Introduction

Most adult second language (L2) learners fail to achieve native-like proficiency levels in the L2. In fact, non-native-like ultimate attainment in the L2 has often been taken to be the defining characteristic of post-childhood, i.e. 'late', L2 acquisition. In consequence, much research is directed at the question of why late L2 acquisition typically results in lower success than early L1 or early L2 acquisition. One of the most influential answers to this question has been that (second) language acquisition is constrained by a critical period (e.g. Lenneberg, 1967). For language acquisition, a critical period demarcates a maturationally limited time period of privileged learning before neurocognitive changes preclude language acquisition to criterion.

However, late L2 acquisition is not equally unsuccessful in all linguistic domains. For instance, late L2 learners are typically better at acquiring the syntax of the target language (TL) than they are at acquiring native-like phonology. It is therefore unlikely that differences in outcomes between late L2 acquisition and early language acquisition can be explained in terms of a single critical period for language acquisition. Rather, it seems necessary to specify which, if any, components of linguistic knowledge (syntax, morphology, semantics, phonology, etc.) and/or components of language processing are subject to a critical period that constrains convergence of late L2 learners on native performance (e.g. DeKeyser & Larson-Hall, 2005; Eubank & Gregg, 1999; Newport, Bavelier & Neville, 2001).

Following this differentiation, this thesis aims to identify the loci of (non-) convergence between mature native and high-proficient non-native speakers at L2 ultimate attainment. It tests multiple domains of linguistic knowledge and processing that could possibly be subject to a critical period. It thus contributes to answering the questions (a) in which areas of linguistic knowledge and processing non-natives converge on the target language, (b) what the conditions for convergence in these areas are, and (c) how the causes and the scope of non-convergence can be characterized.

Theoretical background

To this end, this thesis adopts the modular mental architecture of generative linguistic theory. According to generative linguistic theory, language comprises grammatical modules, such as syntax, morphology, etc. and their coordinations, so-called interfaces. Interfaces are either internal, connecting grammatical modules with one another, or external, connecting grammatical modules with cognitive components dedicated for language processing or non-linguistic cognition (Chomsky, 2000). These distinctions provide a suitable foundation for testing whether some module or interface is unavailable or impaired as the consequence of a critical period in late L2 acquisition.
Generative L2 acquisition research reports that late L2 learners show a relatively high degree of convergence on the target-language (TL) word order, while they experience protracted difficulty with inflectional morphology or discourse-functional interpretations of TL word orders (e.g. Sorace, 2003; White, 2003a). For instance, although advanced late L2 learners acquire the TL syntax, they show variability in morphological gender marking (e.g. Franceschina, 2005; Sabourin, 2003), and they show indeterminate intuitions on when to use which word order in discourse (e.g. Belletti, Bennati & Sorace, 2007). This disjunction between success in syntax and difficulties at, e.g., the syntax-morphology and syntax-discourse interfaces has been termed the 'Interface Hypothesis' (Sorace & Filiaci, 2006). The Interface Hypothesis holds that the syntactic interfaces are prone to residual non-convergence in L2 acquisition.

The Interface Hypothesis takes centre stage in this thesis. The thesis’ primary aim is to test whether late L2 learners of various L1 backgrounds can converge on target grammar and processing at and across various interfaces. I assume that TL convergence consists of minimally three components in (1).

(1) Components of convergence
a. target grammatical representations in various linguistic modules (e.g. syntax, morphology, semantics, etc.)

b. target integration of grammatical representations across linguistic modules, i.e. interface mappings

c. target use of grammatical representations in and across linguistic modules in real-time language processing

In relation to the components in (1), there are several ways in which late L2 acquirers and native speakers could differ. First, a critical period might constrain the availability of grammatical representations in one or several modules (e.g. Clahsen & Muysken, 1986; Hawkins & Chan, 1997; Sorace, 2003). Second, a critical period may lead to qualitative differences in the mental processing of grammatical information (e.g. Clahsen & Felser, 2006b; DeKeyser, 2003; Paradis, 2004; Ullman, 2005). Third, L2 learners may suffer from computational resource limitations which lead to less automatized mapping of information across interfaces in L2 processing, either as a consequence of particular L1-TL pairings or as a general effect of bilingualism (e.g. McDonald, 2006; Prévost & White, 2000b).

Against the background of these different approaches, this thesis aims to identify whether convergence at L2 ultimate attainment is restricted to particular grammatical modules or grammatical interfaces, and whether non-convergence is due to limitations in linguistic competence or restrictions in processing performance. Finally, since it examines L2 speakers of various L1 backgrounds, the thesis explores whether convergence depends on particular L1-TL pairings.
Introduction

The experiments

This thesis tests L1 English, Dutch and Russian advanced to near-native speakers of German and native-speaker controls. Seven experiments will be reported on the grammatical representation and processing of discourse-driven word order optionality in German, so-called ‘scrambling’. Scrambling constitutes a good test case for studying the coordination of different types of linguistic information, since it brings together several aspects of linguistic knowledge and shows characteristic patterns in native processing (Table 0.1).

German allows for the linear reordering of verbal arguments. As shown in the embedded clause in (2b), the object can optionally precede the subject.

(2) a. Maria glaubt, dass der Vater den Onkel schlägt. (SO)  
Maria thinks that the-nom father the-acc uncle beats  
‘Maria thinks that the father beats the uncle.’
b. Maria glaubt, dass [den Onkel]₁ der Vater t₁ schlägt. (OS)

Scrambling in (2b) reorders the verbal arguments. Morphologically, scrambling is indexed by case marking on the determiners. Further, the optionality of scrambling is constrained at the interfaces of syntax with (a) the lexicon, (b) semantics, and (c) discourse. These interfaces also modulate the processing of scrambling in that they affect the ease of processing scrambled OS orders (2b) compared to SO orders (2a), so-called reanalysis.

<table>
<thead>
<tr>
<th>Module/Interface</th>
<th>Effects in grammar</th>
<th>Effects in processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syntax</td>
<td>Argument reordering</td>
<td>Reanalysis from SO to OS order</td>
</tr>
<tr>
<td>Syntax-Morphology</td>
<td>Inflectional marking of argument reordering</td>
<td>Different reanalysis effects depending on inflection type (case vs verbal agreement)</td>
</tr>
<tr>
<td>Syntax-Lexicon</td>
<td>Thematic constraints on argument order</td>
<td>Thematic effects on reanalysis</td>
</tr>
<tr>
<td>Syntax-Semantics</td>
<td>Interpretive constraints on argument reordering (definiteness)</td>
<td>-</td>
</tr>
<tr>
<td>Syntax-Discourse</td>
<td>Information-structural constraints on argument reordering (focus)</td>
<td>Information-structural effects on reanalysis</td>
</tr>
</tbody>
</table>

**Table 0.1. Interfaces of scrambling in grammar and processing.**

Table 0.1 gives an overview of the types of interface phenomena in grammar and processing studied in this thesis. Table 0.1 lists the type of grammatical module or
interface, the effects of the interface in the grammar of scrambling, and, in the rightmost column, their effects in the native processing of scrambling.

For the syntax-semantics interface, no processing effects have been reported in native processing research, so this aspect will not be considered for L2ers in this thesis. All other phenomena will be tested in seven off-line and on-line experiments on the grammar and processing of scrambling at L2 ultimate attainment.

Research questions and hypothesis

For each phenomenon, this thesis pursues the general research question in (3)

(3) General research question
Do adult speakers at L2 ultimate attainment converge on target off-line grammatical knowledge and target on-line processing patterns of German scrambling and its associated interface properties?

With respect to the general question, three subquestions will be addressed (4).

(4) Subquestions for research
a. Is there a disjunction in convergence between the syntax and the interfaces of scrambling?
b. Is there a disjunction in convergence between grammatical representation and grammatical processing at the interfaces in the L2?
c. Do L1 properties affect L2 convergence (L1 influence)?

The starting point of the thesis is the Fundamental Identity Hypothesis which states that there are no qualitative differences between late L2 speakers and natives indexing a critical period in either grammatical representation or language processing (5).

(5) 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 follows proposals that non-native grammars are epistemologically similar to native grammars (Schwartz, 1987; Schwartz & Sprouse, 1996) and extends these proposals to language processing. In contrast to previous work on the critical period that takes quantitative identity between non-native and native
performance as the criterion for convergence, the Fundamental Identity Hypothesis isolates \textit{qualitative identity} as the convergence criterion. It thus abstracts away from potential differences between natives and non-natives that inform L2 acquisition independently of possible critical periods.

\textit{The findings}

On the basis of results from seven off- and on-line experiments, I argue that the Fundamental Identity Hypothesis is compatible with L2 performance across interfaces in grammatical representation and language processing.

Although not all L2 groups converge on native performance levels for all interfaces across tasks, non-convergence between non-native and native performance can be systematically related to two factors: (a) computational limitations in accessing morphological information on-line, and (b) L1 transfer of grammatical representations and processing routines. Cross-experiment comparisons and a detailed account of the causes of non-convergence show that neither computational limitations nor persistent L1 transfer are consequences of a critical period in L2 acquisition. Moreover, accounts of L2 acquisition and L2 processing positing critical periods cannot readily explain these effects.

In accordance with the Fundamental Identity Hypothesis, I conclude that late L2 acquisition is not subject to a critical period in the domains of investigation. Finally, the account of L2 ultimate attainment developed in this thesis (Chapter 9) makes testable predictions for the comparative study of native and non-native performance at ultimate attainment.

\textit{Broader significance of the study}

This thesis is the first attempt at testing a broad range of related phenomena in grammar and processing at L2 ultimate attainment for L2 speakers with different L1s. This study hence allows for a more precise identification of which aspects of non-convergence in late L2 acquisition are related to grammatical representation and which aspects of non-convergence index processing limitations.

In this respect, this thesis provides a contribution to research aiming to disentangle the relative impact of competence versus performance aspects in L2 acquisition. The findings reported in this thesis are relevant for the issues of the limits of L2 attainment, the Critical Period Hypothesis, theories of L2 grammar acquisition as well as models of L2 processing.
6 Introduction

How the book is organised

The following nine chapters of this thesis are structured as follows. Chapter 1 introduces the Critical Period Hypothesis and discusses the current state of evidence of maturational constraints in second language acquisition of grammar. Turning to the use of grammar in processing, Chapter 2 reviews non-convergence in L2 processing and discusses in which ways processing difficulties point to effects of a critical period. The next three chapters sketch the background to the experiments reported in this thesis: Chapter 3 develops an account of the grammar of scrambling from a cross-linguistic perspective. Chapter 4 reviews the native processing of scrambling in German and analyses it within the Garden-Path model of sentence comprehension. In Chapter 5, previous research on the L2 acquisition of scrambling is discussed and the specific research questions and hypotheses are presented. Chapters 6 through 8 present the experiments on the morphosyntax (Chapter 6), the interpretation (Chapter 7), and the argument structure (Chapter 8) of German scrambling at L2 ultimate attainment. Finally, Chapter 9 puts all findings in perspective and discusses the guises and causes of non-convergence and their implications for formal L2 acquisition research and the Critical Period Hypothesis.