (1b)), phrase-structural revision (reanalysis) to the less economical OS order in (4b) becomes necessary.

4) a.



b.



Reanalysis to the OS order is computationally costly in that native speakers evince measurable garden-path effects with OS orders in parsing. These garden-path effects are expressed in reading slowdowns on the regions of disambiguation towards the OS order and in lower comprehension accuracy of OS orders. The strength of garden-path effects has been shown to be relative to the type of syntactic disambiguation (among other things). Disambiguation of order via case on NPs as in (1) elicits fairly weak reanalysis effects, while disambiguation via verbal

agreement as in (2) gives rise to strong garden-path effects (Meng and Bader, 2000). This difference is not simply due to the delay of disambiguation in (2) compared to (1), since studies on ambiguous *wh*-questions in German matrix clauses (e.g. the equivalent of 'Which waitress have/has the colleague seen?'), where the region of disambiguation by verbal agreement precedes the region of disambiguation by case on the second NP, yield the same result (Meng and Bader, 2000; Schlesewsky *et al.*, 2003).

Instead, the difference between case and number features for disambiguation has been linked to the degree of informativity of syntactic features for reanalysis (Fodor and Inoue, 2000). According to the Diagnosis Model of reanalysis of Fodor and Inoue (1994; 1998), reanalysis is facilitated if the syntactic feature identifying a misparse redirects the parser to the original parsing error by means of grammatical relations and then also leads to the automatic correction of the erroneous parse.

To illustrate, overt accusative case marking on the first incoming NP in (1b) signals to the parser, first, that this NP is an object rather than the grammatical subject of the clause and, second, that the parser needs to create an additional slot for this NP to keep the subject position available. Hence, a case cue signals a misparse (diagnosis) in parsing and automatically leads to the correct parse (repair). By contrast, consider (2) in this respect: Having filled the subject position with the singular NP *die Kellnerin* ('the waitress'), the parser encounters the plural verb *haben* ('have') and tries to coindex the two by means of an agreement relation. This, however, leads to a number mismatch that signals an erroneous parse (diagnosis). Although the number mismatch engenders a severing of the agreement relation between the first NP and the verb, it does not entail the correct parse, since it specifies neither the syntactic function of the first NP nor the correct agreement relation of the verb. In short, verbal agreement is a negative symptom in that it diagnoses the misparse, yet does not automatically lead to repair, whereas case is a positive symptom in reanalysis that elicits automatic repair (Fodor and Inoue, 2000). The differential characteristics of syntactic features in parsing lead to more depressed processing accuracy for OS orders disambiguated by verbal agreement than by case.

The Diagnosis Model also correctly predicts that the inverse pattern, i.e. more depressed accuracy for case than for verbal agreement, obtains in the processing of ungrammatical sentences under time pressure (Meng and Bader, 2000; Schlesewsky *et al.*, 2003). Judging a sentence to be ungrammatical presupposes that no grammatical parse could have been constructed. Crucially, this means that the reanalysis process sketched above applies for ungrammatical sentences, too, since the parser must attempt reanalysis before concluding that a sentence is ungrammatical. Detecting a case mismatch on the second NP in an ungrammatical sentence as in (5) thus leads the parser to attempt automatic repair of the mismatch by (erroneously) reanalysing the parse towards an OS structure and – under time pressure – engenders false positive responses.

5) Maria glaubt, dass der Vater der Onkel schlägt.
Maria thinks that the$_{NOM}$ father the$_{NOM}$ uncle beats
'Maria thinks that the father beats the uncle.'

By contrast, the characteristics of agreement mismatches ensure more reliable ungrammaticality detection even under time pressure since they do not initiate an automatic repair process. Table 1 shows how the processes of diagnosis and repair lead to different parsing accuracy for case and verbal agreement in grammatical and ungrammatical sentences.

In sum, processing preferences and the strength of reanalysis effects are determined by the interaction of universal phrase-structural parsing principles and the type of syntactic features that disambiguates order (case vs. verbal agreement). Since German scrambling thus gives rise to a varied pattern of reanalysis effects, comparing SO to OS orders constitutes a good test case for identifying qualitative similarities and dissimilarities between non-native and native processing.

Table 1 Interaction of feature of disambiguation and sentence type in first-pass parsing: accurate responses

	Case	Verbal agreement
Grammatical OS sentences	high	low
Ungrammatical sentences	low	high

IV The experiments

The present study tests how L1 English and L1 Dutch speakers process subject–object ambiguities in German. Neither English nor Dutch instantiates pre-subject scrambling of objects or case marking on full NPs. Dutch does, however, show scrambling as movement of the object across adverbs or negation (Zwart, 1997), yet, importantly, Dutch does not allow object–subject reordering. Hence, neither non-native group can make recourse to analogous processing routines or syntactic features of their L1 when parsing their L2.

Two on-line experiments were designed to probe:

- whether – in the absence of lexical-semantic and pragmatic cues – non-natives can effect incremental revisions of phrase structure;
- whether, like natives, non-natives show a difference in strength of garden-path effects depending on type of syntactic disambiguation (case vs. verbal agreement); and
- whether, like natives, non-natives show an interaction of syntactic feature type and accuracy in the processing of grammatical and ungrammatical sentences.

Finally, the experiments investigate if level of proficiency affects the time course and the accuracy of non-native parsing.

1 Participants

Twenty advanced to near-native L1 English speakers (13 female; 7 male) and 20 L1 Dutch speakers (15 female; 5 male) and 20 native German controls (9 female; 11 male) took part in the experiments. All non-native speakers of German started learning German after age 11 and were residents in Germany at the time of testing. They had each been exposed to German for more than 12 years. All non-natives completed a timed web-based C-test to gauge their proficiency in German. Similar to the cloze test, the C-test is a general proficiency test based on multiple deletions of parts of words in continuous texts (for details, see for example Grotjahn, 1996). The non-natives scored between 43% and 89%, and the natives scored between 76% and 93%. In order to be able to consider potential effects of proficiency level, the non-natives were

Table 2 Participant information by group

	English: advanced ($n = 10$)	English: near-natives ($n = 10$)	Dutch: advanced ($n = 10$)	Dutch: near-native ($n = 10$)	German: native speakers ($n = 10$)
C-test (timed) (%)	43–61 (53)	67–81 (71)	46–62 (54)	67–89 (76)	76–93 (83)
Length of exposure (years)	17–35 (24.2)	12–41 (22.2)	14–43 (27.0)	12–32 (23.0)	
Length of residence (years)	3–31 (19.5)	3–32 (14.5)	3–15 (7.7)	5–30 (14.2)	
Age of onset (years)	12–30 (19.3)	11–22 (15.3)	11–26 (13.9)	12–20 (13.7)	
Age (years)	31–62 (50.6)	27–55 (37.6)	28–58 (38.8)	24–48 (36.8)	25–69 (51.4)

Note: Figures given are ranges, with averages in parentheses

allocated to two proficiency groups according to the median score in the cloze test for each group, namely, advanced ($<67\%$) and near-native ($\geq 67\%$).[2] Detailed participant information is listed in Table 2. All participants took part in two experiments: a self-paced reading task and a speeded grammaticality judgement task.

2 *Experiment 1: self-paced reading*

In a self-paced reading task, participants read sentences segment by segment. The rationale of this paradigm is that increased processing effort, i.e. reanalysis effects, can be detected locally in higher reading times on a given segment compared to the same segment in a control condition.

a Materials: Twenty-four quadruplets of experimental sentences were constructed. Half of the quadruplets were disambiguated by case

[2]An anonymous reviewer wonders whether the classification according to proficiency is legitimate noting that the difference between the highest-scoring participant in the advanced group is just 6% below the score of the lowest-scoring participant in the near-native group. However, the difference between group means is 20%; a *t*-test for independent samples on the C-test scores shows a significant difference between advanced and near-natives ($F(1,38)$ –9.370, $p < 0.001$), yet no difference between the L1 English and L1 Dutch advanced or near-natives ($p < 0.05$). The allocation of participants into proficiency groups was, thus retained in order to render potential effects of proficiency statistically interpretable.

on determiners – e.g. (6) – and half by number marking on the verb: e.g. (7) (Factor Ambiguity). All sentences were initiated by a matrix clause.

6) a. Er denkt, dass **der** Physiker am Freitag **den** Chemiker gegrüsst hat.
He thinks that the$_{NOM}$ physicist on Friday the$_{ACC}$ chemist greeted has

b. Er denkt, dass **den** Physiker am Freitag **der** Chemiker gegrüsst hat.

7) a. Sie sagt, dass **die** Baronin am Freitag **die** Bankiers eingeladen **hat**.
She says that the baroness$_{SG}$ on Friday the bankers$_{PL}$ invited has

b. Sie sagt, dass **die** Baronin am Freitag **die** Bankiers eingeladen **haben**.
She says that the baroness$_{SG}$ on Friday the bankers$_{PL}$ invited have

Sentences were in SO or OS order (Factor Order). Two additional versions within each quadruple set were constructed by reversing the position of the nouns (i.e. N1–N2 and N2–N1), so that any potential effect of lexical semantics or pragmatics of the SO and OS manipulation would be completely matched. Further, all N1–N2 and N2–N1 SO combinations were matched on plausibility, i.e. they had been judged to be semantically reversible in an off-line plausibility judgement pretest by a separate group of German natives. Sentences disambiguated by verbal agreement contained two NPs – one plural and one singular – with ambiguous case inflection, and the finite verb was plural in half of the sentences and singular in the other. Sentences disambiguated by case contained two NPs: one unambiguously marked for nominative, the other unambiguously marked for accusative. The quadruplets were matched in length of NPs and verbs (number of characters), gender, number, animacy, and in corpus frequency (CELEX database; Baayen *et al.*, 1995). In this way, the stimulus design ensured that case or number, respectively, was the only cue for the syntactic function of the NPs in the respective conditions.

The quadruple sets were distributed across four lists in such a way that a list contained only one member of each set and an equal number of sentences in each condition. For each participant, the self-paced reading task comprised 24 items (plus 72 fillers), with six items per experimental condition. During list creation it was ensured that length and frequency were matched across conditions per list.

The paradigm was a non-cumulative Moving Windows task (Just *et al.*, 1982) and was run using E-Prime software (Schneider *et al.*, 2002). The experimental sentences were divided into 7 segments (8), which were presented consecutively at the push of a button. The end of

a sentence was signalled by a full stop following the last word in the final segment.

8) Matrix COMP NP1 adverbial NP2 V-part V-fin
Er denkt | dass | der Physiker | am Freitag | den Chemiker | gegrüsst | hat.

Each item was followed by a comprehension sentence to check if participants accurately understood the items. The participants had to judge whether the comprehension sentence expressed the same meaning as the experimental item by pressing a green button ('yes') or a red button ('no'). For half of the experimental stimuli and the fillers, the comprehension sentence expressed the same meaning as the experimental item. Instructions and practice items preceded the task. All stimuli were presented in Courier New Font, font size 14, in white letters against a black background on a 15-inch TFT screen. Reading times for each segment, type of response and response time were recorded.

In the discussion, I focus on the analyses of all items regardless of comprehension accuracy, since at issue is how (non-native) participants typically read and process sentences, rather than how they read and process the proportion of sentences about which they correctly answer questions. Considering only this subset of sentences might give a picture of L2 performance that is in fact characteristic only of a small percentage of items. Moreover, for the question as to whether non-natives use syntactic information in on-line reading of the target language, it is irrelevant if participants correctly respond to a comprehension question that they read and answer subsequent to reading the item sentence. Answering questions about linguistic stimuli involves additional processes, preferences and strategies compared to the process of reading sentences. Hence, errors in the comprehension questions may be caused by many factors and, for this reason, the participants' accuracy scores for answering the comprehension questions is be analysed and discussed separately.

Two mixed three-way Repeated Measures ANOVAs both with Order and Ambiguity as within-participants factors and with, respectively, Language (German, English, Dutch) and Proficiency (native, advanced L2 and near-native L2) as between-participants factors were performed on accuracy scores and on reading times of all items by segment. Finding interactions with the factor Language would indicate that non-native processing is different from native processing; finding interactions with the

factor Proficiency would indicate that processing differs according to proficiency level. Post-hoc two-way analyses were computed to investigate the cause of interactions of the within-participants factors and Language or Proficiency. The segments of interest were, for disambiguation by case, segment 3 (first NP), which was collapsed with the following segment 4 (adverbial) to catch potential spillover effects, and, for disambiguation by verbal agreement, segment 7 (finite verb).

b Data trimming: If a participant did not make a judgement within 4000 ms, the trial was aborted and the response recorded as incorrect. In total, this affected less than 1% of the trials. In addition, the participants' reading times were screened for outliers; reading times above 5000 ms on a segment were treated as missing values, and reading times of a segment below or above two standard deviations of the group mean for that segment were trimmed to the group mean ±2sd. This affected less than 2% of the trials in each group. Finally, one participant in the near-native English group was removed from analyses because the data set was incomplete.

c Accuracy: Table 3 gives the results (accuracy and reading times by segments) of the self-paced reading task. The high comprehension accuracy scores for the SO sentences in (6a) and (7a) for all groups (85%–96%) bear out that the participants paid attention to the task and read the sentences properly. The between-participants analysis yields a significant effect of Order (F_1(1,54) 224.067, $p < 0.001$; F_2(1,117) 219.639, $p < 0.001$), Ambiguity (F(1,54) 14.614, $p < 0.001$) and an interaction of Order and Ambiguity (F(1,54) 34.573, $p < 0.001$). There are no significant interactions with the factor Language, but the interaction between Order and Proficiency reaches significance (F_1(2,54) 14.297, $p < 0.001$; F_2(2,115) 54.487, $p < 0.001$), largely due to the better performance of the near-natives on the OS sentences in general compared to the natives and to the advanced L2 group. In addition, there are three-way interactions between Order, Ambiguity and Language (F(2,54) 6.251, $p = 0.015$) as well as a marginal interaction between Order, Ambiguity and Proficiency (F(2,54) 3.189, $p = 0.080$), which appears to be due to the fact that the advanced Dutch group does not differ in comprehension accuracy between OS sentences disambiguated by

Table 3 Accuracy scores and reading times (standard deviations) for relevant segments by group and condition: (6a) SO order disambiguated by case; (6b) OS order disambiguated by case; (7a) SO order disambiguated by verbal agreement; (7b) OS order disambiguated by verbal agreement

Type	Correct answers	S1/ matrix (ms)	S2/ COMP	S3/ NP1	S4/ adv.	S5/ NP2	S6/ V-part	S7/ V-fin
6a) SO order disambiguated by case:								
German: native speakers	103/120 (86%)	920 (386)	668 (232)	927 (342)	821 (277)	1115 (505)	1020 (399)	875 (383)
English: advanced	53/60 (88%)	1181 (401)	752 (270)	1227 (405)	932 (276)	1486 (594)	1095 (469)	961 (453)
Dutch: advanced	57/60 (95%)	823 (314)	605 (199)	1080 (397)	896 (316)	1500 (682)	957 (363)	966 (448)
English: near-native	47/54 (87%)	870 (409)	644 (275)	1159 (525)	820 (286)	1357 (603)	1105 (474)	959 (437)
Dutch: near-native	54/60 90%	784 (314)	568 (167)	864 (298)	789 (242)	1101 (441)	907 (323)	840 (432)
6b) OS order disambiguated by case:								
German: native speakers	67/120 (56%)	838 (278)	648 (191)	1087 (465)	862 (277)	1149 (477)	1193 (570)	1043 (653)
English: advanced	25/60 (42%)	1039 (394)	767 (314)	1373 (585)	959 (337)	1532 (775)	1307 (661)	1019 (568)
Dutch: advanced	13/60 (22%)	974 (381)	671 (244)	1151 (438)	878 (256)	1353 (546)	1130 (461)	1179 (750)
English: near-native	40/54 (74%)	811 (351)	629 (272)	1378 (579)	979 (423)	1379 (649)	1176 (548)	1043 (558)
Dutch: near-native	36/60 (60%)	771 (325)	591 (221)	997 (387)	849 (257)	1163 (435)	937 (421)	977 (678)
7a) SO order disambiguated by verbal agreement:								
German: native speakers	111/120 (93%)	890 (354)	684 (242)	945 (375)	777 (250)	1095 (469)	1003 (387)	964 (460)
English: advanced	57/60 (95%)	1105 (409)	765 (270)	1407 (586)	1073 (348)	1486 (613)	1173 (494)	1105 (535)
Dutch: advanced	57/60 (95%)	833 (318)	614 (186)	1039 (324)	878 (355)	1357 (546)	1033 (438)	1209 (658)
English: near-native	49/54 (91%)	724 (256)	627 (238)	1289 (588)	936 (336)	1492 (610)	1090 (456)	1123 (523)
Dutch: near-native	56/60 (93%)	774 (325)	615 (204)	913 (374)	770 (190)	1055 (399)	924 (415)	1003 (613)
7b) OS order disambiguated by verbal agreement:								
German: native speakers	34/120 (28%)	844 (333)	657 (197)	1003 (381)	839 (279)	1139 (527)	1038 (413)	1496 (1107)
English: advanced	14/60 (23%)	975 (328)	687 (197)	1258 (499)	974 (345)	1421 (643)	1104 (478)	1269 (917)
Dutch: advanced	17/60 (28%)	832 (318)	622 (193)	1107 (437)	865 (312)	1279 (613)	1036 (373)	1442 (1012)
English: near-native	24/54 (44%)	738 (230)	623 (232)	1342 (665)	938 (363)	1426 (632)	1195 (531)	1753 (1410)
Dutch: near-native	27/60 (45%)	728 (238)	627 (189)	893 (373)	770 (208)	1051 (475)	950 (371)	1333 (807)

case or by verbal agreement. In total, though, all groups prefer SO sentences to OS sentences, with the preference being considerably stronger for the native and the near-native group when disambiguation occurs via verbal agreement. Pairwise comparisons by proficiency group between (6a–b) and (7a–b) yield significant effects of Ambiguity for natives and near-natives (natives: $F(1,19)$ 6.766, $p = 0.018$; near-natives: $F(1,18)$ 15.034, $p < 0.001$), yet not for the advanced group ($F(1,19)$ 0.222, $p = 0.643$).

d Reading times: between-groups analysis: On segments 3 and 4, i.e. where reanalysis of the first NP for disambiguation by case is expected to occur, the between-groups ANOVA of the reading times shows a significant effect of Order on segments 3 and 4 ($F_1(1,54)$ 16.475, $p < 0.001$; $F_2(1,115)$ 9.238, $p = 0.003$) and an interaction between Order and Ambiguity ($F(1,54)$ 19.567, $p < 0.001$). This interaction signals that the slowdowns are specific to the OS order in (6b), where disambiguation by case occurs. Furthermore, there is an interaction between Order and Proficiency in the analysis by participants and marginally in the analysis by items ($F_1(2,54)$ 4.365, $p = 0.041$; $F_2(2,115)$ 2.683, $p = 0.104$). There is no interaction with the factor Language ($F_1(2,54)$ 0.2, $p = 0.889$; $F_2(2,115)$ 0.356, $p = 0.552$). On segment 7 (V-fin), i.e. where reanalysis to the OS order for disambiguation by verbal agreement is expected to occur, the between-groups analysis unearths a main effect of Order ($F_1(1,54)$ 27.967, $p < 0.001$; $F_2(1,115)$ 25.088, $p < 0.001$) and Ambiguity ($F(1,54)$ 36.033, $p < 0.001$) as well as an interaction between Order and Ambiguity ($F(1,54)$ 8.455, $p = 0.005$). This interaction indicates that the slowdown is specific to the OS sentences disambiguated by verbal agreement (7b). The interaction of Order with Proficiency becomes marginally significant in the analysis by items ($F_1(2,54)$ 0.923, $p = 0.341$; $F_2(2,115)$ 2.734, $p = 0.101$), yet, there is no interaction with Language ($F_1(2,54)$ 0.002, $p = 0.965$; $F_2(2,115)$ 0.002, $p = 0.964$). Given the (marginal) interactions with the factor Proficiency, the main effects and interactions from each of the proficiency groups were analysed separately.

e Reading times: native speakers: On segments 3 and 4, natives show a main effect of Order ($F_1(1,19)$ 19.751, $p < 0.001$; $F_2(1,23)$

5.467, $p = 0.028$); pairwise comparisons reveal a significant difference between (6a) and (6b) ($F_1(1,19)$ –3.407, $p = 0.003$; $F_2(1,11)$ –2.581, $p = 0.026$). These effects document that the OS order (6b) evinces longer reading times on segment 3 and 4 than in the corresponding SO order. On segment 7 there are significant main effects of Order ($F_1(1,19)$ 13.769, $p = 0.001$; $F_2(1,23)$ 15.127, $p = 0.001$) and Ambiguity ($F(1,19)$ 7.775, $p = 0.012$); in addition, the interaction between Order and Ambiguity reaches significance($F(1,19)$ 4.297, $p = 0.052$), which suggests that the slowdowns are specific to the critical segments for disambiguation in (7a) and (7b). Indeed, pairwise comparisons between (7a) and (7b) become significant ($F_1(1,19)$ –2.089, $p = 0.006$; $F_2(1,11)$ –3.505, $p = 0.005$). In sum, the native speakers evince reading delays on segments 3 and 4 for OS sentences disambiguated by case and delays on segment 7 for OS sentences disambiguated by verbal agreement.

f Reading times: non-native speakers: near-native second language speakers: On segments 3 and 4, the near-natives show a main effect of Order ($F_1(1,18)$ 12.512, $p = 0.002$; $F_2(1,23)$ 5.454, $p = 0.029$); pairwise comparisons between (6a) and (6b) become significant ($F_1(1,18)$ –5.3, $p < 0.001$; $F_2(1,11)$ –3.843, $p = 0.003$). On segment 7 the near-natives evince main effects of Order ($F_1(1,18)$ 9.109, $p = 0.007$; $F_2(1,23)$ 9.805, $p = 0.005$) and Ambiguity ($F(1,18)$ 19.122, $p < 0.001$); the interaction between Order and Ambiguity ($F_1(1,18)$ 4.293, $p = 0.053$) also reaches significance. Pairwise comparisons bear out significant differences between (7a) and (7b) ($F_1(1,18)$ –2.795, $p = 0.012$; $F_2(1,11)$ –2.935, $p = 0.014$). Hence, the near-natives demonstrate local slowdowns analogous to the natives for disambiguation both by case and by verbal agreement.

g Reading times: Non-native speakers: advanced second language speakers: For segments 3 and 4, unlike the two other groups, the advanced group does not show an effect of Order ($F_1(1,19)$ 0.106, $p = 0.748$; $F_2(1,23)$ 0.264, $p = 0.264$). On segment 7, the main effect of Order is significant in the analysis by participants and marginally by items ($F_1(1,19)$ 7.019, $p = 0.016$; $F_2(1,23)$ 2.698, $p = 0.114$); furthermore there is a main effect of Ambiguity ($F(1,19)$ 14.452, $p < 0.001$),

yet, importantly, no interaction between Order and Ambiguity (F_1(1,19) 0.468, $p = 0.502$). Pairwise comparisons bear out significant differences by participants between (7a) and (7b) (F_1(1,19) –2.173, $p = 0.043$; F_2(1,11) –1.008, $p = 0.335$) as well as between (6a) and (6b) (F_1(1,19) –2.143, $p = 0.045$; F_2(1,11) –1.473, $p = 0.169$). Hence, the advanced group does not show a significant slowdown on segments 3 and 4, nor does it demonstrate a slowdown specific to the critical region on segment 7. Rather, the advanced group shows a general slowdown for OS sentences at the end of the sentence, irrespective of the type of syntactic disambiguation.

3 Discussion: Experiment 1

For natives, the self-paced reading task bears out the structural subject-initial preference of the parser in terms of depressed comprehension accuracy and locally elevated reading times for OS sentences. OS orders disambiguated by case and by verbal agreement elicit garden-path effects of differing strengths in that OS orders signalled by verbal agreement are associated with greater difficulty than OS orders signalled by case.

In terms of comprehension accuracy, the L2 groups demonstrate analogous garden-path effects for OS sentences in both conditions. Except for the advanced Dutch group, the differentially depressed accuracy scores for OS orders depend on the type of disambiguation. More specifically, this demonstrates that the non-native groups are garden-pathed more strongly when syntactic disambiguation is by verbal agreement than by case. Since all lexical-semantic, pragmatic and frequency cues were controlled for in Experiment 1, this finding demonstrates that the second language speakers were able to use case information more robustly than verbal agreement information to reach appropriate interpretations.

In the analysis of reading times, however, the non-native groups differ in their behaviour according to proficiency. Despite showing relative contrasts in comprehension accuracy similar to the natives, the advanced learners fail to show a native-like pattern in on-line reading in that they evince no locally specific slowdowns for OS sentences. By contrast, the near-natives demonstrate a native-like pattern of slowdowns for sentences disambiguated by case (6) on segments 3 and 4 and

for sentences disambiguated by verbal agreement (7) on segment 7. This finding attests to incremental sensitivity to syntactic features in phrase-structural reanalysis by the near-native group.

4 Experiment 2: speeded grammaticality judgements

Experiment 2 asks whether the non-native groups can effect reanalysis under speeded presentation. In addition, Experiment 2 probes whether the processing differences between syntactic features show up in inverse direction in the processing of ungrammatical sentences. The rationale underlying the speeded judgement paradigm of Experiment 2 is that, under time pressure, dispreferred sentences elicit lower accuracy scores and higher reaction times than comparable control sentences.

a Materials: In a partially factorial design, four lists were created: (9) and (10) according to the factor Order (SO and OS) and reversed noun position (i.e. N1–N2 and N2–N1); (11) and (12), and (13) and (14) according to the factor Condition (type: case violation, type: agreement violation) and reversed NP position. For case violations, the double nominative in (11) was the ungrammatical counterpart of the SO order, and the double accusative in (12) was the ungrammatical equivalent of the OS order. The speeded-grammaticality judgement task thus included the six following conditions: SO (9) and OS (10) sentences disambiguated by case marking vs. case violations, i.e. 'doubly-nominative marked' sentences (*der–der*) (11) and 'doubly-accusative marked' sentences (*den–den*) (12), and violations of verbal agreement (number) in SO order (13) and in OS order (14).

9) Er glaubt, dass **der** Vater am Freitag **den** Onkel gegrüsst hat.
He thinks that the$_{NOM}$ father on Friday the$_{ACC}$ uncle greeted has

10) Er glaubt, dass **den** Onkel am Freitag **der** Vater gegrüsst hat.

11) * Er glaubt, dass **der** Bäcker seit langer Zeit **der** Metzger beliefert hat.
He believes that the$_{NOM}$ baker for long time the$_{NOM}$ butcher supplied has

12) * Er glaubt, dass **den** Bäcker seit langer Zeit **den** Metzger beliefert hat.
He believes that the$_{ACC}$ baker for long time the$_{ACC}$ butcher supplied has

13) * Er glaubt, dass **der** Bäcker seit langer Zeit **den** Metzger beliefert **haben**.
He believes that the$_{NOM}$ baker for long time the$_{ACC}$ butcher supplied have

14) * Er glaubt, dass **den** Bäcker seit langer Zeit **der** Metzger beliefert **haben**.

The task comprised 36 experimental items, i.e. 6 items per condition, and 66 fillers of various other structures. As in Experiment 1, reversed orders were used to control for potential lexical and plausibility differences. All items were matched in and across conditions as in Experiment 1. In this way, the stimulus design ensured that case was the only cue for the syntactic function of the NPs in the respective conditions.

In the task, the sentences were presented word-by-word in the centre of a 15-inch TFT screen in white font (Courier New, 18) against a black background. The rate of presentation was 250 ms per word plus 17 ms per letter. After the final word of each sentence the screen changed colour and the participants made an immediate binary grammaticality judgement by pressing a green ('grammatical') or red ('ungrammatical') button. Participants' responses and response times following the off-set of the final word in the sentence were recorded.

Three Repeated Measures ANOVAs with the factors Order (SO, OS) or Condition (grammatical, case violation, agreement violation) as within-particpants factors and Language (German, English, Dutch) and Proficiency (native, advanced L2 and near-native L2) as between-participants factors were performed on accuracy scores and on the reaction times. Analyses of the reaction times were run separately on all items and on items that had been judged correctly. Data trimming was as in Experiment 1. The data from all 20 native and 40 non-native participants were analysed. Table 4 displays the number (as a percentage) of accurate responses per condition. Mean reaction times (RT) for all responses are also given.

b Accuracy: A between-groups comparison for sentences (9) and (10) shows a significant main effect of Order (F_1(1,55) 21.228, $p < 0.001$; F_2(1,54) 34.232, $p < 0.001$). There are no significant interactions with the factors Language or Proficiency, bearing out that all groups demonstrate an SO preference compared to the OS order. To determine whether participants make a difference between grammatical and ungrammatical case marking, comparisons of accurate judgements on (9) and (10) (Condition: grammatical), on the one hand, with the false positive judgements of (11) and (12) (Condition: case violation), on the other hand, were run. They reveal a main effect of Condition (F(1,55) 83.888, $p < 0.001$) and a significant interaction of Condition

Table 4 Accuracy scores (with mean reaction times in parentheses) per group and condition

	English: advanced (n = 10)	English: near-native (n = 10)	Dutch: advanced (n = 10)	Dutch: near-native (n = 10)	German: native speaker (n = 20)
9) SOV	93% (1035 ms)	92% (1008 ms)	85% (1192 ms)	82% (839 ms)	94% (770 ms)
10) OSV	65% (1204 ms)	83% (1194 ms)	70% (1321 ms)	65% (1121 ms)	75% (941 ms)
11) *NP_{NOM} NP_{NOM} V	28% (1083 ms)	50% (1166 ms)	15% (1215 ms)	48% (930 ms)	71% (858 ms)
12) *NP_{ACC} NP_{ACC} V	35% (966 ms)	48% (1051 ms)	42% (1149 ms)	65% (984 ms)	62% (989 ms)
13) *SOV_{*NUM}	72% (1377 ms)	72% (1078 ms)	82% (1269 ms)	85% (1003 ms)	88% (975 ms)
14) *OSV_{*NUM}	75% (1437 ms)	78% (1295 ms)	80% (1296 ms)	83% (1080 ms)	92% (1029 ms)

with the factor Proficiency (F(2,55) 10.004, $p = 0.003$), yet not with the factor Language (F(2,55) 0.545, $p = 0.464$). Subsequent analyses by proficiency group reveal significant differences between grammatical (10) and ungrammatical (12) OS orders show significant effects for the natives (F(1,19) 25.126, $p < 0.001$) and the near-natives (F(1,19) 14.052, $p = 0.001$), yet not for the advanced group (F(1,19) 1.430, $p = 0.246$). These results demonstrate that the natives and the near-native group distinguish between grammatical and ungrammatical case marking in OS orders, while the advanced group does not distinguish significantly between case violations and grammatical case marking. Finally, the comparison of case and number violations yields a main effect of Condition (F_1(1,55) 110.924, $p < 0.001$; F_2(1,115) 133.410, $p < 0.001$) and an interaction of Condition with the factor Proficiency (F_1(2,55) 7.172, $p = 0.010$; F_2(2,115) 18.426, $p < 0.001$), yet only marginally with the factor Language in the analysis by item (F_1(2,55) 0.672, $p = 0.416$; F_2(2,115) 3.076, $p = 0.082$). This interaction reflects the much lower accuracy in detecting the ungrammaticality of case violations by the advanced group. Analyses by proficiency group yield highly significant effects of condition for each group ($p < 0.001$), bearing out that, for each group, the judgement accuracy on detecting case violations is lower than on detecting verbal agreement violations.

c Reaction times: A between-groups analysis of the SO (9) and the OS (10) orders yields a significant main effect of order in the analysis of all items (F_1(1,55) 20.406, $p < 0.001$; F_2(1,55) 11.766, $p = 0.001$) and in the analysis of correct trials (F_1(1,53) 18.221, $p < 0.001$; F_2(1,55) 6.668, $p = 0.013$), yet no interactions with the factors Language or Proficiency. Subsequent analyses by proficiency group replicate the main effect of order for the natives (all items: F_1(1,19) 8.777, $p = 0.008$; F_2(1,11) 6.966, $p = 0.023$; correct trials: F_1(1,18) 6.893, $p = 0.017$; F_2(1,11) 3.677, $p = 0.081$) and the near-natives (all items: F_1(1,19) 12.919, $p = 0.002$; F_2(1,11) 32.293, $p < 0.001$; correct trials: F_1(1,19) 6.101, $p = 0.023$; F_2(1,11) 16.195, $p = 0.002$). For the advanced group, there is no significant effect of order in the analysis of all items (F_1(1,19) 2.567, $p = 0.126$; F_2(1,11) 0.803, $p = 0.389$); in the analysis of the correct trials, the main effect of order becomes significant in the analysis by participants (F_1(1,18) 4.741, $p = 0.043$; F_2(1,11) 1.132, $p = 0.310$). All other comparisons do not yield significant effects ($p > 0.05$). In sum, the slowdowns for OS orders compared to SO order for the natives and the near-natives provide evidence of reanalysis according to syntactic case features under time pressure; by contrast, the advanced groups do not show robust reanalysis effects under pressure.

5 Discussion: Experiment 2

The speeded acceptability judgement task replicates the finding of Experiment 1 that differences in reanalysis are due to proficiency, not language. The phrase-structural SO preference is operative in the processing by native and near-native speakers as borne out in depressed accuracy and elevated response time for the OS orders. By contrast, the advanced group shows decreased judgement accuracy for OS orders, yet no increased reaction times. In addition to effecting reanalysis under time pressure, the near-natives robustly differentiate between grammatical and ungrammatical case marking, which shows that the target-like processing of case persists under time pressure. The advanced learners, however, accept OS orders (10) disambiguated by case (at 67.5%) as readily as OS orders with case violations (12) (at 62.5%), which suggests that – under speeded presentation – they do not make a distinction

between sentences with dispreferred grammatical orders and sentences rendered ungrammatical by case marking.

As for case and number violations, for all groups, sentences ungrammatical by case lead to significantly more false positive responses than sentences ungrammatical by verbal agreement. This disjunction in ungrammaticality detection indicates two things: first, the difference in garden-path strength between the disambiguation of sentences by case vs. by verbal agreement in Experiment 1 is not due to a difference in the linear position of the regions of disambiguation (see also Meng and Bader, 2000). Otherwise case violations, for which information identifying the violation occurs earlier than for verbal agreement violations in Experiment 2, should receive higher accuracy scores than verbal agreement violations. Second, for all groups, case disambiguation was judged more accurately than verbal agreement disambiguation (Experiment 1), while case violations in Experiment 2 are judged less accurately than verbal agreement violations. This interaction between syntactic feature type and sentence type (Table 1) points to differential properties of the syntactic features for phrase-structural reanalysis in both native and near-native parsing.

V General discussion

Two experiments probed syntactic reanalysis effects in the processing of locally ambiguous OS clauses by advanced and near-native English and Dutch speakers of German. In line with previous studies on native German processing (e.g. Meng and Bader, 2000), the present experiments find that native parsing preferences of word order are effected by the interaction of phrase-structural parsing principles and syntactic feature types marking ordering variants. In grammatical sentences, OS orders were found to induce weaker garden-path effects when disambiguation was by case compared to verbal agreement (Experiment 1); in ungrammatical sentences, however, case violations elicited a higher number of misparses in comparison to verbal agreement violations (Experiment 2).

In both experiments, the non-native groups did not mainly manifest different behaviour according to L1 (English vs. Dutch); rather, they

predominantly demonstrated different performance according to proficiency level:

- The advanced speakers manifest a general SO-preference in reading and judgement accuracy, yet they do not reliably show local reading delays (Experiment 1) or response latencies and judgement accuracies associated with native reanalysis patterns (Experiment 2).
- The near-native speakers demonstrate an SO-preference and incremental reanalysis effects (Experiment 1) whose strength is differentially modulated by the type of syntactic features in grammatical and ungrammatical sentences (Experiment 2).

In these respects, the near-native behaviour proves isomorphic to the performance by native speakers.

One of the clearest findings in the experiments is an effect of proficiency level on parsing routines in the L2. Despite the fact that all second language learners have had long exposure to German and have reached a high command in the language, proficiency differences at advanced stages of L2 acquisition account for major differences in non-native processing. Compared to the advanced speakers, who show lower accuracy and flatter processing patterns in comprehending the L2, speakers at near-native proficiency levels show evidence of more nuanced processes in parsing the L2. In fact, in this study, it is only at the near-native level that L2 speakers of German converge on the parsing accuracy and functional reanalysis patterns in native German processing.

Proficiency effects in non-native processing have been reported in an eye-tracking study by Frenck-Mestre (2002) and in event-related potential (ERP) studies (Hahne, 2001; Hahne and Friederici, 2001; Sabourin, 2003), in which more advanced learners demonstrate evidence of automatic neurophysiological responses to morphosyntactic ungrammaticalities in the L2 that are absent in less proficient participants. However, L1 effects are a potential confound of proficiency in these studies, since comparisons are made across different L1 groups of different proficiency levels. Also using ERPs, Friederici *et al.* (2002) and Mueller (2005) report similar proficiency effects in the acquisition of 'miniature' L2 systems, where comparatively fast advances in proficiency correlate with massive changes in ERP responses. In neuroimaging studies on sentence comprehension in the L2, Perani *et al.* (1998; 2003) and

Abutalebi *et al.* (2001) equally find that the areas and extent of neural activation in processing the L2 converge on native activation patterns as a function of proficiency. The findings of the present study on syntactic ambiguities underline the importance of proficiency level in the development of the architecture and mechanisms in L2 processing. Seeing distinct performance in the two proficiency groups in the present study suggests that even at very advanced proficiency levels and after long L2 exposure and immersion, further acquisition and practice in the L2 leads to more native-like parsing routines. Not least, this finding highlights the importance of studies on ultimate attainment in the L2 and cautions that arguments about the qualitative status of interlanguage systems in comparison with those of mature native speakers necessitate careful consideration of variables such as degree of proficiency.

The present findings do not support the hypothesis that L2 processing is 'shallower' than native-language processing such that L2 speakers are sensitive to lexical-semantic and pragmatic information, yet make only very restricted or no use of syntactic or phrase-structural information in parsing (compare Felser *et al.*, 2003; Clahsen and Felser, 2006; Felser and Roberts, to appear). The Shallow Structure Hypothesis might explain the relatively poor performance by the advanced group on incremental processing (Experiment 1) and the use of syntactic cues under time pressure in this study (Experiment 2). However, the Shallow Structure Hypothesis fails to account for the behaviour of the near-natives. The near-native group shows reliable use of syntactic features in phrase-structural reanalysis. They also show evidence of incremental processing by syntactic features. Moreover, the near-natives show an interaction of syntactic feature type and phrase-structural parsing principles in parsing ambiguous grammatical sentences as well as ungrammatical sentences. Given that all lexical, semantic, pragmatic and frequency-based cues to sentence interpretation were absent in Experiments 1 and 2, the observed behaviour cannot possibly derive from the use of non-syntactic information in processing. Moreover, the near-native behaviour cannot be accounted for by means of surface strategies, e.g. a linear 'subject-first' preference. As shown by the interactions of the factors Order and Ambiguity in the reading delays (Experiment 1), the subject-initial preference varies in native and near-native speakers according to the syntactic type of disambiguation. The reading delays

reflecting reanalysis in the near-natives are locally specific to the regions of syntactic disambiguation, i.e. segments 3 and 4 for case and segment 7 for verbal agreement. In addition, the interaction (Table 1) between syntactic feature type (case vs. verbal agreement) and sentence type (grammatical vs. ungrammatical) in native and near-native processing (Experiments 1 and 2) implies that syntactic features are used differentially in sentence comprehension. A general linearization principle could not capture any of these effects. Any satisfactory explanation thus needs to include a syntactic analysis that makes use of a distinction of syntactic features and that accounts for their differential status in reanalysis.

The observed reanalysis pattern by the near-natives in both experiments can easily be explained by parsing models that posit that native speakers:

- employ a phrase-structural preference like the Minimal Chain Principle (3) (de Vincenzi, 1991);
- establish syntactic relations incrementally in parsing; and
- attempt reanalysis by means of syntactic relations in parsing.

As argued by Fodor and Inoue (1994; 1998; 2000), the serial parser is redirected to the source of a misparse by the syntactic relations expressed by the mismatching feature (Det–Noun or Subject–Verb agreement) and attempts reanalysis. Reanalysis is attempted irrespective of whether the structure turns out to be dispreferred or ungrammatical. The different degrees of informativity of case and verbal agreement features for reanalysis lead to a disjunction in parsing accuracy between dispreferred OS sentences and ungrammatical sentences (Table 1). Since near-natives show evidence of exactly this performance, syntactic parsing principles and syntactic features are implicated in processing the L2.

In spite of the convergence of near-native and native processing patterns, all L2 groups suffer a much larger proportional decrease than the natives in judgement accuracy on case violations than on violations of verbal agreement in Experiment 2. At first glance, it seems that this specific difference between natives and non-natives could follow from two factors: first, L1 transfer and, second, greater computational difficulty in coordinating different types of grammatical information in the L2. We consider each in turn.

The role of L1 transfer in non-native processing is a matter of contention. Some studies find evidence of L1 properties in L2 parsing

(e.g. Juffs, 1998; Frenck-Mestre, 2002; Fernandez, 2003; Sabourin, 2003) and others report no L2 processing differences between L1 groups (Papadopoulou and Clahsen, 2003; Marinis *et al.*, 2005). Since neither English nor Dutch uses case marking to signal the syntactic function of non-pronominal NPs, the L2 German finding that integrating such case-marked NPs into syntactic structure causes additional processing effort for the non-natives might derive from the lack of such automatic processes in parsing the L1 (e.g. MacWhinney *et al.*, 1984). With no L2 group from a case-marking L1 background for comparison in the present experiments, it is unfortunately not possible to ascertain whether the specific demands of these NPs reflect L1 effects. In another study, this issue has been explored with L1 Russian speakers of German (see Hopp, 2006).

Other research argues for increased integration difficulty of morphological and syntactic knowledge. Hahne (2001) argues on the basis of ERP studies on phrase-structure violations that the degree of automaticity in integrating syntactic category information into phrase structure is reduced in non-native processing. In case studies on fossilized endstate learners, Lardiere (1998a; 1998b; 2000) and White (2003) suggest that dissociations between impaired suppliance of morphology and target-like production of associated syntactic properties stem from increased computational demands in accessing morphological forms and matching them with syntactic features. According to these claims, processing delays and failures in coordinating morphosyntactic information in comprehension and production obtain generally in non-native processing and can persist to near-native proficiency levels, possibly irrespective of L1 properties. The findings of the current study are compatible with this proposal, although the difficulties found here seem specific to case marking and do not seem to extend to other morphosyntactic phenomena, specifically verbal (number) agreement. Further research is needed to give substance to the nature and extent of computational difficulties in form–function mapping at the endstate of L2 acquisition.

VI Conclusions

This study shows that level of proficiency arbitrates the degree of native-like processing of subject–object ambiguities in the L2. The

near-native group, yet not the advanced group, of L1 English and Dutch speakers of German was found to employ syntactic principles and syntactic features in parsing to native-like degrees, even though the L1s instantiate neither analogous options for syntactic reordering nor the same morphosyntactic cues. These results suggest that sensitivity to syntactic information is not in principle restricted in non-native processing. It of course remains to be seen in future research whether the finding that highly proficient L2 speakers at ultimate attainment invoke native-like syntactic processing routines in the L2 generalizes to other phenomena and other language groups.

Acknowledgements

For helpful comments and discussion, I would like to thank Kees de Bot, Harald Clahsen, Bonnie Schwartz, Laurie Stowe and two anonymous reviewers for *Second Language Research*. All remaining errors are my responsibility.

VII References

Abutalebi, J, Cappa S.F. and **Perani, D.** 2001: The bilingual brain as revealed by functional neuroimaging. *Bilingualism: Language and Cognition* 4, 179–90.

Baayen, R.H., Piepenbrock, R. and **Gulikers, L.** 1995: *The CELEX lexical database*. Release 2. Linguistic Data Consortium.

Bader, M. and **Meng, M.** 1999: Subject–object ambiguities in German embedded clauses: an across-the-board comparison. *Journal of Psycholinguistic Research* 28, 121–43.

Clahsen, H. and **Felser, C.** 2006: Grammatical processing in first and second language learners. *Applied Psycholinguistics* 27, 3–42.

Clifton, C. and **Frazier, L.** 1989: Comprehending sentences with long-distance dependencies. In Carlson, G.M. and Tanenhaus, M.K., editors, *Linguistic structure in language processing*. Kluwer, 273–317.

de Vincenzi, M. 1991: *Syntactic parsing strategies in Italian*. Kluwer.

Dussias, P. 2003: Syntactic ambiguity resolution in second language learners: some effects of bilinguality on L1 and L2 processing strategies. *Studies in Second Language Acquisition* 25, 529–57.

Felser, C. and **Roberts, L.** to appear: Processing *wh*-dependencies in a second language: a cross-modal priming study. *Second Language Research*.

Felser, C., Roberts, L., Marinis, T. and **Gross, R.** 2003: The processing of ambiguous sentences by first and second language learners of English. *Applied Psycholinguistics* 24, 453–89.

Fernandez, E. 2003: *Bilingual sentence processing*. John Benjamins.

Fodor, J.D. and **Inoue, A.** 1994: The diagnosis and cure of garden paths. *Journal of Psycholinguistic Research* 24, 407–34.

—— 1998: Attach anyway. In Fodor, J.D. and Ferreira, F., editors, *Reanalysis in sentence processing*. Kluwer, 101–41.

—— 2000: Syntactic features in reanalysis: positive and negative symptoms. *Journal of Psycholinguistic Research* 29, 25–36.

Frazier, L. 1987: Sentence processing: a tutorial review. In Coltheart, M., editor, *Attention and performance XII: the psychology of reading*. Erlbaum, 559–86.

Frenck-Mestre, C. 2002: An on-line look at sentence processing in the second language. In Heredia, R. and Altarriba, J., editors, *Bilingual sentence processing*. Elsevier, 217–36.

—— 2005: Eye-movement recording as a tool for studying syntactic processing in a second language: a review of methodologies and experimental findings. *Second Language Research* 21, 175–98.

Frenck-Mestre, C. and **Pynte, J.** 1997: Syntactic ambiguity resolution while reading in second and native languages. *Quarterly Journal of Experimental Psychology* 50A, 119–48.

Friederici, A.D., Hahne, A. and **Pfeifer, E.** 2002: Brain signatures of artificial language processing: evidence challenging the critical period hypothesis. *Proceedings of the National Academy of Sciences* 99, 529–34.

Gibson, E., Pearlmutter, N., Canseco-Gonzalez, E. and **Hickok, G.** 1996: Recency preferences in the human sentence processing mechanism. *Cognition* 59, 23–59.

Gorrell, P. 1995: *Syntax and parsing*. Cambridge University Press.

Grotjahn, R. 1996: *Der C-Test: Theoretische Grundlagen und praktische Anwendungen [The C-test: Theoretical foundations and practical applications]*. Brockmeyer.

Hahne, A. 2001: What's different in second-language processing? Evidence from event-related brain potentials. *Journal of Psycholinguistic Research* 30, 251–66.

Hahne, A. and **Friederici, A.** 2001: Processing a second language: late learners' comprehension mechanisms as revealed by event-related brain potentials. *Bilingualism: Language and Cognition* 4, 123–41.

Haider, H. and **Rosengren, I.** 1998: *Scrambling*. University of Lund.

Hemforth, B. and **Konieczny, L.** 2000: *German sentence processing.* Kluwer.

Hopp, H. 2006: Subject–object ambiguities in L2 parsing. In Bamman, D., Magnitskaia, T and Zaller, C., editors, *Proceedings of the 30th Annual Boston University Conference on Language Development*.

Hyltenstam, K. and **Abrahamsson, N.** 2003: Maturational constraints in SLA. In Doughty, C. and Long, M., editors, *The handbook of second language acquisition*. Blackwell, 539–88.

Juffs, A. 1998: Main verb versus reduced relative clause ambiguity resolution in second language sentence processing. *Language Learning* 48, 107–47.

—— 2005: The influence of first language on the processing of *wh*-movement in English as a second language. *Second Language Research* 21, 121–51.

Juffs, A. and **Harrington, M.** 1996: Garden-path sentences and error data in second language sentence processing. *Language Learning* 46, 283–326.

Just, M.A., Carpenter, P.A. and **Woolley, J.D.** 1982: Paradigms and processes in reading comprehension. *Journal of Experimental Psychology*: General 3, 228–38.

Lardiere, D. 1998a: Case and tense in the 'fossilized' steady-state. *Second Language Research* 14, 1–26.

—— 1998b: Dissociating syntax from morphology in a divergent L2 end-state grammar. *Second Language Research* 14, 359–75.

—— 2000: Mapping features to form in second language acquisition. In Archibald, J., editor, *Second language acquisition and linguistic theory*. Blackwell, 102–29.

MacWhinney, B., Bates, E. and **Kliegl, R.** 1984: Cue validity and sentence interpretation in English, German, and Italian. *Journal of Verbal Learning and Verbal Behavior* 23, 127–50.

Marinis, T., Roberts, L., Felser, C. and **H. Clahsen** 2005: Gaps in second language sentence processing. *Studies in Second Language Acquisition* 27, 53–78.

Meng, M. and **Bader, M.** 2000: Ungrammaticality detection and garden path strength: evidence for serial parsing. *Language and Cognitive Processes* 15, 615–66.

Mueller, J.L. 2005: Electrophysiological correlates of second language processing. *Second Language Research* 21, 152–74.

Papadopoulou, D. 2005: Reading-time studies of second language ambiguity resolution. *Second Language Research* 21, 98–120.

Papadopoulou, D. and **Clahsen, H.** 2003: Parsing strategies in L1 and L2 sentence processing: a study of relative clause attachment in Greek. *Studies in Second Language Acquisition* 24, 501–28.

Perani, D., Abutalebi, J., Paulesu, E., Brambati, S., Scifo, P., Cappa, S.F. and **Fazio, F.** 2003: The role of age of acquisition and language usage in early, high-proficient bilinguals: an fMRI study during verbal fluency. *Human Brain Mapping* 19, 170–82.

Perani, D., Paulesu, E., Galles, N.S., Dupoux, E., Dehaene, S., Bettinardi, V., Cappa, S.F., Fazio, F. and **Mehler, J.** 1998: The bilingual brain: proficiency and age of acquisition of the second language. *Brain* 121, 1841–52.

Sabourin, L. 2003: *Grammatical gender and second language processing*. Grodil Press.

Schlesewsky, M., Fanselow, G. and **Frisch, S.** 2003: Case as a trigger for reanalysis: some arguments from the processing of double case ungrammaticalities in German. In Fischer, S., van de Vijver, R. and Vogel, R., editors, *Linguistics in Potsdam* 21, 31–60.

Schneider, W., Eschman, A. and **Zuccolotti, A.** 2002: *E-Prime reference guide*. Psychology Software Tools.

Sorace, A. 2003: Near-nativeness. In Doughty, C. and Long, M., editors, *Handbook of second language acquisition theory and research*. Blackwell, 130–51.

—— 2005: Interfaces in language development. Unpublished paper presented at Generative Approaches to Language Acquisition, Siena.

White, L. 2003: Fossilization in steady state L2 grammars: persistent problems with inflectional morphology. *Bilingualism: Language and Cognition* 6, 129–41.

Williams, J., Möbius, P. and **Kim, C.** 2001: Native and non-native processing of English *wh*-questions: parsing strategies and plausibility constraints. *Applied Psycholinguistics* 22, 509–40.

Zwart, J.-W. 1997: *Morphosyntax of verb movement: a minimalist approach*. Kluwer.