9. Summary, Discussion and Conclusions

Introduction

This thesis tested whether late L2 learners of a variety of L1 backgrounds converge on the target language in off-line knowledge and on-line sentence comprehension. The focus was on potential non-convergence at the syntactic interfaces (the ‘Interface Hypothesis’). The seven experiments in Chapters 6, 7 and 8 provide the empirical basis for an investigation of the interplay of various grammatical modules at L2 ultimate attainment in order to identify (a) the loci of persistent difficulty in L2 grammars and processing and (b) the conditions for convergence on the target language in these domains. Specifically, these experiments probed the interaction of syntax and its interfaces with the morphology, semantics, discourse and the lexicon in advanced to near-native L2 speakers of German. All experiments centred on scrambling in German which brings together syntactic and interface aspects in the licensing and morphosyntactic realization of word order variation. The results of the series of experiments indicate that the degree of convergence varies according to (a) the architecture of grammar, i.e. the type of interface, (b) acquisition conditions, i.e. L1 and proficiency level, and (c) computational aspects, i.e. task demands.

In this chapter, I discuss the results and their implications for the architecture of L2 grammars at ultimate attainment. I put the findings into the contexts of previous approaches to L2 acquisition and L2 processing as well as the context of previous research on the limits of ultimate attainment in L2 acquisition. I argue that the pattern of results across Experiments 1 through 7 cannot be captured by approaches positing critical period effects in either grammatical representation or mental processing. Instead, I outline how non-convergence across the experiments systematically relates to computational difficulties at the syntax-morphology interface and learnability due to grammatical L1 transfer. I conclude that the empirical findings are compatible with the Fundamental Identity Hypothesis.

This chapter is structured as follows: First, I summarize the main findings for each grammatical interface (Section 9.1). Second, I discuss whether and how the diverse approaches to L2 acquisition and L2 processing can accommodate the results in the experiments in this thesis (Section 9.2). I argue that the pattern of results points neither to qualitative differences in grammatical representation nor to qualitative differences in mental processing between non-natives and natives. Even more tellingly, models of L2 acquisition positing qualitative differences of these kinds between L1 and L2 speakers fail to capture the pattern of findings across tasks. Instead, Section 9.2.3 develops a detailed account of how computational limitations and L1 transfer conspire in giving rise to the pattern of convergence and non-convergence observed across Experiments 1-7. Subsequently, I situate the findings within the debate about the Critical Period Hypothesis.
(Section 9.4). Finally, I discuss the limitations of the present study (Section 9.5) and sketch its implications for future research on L2 ultimate attainment (Section 9.6).

9.1. Interfaces at L2 ultimate attainment: The picture so far

Experiments 1-7 found that convergence on scrambling is attainable at least for some L2 groups. At the same time, other L2 groups fail to converge on target performance in various experiments. For overview, Table 1 lists the areas of convergence and non-convergence by the L2 groups depending on (a) type of interface, (b) type of task, (c) grammatical phenomenon and (d) group. The L2 groups are broken down according to L1 and proficiency level. Convergence is defined as target-like performance, i.e. isomorphy with the relative patterns of native performance.

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<td>Off-line judgements</td>
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<td>6</td>
<td>On-line reading</td>
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<td>Syntax-Lexicon</td>
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<td>Speeded Judgements</td>
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<td>Off-line judgements</td>
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Table 9.1. Areas of convergence in Experiments 1-7. (‘+’ denotes convergence, ‘-’ marks non-convergence).
The overview in Table 9.1 clearly illustrates that there is no uniform pattern of convergence or non-convergence in the set of experiments reported in this thesis. No L1 group achieves convergence across all interfaces and tasks; conversely, no group, with the exception of the L1 Dutch advanced group, fails to converge across all interfaces and tasks. At first glance, then, the results do not allow for any straightforward interpretation of the potentials for and the limitations of convergence in adult L2 acquisition. In the following, I summarize the results for each interface in relation to the main research questions, and I extract the relevant factors governing non-convergence for each interface. All experiments investigated whether L1 and/or proficiency differences affect convergence. However, the syntax-semantics interface will be excluded from discussion, since the findings of Experiment 4 were inconclusive. As only 60% of the native controls displayed the target pattern of judgement for the semantics of scrambling (Chapter 7), the fact that the L2 groups do not show the target pattern cannot be taken to equal non-convergence.

9.1.1. The syntax-morphology interface (Chapter 6)

Experiments 1 through 3 probed the syntax-morphology interface in off-line judgements and on-line tasks. Off-line judgements investigated whether L2ers have acquired knowledge of the morphosyntax of scrambling. In the on-line experiments, I tested whether L2 speakers carry out syntactic reanalysis using morphological cues. The main research questions can be answered as follows.

(1) Do L2 speakers show knowledge of the morphosyntax of word order optionality, i.e. scrambling, in off-line judgements? (Experiment 1)

At advanced levels, only the L1 Russian group shows convergent judgements, whereas neither the L1 English group nor the L1 Dutch group uses case marking for determining syntactic order. At near-native levels, however, all L1 groups show convergent judgements on scrambling and case marking.

(2) Do L2 speakers show incremental reanalysis in on-line reading? (Experiment 2, replicated in Experiment 6)

In on-line reading, the L2 groups show differential performance according to proficiency, yet not L1. The lower-proficient advanced groups show no local reanalysis effects according to morphological cues, that is, they do not appear to use morphological information immediately for syntactic function assignment in L2 processing. In contrast,
the near-native speakers do evince target-like local slowdowns associated with syntactic reanalysis. For all near-native groups, target reanalysis effects are measurable for case marking as well as verbal agreement marking, despite L1 differences in the morphological realization of these features.

(3) Do L2 speakers show use of morphological information for reanalysis? (Experiments 2 & 3)

All L2 groups show an interaction of morphosyntactic feature type (case versus verbal agreement) and sentence type (grammatical versus ungrammatical) in comprehension and judgement accuracy. Accordingly, all groups are sensitive to morphosyntactic features in syntactic reanalysis. Yet, only the L1 Russian near-natives converge on morphosyntax across tasks, including judgements on case violations under time pressure (Experiment 3).

9.1.2. The syntax-discourse interface (Chapter 7)

The syntax-discourse interface was explored by investigating the effects of information structure (IS) on scrambling in off-line judgements and in on-line reading (Experiments 5 and 6). I investigated whether embedding scrambling in favourable discourse contexts increases its acceptability and reduces the reanalysis costs associated with scrambling.

(4) Do L2 speakers show knowledge of the interaction of scrambling and information structure in off-line judgements? (Experiment 5)

The L1 English near-native group and the L1 Russian group display convergent interactions of IS and scrambling, while the L1 English advanced group and the L1 Dutch group show no sensitivity to IS manipulations.¹

(5) Do L2 speakers show incremental effects of the interaction of information structure and syntax on reanalysis in on-line reading? (Experiment 6)

The L1 English and L1 Russian groups show convergent performance on-line. This shows that even L2ers of non-scrambling L1s can converge on the IS of scrambling. However, the L1 Dutch group shows non-convergent performance.

¹ The L1 English advanced group did show IS effects on-line. In Chapter 7, I related this difference to different task demands in off-line judgements and on-line reading.
9.1.3. The syntax-lexicon interface (Chapter 8)

The interface of syntax with the lexicon was probed by investigating reanalysis effects for dative-experiencer verbs in a speeded grammaticality judgement task (Experiment 7). It tested whether dative-experiencer verbs, which project a base OS order by virtue of their thematic properties, affect processing by not evincing reanalysis costs from SO to OS.

(6) Do L2 speakers show effects of the interaction of argument structure and syntax on reanalysis in speeded on-line judgements? (Experiment 7)

Convergence on dative experiencers is affected by L1 properties in argument structure. The L1 Russian group and L1 Dutch near-native group converge on target processing of dative experiencers in L2 German, whereas the L1 English group does not show target-like effects of argument structure on reanalysis. However, L1 effects in argument structure are interleaved with L1 effects on case marking for the L1 English group and the advanced L1 Dutch group, which were argued to conceal convergence on argument structure (Chapter 8).

Figure 9.1 summarizes the findings across the respective interfaces and the groups. In Figure 9.1, the shaded and framed areas denote convergence for the interface in question (shown in boldface). For instance, it can be seen that the L1 Russian near-natives converge at all interfaces, whereas the L1 English advanced group converges only at the syntax-discourse interface.

Figure 9.1. The pattern of convergence at the interfaces. Shaded and framed cells denote convergence at the respective interfaces (shown in bold).

Figure 9.1 shows that the grammar and processing at L2 ultimate attainment are differentially affected by L1 differences (syntax-discourse and syntax-lexicon) and
differences in proficiency (syntax-morphology). Now that we have catalogued the differences at the interfaces and related them to the between-group factors L1 and proficiency, respectively, let us assess the implications of the findings, first, for models of L2 acquisition and L2 processing, and, second, for the Critical Period Hypothesis.

9.2. Difference-oriented approaches and the patterns of non-convergence

In this section, I review whether difference-oriented approaches to L2 acquisition (Figure 9.2; repeated from Chapters 1 & 2) can account for the patterns of non-convergence. At this point, I do not aim to review all arguments already discussed in the context of the individual chapters; rather, I intend to evaluate how the total performance and (non-)convergence patterns of the groups across the interfaces can be captured by these models. Specifically, I discuss whether non-convergence in Figure 9.1 points to (a) differences in grammatical representation in L2 speakers versus natives (Section 9.2.1; italicized in Figure 9.2), (b) differences in mental processing between non-natives versus natives (Section 9.2.2; underlined in Figure 9.2) and/or (c) L1 transfer and differences in computational resources between non-natives versus natives (Section 9.2.3; bolded in Figure 9.2).

\begin{table}
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\begin{tabular}{lll}
\hline
\textbf{Nature} & representational & computational \\
\hline
\textbf{Cause} & impairment & L1 interference & impairment inefficiency & L1 interference \\
\hline
\textbf{Domain} & modules & interfaces & parsing routes & (- Competition Model) \\
\hline
\hspace{1cm} & - Sorace (1993); & & & \\
\hspace{1cm} & - Schwart\& Sprouse (1996) & & & \\
\hspace{1cm} & - syntax-morphology (Lardiere, 2000) & & & \\
\hspace{1cm} & - Interpretable Features (Sorace, 2003) & & & \\
\hspace{1cm} & - Failed Functional Features & & & \\
\hspace{1cm} & (Hawkins \& Chan, 1997) & & & \\
\hspace{1cm} & - Shallow Structures (Clahsen \& Felser, 2006) & & & \\
\hspace{1cm} & & - attenuation of procedural system & & \\
\hspace{1cm} & & (Ullman, 2005) & & \\
\hline
\end{tabular}
\caption{Approaches to non-convergence in adult L2 acquisition.}
\end{table}

9.2.1. Grammatical impairment

Framed within grammatical theories of L2 acquisition, impairment models constitute particular conceptualizations of the Critical Period Hypothesis in that specific components of mental grammars are taken to suffer representational impairment due to
maturation. As reviewed in Chapters 1 and 2, the three approaches at issue here differ in the scope of impairment that L2 grammars are assumed to sustain: The ‘Shallow Structure Hypothesis’ claims that L2 grammars do not represent abstract phrase structure. The ‘Failed Functional Features’ model holds that morphosyntax is restricted to L1 properties, the ‘Interpretative Features’ approach posits that interpretative aspects of syntax are determined by the L1 values in L2 acquisition. I discuss whether any of these models individually, or in conjunction, accommodate the pattern of non-convergence shown in Figure 9.1 in order to establish whether non-convergence in this study can be explained as a consequence of maturational constraints on grammatical representations in L2 acquisition.

The Shallow Structure Hypothesis (SSH) (Clahsen & Felser, 2006b) addresses L2 processing by arguing that syntactic representations in the L2 fail to conform to native grammars in that they lack abstract phrase-structure hierarchy. Rather, L2 learners are supposed to draw primarily on (non-syntactic) surface properties of the TL input in modeling an IL system by means of general learning mechanisms (e.g., Clahsen & Muysken, 1986; Meisel, 1997). As a consequence, the processing of, e.g., non-local filler-gap dependencies, is argued to be shallow since phrase-structure-based reanalysis is impossible for L2 learners.

Descriptively, shallow processing adequately captures the reading patterns of the advanced L2 groups in the present study who seem to rely on linear order or canonical thematic templates in assigning syntactic function, rather than revising phrase structure relations incrementally in on-line comprehension as the natives and near-natives do. It seems rather doubtful, however, that such shallow strategies in processing can be related to impairment in grammatical knowledge. In particular, such an account has no explanation as to why the L1 Russian advanced group, unlike the other advanced groups, shows target-like grammatical knowledge (Experiment 1), yet, like the other advanced L1 groups, fails to show target-like performance in processing (Experiments 2 and 3). Differences between L1 groups in off-line knowledge and on-line performance cannot be accommodated within a model that holds that shallow processing obtains in L2 processing in general.

Moreover, if the failure of the advanced L2 groups to display local effects of reanalysis is an indication that they cannot effect phrase-structure-based reanalysis, it is unexpected to find target-like effects of morphosyntactic features for syntactic reanalysis in global processing measures. Recall that all advanced groups show target-like distinctions in comprehension accuracy depending on the type of morphological disambiguation (case versus verbal agreement) in Experiments 2 and 3. In order for these behavioural differences to surface, the advanced groups must make some use of morphosyntactic features in processing subject-object ambiguities. Counter to the contention of the SSH that “during shallow processing, nonlocal checking of formal (as
opposed to semantic) features will not normally be possible” (Claessen & Felser, 2006a: 121), the similarities in degree in the use of morphosyntactic features between the advanced and near-native groups suggest that identical reanalysis mechanisms are implicated in the groups’ performance in principle, albeit not to the same degree of accuracy. Of course, it is imaginable that the global effects of morphosyntactic features and reanalysis in the advanced L2 groups follow from a fundamentally different IL system or from processing strategies that somehow emulate the target pattern. In the absence of independent evidence in the data supporting the SSH, however, such an analysis would be stipulative. Further research would be needed to elucidate these matters.

Finally, the differences between the advanced and near-native groups are also problematic for the SSH. The near-natives’ convergent processing performance suggests they have indeed acquired target-like grammatical representations that are utilized in processing. If L2 processing in the advanced groups is qualitatively different, the SSH faces problematic issues of continuity in accounting for why and how deviant grammatical representations allegedly forcing shallow parsing transmute into target-like representations at near-native proficiency levels.

Two further impairment approaches assume local and L1-specific representational impairment in L2 acquisition. According to the Failed Functional Features Hypothesis, also termed the Representational Deficit Model (Hawkins, 2001a; Hawkins & Chan, 1997; Tsimpli, 2003), uninterpretable features encoding morphosyntax cease to be available in adult L2 acquisition, unless they are expressed in the L1. Adult L2 speakers whose L1 repertoire of morphosyntactic representations cannot accommodate the TL morphosyntax emulate the TL surface syntax by modelling the TL within the more restrictive set of L1 features or they construct metalinguistic ‘parasites’ (Beck, 1998) to compensate for missing grammatical representations. This approach entails categorical effects of the L1 on (non-)convergence in the area of morphosyntax in that morphological features and associated syntactic movement operations should be acquirable to criterion only for speakers whose L1 matches the TL in the inventory of uninterpretable features. Clearly, this hypothesis is incompatible with the data from the near-native groups in off-line knowledge and on-line use of case marking and syntactic reordering in Experiments 1 through 3. These data show that all near-natives, irrespective of L1 differences in the inventory of morphosyntactic features, converge on the target pattern in morphosyntax.

Another model assuming representational impairment contends that interpretable features, i.e. syntactic markers encoding discourse-semantic properties, become inert in adult L2 acquisition, unless they were selected for the L1 (Sorace, 2000; 2003). This account predicts that both L1 English and L1 Dutch speakers should diverge from the TL on the information structure of scrambling, since neither English nor Dutch instantiates
Summary, Discussion and Conclusions

pre-subject scrambling and its associated information structure. Neither thus selects the same interpretable feature (Chapter 3). In opposition to this prediction, the findings in Experiment 6 show that the L1 English speakers do converge on the IS of scrambling. Convergence by the L1 English group also implies that the result that the L1 Dutch speakers do not converge cannot be due to impaired interpretable features, since, at the featural level, they are no different from the L1 English group, because neither English nor Dutch allows for pre-subject scrambling. Hence, the non-convergence of the L1 Dutch group must be explained in different terms; there is no evidence that ultimate attainment in L2 interpretation is restricted to the features of the L1 grammar.

In sum, of the three approaches to L2 ultimate attainment in terms of grammatical impairment, none is supported by the data relevant to its predictions. Moreover, none of the models provides a framework to capture the interacting effects of L1 and proficiency across groups and interfaces elicited in the experiments (Figure 9.1). I conclude that these specific models positing critical period effects on grammatical representation in late L2 acquisition are not supported by the empirical evidence.

Of course, these specific hypotheses do not exhaust the logically possible manifestations of grammatical impairment one might envisage as constraining adult L2 acquisition. It seems, though, that the pattern of (non-)convergence found across interfaces in this thesis cannot easily be captured by any grammatical impairment account. If a critical period forces discontinuity in grammatical architecture, then manifest behavioural differences should either affect late L2 acquisition in general or systematically align with L1-TL differences in grammatical properties.

In contrast, the findings across experiments show that late L2 learners whose L1s differ from the TL in the realization of grammatical properties can acquire target-like off-line competence and on-line performance. At the same time, not all late L2 learner groups do acquire target-like competence and performance on scrambling. The former finding strongly argues against grammatical impairment as a likely explanation of non-convergence in the areas tested, and the latter finding demonstrates that grammatical impairment, if true, is unlikely to be the major cause of non-convergence. Let us consider this final point further.

The finding that the near-natives converge on the morphosyntax of scrambling in off- and on-line tasks implies that grammatical impairment does not constrain ultimate attainment on morphosyntax. It thus remains to be explained why not all proficiency groups demonstrate convergence on morphosyntax (Experiments 2 and 3). In the same vein, convergence by both the L1 Russian group and the L1 English group on the IS of scrambling, despite L1 differences, rules out grammatical impairment as a principled cause for non-convergence at the syntax-discourse interface (Experiment 6). An account, then, needs to be given as to why the L1 Dutch group does not converge. Evidently, the causes of non-convergence by the lower-proficient groups for morphosyntax and by the
L1 Dutch group for IS need to be sought in factors other than grammatical impairment. The explanatory scope of grammatical impairment for the pattern of non-target-like behaviour found in Experiments 1 through 7 is thus limited.

If grammatical impairment does not constrain ultimate attainment and cannot account for between-group differences, which other factors limit the potential of L2 acquisition? Let us next consider whether different mental processes underlie the L2 performance pattern in comparison to native speaker performance.

9.2.2. Differences in mental processing

Several models assume that L2 acquisition proceeds by different mental routes, accessing different knowledge types, e.g. explicit and implicit knowledge, compared to monolinguals as the result of a critical period (e.g. DeKeyser, 2000; Jiang, 2004; Paradis, 1997, 2004; Ullman, 2005). As opposed to models of grammatical representation discussed above, these models focus on how linguistic knowledge is accessed and applied in language comprehension and production. One of these models, Ullman’s Declarative/Procedural (DP) model, frames differences between non-native and native performance as the effects of the recruitment of two distinct neurocognitive pathways of representing and processing language: the declarative system and the procedural system (Ullman, 2005; 2006). The DP model holds that adult L2 acquisition predominantly relies on the declarative memory system that is confined to storing explicitly memorized formulas; as proficiency increases, L2 speakers gradually engage the procedural system in which abstract morphosyntactic processes are automatized. In a model like the DP model that correlates rises in proficiency with the activation of the procedural system, L2 development can be characterized as the gradual recruitment of native-like mental processing routes. The DP model thus turns out to be compatible with the increase in convergence from the advanced to the near-native groups in the present experiments. In contrast to models of grammatical divergence, the DP model seems right in identifying that the degree of proceduralization and processing efficiency in L2 comprehension, rather than differences in grammatical representation, characterizes advanced stages of late L2 acquisition.

In relation to possible critical period effects in mental processing, the central issue is whether the potential for proceduralization is maturationally bounded or becomes gradually less available in late L2 acquisition. With respect to this issue, however, the DP model suffers from its vague distinctions between native and L2 processing. According to the DP model, L2 acquisition is characterized by the reduced availability of the procedural system. However, the DP model offers no specification whether the reduced availability of the procedural system is to be understood as a quantitative attenuation of the procedural system in total or whether reduced availability means that some parts of the system are inaccessible. Furthermore, Ullman’s contention that “with sufficient
experience with the language, the procedural system should be able to acquire much or perhaps even all of the grammatical knowledge that it subserves in L1” (Ullman, 2005: 157) implicates that the putative differential mental bases of L1 and L2 acquisition have no consequences for convergence at L2 ultimate attainment. Such a gradient notion of the declarative-procedural divide is hard to marry with the contention that the increased reliance of L2 processing on the declarative system is a consequence of abrupt maturational changes. Indeed, although attributing a key role to age of acquisition, the DP model posits that the relative recruitment of the procedural system in the L2 is also modulated by practice and usage of the L2, L2 proficiency, domain-general cognitive capacities, sex and hormone levels (Hartshorne & Ullman, 2006; Ullman, 2001; 2005). It is not clear which relative impact maturational effects might have among the multitude of factors; moreover, it remains open what (combination of) factors might engender possible transitions from reliance on the declarative system to engagement of the procedural system.²

On top of these conceptual problems, the DP model does not provide an articulated framework to capture other between-group differences. As discussed in Chapter 2 (see also Bornkessel & Schleseway, 2006a; Clahsen & Felser, 2006b), the DP distinction is a cover term which does not differentiate between types of linguistic information beyond lexical-semantic information that is stored in the declarative system and other grammatical information, e.g. syntax or agreement, in the procedural system. The DP model does not build on an articulated theory of grammar, and hence offers no principled distinction of grammatical interfaces. Let us briefly consider how the global distinctions made between declarative and procedural memory systems are problematic in light of the data in the self-paced reading tasks (Experiments 2 and 6). Syntactic reanalysis was found to be affected by morphosyntactic agreement marking and by IS focus marking. Both establishing morphosyntactic agreement relations and establishing focus relations incrementally in processing involve the computation of dependencies of, respectively, subject-verb agreement and focus structure for embedded scrambled sentences. Since these dependencies cannot be memorized or consciously calculated in real-time comprehension, both fall under the rubric of the procedural system. It may be assumed, then, that target-like processing of morphosyntactic agreement and focus relations should each correlate with proficiency, since proficiency determines the engagement of the procedural system in L2 processing. However, the self-paced reading tasks show differential performance for information structure according to L1, yet not according to proficiency, on the one hand (Experiment 6), and differential performance for morphosyntax according to proficiency, yet not according to L1, on the other (Experiment 2). It is unclear how a model like the DP model that subsumes all types of

² In contrast to the DP model, e.g. DeKeyser (2000) and Paradis (2004) claim more strongly that the availability of proceduralized, implicit knowledge is maturationally bounded. These accounts are incompatible with the data from the near-natives.
non-local dependencies in the procedural system could account for these differences between types of reanalysis and between different L1s in L2 processing.

More generally, such dissociations between interfaces illustrate that dualistic models of mental L2 processing that segregate L2 processing in declarative versus procedural (Ullman), explicit versus implicit (e.g. DeKeyser, 2000; Paradis, 2004), or non-integrated versus automatic and integrated knowledge processing (Jiang, 2004; 2007) meet the same challenges as the grammatical impairment models reviewed in Section 9.2.1 above: Positing that the potential for target-like processing is maturationally delimited, they cannot account for the pattern of non-convergence; at the same time, their dualism fails to accommodate the complex pattern of non-convergence in Figure 9.1.

In sum, the approaches claiming that different mental processes and representations distinguish L1 and L2 acquisition can potentially explicate L2 acquisition at lower proficiency levels when explicit, attentionally controlled and memorized sequences may inform L2 production and comprehension. Yet, e.g., the declarative-procedural (Ullman) or explicit versus implicit (DeKeyser, Paradis) distinctions do not seem pertinent to the characterization of more advanced stages of L2 processing or potential group and L1 differences at advanced to near-native stages of L2 acquisition. Rather than by qualitatively different mental processes, these stages seem to be characterized by differences in the degree of automization of identical mental processes.

9.2.3. The Fundamental Identity Hypothesis

I conclude that neither models of adult L2 acquisition positing grammatical impairment nor models positing different mental processes fully accommodate the patterns of (non-) convergence in Figure 9.1. Hence, neither type of model seems a likely explanation of the findings. I therefore next consider the Fundamental Identity Hypothesis which proposes that there are no qualitative differences between non-native and native language acquisition or processing that curtail convergence at L2 ultimate attainment (1).

(1) Fundamental Identity Hypothesis
There are no fundamental differences between non-native and native grammatical representation or processing architecture forced by a critical period. Differences, if found, relate to factors characterizing L2 acquisition independently of a critical period, e.g. L1 transfer or performance factors, such as computational limitations, etc.

*Prima facie*, the pattern of non-convergence in Figure 9.1 provides strong countervidence to the Fundamental Identity Hypothesis, since L2 performance is demonstrably non-native-like in all groups except for the L1 Russian near-natives.
In the following sections, I explore whether the Fundamental Identity Hypothesis about the absence of maturational constraints can be upheld by relating the pattern of non-convergence to factors that either are inherent features of L2 acquisition and/or affect L2 acquisition independently of critical period constraints. In other words, I gauge the degree to which non-convergence can be accounted for without invoking qualitative differences between native and non-native grammatical and processing architecture. Specifically, I suggest that non-convergence across L1, proficiency groups and tasks reduces to computational difficulty with inflectional morphology and L1 transfer. I propose that problems with inflectional morphology in the non-native groups are due to the use of defaults in the processing of inflectional morphology and the reduced automaticity in L2 processing. The following sections offer a detailed discussion of (a) problems with inflectional (case) morphology in the L2 groups (Section 9.2.3.1), (b) analogous problems with case inflection in the child L1 acquisition of German (Section 9.2.3.2) and mature native processing in German under heightened task demands (Section 9.2.3.3). These parallels point to qualitative identity in L1 and adult L2 acquisition as well as L1 and L2 processing. Once these parallels have been established, I discuss (c) how the notion of defaults can be substantiated in grammatical terms (Section 9.2.3.4), and (d) how defaults are applied in native and L2 processing (Section 9.2.3.5). In a second step, I show how L1 transfer can prevent convergence due to learnability (Section 9.2.3.11).

9.2.3.1. Inflectional morphology

Across Experiments 1, 2, 3, 6 and 7, it was seen that non-convergence of the L2 groups is largely due to problems in processing inflectional morphology in syntactic agreement relations, in particular, case marking. The following patterns were observed:

- **Morphosyntax:** Advanced groups across L1s do not use case or verbal agreement information incrementally
- **Information Structure:** Lack of incremental use of case morphology masks target-like performance on the IS of scrambling
- **Argument Structure:** The L1 English and L1 Dutch advanced groups map dative-marked objects to canonical object position

According to approaches to the syntax-morphology interface in L2 acquisition that do not assume grammatical impairment (see Chapter 1.4.6.3.2 and, e.g., Haznedar & Schwartz, 1997; Lardiere, 1998b, 2000; Prévost & White, 2000b), difficulties with inflection in L2 acquisition are due to two potential factors:
(a) Incomplete acquisition of morphophonological forms and lexical learning of, for instance, which verbs take structural case and which verbs take lexical case (e.g. Herschensohn, 2001).
(b) Incomplete access to morphophonological forms: Although the forms have been acquired, processing pressures may preclude the target-like mapping of syntactic features to morphophonological forms (e.g. Prévost & White, 2000b; White, 2003b).

From these factors, two predictions follow for inflectional morphology in L2 acquisition.

(c) Problems with inflectional morphology are systematic. Non-target-like inflection should either be omission of inflection or the use of default inflection. Random production of inflectional markers should not occur. For case marking, errors should be higher for lexical case marking than for structural case.
(d) Problems with access to inflection due to processing pressures should be replicable in monolinguals under increased cognitive demands, i.e. when processing pressures approximate the cognitive load of L2 processing.

Let us test these predictions against the empirical findings in turn. In the experiments in this thesis, two types of inflectional morphology are relevant: number agreement between subjects and verbs, and case morphology. Since the problems of the L2 groups with case were much more pronounced than problems with subject-verb agreement, I concentrate on case morphology in the following. Moreover, the paradigm of German case morphology is more varied than that of number morphology, so that investigating case will give more detailed insight into the nature of problems with inflection. First, I review the evidence from the present experiments that variability in case inflection is systematic in L2 acquisition, and I explore the extent to which this systematicity resembles problems with inflectional morphology in L1 acquisition. I argue that the problems with case in both L1 and L2 acquisition reflect the systematic use of default forms. Second, I show that similar problems with inflection can be induced in native speakers performing under increased task demands.

9.2.3.2. Case marking in L2 acquisition

In order to investigate the systematicity of the use of inflection in the L2 participants, the oral production tasks administered for proficiency classification (see Chapter 6.2.2 and Chapter 7.3.2) as well as from the written pretest on case marking administered in conjunction with Experiment 7 (see Chapter 8.7) were analysed. Since the oral production data yield fewer than 40 case errors in total amongst the 92 non-natives of the study, I only consider the written production data from the pretest on case marking.
Recall from Chapter 8 that the pretest was a timed, off-line production task that required participants to fill in definite determiners that were systematically blanked out in continuous texts. In total, the test contained 18 omitted nominative articles, 19 omitted accusative articles, 34 omitted dative articles and 12 omitted genitive articles (see Appendix J).

<table>
<thead>
<tr>
<th></th>
<th>ENGLISH Advanced (n=8)</th>
<th>ENGLISH Near-Native (n=9)</th>
<th>RUSSIAN Advanced (n=12)</th>
<th>RUSSIAN Near-Native (n=10)</th>
<th>DUTCH Advanced (n=11)</th>
<th>DUTCH Near-Native (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accusative contexts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nom</td>
<td>9 69%</td>
<td>3 60%</td>
<td>8 57%</td>
<td>6 86%</td>
<td>11 69%</td>
<td>0 0</td>
</tr>
<tr>
<td>Dat</td>
<td>4 31%</td>
<td>2 40%</td>
<td>6 43%</td>
<td>1 14%</td>
<td>5 31%</td>
<td>2 100%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>22</td>
<td>15</td>
<td>16</td>
<td>11</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>35/152 (22.4%)</td>
<td>20/171 (11.7%)</td>
<td>30/228 (13.2%)</td>
<td>18/190 (9.5%)</td>
<td>40/209 (19.1%)</td>
<td>18/171 (10.5%)</td>
</tr>
<tr>
<td><strong>Dative contexts</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nom</td>
<td>10 17%</td>
<td>4 9%</td>
<td>6 15%</td>
<td>3 21%</td>
<td>37 35%</td>
<td>10 29%</td>
</tr>
<tr>
<td>Acc</td>
<td>47 83%</td>
<td>39 91%</td>
<td>33 85%</td>
<td>11 79%</td>
<td>69 65%</td>
<td>26 71%</td>
</tr>
<tr>
<td>Nom/Acc</td>
<td>59</td>
<td>45</td>
<td>45</td>
<td>17</td>
<td>113</td>
<td>38</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>118/228 (43.4%)</td>
<td>88/306 (28.8%)</td>
<td>85/408 (20.6%)</td>
<td>31/340 (9.1%)</td>
<td>222/374 (59.4%)</td>
<td>83/306 (27.1%)</td>
</tr>
</tbody>
</table>

Table 9.2. Errors in case marking from pretest on dative case (Chapter 8). Percentages in bold denote unambiguous case errors for each group. Percentages in italics denote the total amount of errors made for each case by group.

Table 9.2 provides the types of errors with case marking from the pretest on case marking. This table reports only the errors for accusative and dative contexts, since errors on determiners in nominative contexts were almost exclusively gender errors across groups (see also Prévost & White, 2000b), and errors in genitive contexts were always ambiguous between nominative and accusative case. Due to syncretism in the German case paradigm, the largest number of errors in dative contexts is ambiguous between
nominative and accusative case (i.e. *die* for feminine singular and all plurals, and *das* for neuter singular). Further, a large number of errors in determiners is due to non-target-like gender marking across case distinctions. These are listed separately. The percentages bolded in Table 9.2 denote the relative proportion of unambiguous case marking errors in the respective case contexts, whereas the percentages in italics indicate the overall number of errors in the respective case contexts.

Across L1 groups, Table 9.2 shows systematicity in case errors in two ways. First, nominative serves as the default case in accusative contexts, since nominative is mostly incorrectly supplied in accusative contexts. The comparatively high number of case errors caused by suppliance of dative case might reflect the design of the experiment which contained almost twice as many verbs taking dative complements than verbs taking accusative complements. According to a recent corpus analysis of the German Mittelfeld (Kempen & Harbusch, 2003), accusative complements outnumber dative complements by approximately 12:1 in written German. It is hence reasonable to assume that the frequency bias of the pretest towards dative verbs augments the suppliance of dative determiners. Other research confirms that nominative acts as a default in accusative-marking contexts in L2 German. In a cross-sectional study on L1 English learners of German, Hopp & Schwartz (2002) find that nominative is the only error type for direct objects requiring accusative case in a written elicited production task. Similar findings have been reported for the production of case marking in English-Turkish Interlanguage where unmarked, default nominative exclusively occurs as a non-target-form in accusative contexts (Gürel, 2000; Haznedar, 2003).

Second, accusative serves as the default for the complements of dative verbs: L2ers across groups overgeneralize structural accusative case to verbs that lexically assign dative case. Overextending accusative to dative likely reflects incomplete lexical learning, i.e. L2ers have not acquired the association of a particular verb with a dative-marked complement. Initially, L2 learners appear to associate objecthood with accusative case marking and retract from this assumption by acquiring dative case marking for each dative-selecting verb on a one-by-one basis. Support for a lexical learning explanation of overgeneralization errors here comes from the asymmetric distribution of case errors across verbs: The five most error-prone dative-taking verbs constitute 16% of all dative verbs in the experiment, yet they account for 29% of case errors; of these five verbs, one (*nützen*, ‘to be useful’) is a dative experiencer, and the other four verbs (*widersprechen*, ‘contradict’, *berichten*, ‘report’, *zuwinken*, ‘wave at’, *nachsehen*, ‘look after’) are dative-active verbs. Hence, these verbs cross-cut argument structure differences, such that difficulty with case marking appears to be independent of thematic distinctions.

In sum, the results from the pretest yield three conclusions about the nature of problems with case marking. First, the pattern of case errors demonstrates that the L2 learners have all acquired systematic distinctions between nominative case marking for subjects and non-nominative case marking for objects. For all L2 subjects combined, the use of
unambiguous nominative case marking in non-nominative contexts is 107 out of 3083, i.e. 3.5% of all instances. Hence, advanced and near-native L2ers make robust case distinctions in the L2. Second, L2ers have more difficulty with lexical (dative) case than with structural (accusative) non-nominative case. Third, the pretest on case attests the systematic use of default case in non-nominative contexts. L2ers across proficiency level and across L1s overgeneralize nominative to accusative contexts and accusative to dative contexts. The high number of overgeneralizations of accusative to dative suggests that L2ers associate direct objects with structural case marking. In the following, I show that this pattern of case errors is not specific to L2 speakers; rather, it parallels difficulties with German case marking in child L1 acquisition and adult L1 processing of German.

9.2.3.3. Inflectional case morphology in child L1 acquisition

A pattern of case errors similar to that of L2 speakers as well as evidence for the use of default case has been documented for the L1 acquisition of German. A large body of research has investigated the L1 development of case marking in German (e.g. Clahsen, 1984; Eisenbeiss, 1994, 2002; Eisenbeiss, Bartke & Clahsen, 2005/2006; Schütze, 1997; Tracy, 1986). Across studies, three types of errors predominate in the acquisition of case marking. (a) Even when the contrast between nominative and accusative case has been acquired, children frequently overgeneralize nominative to accusative contexts, yet not vice versa, suggesting that nominative acts as a default case (Clahsen, Eisenbeiss & Penke, 1996; Eisenbeiss, 1994; Schütze, 1997). At later points in development, accusative is overgeneralized to dative-taking verbs and frequently extended to prepositions subcategorizing for datives, yet not the other way around (Eisenbeiss, 2002). Eisenbeiss, Bartke & Clahsen (2005/2006), amongst others, argue that children canonically associate phrase-structural positions with particular case markings (i.e. subject-nominative, object-accusative, complement of preposition-accusative) even until after lexical exceptions have been acquired. (b) Children omit case markers on indefinite determiners (e.g. nur ein Fisch, ‘only aNOM fish’ instead of nur einen Fisch, ‘only anACC fish’). (c) Dative-marking m-endings are substituted by accusative-marking n-endings (Eisenbeiss, 2002). Both of the latter two types of mistakes have been analysed as simplifications of the morphophonological paradigm, possibly due to processing limitations (Phillips, 1995).

Note that the pattern of case errors in L1 development parallels the errors in case marking observed in adult L2 acquisition in two respects: First, nominative is employed as a default in accusative contexts. Second, structural case is acquired earlier, while lexical (dative) case is mastered later still due to item-specific lexical learning. As a consequence, accusative is overgeneralized to dative complements by virtue of a canonical association of case marking and phrase structure positions. Such parallels indicate that the acquisition of case morphology follows the same regularities
independently of age of acquisition. In sum, then, parallel patterns can be seen for L1 and L2 acquisition for case in production. In the next section, I show that these L1-L2 parallels extend to case in comprehension.

9.2.3.4. Inflectional case morphology in processing

Problems with case in L2 comprehension are mirrored by problems with case in mature L1 processing under increased task demands. For the L2 groups, the comparison of the self-paced reading task (Experiment 2) and the speeded grammaticality judgement task (Experiment 3) shows that the robustness of the use of case marking in comprehension is systematically affected by presentation speed. In the speeded grammaticality judgement task, use of case marking breaks down completely for the advanced L2ers. Even for the near-natives, the L1 English and L1 Dutch groups demonstrate chance performance under time pressure. In contrast, accuracy on detecting verbal agreement violations remains at above chance levels for all groups. Adult native speakers also demonstrate differences in the use of inflectional morphology depending on task.

Although double nominative case violations were robustly recognized in off-line judgements (Experiment 1), natives evince depressed performance on detecting case violations at 71% accuracy in Experiment 2. In contrast, judgements on verbal agreement violations stay at about 90% accuracy. Other studies on German natives that employ faster stimulus presentation report chance performance on double nominative case violations in wh-questions under time pressure (Meng & Bader, 2000; Schlesewsky, Fanselow et al., 2003), while accuracy on ungrammatical verbal agreement is less strongly affected at above 80% accuracy. Although direct between-study comparisons cannot be made due to differences in the construction types tested in the present thesis (scrambling) and previous studies (wh-movement), the finding that accuracy on double nominative case violations drops to chance levels at faster presentation rates suggests that accurate processing of inflection correlates with processing time in native speakers.

A set of studies conducted within the framework of the Competition Model adds evidence that inflectional morphology, e.g., articles, subject-verb agreement and past tense marking, is particularly affected in native processing under stress. For native speakers of German (Dick, Bates & Ferstl, 2003; Kilborn, 1991) and native English (Blackwell & Bates, 1995; McDonald, 2006), performance on inflectional morphology in agent-identification and grammaticality judgement tasks is significantly reduced under speeded presentation or noisy conditions, whereas the detection of word order violations remains robust. In line with the present results, these studies attest that inflectional morphology is particularly vulnerable in processing under inadequate processing time.

These difficulties with inflection do not seem to stem from the diminished perceptual salience of inflectional morphology under stress. In auditory tasks (Dick et al., 2003), the stimuli were designed such that inflectional markers were fully realized, and
Experiment 3 in this thesis standardized the visual presentation rate by setting it according to number of characters. Given that reading times for function words are generally shorter than for lexical words of the same length in normal reading (see Experiments 2 and 6, see also Stowe, 1986), the experimental design actually increases the relative processing time available for inflectional case marking expressed on determiners compared to the processing time for content words.

Instead of being due to reduced perceptual salience, these problems in native processing have been related to morphological defaults and feature underspecification. Consider case in this respect. In native processing of case-ambiguous subject-object ambiguities, nominative acts as a default case in structural case contexts and accusative acts as the default case for objects (Bader & Bayer, 2006; Bader, Meng, Bayer & Hopf, 2000; Schlesewsky & Frisch, 2003). Bader & Bayer (2006) capture default case assignment in processing in the Case Preference Principle (2).

(2) The Case Preference Principle (Bader & Bayer 2006: 108)
   (a) If possible, prefer structural Case over lexical Case.
   (b) If possible, prefer nominative Case over accusative Case.

The Case Preference Principle formalizes case assignment for NPs that show ambiguous morphological case marking, dictating the parser to first assign less marked, structural case and default nominative case, if possible. In three-way comparisons between case violations involving double nominative, double accusative and double dative case marking, nominative is judged significantly less accurately than the other cases, indicating its default status (Schlesewsky, Fanselow et al., 2003). For subject-verb number agreement, singular is the default in verbal number agreement, with plural constituting the more marked option (Barker & Nicol, 2000).

In sum, research finds that L1 children acquiring German employ defaults in case marking and default positional mappings before the morphology of case marking is mastered (Section 9.2.3.3). Moreover, adult L1 processing research reports an asymmetric decrement in the use of agreement marking under processing pressure for natives that has been related to the use of default forms. These defaults in child L1 and adult L1 performance show striking similarity to the difficulties in L2 production and comprehension of case found in the experiments of this thesis. In order to complete the comparison of L1-L2 analogies, the following section explores how morphological defaults can be defined. It will be shown that, instead of being an ad hoc explanation, defaults systematically derive from the mental representation of morphological paradigms, and that these systematic defaults inform child L1, adult L1 and adult L2 performance.
9.2.3.5. Specifying defaults

Default forms in L1 and L2 acquisition are the consequence of the insertion of lexically underspecified morphophonological forms (for L1 acquisition, see, e.g., Clahsen et al., 1996; Ferdinand, 1996; Poeppel & Wexler, 1993; Schütze, 1997; for L2 acquisition, see, e.g., Prévost & White, 2000b). In the framework of Distributed Morphology (Halle & Marantz, 1993), the insertion of morphological forms is subject to competition. It is assumed that terminal nodes in syntax are featurally fully specified, while lexical items, i.e. morphophonological forms, may be underspecified for certain features. Lexical insertion proceeds according to the Subset Principle (Halle, 1997, see also Chapter 3.4.1) which ensures that the most fully specified form of the lexical item matching the feature matrix of the terminal syntactic node wins in the competition for insertion. If no exact feature match between terminal node and lexical item can be found, an elsewhere form is inserted that bears a subset of the features of the terminal node. As a consequence, lexical items are not required to match all features; rather, it is sufficient that they provide a subset of the features to be eligible for insertion as an elsewhere form.

Accounts of underspecification in L2 acquisition, such as the ‘Missing Surface Inflection Hypothesis’ (Prévost & White, 2000b, see Chapter 1.3.6.2.2), argue that variability in L2 inflection stems from lexically underspecified default forms. In their investigation of variable verb inflection in L2 acquisition, Prévost and White, following Ferdinand (1996) and Müller (1998), contend that underspecified forms take the form [aperson], [anumber] and so on, which results in the insertion of infinitive or bare stem forms. By analogy for nominal inflection, Hopp & Schwartz (2002) argue that default case in L2 acquisition occurs in [a-case]. For instance, [a-case] corresponds to unmarked case forms, i.e. nominative in German or Turkish (Gürel, 2000). Due to their being underspecified, these forms can be inserted without giving rise to a clash in features. Note, though, that these approaches do not postulate underspecified forms; rather, they advance the idea of unspecified forms, i.e. [a-feature]. Such an approach would predict the occurrence of one single default case across different syntactic contexts. This conceptualization seems overly simplistic for morphologically rich languages like German, where systematic variation between different inflected case forms is found in acquisition (see Table 9.2; for the verbal domain, see McCarthy, 2006).

Theories of morphological feature specifications offer the potential to explain variation among inflected forms in terms of the internal make-up of inflectional paradigms. These theories substantiate the notion of default cases in L1 and L2 acquisition by showing that default cases are not ad hoc explanations, but follow from the systematic properties of paradigmatic inflectional representation. In morphological theory, underspecification is a parsimonious means of excluding redundant information in the representation of morphophonological inventories. Recall the feature matrix for German case marking proposed by McFadden (2004), discussed in Chapter 3. The feature
matrix for definite determiners is repeated in (3). For illustration, (3) only lists singular
definite determiners; features for gender are separated from case features by ‘|’. The
feature ‘inferior’ is for case in object position, and the feature ‘lexical’ denotes lexical
case. In this system, underspecified forms correspond to unmarked forms, where
markedness is expressed in the number or presence of features.

(3)  a. [+case | -fem, -neut] ↔ /eːr/
b. [+case | +fem, -neut] ↔ /iː/
c. [+case | -fem, +neut] ↔ /as/
d. [+case, +inferior, | -fem, -neut] ↔ /eːn/
e. [+case, +inferior, +lexical | -fem] ↔ /eːm/
f. [+case, +inferior, +lexical | +fem, -neut] ↔ /eːt/
g. [+case, +inferior, +lexical, +genitive | -fem] ↔ /eːs/

The feature geometry in (3) handles all expressions and all cases of syncretism in the
morphophonological paradigm of singular case marking in German (for indefinites and
plurals, see McFadden, 2004, Chapter 6). Moreover, it provides a matrix to account for
underspecified and default forms that may occur in the German case paradigm. Let us
consider the relevant situations.

On the assumptions about lexical insertion made in Distributed Morphology,
nominative case acts as an overall default by virtue of being the unmarked [+case] option.
Nominative is the global elsewhere form that can be inserted in any context specified for
case, unless more specific features are encoded in syntax. For object case, denoted by the
feature [+inferior] in (3), accusative is the least marked case form. Hence, accusative acts
as the elsewhere form for contexts specified for case and objecthood.\(^3\) For lexical case,
dative represents the unmarked case over genitive, since genitive case carries a
[+genitive] feature in addition to the lexical case feature. To sum up, the feature geometry
in (2) leads to different elsewhere forms for different syntactic contexts, listed in Table
9.3. The shaded cells mark the potential candidates for insertion; if the target form is not
available, the relevant elsewhere forms will be inserted.

\(^3\) Note that the syncretism between nominative and accusative forms for feminine and neuter does not
necessitate separate entries.
Table 9.3. Default cases and syntactic contexts; elsewhere forms are marked.

Table 9.3 shows that nominative in accusative contexts follows from the insertion of nominative as an elsewhere form. Overgeneralization of accusative case in dative contexts arises as insertion of the more specified accusative /e:n/ form, rather than the nominative /e:r/ form. In other words, the non-target accusative forms inserted in dative contexts are specified for objecthood ([+inferior]), yet not specified for lexical case ([+lexical]). Note that the feature-based approach provides a natural explanation as to why dative case is not overgeneralized to accusative contexts: Dative constitutes a more marked form by bearing more features and can thus never act as an elsewhere form in accusative contexts, because this would cause a feature clash between morphophonological form and syntactic terminal node.

The feature geometry in (3), independently motivated by economy of representation in morphological theory, accounts for the overgeneralization errors found in child L1 development and adult L2 acquisition of German. Both in the L1 and the L2 acquisition of case marking, erroneous case marking generally does not constitute feature clashes between the feature matrices of lexical items and those of syntactic nodes; instead, errors in case marking are overwhelmingly examples of underspecified lexical items being matched to syntactic nodes. Such underspecified forms can be grammatically licensed as elsewhere forms.

There are two conditions for insertion of elsewhere forms. First, elsewhere forms occur if no other lexical item bearing more matching features exists in the lexicon. In the context of case errors in L1 and L2 acquisition, this condition equals lack of acquisition in the mental lexicon. For instance, insertion of accusative case in dative contexts arguably follows from missing feature specification [+lexical] in the verb selecting dative case. Case errors of this kind should diminish as a result of lexical learning. Second, since feature checking or matching requires computational effort, elsewhere forms may surface when processing pressures limit the amount of time available for checking the entire
feature inventory of a given lexical item or for searching the functional lexicon for all forms.

Given that native-speaker adults have successfully acquired the lexicon, incomplete lexical learning cannot explain problems with case morphology by natives under increased task demands. Rather, these problems are caused by computational load restricting the search of the lexicon of morphophonological forms for all features. For the L2 participants, the target-like command of nominative and accusative case marking among the near-natives, too, drops in speeded judgements, which indicates that computational task demands are also a major cause of problems with inflection in non-native processing. Before we turn to the issue how computational task demands compromise the processing of case in Section 9.2.3.8, I consider L1 effects in the processing of case morphology.

9.2.3.6. L1 effects in inflectional case morphology

In the present experiments, L1 effects in the processing of inflectional (case) morphology are observed, in particular, in speeded judgements among the near-native groups.

First, consider the asymmetry between the L1 English and L1 near-native Dutch groups, on the one hand, and the L1 Russian near-native group, on the other, in speeded judgements of case violations (Experiment 3). The former perform at chance levels, whereas the latter recognizes case violations at native levels. In light of the fact that all near-native groups perform to criterion in off-line judgements and in the on-line use of case in the self-paced task, near-natives can be considered to have successfully acquired the case morphology of structural cases. The breakdown of ungrammaticality detection of case marking in the L1 English and L1 Dutch groups vis à vis the L1 Russian near-natives does thus not result from representational differences or the reduced availability of grammatical knowledge. Rather, these L1 differences appear to index asymmetries in the automaticity of L2 processing. Due to similarities in morphological paradigm complexity of case marking (see below), L1 Russian speakers of German bring L1 routines of accessing and searching the functional lexicon for features and matching these to morphophonological forms to these tasks in L2 German. L1-TL analogies in morphological paradigms thus seem to confer procedural advantages in the L2 processing of morphosyntax.

Such an account can also explain L1 effects observed at the syntax-morphology interface in near-native L2 acquisition of gender concord in L2 Spanish by L1 English and L1 Romance speakers (Franceschina, 2005). In this study, L1 Romance learners performed within the native range on grammatical gender, whereas L1 English speakers did not. In Franceschina (2005), task demands were not systematically varied, such that the locus of L1 differences cannot be pinpointed. However, systematic differences between the L1 groups according to the type of gender concord suggest that
computational difficulties contribute to non-target-like performance. Across comprehension and production tasks, accuracy scores for the L1 English group are systematically lower for non-local gender concord between pronouns and noun antecedents than for local gender concord between determiners, adjectives and nouns (see Chapter 1, Table 1.4). It appears that the additional computational load of checking gender features non-locally is mastered more efficiently by L2 speakers who perform non-local gender checking in the L1 than for L2 speakers with L1s that do not include gender in non-local feature checking.4

Second, L1 differences in speeded judgements are also observable for dative experiencers between the L1 English and L1 Dutch near-natives (Experiment 7). Although both the L1 English and L1 Dutch groups make a distinction between dative-active and dative-experiencer verbs, only the L1 Dutch group demonstrates facilitation for OS orders with dative experiencers. Since neither English nor Dutch instantiates dative case marking, these differences do not relate to case marking. Yet, in native Dutch, the processing of OS orders is facilitated in the context of dative-experiencer verbs (Lamers, 2001). It appears, then, that the availability of thematic OS orders in the L1 aids the abandonment of the canonical association of dative case with the phrase-structural object position that was argued to underlie the difficulties with dative experiencers in the L2 groups. This effect may be enhanced due to the large number of translation equivalents of German dative experiencers that have the same thematic structure in Dutch (e.g. gefallen (German), bevalen (Dutch), ‘to please/to be appealing to’).

These findings are suggestive that processing routines in the L1 aid and speed up processing routines in the L2 in coordinating morphology and syntax. Further evidence of the recruitment of L1 procedures in adult L2 morphosyntactic processing comes from cross-linguistic priming in syntax (e.g. Desmet & Declercq, 2006; Hartsuiker, Pickering & Veltkamp, 2004; Schoonbaert, Hartsuiker & Pickering, 2007). In these experiments, syntactic constructions employed in L1 production were found to strengthen subsequent use of analogous constructions in the L2. For ditransitive verbs, e.g., priming of double object constructions in L1 Dutch leads to significantly increased production of analogous double objects in L2 English (Schoonbaert et al., 2007). Priming experiments point to the permeability of L1 and L2 processing routines in syntax, in addition to the well-documented linkage of the L1 and L2 lexicons (e.g. Dijkstra, 2005).

9.2.3.7. Summary: Problems with case in L2 processing

In sum, the analysis of case errors in the L2 groups documents (a) parallels between problems with inflection in production for L1 and L2 acquisition, and (b) parallels between problems with inflection in comprehension for non-native and native processing.

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4 Of course, it is necessary to establish to which extent these L1 effects are interleaved with inter-individual working memory differences affecting storage cost for non-local agreement.
In addition, (c) the systematic pattern of case errors in L2 acquisition could be shown to follow from the geometry of the feature inventory of case morphology in German rather than being specific to L2 acquisition. Finally, (d) L1 effects in taxing speeded judgements can be related to L1 processing routines. Against this background, the pattern of errors shows that difficulties with case marking are greater for the non-natives than for natives in degree, yet there is no evidence to support the conclusion that difficulties with inflection are different in nature. In the following, I explore the causes and consequences of computational difficulties in native and non-native sentence comprehension.

9.2.3.8. Incomplete processing in L1 and L2 comprehension

Problems with inflectional morphology surface predominantly in production whose real-time nature entails high processing demands. In comprehension, higher demands can be created by increasing processing pressures, such as higher reading speed or noisy environments. In these conditions, inflectional morphology has been shown to be vulnerable in native comprehension. Plotting the relative use of word order versus inflection, Kilborn (1991) and Dick et al. (2001) report that German natives prioritize agreement information over word order under normal processing conditions in agent-identification tasks, yet prioritize word order over agreement information in noisy conditions. These judgement data are consistent with on-line data from L1 adult processing. In native processing, failures to use inflectional morphology have been argued to follow from incomplete processing that leads to ‘good enough’ parsing outputs (Ferreira, 2003). Alternatively, dual route models posit that processing always encompasses a shallow processing route (Townsend & Bever, 2001) that is computed in addition to a full syntactic analysis. Common to these approaches is the claim that a provisional and incomplete parse based on surface and lexical-semantic information is calculated prior to a full parse that includes hierarchical syntactic relations and inflectional agreement relations (see Chapter 2.7.3). In native comprehension, incomplete processing surfaces when communicative or processing pressures do not leave enough time to engage in constructing a more elaborate full parse (Christianson et al., 2006; Ferreira & Patson, 2007). Analogous incomplete processing routines in L2 speakers are expected to occur earlier and in a more pronounced fashion due to computational resource limitations in L2 processing.

In the present experiments, there is evidence of incomplete processing in the advanced L2 groups. The comprehension patterns and flat processing curves of the advanced L2 groups in this study suggest that these L2 groups indeed assign the syntactic functions of NPs initially on the basis of linear precedence, rather than checking them against morphosyntactic agreement relations (Chapter 6). Reanalysis does not occur incrementally, and effects of phrase-structure revision to OS due to morphological cues only surface at the end of the sentence. Independent of the specifics of any model of
incomplete processing, the processing patterns of reanalysis seen in the advanced L2 groups can thus be accommodated within models of native processing. These parallels of L2 processing with incomplete processing in natives suggests that even non-near-native L2 processing is not qualitatively distinct from adult L1 processing.

9.2.3.9. Computational restrictions in L2 processing

Computational resource limitations in L2 grammatical processing are only beginning to be explored (e.g. Bowden, Sanz & Stafford, 2005; McDonald, 2006). Since the present thesis did not investigate cognitive resources in L2 learners independently of grammatical processing, I can only speculate about the nature of computational restrictions limiting L2 performance and list a number of explanations that have been put forth in previous research. Computational restrictions in L2 acquisition can be characterized as a consequence of L1 effects, both general and specific.

As a general L1 effect, the cognitive cost of concurrently maintaining two languages is an inherent characteristic of bilingualism (Grosjean, 1998) that entails the allotment of comparatively fewer resources to the L2, especially in the case of non-L2-dominant L2 speakers (Birdsong, 2005b; 2006). In addition, the fact that in late L2 acquisition, quantitatively less exposure to the TL is available to L2 learners compared to natives may entail lower degrees of resources or reduced automatization of applying resources in on-line processing (Jia, Aaronson & Wu, 2002). Empirically, these general effects in L2 acquisition surface in slower L2 processing, larger strains on working memory capacities in L2 processing (Juffs, 2004; McDonald, 2006; Service et al., 2002), reduced L2 decoding ability in word recognition (e.g. Sanders, Neville & Woldorff, 2002; Weber & Cutler, 2004) or slower lexical access in the L2 (De Bot, 1992; Michael & Gollan, 2005).

As a specific L1 effect, the grammatical representations or proceduralizations of the L1 may interfere or transfer in L2 processing (Dekydtspotter, Schwartz & Sprouse, 2006; for the lexicon, see, e.g., Finkbeiner, Gollan & Caramazza, 2006; for phonology, see, e.g., Flege, MacKay & Piske, 2002; for syntax, see, e.g., Frenck-Mestre, 2002). Such transfer may lead to facilitatory effects in L2 processing in cases where L1 and TL properties align, as argued above for the L1 Russian groups. In cases where L1 and TL diverge, resources may be used up for the suppression of L1 properties that interfere in L2 processing (e.g. Green, 1998). As Cutler et al. (2004) discuss, lower efficiency due to computational restrictions is likely to be cumulative and exponential in L2 processing. Cutler et al. (2004) study phoneme identification in noisy environments for L1 adults and L2 adults. The relatively poor performance of L2ers vis à vis the natives could not be traced to problems in phoneme identification as such; rather, these problems appear to occur because prior processing steps are less efficient. In this vein, inefficient processes or L1 interference in word segmentation or in lexical access impact on later stages in
processing, e.g. syntactic processing, by delivering faulty or insufficiently analysed input to the later stages. Cumulative effects of procedural inefficiencies at all levels thus magnify computational limitations in L2 processing.

In the context of general and specific L1 effects, let us zoom in on the processing of inflectional morphology in order to see how they may attenuate the efficiency of processing case morphology. Research on morphological processing in natives supports a dual route model of morphology consisting of an associative pathway for irregular forms and a rule-governed pathway for regular inflectional forms (e.g. Clahsen, 1999; Pinker, 1999; for L2 acquisition, see Hahne et al., 2006). Moreover, regular inflection is processed with recourse to morphological paradigms (e.g. Clahsen, 2006). In cross-modal priming experiments, Clahsen, Sonnenstuhl, Hadler & Eisenbeiss (2001) find that German adjectives and verbs with more specific morphological feature matrices are harder to prime than less specified forms. Moreover, priming was significantly reduced if the prime contained features different from those of the target. These selective priming effects point to the use of morphological paradigms in early stages of language processing. In sum, morphological processing for regular inflection is rule-based and informed by paradigms. Against this background, consider the relevant cases of the German case paradigm again, this time illustrated as the mapping from morphophonological forms to morphosyntactic features in (4).

(4)  

(a) /de:r/ → [+case, +sg, +masc]
    [+case, +in inferior, +lexical | -sg]
    [+case, +in inferior, +lexical | +sg, +fem, -neut]
    [+case, +in inferior, +lexical, +genitive | +sg, +fem, -neut]

(b) /de:n/ → [+case, +in inferior |+masc]
    [+case, +in inferior, +lexical | -sg]

(4) shows that *der* and *den* map to different syntactic functions, as specified in their respective feature inventories. In the processing of subject-object ambiguities, the processor needs to access the lexicon of morphophonological forms of the type in (4) in order to assign a given morphophonological form a target feature matrix of syntactic function and agreement (morphological checking). In addition, the processor needs to retain the target feature matrix in working memory to link the relevant features to subsequent elements in the input in order to establish agreement relations. Accordingly, morphological checking in sentence comprehension (a) involves access to the functional lexicon of morphophonological forms, and (b) requires storage of morphosyntactic features. The costs of storage are measurable in working memory effects on morphological checking (Bader & Bayer, 2006, Chapters 7 & 8). Let us therefore consider the status of lexical access and storage in L2 processing.
(a) Both lexical access to inflectional form and form-feature checking are heavily overlearnt routines in native sentence processing (e.g., Phillips, 1995). Due to comparatively less exposure and practice in adult L2 processing, the degree of overlearning is invariably lower which results in reduced automaticity of lexical access. In addition, the efficacy of morphological checking seems to be modulated by L1-TL similarities in morphological paradigm complexity. Although, overall, the Russian case system is more complex than the German case system (Kempe & MacWhinney, 1998), they share core characteristics in that case marking is overt and entwined with number and gender marking, such that both have one-to-many mappings of form and function. In consequence, both Russian and German require natives to (a) identify complex form-to-function mappings and (b) store them in working memory in order to establish syntactic function assignment. Such similarities in morphological paradigm complexity between Russian and German appear to augment the efficiency of morphological checking in the L2 German of L1 Russian speakers. In a similar vein, Sabourin (2003) finds greater convergence on L2 Dutch grammatical gender depending on whether similar gender paradigms obtain in the L1.

(b) As for storage costs of inflection, working memory effects in native processing of inflection surface in that parsing accuracy covaries with sentence length in the processing of non-local subject-object ambiguities (Bader & Bayer, 2006; Gibson, 1998). For instance, Bader & Bayer (2006) show that German natives are increasingly inaccurate in carrying out syntactic reanalysis due to case and verb agreement morphology in OS orders as sentence length increases. These effects suggest that the activation of inflectional features decays gradually in the course of sentence comprehension. In L2 processing, such decays may be speeded up because of inherently greater load on working memory capacities in the L2 (Service et al., 2002), or because the concurrent activation of L1 lexical representations during L2 processing drains working memory capacities sooner than it does for natives (Green, 1998). In consequence, even if the mapping between morphophonological form and syntactic function can be effected, this connection might not be actively maintained to the same degree in L2 processing as in L1 processing. Effects of reduced maintenance of displaced constituents have been documented in L2 processing of long-distance wh-movement by, e.g., Love et al. (2003, see Chapter 2).

Summarizing, computational limitations likely affect access to and the storage of morphophonological forms in real-time L2 sentence comprehension. I related these computational restrictions to general L1 effects of limited overlearning of form-to-function correspondences, concurrent activation of L1 lexical representations and smaller working memory as well as to specific facilitatory L1 effects of morphological paradigm
similarity. Future research will have to gauge the relative contributions of these factors to L2 processing resources.

9.2.3.10. Summary: Inflectional morphology and computational limitations

In conclusion, the previous sections analysed the pattern of case errors in the L2 groups, finding that the error pattern and processing of OS orders resemble native processing patterns of morphosyntax under increased processing demands. Further, I discussed how L1 effects may give rise to greater computational effort in L2 processing of morphosyntax.

As for other types of inflection, the results for subject-verb agreement in Experiments 2 and 3 tie in with the analysis for case morphology. There is no evidence of the incremental use of number marking at advanced L2 levels (see also Jiang, 2004), while the near-natives robustly use subject-verb number agreement for incremental reanalysis (Experiment 2). This adds to the claim that advanced L2 processing can be characterized as incomplete processing. In the speeded task (Experiment 3), accuracy of detecting ungrammatical number agreement does not decay as strongly as it does for case. Not least, this difference may obtain because the suppletive forms of number marking (hat-haben, 'has-have', ist-sein, 'is-are') are more transparent and salient than the more complex, partially ambiguous and syncretistic case paradigm (see also Hahne et al., 2006). Further, unlike for case, the results show no L1-dependent differences for number agreement in the speeded task. Given that all L1s at issue have number marking, yet only Russian realizes overt case morphology, this finding is compatible with the assumption that the performance advantage of the L1 Russian near-natives on case likely derives from the higher routinization of accessing and matching case features carried over from L1 processing.

The results from case and verbal agreement in L2 production and comprehension are compatible with the Fundamental Identity Hypothesis which states that grammatical knowledge and processing architecture in L2 speakers is not qualitatively different from that of native speakers. Even though differences between non-native and native speakers occur in the use of inflection under the same processing demands in real-time comprehension (see also Jiang, 2004; McDonald, 2006), these do not indicate qualitatively different processing. Rather, parallels between natives performing under stress and non-natives indicate that performance dissimilarities between natives and non-natives are a function of differential task demands that make it difficult to apply extant grammatical knowledge and not necessarily a consequence of different processing mechanisms or systems.

However, an explanation of L1-L2 differences framed in terms of computational processing difficulties can nevertheless not completely capture L1 effects at the syntax-discourse interface found in Experiment 6. The results instead point to transfer of L1
grammatical properties that may persist in L2 grammatical representation to near-native levels and curtail convergence.

9.2.3.11. L1 transfer and learnability

Evidence that properties of the first language affect L2 grammar acquisition is abundant across the course of L2 development. Many approaches regard the point of departure of L2 acquisition as being informed by or equivalent with the L1 grammar (see Odlin, 2003; White, 2003b). In its most explicit form, this claim has been embraced by the ‘Full Transfer/Full Access’ (FT/FA) model of Schwartz & Sprouse (1994; 1996) that hypothesizes that (a) the initial state of L2 acquisition is a copy of the abstract L1 grammar and (b) L2 development is a gradual restructuring from L1 to TL grammatical representations forced by the TL input. The FT/FA model explicitly relates non-convergence in L2 development and outcome to the influence of the L1 at the outset of L2 acquisition.

[C]onvergence on the TL grammar is not guaranteed. Again, this is utterly distinct from what happens in L1 acquisition. In brief, given that the starting point is simply not open (or set to learning-theoretically delearnable ‘defaults’), it may be that the L2 acquirer (L2er) will never be able to arrive at the TL grammar: either the data needed to force restructuring simply do not exist […] or the positive data needed are highly obscure, being very complex and/or very rare. This view can thus account for (aspects of) fossilization in L2 acquisition. […] Under the FT/FA model, the starting points of L1 and L2 acquisition differ, and the endpoints of L1 and L2 acquisition are likely to differ; however, there is no attendant conclusion that the cognitive processes underlying L1 and L2 acquisition differ. (Schwartz & Sprouse, 1996: 42; italics in original)

Let us consider the claim that learnability may curtail convergence in somewhat closer detail for the acquisition of the information structure of German scrambling. Recall that German pre-subject scrambling is canonically associated with defocusing in so far as the scrambled constituent moves out of focus (Chapters 3 and 7). However, in particular interpretive contexts, namely contrastive or corrective topics, scrambled elements may carry focal stress (Haider & Rosengren, 2003).

Assuming that the abstract L1 grammar constitutes the beginning of L2 acquisition, there are important learnability differences between the L1 English, L1 Dutch and L1 Russian groups. Starting with the latter, L1 Russian learners of German map the Russian association of IS and scrambling onto their IL grammar. Since Russian and German align in IS-to-syntax mappings, the TL input will provide no evidence that is incompatible with the abstract L1 grammatical representation, such that no grammatical restructuring is necessary. In terms of learnability, L1 Russian learners of German are expected not to show divergence in IS-to-syntax mappings at any point in L2
development. To the extent that the present data from advanced and near-native L2ers address IL development, this prediction is borne out.

As discussed in Chapters 3 and 7, embedded OS orders in Dutch are possible in a highly restricted set of discourse contexts. NPs containing deictic markers can front as contrastively stressed topics (4). In such so-called focus scrambling (Neeleman, 1994), primary stress falls on the fronted topic (zulke boeken, ‘such books’), and secondary stress on the subject (Jan).

\[(4) \quad \ldots \text{dat ZULKE BOEKEN zelfs Jan niet koopt.} \quad \text{(Dutch)}
\]  
\[
\ldots \text{that such books even John not buys}
\]
\[
\ldots \text{that not even John buys such books.’}
\]

On the assumption that the abstract L1 grammar transfers in full to the IL, L1 Dutch speakers initially carry over to German the exclusive association of scrambling across the subject with contrastive stress. Given that focus scrambling is an option in German, too, the TL input is likely to be ambiguous with respect to the IS of scrambling. Faced with ambiguous TL input, L1 Dutch speakers seem to retain the association of scrambling with contrastive stress because the TL partially supports the L1-based representation of the IS of scrambling.

Grammatical restructuring in the L2 is assumed to occur only when the TL input is manifestly incompatible with the L1 grammatical representation (e.g. Carroll, 2001; Schwartz & Sprouse, 1996). With respect to the IS of scrambling, two factors may militate against restructuring for the L1 Dutch group. First, the low frequency of scrambling in the TL input could be treated as noise or could be insufficient to reach threshold level for restructuring. Second, syntax-discourse correspondences are often not transparent in language use that permits multiple ways of relating utterances to context. The IS of scrambling may thus be interpreted differently by L1 Dutch speakers, such that they attempt to accommodate scrambling within contrastive topic interpretations. At this point, these suggestions must remain tentative, since there is no direct evidence showing that the L1 Dutch group imposes a contrastive topic interpretation on German scrambling.

In light of the absence of scrambling in English, L1 English speakers cannot map L1 properties onto scrambling in German. With respect to the syntax of scrambling, the occurrence of OS orders in the TL input eventually forces grammatical restructuring in English-German IL grammars to accommodate the distributional option of argument reordering in German. At first sight, however, the ambiguity of the TL between canonical scrambling and focus scrambling may appear to pose problems in the L2 acquisition of the IS of scrambling for the L1 English group much in the same way it causes problems for grammatical restructuring for the L1 Dutch group. How, then, do L1 English speakers come to acquire the IS of German scrambling?
It was argued in Chapter 3 that the canonical IS of scrambling arises as the consequence of applying universal principles of prosodic phrasing to word order (e.g. Büring, 2001a; 2001b; Cinque, 1993). In non-technical terms, prosodic phrasing assigns prosodic prominence to the preverbal constituent in verb-final embedded clauses. For non-scrambled sentences, this is the object; for scrambled sentences, it is typically the subject. The syntax of scrambling is not directly associated with IS; rather, it provides the word order for reading off the canonical IS of scrambling at PF. In other words, the target-like IS of scrambling follows from default prosody assigned to word order, so that L1 English L2ers can map the canonical IS onto scrambling without making additional inferences about the discourse-relatedness of scrambling. As for focus scrambling, I assume that L1 English learners will come to acquire focus scrambling as a marked exception in a way similar to how child L1 acquirers of German come to associate scrambling with a canonical IS and, in addition, with a marked IS. It would be interesting to explore how exactly IS mappings for contrastive topics are acquired, but such explorations are beyond the scope of this thesis.

In sum, learnability considerations explain L1 effects on convergence on the IS of scrambling. L1 Russian speakers can map L1 properties onto the IS of German scrambling and L1 English speakers acquire it as a consequence of applying canonical PF principles to word order. In contrast, L1 properties of Dutch block such a mapping of canonical PF principles, since the distributionally identical Dutch word order is associated with a marked contrastive topic IS. The relevant TL input is rare and ambiguous and is thus arguably not sufficient to force Dutch-German IL grammars to abandon the L1-based identification of syntax and contrastive IS. Accordingly, the cross-linguistic comparisons in Experiments 5 and 6 demonstrate that asymmetries in L1-TL realization of IS mappings onto syntax constrain convergence on the L2.

9.2.4. The Fundamental Identity Hypothesis and its competitors

In the preceding sections, I discussed how differences between the non-native and native groups in performance can be explained as following from (a) computational resource limitations that affect non-native performance sooner than native performance and (b) L1 transfer in grammatical knowledge (information structure) and processing (morphological checking). Of course, grammatical impairment approaches (Clahsen & Felser, 2006b;

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5 It might be argued that L1 English learners initially analyse German scrambling as a form of embedded topicalization, which is also marginally possible in English (e.g. I think that nuts he would never eat). Note, though, that English topicalization can be associated with given information (topic-topicalization) as well as with new information (focus-topicalization) (see, e.g., Gundel, 1988; Prince, 1981). Hence, unlike Dutch focus scrambling, English topic-topicalization instantiates an IS similar to German scrambling. As a consequence, L1 English learners of German should demonstrate target-like performance on canonical German scrambling even if they analyse it as similar to English topicalization.
Hawkins & Chan, 1997; Sorace, 2003) or mental difference approaches (Ullman, 2005) could invoke additional factors, like computational limitations, L1 transfer, etc., as modulating L2 performance in order to model the current set of data.

However, (a) principles of explanatory parsimony, e.g. Ockham's razor, dictate that the account making the fewest assumptions to accurately model a set of data is to be preferred over accounts requiring additional assumptions. Relatedly, (b) the experimental null hypothesis for comparisons between non-native and native speakers holds that equality between groups is to be assumed, unless proven wrong. Regarding the epistemological state of L2 acquisition, Schwartz (1987) stressed that the experimental null hypothesis for comparisons between native and non-native grammars is that the two are type-identical in representational and processing architecture, unless manifest differences in performance can be found that are incompatible with this experimental null hypothesis (see also Dekydtspotter et al., 1998; White, 1996). It is therefore not sufficient to demonstrate that behavioural differences between natives and non-natives exist; rather, these behavioural differences must be shown to necessitate the assumption of fundamental differences.

In the present context, two types of explanations that appeal to epistemological non-identity were examined against the empirical data: (a) grammatical impairment (Section 9.2.1) and (b) differences in mental processing (Section 9.2.2). I argued that there is no evidence in the data that performance asymmetries between non-natives and natives point to fundamental disjunctions between the two in either acquisition or processing systems, since analogous non-target-like performance could be seen for native acquisition and processing. Hence, differences between non-natives and natives can be accommodated within the same mental architecture in L1 and L2 acquisition. I thus conclude that there is no reason to abandon the experimental null hypothesis as conceptualized in the Fundamental Identity Hypothesis (6).

(6) Fundamental Identity Hypothesis
There are no fundamental differences between non-native and native grammatical representation or processing architecture forced by a critical period. Differences, if found, relate to factors characterizing L2 acquisition independently of a critical period, e.g. L1 transfer or performance factors, such as computational limitations, etc.

The Fundamental Identity Hypothesis does not entail that differences between native and non-native performance are in some sense unreal or in substantial. As I argued in the preceding sections, the causes of group differences are not due to vague ‘performance factors’ or other un(der)defined variables potentially affecting L2 behaviour. Rather, the causes relate to (a) computational restrictions in accessing morphological forms, (b) L1 transfer, and (c) incomplete lexical learning at non-near-native levels, i.e. to factors independently established as characterizing L2 performance. In the following section, I
will explore the implications of these findings in the context of the Critical Period Hypothesis.

9.3. The Critical Period Hypothesis revisited: Patterns of convergence

In Chapter 1, a working definition of a critical period constraining L2 acquisition and processing was put forth (7).

(7) Critical Period Hypothesis (working definition)
There is a Critical Period for language acquisition terminating at the latest by or around puberty, beyond which it is not possible to acquire native-like neurocognitive representations and processing of (components of) syntax and its interfaces.

This thesis put two aspects of the Critical Period Hypothesis to test, namely, (a) whether native-like performance is attested for late L2 learners and (b) whether L1 differences affect L2 ultimate attainment. Across interfaces and across tasks, the L1 Russian near-natives perform indistinguishably from native speakers. On an understanding of the Critical Period Hypothesis that categorically rules out native-like performance for all postpubescent L2 speakers (DeKeyser & Larson-Hall, 2005; Johnson & Newport, 1989; Long, 1990, 2005), the evidence in the experiments from the L1 Russian near-natives stands in opposition to the hypothesis that bounded maturational constraints curtail convergence in L2 acquisition or L2 processing. In addition, the cross-linguistic differences in performance among the near-natives prove that effects of the L1 modulate the degree of native-likeness at ultimate attainment (see also Birdsong & Molis, 2001; McDonald, 2000; Sorace, 1993; van Boxtel, 2005). Hence, age of acquisition, if at all, is not the single determinant of convergence.

Seen in conjunction, the data patterns obtained in Experiments 1-7 do not lend support to the hypothesis that a critical period, defined as in (7), constrains L2 grammatical knowledge and processing performance in the domains under investigation. Of course, the present results cannot speak to the question of whether critical periods affect L2 acquisition in other linguistic domains or interfaces, e.g. phonology.

For the L2 acquisition of grammatical knowledge, the present findings for the L1 Russian near-natives are in line with previous studies attesting convergence for at least a subsample of L2 speakers tested (e.g. Birdsong, 1992; Birdsong & Molis, 2001; Montrul & Slabakova, 2003; van Boxtel, 2005; White & Genesee, 1996). The present study extends these findings to the morphosyntax and interface aspects of German scrambling. For L2 grammatical processing, this study adds to processing studies of highly-proficient L2 learners (e.g. Frenck-Mestre, 2002; Rossi et al., 2006) that document qualitatively identical processing patterns. The current experiments show that native-like processing performance also holds for the L2 processing of subject-object ambiguities.
disambiguated by morphological marking and for the L2 processing of information structure. Morphosyntax and information structure have been associated with particular difficulty in L2 processing (Clahsen & Felser, 2006b; Sorace & Filiaci, 2006). Experiments 2, 3 and 6 show, however, that native-like processing is within reach for high-proficient L2 speakers also in these areas.

In the next sections, I discuss some of the consequences for research on L2 ultimate attainment, in particular, comparisons between non-native and native performance that are at the heart of L2 ultimate attainment research.

9.3.1. Computational limitations, convergence and native-likeness

Many authors define the scope of a critical period behaviourally “in terms of absolute language acquisition capacity” that precludes attainment of “native-like proficiency levels” (Long, 2005: 289) for late L2 learners (see also DeKeyser & Larson-Hall, 2005; Hyltenstam & Abrahamsson, 2003). Critical period studies investigating ultimate attainment in the L2 thus typically consider whether late L2 learners show performance levels that are statistically indistinguishable from those of native controls in one or many tasks (see Chapter 1.4.4, e.g., Birdsong, 2005c; Marinova-Todd, 2003; van Boxtel, 2005). Performance identity is defined holistically across all areas of linguistic knowledge, including, e.g., idioms and metaphors, and all aspects of linguistic processing, including, e.g., processing speed. For instance, Hyltenstam & Abrahamsson (2003) contend that “it is important to investigate the extent to which advanced L2 speakers can pass as native-like speakers under a variety of conditions, such as in stressful versus relaxed situations of language production/comprehension” (Hyltenstam & Abrahamsson, 2003: 576-577). According to these views, performance identity should be observed in three types of processing data: (1) outputs of processing, e.g. judgements, accuracy rates, (2) the time course of processing, e.g. relative slowdowns, and (3) processing speed.

This thesis tested late L2 speakers on a variety of tasks that have different task demands. In particular, the speeded grammaticality judgement tasks in Experiments 3 and 7 amount to experimental conditions that are stressful and taxing for (non-)native speakers. Even under these demands, the L1 Russian near-natives hold up to native levels in terms of judgement accuracy, which indicates that native-like performance in late L2ers extends beyond normal processing conditions. Yet, although the L1 Russian near-natives perform at native judgement levels in speeded judgements, they are consistently slower than native speakers in making these judgements. In the speeded judgement tasks, their mean reaction times are on average 190ms per condition longer than those of the natives. Similarly, in the self-paced reading tasks (Experiments 2 and 6), the near-native groups take longer to read sentences than natives do (see also McDonald, 2000; White & Genesee, 1996). For research on critical periods in L2 acquisition that employs quantitative identity in performance between L2ers and natives as the criterion for convergence, such
differences in processing speed or efficiency might thus be empirical signatures of critical periods. For instance, DeKeyser & Larson-Hall (2005) argue:

> [T]he concept of CP [Critical Period; H.H.] refers to a discontinuous maturational AoA [age of acquisition; H.H.] effect regardless of whether its locus is in processing or in representation. Whether the changes are in processing efficiency or at the representational level, they require a deeper explanation of why they show a specific AoA-dependent function. (DeKeyser & Larson-Hall, 2005: 99)

However, I will argue that the present findings add evidence that lower efficiency and reduced processing speed in the L2 are not maturationally bounded, since (a) they occur even in early, simultaneous bilingualism and (b) they show a correlation with age after the offset of a putative critical period. Let us review both points in turn.

Recent studies document that slower processing speed affects L2 acquisition independently of age of acquisition, since it can already be seen in early L2 learners. In Foursha, Austin & van de Walle (2005), English monolinguals and early balanced Spanish-English L2ers were administered an auditory grammaticality judgement task on various aspects of English morphosyntax. The L2 speakers, adults at age of testing, had been exposed to both languages since before three years of age and were assessed as being balanced by tests and self-report. Although both groups performed identically in judgement accuracy, the Spanish-English group consistently took longer for judgements, irrespective of sentence type (see also Bialystok & Miller, 1999; McDonald, 2000, for child L2A). Comparable results are reported in an ERP study by Proverbio, Cok & Zani, 2002) on semantic and syntactic processing in early, balanced Slovenian-Italian bilingual adults, who had been exposed to both languages from birth. Across sentence types, reaction times in grammaticality judgements are slower for bilinguals than monolingual Italian controls in spite of identical ages of onset. Importantly, the bilinguals showed longer reaction times in both their languages (Slovenian and Italian) than monolinguals did. Slower processing speed for L2 morphosyntax thus appears not to be a correlate of language dominance or an effect of age of acquisition.

Second, processing speed correlates with age beyond the end of a putative critical period as a consequence of general cognitive age effects. Effects of cognitive aging are manifested in three processing limitations, i.e. reductions in processing speed, decreases in working memory, and deficits in attentional focus on a task (Park, 2000). Processing performance in these areas begins to continuously decline in early adulthood (Wingfield & Stine-Morrow, 2000). These declines are correlated with or caused by neurophysiological changes according to age across the lifespan (e.g. Cabeza, Nyberg & Park, 2005; for review in the context of L2 acquisition, see Birdsong, 2006). Although some hold that linguistic aspects of sentence processing may be immune to age-related performance decrements (Caplan & Waters, 2005), there is general agreement that aging in adulthood entails slower and less efficient information integration in language comprehension. As
Birdsong (2006) notes, general cognitive effects of aging may then add to L2-specific computational limitations at L2 ultimate attainment.

With increasing age, both L1 and L2 use are affected via declines in […] language processing. In L2 use, age effects in these domains are likely to be more pronounced than in the L1 case, due to a relatively low degree of automaticity in L2 processing. (Birdsong, 2006: 29)

In the experiments in this thesis, age at testing was not controlled for, and the participants’ ages ranged from 21 to 66. It was ensured that the natives were roughly matched to the L2 participants in age, such that differences between non-native and native performance are unlikely to reflect age differences. However, there are differences in age between the non-native groups; across all experiments, mean age was 45.3 years for the L1 English group, 38.6 years for the L1 Dutch group and 29.5 years for the L1 Russian group. In order to test for age effects on processing speed, a correlational analysis was run on both total sentence reading times for all non-natives in the self-paced reading task (Experiment 2) and the reaction times in the speeded grammaticality judgement task (Experiment 3). Age was the independent variable, and processing speed the dependent variable. For the self-paced task, there is a moderate correlation between age and reading speed $r=0.366$ ($p<0.01$). For the speeded grammaticality judgement task, no significant correlation obtains $r=0.19$. This discrepancy might be due to the fact that the uniform time limit imposed in the speeded grammaticality judgement task levelled individual differences in speed. In contrast, the self-paced task allowed participants to read according to individual processing speed. Given the correlation of reading speed and age, the more target-like performance by the L1 Russian group might thus partially be due to their comparatively younger mean age. However, comparisons across L1 groups according to processing speed are complicated by additional L1-specific differences between these groups that affect processing speed, for instance, dissimilarity in script between German and Russian and the large number of cognates in Dutch and German. While the results thus suggest that age effects in L2 acquisition may partly be effects of general aging (see also Bialystok & Miller, 1999), it is beyond the scope of this thesis to investigate the precise contribution of general aging effects on L2 performance.

In sum, (a) the early onset of processing inefficiency in the L2 and (b) its continuous decline according to age throughout adulthood show that reduced processing efficiency signaled by decreased processing speed in the L2 is not a maturationally bounded phenomenon. Instead, it indexes general effects of bilingualism that are compounded by general effects of aging.

For these reasons, some researchers advocate disregarding procedural effects that are not maturationally bounded in the convergence criterion applied in ultimate
attainment studies by, e.g., ignoring quantitative differences in processing speed in L2 speakers vis à vis native speakers (e.g. Birdsong 2005).

Experiments 1-7, however, document that slower and less efficient L2 processing of morphosyntax, rather than just being a quantitative difference in speed, affects both the time course and the qualitative outputs of syntactic processing. For subject-object ambiguities, I argued that slowness in L2 processing largely reflects inefficiencies in morphological checking, because L2 performance in this domain is disproportionately compromised at speed, i.e. the speeded judgement task (Experiments 3 and 7). L1 English and L1 Dutch near-natives, who perform native-like on case marking in the self-paced reading tasks (Experiments 2 and 6), show breakdowns of processing case marking at higher speed. For these groups, lower general L2 processing efficiency combines with L1 effects, reflecting lower degrees of routinization of accessing and matching morphophonological paradigms. These near-natives thus appear to show qualitative differences compared to natives under above-normal processing demands for reasons entirely unrelated to critical period effects.

As argued in Chapters 6 and 7, slower and less efficient morphological checking causes delays in the time course of processing in that slowdowns occur at the end of sentences. The L1 Russian advanced group, who showed target knowledge of case in off-line judgements (Experiment 1), fails to apply it quickly for incremental reanalysis. Rather, effects of reanalysis surface at the end of sentences (Experiments 2 and 6). This dovetails with findings from reading-time studies that indicate that L2ers evince target processing effects on later segments than natives (e.g. Dekydtspotter et al., 2006) and findings from ERP studies in which delays in L2 speakers are marked by postponed onsets or extended latencies of ERP components associated with morphosyntactic violations (e.g. Hahne, 2001; Sabourin, 2003). Finally, the low efficiency of morphological checking for the L1 English advanced group conceals convergence at the syntax-discourse interface in off-line judgements (Experiment 5); in Experiment 6, the task abstracts away from these difficulties, and target-like performance is witnessed.

These findings illustrate that computational inefficiencies due to slower speed and L1 effects at earlier stages in L2 processing, e.g. in lexical access for morphological checking, have knock-on effects in later stages in L2 comprehension, e.g. the processing of information structure. Similarly, Cutler et al. (Cutler et al., 2004) argue that L2 speech comprehension in noise suffers due to the cumulative effects of lower-level slowness or inefficiency in, e.g., word segmentation, lexical access, and the mapping of prosodic cues to interpretation (Akker & Cutler, 2003). Quantitative differences between natives and L2 learners in processing speed and efficiency as a result of bilingualism and/or aging may thus implicate manifest behavioural differences in processing outcomes.
Summary, Discussion and Conclusions

Summarizing, there are at least three potential sources of reduced computational efficiency in L2 performance: (1) General L1 effects as a consequence of bilingualism, such as reduced speed, limited working memory capacity, etc. (2) Specific L1 effects, such as L1 grammatical transfer, recruitment of L1 processing routines, L1 lexical interference (e.g. cognates), differences in script between L1 and the TL, etc. (3) Cognitive effects of general aging on the procedural efficiency of language processing. Although they are not maturationally bounded, these factors combine in placing greater burdens on L2 comprehension and production. In the next section, I discuss how these factors complicate research on L2 ultimate attainment that relies on quantitative identity in L1-L2 performance as the convergence criterion, and I outline the logic of an alternative conceptualization of ultimate attainment studies.

9.3.2. Ultimate attainment and the ‘Extended Pattern Approach’

Most generally, a critical period for language refers to qualitative neurocognitive changes within a restricted time span that curtail language acquisition capacity (Newport et al., 2001). Critical period studies attempt to unravel these potential qualitative differences in language representation and processing between late L2 speakers and native speakers.

In much research on the Critical Period Hypothesis, these putative neurocognitive changes are tightly associated with their possible behavioural result, namely, the failure of L2ers to reach native-like levels of ultimate attainment (Hyltenstam & Abrahamsson, 2003; Long, 2005). Yet, in and of itself, the attainability of native-likeness is not tied to critical periods, since critical periods are defined in terms of maturationally bounded changes of neurocognitive organization and not in terms of behaviour (Knudsen, 2004). Nevertheless, native-likeness has been widely used as a behavioural operationalization of critical period or maturational effects in L2 acquisition (Hyltenstam, 2007; Hyltenstam & Abrahamsson, 2003; Long, 1990, 2005). It should be borne in mind, though, that the standard of native-likeness is only a valid operationalization in testing for critical period effects insofar as it captures differences that ultimately relate to maturationally bounded aspects of neurocognitive language representation and processing.

However, as a criterion for L2 ultimate attainment, native-likeness faces at least four empirical problems: First, as I discussed above, lower processing speed as a general bilingualism effect and general aging effects affect L2 performance (Section 9.3.1). Second, effects of grammatical L1 transfer may implicate partial non-native-likeness in L2 acquisition for reasons independent of critical periods (Section 9.2.3.13, see also Schwartz & Sprouse, 1996). Third, as discussed in detail by Birdsong (2005b), it is questionable whether native-likeness should comprise all aspects of language, including idioms, proverbs and metaphors (as suggested in Hyltenstam & Abrahamsson, 2003). After all, these aspects more likely reflect cultural socialization to some extent than exclusively language acquisition capacity. Fourth, native-likeness presupposes some kind
of native speaker to be used as the norm and empirical benchmark for L2 acquisition. However, it is difficult to define the ‘native speaker’ (e.g. Birdsong, 1989; Davies, 2003). Defining native-likeness in terms of the range of native performance, as commonly done in critical period studies, cannot solve the problem: Native-speaker linguistic performance varies according to education (Juffs, 2007), working memory capacity and age (see above). Against this background, it is not clear what the native group for comparison in L2 ultimate attainment research should be. For instance, if L2 speakers fail to reach quantitative performance levels of native speakers matched in age, education and memory span, but they – hypothetically – perform on a par with low-educated, low-span elderly native speakers, what does that mean in terms of the Critical Period Hypothesis?

Applying a strict and comprehensive criterion of native-likeness may thus amount to committing a ‘comparative fallacy’ (Bley-Vroman, 1983) of pitting non-native performance against native performance without consideration of whether potential differences are significant, i.e. whether they index qualitative dissimilarities in neurocognitive language representation and processing. Conceptually, the native-likeness standard thus runs the risk of mistaking effects of bilingualism, L1 transfer, or gradual and unbounded age effects for critical period effects (see also Birdsong, 2005b; Cook, 1997; Eubank & Gregg, 1999; Grosjean, 1998).

In light of these problems, it seems worth considering whether there is an approach to L2 ultimate attainment that does not rely on absolute performance comparisons between groups. In research testing for qualitative (dis-)similarities in grammatical representation and neurocognitive processing, a possible reconceptualization in this vein may be the study of relative distinctions across a range of related phenomena in the L2 grammar as a gauge of its internal coherence. Dubbed the ‘pattern hypothesis’ (Martohardjono, 1998), the investigation of multiple sites in the IL grammar seeks to unravel its internal systematicity as specified by grammatical architecture (see also Schwartz & Sprouse, 2000). The pattern hypothesis abstracts away from comparisons of absolute performance between non-natives and natives and focusses on fundamental identity in linguistic representation.

The pattern hypothesis is perhaps best illustrated by a study on long distance wh-movement by Martohardjono (1993) that tested whether constraints on wh-movement are operative in L2 grammars. The study focussed on the relative distinctions between ‘strong’ and ‘weak’ violations of wh-constraints. Strong and weak violations denote relative degrees of ungrammaticality invoked by the severity and interaction of movement violations as defined in the Barriers framework (Chomsky, 1986). In a cross-linguistic comparison of grammaticality judgements from intermediate learners of English whose L1s are Chinese, Indonesian and Italian, and native English controls, Martohardjono (1993) reports differences in absolute judgements between L2ers and natives and among the different L1 groups; however, all groups were found to make
gradient (target-like) distinctions between strong violations and weak violations (see also Li, 1998). Since L2ers show a pattern of behaviour conforming to distinctions in grammatical architecture, their relative pattern of performance bears witness to underlying knowledge of the target grammar, even though it does not always surface unperturbed by performance confounds in target absolute performance levels (for child L1 acquisition, see also Grimshaw & Rosen, 1990).

The present study can be seen as an extension of the pattern hypothesis, first, to L2 ultimate attainment and, second, to L2 processing. These two additions are central features of the ‘Extended Pattern Approach’ which investigates the internal systematicity of endstate L2 systems across interconnected grammatical phenomena in linguistic representation and processing. First, the focus on L2 ultimate attainment isolates permanent properties of L2 acquisition. Research on developing L2 learners that finds non-convergent patterns of L2 behaviour meets the potential objection that non-convergence might give way to convergence on the TL in later acquisitional stages. Since near-natives can be assumed to have reached a steady state of L2 acquisition that will not significantly develop further, any non-convergence can be taken to be a permanent feature of L2 acquisition (see also Borer, 1996; Sorace, 2003). Second, the Extended Pattern Approach extends the pattern hypothesis previously formulated with respect to grammatical competence to L2 processing, so that knowledge representation as well as processing can be considered in conjunction. Unlike the off-line tasks predominantly used in the study of L2 ultimate attainment, processing tasks do not make it possible to apply explicitly memorized or metalinguistic knowledge (Clahsen & Felser, 2006b; White & Juffs, 1998). Finding convergent processing effects across several tasks and related phenomena is a strong indication that L2ers access the same cognitive knowledge sources in language processing as native speakers. Since it spans related domains of grammatical knowledge and processing, the Extended Pattern Approach to L2 representation and processing is thus not limited in its conclusions to applying the criterion of quantitative identity in performance to each and every experiment; rather, it evaluates the overall systematicity of grammatical representation and processing at L2 ultimate attainment.6

In the present study, all near-native groups evince a coherent and interlinked relative pattern of performance on the syntax, morphology, information structure and argument structure of scrambling. In off-line judgements, acceptance rates of scrambling are affected by information structure (Experiment 5). In on-line processing, syntactic

6 Note that the Extended Pattern Approach is different from the ‘multiple-task’ method (Birdsong, 2005c) that strives to circumvent problems with the native-likeness standard on one task by investigating whether late L2 learners perform native-like on several (unrelated) tasks (see Chapter 1.4.4, e.g. Marinova-Todd, 2003; van Boxtel, 2005). Crucially, the multiple-task method does not do away with the (problems of the) native-likeness standard; rather, it applies it across several tasks and phenomena.
reanalysis, first, interacts with morphology in that reanalysis strength varies according to the informativity of morphological features, i.e. case versus verbal agreement (Experiments 2 and 3): Reanalysis costs are higher for OS orders disambiguated by case than for OS orders disambiguated by verbal agreement; in ungrammatical sentences, case violations are harder to detect than verbal agreement violations, since case violations prompt reanalysis. Second, syntactic reanalysis interacts with information structure in that reanalysis costs are modulated by the felicity of IS contexts (Experiment 6): Reanalysis costs for OS orders are lower in IS contexts that match the IS of scrambling than in mismatching contexts. Third, syntactic reanalysis interacts with argument structure in that reanalysis costs differ between dative-active and dative-experiencer verbs (Experiment 7): Due to their thematic OS base order, OS orders with dative experiencers evince no or reduced reanalysis costs compared to SO orders. These interactions obtain even though not all L2 near-native groups demonstrate performance levels congruent with natives in absolute terms. Where L1 and L2 performance levels are not identical, similar performance patterns are seen at lower accuracy levels; in other words, the L2 near-natives do not all converge on absolute native performance levels, but they converge on relative target patterns of performance. Moreover, deviations from the relative target pattern by the L1 Dutch group on the IS of scrambling and by the L1 English group on the argument structure of scrambling could be linked to learnability due to L1 transfer (Section 9.2.3.12).

In short, the relative target pattern across interfaces and across tasks in Experiments 1-7 points to the involvement of interlinked L2 grammatical representations and to the use of articulated grammatical architecture in near-native L2 processing. Given that evidence of the interdependence of syntactic and interface aspects of scrambling is rare and non-transparent in the TL input, it is unlikely that the internal systematicity of near-native IL systems is directly patterned on the TL input or somehow accidental. Furthermore, processing tasks do not readily allow for the application of explicit or metalinguistic knowledge rendering it unlikely that different knowledge sources are tapped in L2 performance compared to native processing. Rather, the systematic pattern of near-native L2 performance across tasks is indicative of modular interface-economic grammatical organization and processing akin to that of native grammars (Chapter 3) and native processing (Chapter 4).

In sum, the Extended Pattern Approach investigates qualitative identity between native and non-native grammatical representation and processing at L2 ultimate attainment against the background of an articulated theory of (non-)native (psycho-)linguistic competence. By considering multiple related phenomena, it goes beyond previous research on L2 processing that tests whether L2ers show target processing on a single
It assesses whether the internal systematicity of IL grammar and processing at L2 ultimate attainment conforms to native (psycho-)linguistic architecture. Its criterion for convergence is whether endstate L2ers show a target relative pattern across a range of interconnected linguistic phenomena, and not whether they exhibit quantitative performance identity. Needless to say, studies framed within the Extended Pattern Approach should attempt to account for quantitative differences between non-native performance and native performance as well; importantly, though, against the background of a target pattern of L2 processing, these quantitative differences can be conceptually separated from qualitative differences in grammatical representation and processing.

9.4. Reconsiderations of previous studies

As this thesis is one of the first studies on ultimate attainment that investigates multiple syntactic interfaces in cross-linguistic perspective, it has implications for L2 research in various domains.

9.4.1. L2 research on scrambling

Most directly, this study complements previous research on the L2 acquisition of scrambling. This thesis demonstrates that difficulties in the L2 acquisition of scrambling at relatively lower proficiency levels (e.g. Iwasaki, 2003; Jackson, 2005; Koda, 1993; Neeleman & Weerman, 1997) give way to cross-linguistic convergence at near-native levels. In line with the cross-sectional study by Unsworth (2005) on L2 Dutch scrambling, this study finds that protracted problems predominantly occur at the syntactic interfaces of scrambling. Moreover, the present study accrues further evidence of L1 transfer, previously attested for the syntax of scrambling in Koda (1993) and Hopp (2002; 2005). It is shown that these L1 effects systematically extend beyond syntax to the interfaces of scrambling, in particular, to the syntax-discourse and to the syntax-argument structure interfaces.

With respect to the processing of scrambling, the present experiments go beyond initial insights into the real-time comprehension of L2 German scrambling by Jackson (2005). Confirming the speculations in previous off-line studies (e.g. Clahsen, 1988; Hopp, 2002; Iwasaki, 2003; Koda, 1993; Unsworth, 2005), this thesis showed that non-target-like behaviour on scrambling in the L2 derives in large part from difficulties in

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7 It is important to recognize that the Extended Pattern Approach is formulated for L2 ultimate attainment. Although it can be applied to relatively lower-proficient L2ers, e.g. the advanced L2 groups in this study, qualitative identity is not supposed to necessarily hold for earlier stages in L2 development. Developmental stages in L2 acquisition may be characterized by different grammatical representations and differences in processing between L2ers and natives, for instance, due to L1 transfer and/or non-target analyses of the input (e.g. Schwartz & Sprouse, 1996; Thomas, 1995; White, 1992).
accessing morphological information in real time in order to effect syntactic reanalysis. As a consequence, especially less proficient L2 learners (i.e. the advanced groups in this study) fail to carry out phrase-structure revision incrementally.

### 9.4.2. L2 processing of morphosyntax

The present study also adds to the nascent body of research on the L2 processing of morphosyntax. Unlike previous studies that compared native speakers to L2 learners at intermediate to advanced proficiency levels (e.g. Jiang, 2004; Marinis et al., 2005; Sabourin, 2003), this study includes both advanced and near-native L2 speakers. Experiments 1 through 3 show significant differences between advanced and near-native L2 groups, with the near-natives demonstrating target-like processing of subject-object ambiguities disambiguated by morphological marking. The present study thus highlights the crucial role of proficiency for comparisons between non-native and native speakers in L2 processing.

In light of the present findings, the previous processing studies that examine L2 speakers at below-near-native levels of proficiency must be seen as addressing a stage in L2 development, yet they do not speak to the potential outcome of L2 development. Specifically, the results from previous research claiming that L2ers do not construct syntactic dependencies in on-line processing (Clahsen & Felser, 2006b; Marinis et al., 2005; Papadopoulou & Clahsen, 2003) cannot be upheld as a generalization about all stages of L2 processing. With respect to the question whether L2 processing of morphosyntax is identical to native processing, earlier studies must, in retrospect, therefore be taken to have been premature in their conclusions based on comparisons of developing L2 learners and endstate L1 speakers.

### 9.4.3. The syntax-morphology interface in L2 acquisition

This study adds to research on L2 difficulties with inflection at the syntax-morphology interface (for overview, e.g., White, 2007). Problems were found to be of two kinds: (a) limitations in access to and mapping of morphophonological forms and features and (b) insufficient lexical learning of dative verbs. As shown in the analysis of the fill-in-the-blank task, systematic defaults are supplied when target-like retrieval and mapping of morphosyntax fail. These defaults were shown to be underspecified forms, inserted according to the featural make-up of morphophonological paradigms (McFadden, 2004). In comprehension experiments, accuracy on inflectional case morphology correlated with task demands (Experiments 1-3). The systematicity of default inflection and their dependence on task demands in the L2 groups suggest that these difficulties are to a large extent due to computational limitations (e.g. Prévost & White, 2000b), rather than to
misrepresentations (e.g. Franceschina, 2005; Hawkins & Chan, 1997) or to misanalyses at the level of morphological competence (e.g. Lardiere, 2005).

9.4.4. The syntax-discourse interface in L2 acquisition

Recent studies on the syntax-discourse interface at L2 ultimate attainment identify protracted difficulty of L2 speakers to acquire target-like discourse-to-syntax mappings, unless these mappings are analogously realized in the L1 (Chapter 1.3.6.3). In contrast, Experiments 5 and 6 document that convergence on syntax-discourse relations on scrambling obtains in off-line judgements and on-line processing for the L1 English and L1 Russian groups. This finding is incompatible with accounts claiming that the L1 fully determines convergence (Sorace, 2003), since English has neither scrambling nor its associated interpretable feature. There is thus no evidence that the syntax-discourse interface per se presents problems in advanced L2 acquisition. Rather, as the results from the L1 Dutch group suggest, convergence at the syntax-discourse interface at L2 ultimate attainment seems to be constrained by learnability, ultimately due to L1 transfer.

9.4.5. The syntax-lexicon interface in L2 acquisition

Experiment 7 on the syntax-argument structure interface shows that L2 learners map thematic distinctions to syntax in L2 processing, even if these distinctions are not analogously realized in the L1 (FrencK-Mestre & Pynte, 1997; Juffs, 1998; Montrul, 2004). In line with the off-line study by Sorace (1993), the on-line experiment finds L1 effects on convergence in that thematic L1 properties transfer in L2 processing (FrencK-Mestre & Pynte, 1997; Juffs, 1998): The availability of thematic OS orders with dative-experiencer verbs in Dutch and Russian facilitates processing of non-derived OS orders vis à vis that of the L1 English group. Further research is necessary to test whether these L1 effects are ultimately to be situated at the level of grammatical representation and/or processing routines.

9.4.6. Interacting effects across interfaces

Finally, by exploring L2 performance across different interfaces, this study considered potential interference or interaction effects between interfaces. On the one hand, it was seen that computational problems at the syntax-morphology interface impinge on performance at the syntactic interfaces with information structure and argument structure. Inflectional morphology seems to constitute the ‘bottleneck’ in L2 acquisition (Slabakova, 2006) that most likely cuts short convergence at L2 ultimate attainment. On the other hand, it was also shown that the processing load of interface information affects convergence.
In the context of German scrambling, processing load characterizes interfaces in two ways. First, interface phenomena by definition involve the integration (mapping) of multiple types of information (e.g. syntactic, morphological and IS), and such integration might strain or exceed the processing capacities of L2 speakers. For instance, processing interface information with scrambling inherently requires larger computational costs than processing only the syntax of scrambled orders. Difficulties at the interfaces in L2 acquisition may in large part just reflect the additional computational tasks characteristic of interface mappings, rather than any problem specific to grammatical interface knowledge.

Second, economy or default strategies in (L2) processing of syntax might favour a more parsimonious structural option compared to a more complex, derived syntactic structure associated with interface mappings (e.g. SO versus OS in German, or SV versus VS in Italian, see Belletti et al., 2007). Since these structures require relatively costly phrase-structure revision, L2ers may not accept or produce some of these syntactic structures in the first place. Alternatively, the computation of derived syntactic orders, e.g. scrambling, may tax computational resources of the processor such that no resources are left to compute interface mappings, e.g. information structure or interpretive constraints. For derived OS orders in German, advanced L2 speakers do not fully compute the syntax of these orders in parsing; as a consequence, they fail to evince appropriate discourse mappings associated with these orders. Failure of L2 speakers to show interface knowledge might thus in some cases result from economy considerations that minimize processing resources for syntax rather than from problems related to interfaces (see also Sorace, 2005).

9.5. Limitations of the present study

This thesis has gathered evidence of L2 grammatical competence and processing performance across a variety of tasks, specifically, off-line judgements, speeded judgements and self-paced reading, in order to investigate grammatical and processing (non-)convergence at L2 ultimate attainment. Ideally, these reaction-time methods should be supplemented with other psycholinguistic methods, such as eye-tracking, event-related potentials and imaging techniques, in order to furnish converging evidence on L2 processing performance.

Given my attempt to consider a variety of interfaces at L2 ultimate attainment, I could not explore individual interfaces in great depth. Particularly for the syntax-semantics interface and the syntax-argument structure interface, more experimentation is needed to put the present results into perspective. For the syntax-information structure interface, it would be desirable to run experiments that include additional conditions, e.g. contrastive and corrective focus contexts, to amass direct evidence that supports the
hypothesized relation between the null effect of IS on scrambling and persistent L1 transfer effects for the L1 Dutch groups observed in Experiments 5 and 6.

A further limitation of the present experiments is that they consider L2 comprehension only. In particular for inflectional morphology, non-convergence in endstate L2 grammars, though attested also in comprehension tasks (Franceschina, 2005; Jiang, 2004; 2007), has been found to be more pronounced in production data (Lardiere, 2007; White, 2003a). The written (fill-in-the-blank) production task on case (Chapter 6) illustrates that case marking, in particular for lexical case, presents problems even in untimed written production. As a next step, spontaneous and elicited spoken production data are needed to measure (a) the extent to which difficulties with inflectional morphology are magnified in production and (b) the extent to which the relative difficulties of, e.g., verbal agreement and case marking are replicable in production.

Finally, this study could not address interindividual differences in computational resources by systematically exploring effects of cognitive aging, proficiency, length of exposure, working memory or processing speed on L2 processing. For a more complete picture of the scope of computational limitations in L2 processing, it is desirable to match L2 subjects in age, length of exposure, working memory span etc. or to systematically explore interindividual differences along these lines.

9.6. Predictions

The interpretation of the findings across Experiments 1 to 7 in light of the Fundamental Identity Hypothesis that computational resource limitations in large part underlie non-convergence gives rise to several testable predictions about L2 performance at ultimate attainment. First, the degree of target-like L2 performance on morphosyntax, involving morphological checking, should correlate with task demands in language processing. In particular, levels of target-like performance should increase under lower computational load, such that convergence is observed under minimized processing efforts, at least for sufficiently advanced or near-native L2ers.

Second, natives should evince similar performance patterns to (very advanced) L2ers under processing conditions exogenously approximating the endogenous computational resource restrictions in L2 language processing. Specifically, natives operating under increased task demands are expected to show problems in morphological checking resembling those of L2 speakers performing at lower task demands. Conversely, performance of L2ers under increased task demands should suffer to a greater extent than

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8 This prediction does not apply to phenomena where L1 transfer leads to differences in grammatical representation due to learnability.
native performance under the same demands, as lower L2 processing resources are depleted sooner (see also Cutler et al., 2004).

Third, L2 processing routines in morphosyntax are aided by analogous routines in the L1. This can be examined by testing a variety of, e.g., morphosyntactic ‘mappings’ instantiated differently across L1s in a cross-linguistic study. In contrast to effects of grammatical L1 transfer that should surface across different task demands, effects of L1 processing routines, like the L1 benefit in case checking for the L1 Russian group, should occur predominantly under increased computational load in L2 processing.

In the context of the present experiments, these three predictions could be explored by varying the presentation rate in speeded judgements for L2ers and native speakers. Further, these predictions could be tested across different grammatical constructions and different experimental methods that systematically vary in task demands. Future research will gauge the extent to which the Fundamental Identity Hypothesis holds up to evidence from different grammatical phenomena and from different L1 groups.

9.7. Conclusion

This thesis investigated grammatical knowledge and on-line use of grammatical knowledge at L2 ultimate attainment across a range of grammatical interfaces. Its aim was to identify loci of convergence and non-convergence, following the suggestion that the interfaces of syntax are particularly prone to non-convergence at L2 ultimate attainment (the ‘Interface Hypothesis’). I tested different interfaces to ascertain whether non-convergence reflects critical period effects incurring qualitative L1 versus L2 differences in grammar and/or processing.

Seven experiments on German scrambling indeed adduced new evidence that interfaces present difficulty in L2 acquisition up to and including ultimate attainment. Of the various groups tested, only near-native L1 Russian group converged on native performance across all experiments. However, across off-line and on-line experiments, the pattern of results in this study does not indicate qualitative differences between non-natives and natives at any interface that are suggestive of critical period constraints; instead, the off-line and on-line data point to computational limitations in accessing and mapping morphological information to syntax. Such problems at the syntax-morphology interface were shown to also affect performance at other interfaces, e.g. the syntax-discourse interface. Further, (non-) convergence was found to be delimited by L1 effects of learnability at the syntax-discourse interface. In total, the pattern of non-convergence across L1 groups, across grammatical interfaces and across tasks was explained as a consequence of an interaction of computational limitations and L1 effects. Crucially, these factors inform L2 acquisition independently of critical periods. The present data are
thus compatible with the Fundamental Identity Hypothesis which posits fundamental identity between adult L2ers and natives for grammatical representation and processing.

The combination of off-line and on-line tasks on a range of interrelated phenomena spanning various interfaces also bore witness to systematic patterns of L2 performance at L2 ultimate attainment. Cross-linguistically, this thesis documented that late near-native L2 learners of German have target-like, systematic and intertwined grammatical representations across syntactic interfaces and apply these rapidly in on-line processing. I suggested that the Extended Pattern Approach focusing on systematicity in grammatical representation and processing may be a useful criterion in L2 ultimate attainment studies.

Finally, this thesis highlights the role of the interface of grammar with performance systems in studies on L2 ultimate attainment by considering the interaction between grammatical representation, sentence processing and performance factors. In this cross-linguistic study on L2 ultimate attainment, I sought to demonstrate that the comparison of off-line and on-line data across grammatical interfaces is a fruitful line of research in studying L2 ultimate attainment and, conversely, that the study of ultimate attainment can add useful evidence to these areas of L2 research.