First language attrition

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The overwhelming bias for investigations of bilingualism is to focus on the increase of knowledge and crosslinguistic traffic from the L1 to the L2. Developments which concern loss, deterioration or reduced accessibility of knowledge and traffic from the L2 to the L1 are much less well-studied and understood, and usually treated as a somewhat marginal issue. The present contribution provides an overview of research in first language attrition and argues that changes to the first language system are part and parcel of the development of bilingual knowledge and processing. As such, they can help provide additional insight into controversial issues, such as questions about the existence of maturational constraints in L2 learning, and potentially help resolve these matters.

The human language faculty is probably the most important and intriguing but also the most complex and puzzling feature of human cognition. Despite the exponential growth of language sciences over the past century and a half, how and why human beings are able to learn and use language in all its aspects remains poorly understood. Wallace L. Chafe compares the different approaches to linguistics to a number of blind people, each of whom is touching a small part of an extremely large and complex elephant, and by doing so trying to understand its overall nature (Chafe 1994:9). The different approaches towards this exploration of language have to date most conspicuously comprised diachronic investigations (how does language change over time – and, perhaps more importantly, how does it stay the same over time?), typological investigations (how do languages differ from each other and, perhaps more importantly, how are they similar to each other?), studies of L1 acqusition (what phenomena appear, and in what order, when children learn language?) and L2 acquisition (how is second language learning different from first language learning – and how is it the same?).

Language attrition did not make its entrance on the stage of linguistic investigation until relatively recently. This fact is somewhat surprising, given how universal the self-perceived phenomenon of 'forgetting' a language appears to be. There are few people who would not make the claim that they had more or less entirely lost a language that they might once have been quite good in, whether they had learned it in the family or from a grandparent as a heritage language, on the street from their peers as children, or at school or abroad either as children or adults. And yet, when language attrition research first began to be conducted three

decades ago, it was not so much motivated by the idea that there is as much to be learned about the nature of linguistic knowledge from the way it disappears or becomes inaccessible upon non-use as from the way it is acquired through input. The underlying rationale was a far more practical one, at least initially: A great deal of time was spent at US-American high schools and universities on the teaching of foreign languages. The knowledge that was thus laboriously imparted and acquired, however, seemed to have a disturbingly short half-life, so that researchers engaged in the area of foreign language teaching were asking themselves whether it was even worth the effort – and whether the process of deterioration might not somehow be prevented (Richard Lambert, pc.).

It was in order to elucidate such questions that early investigations, such as Bahrick's seminal 1984 study of L2 attrition, were conducted, investigating the retention of teaching outcomes (e.g. vocabulary knowledge and reading comprehension). The results from these studies were often surprising and did not at all tally with what had been expected, in that they seemed to indicate that language knowledge was far more resilient than the widespread assumptions on the pervasiveness and speed of its loss would have suggested. These findings then sparked a great deal of interest into the nature of L1 and L2 attrition on the background of current theories of language and bilinguals, such as e.g. the Principles and Parameters model (e.g. Håkansson 1995; Sharwood Smith & Van Buren 1991), the Minimalist Program (Platzack 1996) or frameworks of attitude and motivation in bilingual development (e.g. Jaspaert & Kroon 1989). At this stage, investigations were usually targeted towards explaining the phenomena that were observed in the attritional process from the perspective of the relevant theoretical framework.

As language attrition studies became more advanced and the basis of collected data on which they rested more robust, it was gradually realized that the real potential of investigating language attrition might lie in the reversal of this direction of interest. In other words, research began to focus less on explaining attrition phenomena through the lens of different theoretical accounts, but on validating or challenging such accounts on the basis of phenomena witnessed in the attritional process. Linguists came to realize that language attrition is not an exotic and isolated phenomenon experienced by a few individuals under extreme circumstances but part and parcel of the overall process of language development (Schmid & Köpke 2007). That being the case, any theory of such developments should be able to satisfactorily account for attrition alongside other aspects of acquisition, use and processing.

From the late 1990s onwards, investigations of language attrition therefore focussed on predictively identifying, from the point of view of various theoretical frameworks, those areas

of linguistic (in particular grammatical) knowledge that should be particularly vulnerable to attrition as well as those which one would expect to be spared. These assumptions were then tested on the basis of data collected from a variety of language attrition settings (e.g. for the Principles and Parameters approach, Gürel 2002, McCormack 2004; for the Minimalist Program, Montrul 2008, Tsimpli, Sorace, Filiaci & Heycock 2004, Tsimpli, 2007; for Myers-Scotton and Jake's (2000) 4-M model, Gross 2004, Schmitt 2004, 2010. For a more comprehensive overview see Köpke & Schmid 2004 and Schmid 2004).

While such individual investigations of particular grammatical areas or phenomena in specific languages may serve to refine or validate theoretical models of bilingual knowledge and processing, more general questions about the nature of the interaction between and development of two language systems[1] in second language acquisition and first language attrition can be approached on the basis of cumulative evidence from a larger number of studies. These questions concern issues such as the location of attrition effects (do they affect the underlying linguistic system, leading to a restructuring of grammatical rules or phenomena, or are they confined to the surface of the expression, ie. are they purely online?) and the impact of external factors, such as the age at onset or the amount of use, on the rate and eventual extent of the process of loss.

This change in perspective recently culminated in the proposal that language attrition might be a 'missing link' with the potential to help resolve conflicting opinions on bilingual development beyond what can be determined on the basis of L2 data alone (Schmid 2009): L1 attrition studies offer a unique window into questions regarding the fundamental similarity or difference between natives and L2ers and the role of age of acquisition (AoA). Attriters are speakers who have learned the target language from birth, and can therefore be assumed to be unaffected by any possible maturational constraints with respect to the grammatical rules and structures they have acquired. On the other hand, they are usually proficient bilinguals, and for many of them the L2 has become the stronger language and the one they use predominantly in their daily lives. A comparison of attriters and L2ers therefore has the potential of providing evidence that may help resolve the question on identity or difference between languages learned from birth vs. later in life in conditions of intensive cross-linguistic interaction and competition (Bylund 2009, Montrul 2008, Schmid 2009).

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[1] There is currently a growing interest in multilingual situations where more than two languages are involved, see e.g. del Pilar de García Mayo, this volume. The impact of L3 acquisition on L1 attrition has not, to my knowledge, received much attention so far. For the purpose of this article, I shall therefore confine myself to investigations of dual multilingualism.

Competence or performance?

The first question to be asked in this respect concerns the location of attrition effects. Seliger and Vago (1991) approach the question which part of an individual's L1 repertoire may be affected by attrition effects in terms of the *competence-performance* dichotomy. They argue that it is necessary to make a clear distinction between two types of attrition phenomena: Those that are the outcome of two (otherwise intact) linguistic systems being active at the same time and thus contributing to the finalization of the utterance (ie. performance phenomena), and those which are an indication of underlying grammatical knowledge in one of the systems (the L1) being influenced by the presence of the other (the L2). This latter process, they propose, is the one which attrition studies should focus on: "it is erosion that reaches the level of competence that allows for interesting claims about and meaningful insights into the attrition process" (Seliger & Vago 1991: 7).

What Seliger and Vago address here touches on one of the fundamental questions of research not only on language attrition but on bilingual development at large, namely the distinction between representational deficits (ie. an underlying grammatical or phonological system which diverges in some aspects from that of a monolingual native) and surface phenomena (non-targetlike realizations of grammatical or phonological rules due to crosslinguistic interaction in the online integration of the two systems). This debate is closely related to the controversy on the similarity or difference of linguistic knowledge between natives and L2ers (see e.g. the papers in Snape et al. 2009).

L2 learning and the Critical Period debate

It has often been observed that the outcome of monolingual native language acquisition is relatively uniform and homogenic: all speakers who are exposed to one language from birth, unless they are affected by some language-specific disability, will roughly follow the same path of acquisition at the same rate and eventually reach full native knowledge of their L1 (e.g. Bialystok 2001:21). L2 learners, on the other hand, show great variability in their rate of acquisition and ultimate attainment and often fossilize at a certain stage of development. While the most strongly predictive factor of ultimate proficiency appears to be the age at which the acquisition process began, AoA is not deterministic: not all early bilinguals reach the native target, and some late learners can pass for natives (see e.g. the summaries presented in Abrahamsson & Hyltenstam 2009; Hyltenstam & Abrahamsson 2000).

These findings have led to the controversy about the existence of a 'Critical Period', a time period in the maturation of the species during which language acquisition mechanisms

are fully available. After this time window has passed, proponents of some form of maturational constraints (henceforth MCs) take language learning to become impeded, leading to less than fully native ultimate attainment. On this view, those late learners who can achieve target-like performance are assumed to employ non-grammatcial compensatory strategies which allow them to 'mask' the fact that they are underlyingly different from native speakers. Researchers who reject MCs, on the other hand, advance native-like attainment among late learners as evidence for the assumption that L1 and L2 learners are not qualitatitvely different. The controversy can thus be summed up in the question of whether there is a *qualitative* or a *quantitative* difference between natives and late L2 learners: is it merely that older learners *do not* do as well, or is it that they *cannot*? (Long 2005:288)

The disagreement on whether there are maturational restrictions to L2 development spans different theoretical approaches to linguistics. For example, among researchers assuming a dedicated and innate linguistic acquisition mechanism (Universal Grammar, henceforth UG), proponents of an MC account assume that access to this knowledge eventually becomes compromised after native acquisition has taken place. In this tradition it has been proposed that functional categories become unavailable around puberty, so that after this age they can only be acquired if they are pre-instantiated by the L1 (Hawkins & Chan 1997).

Opposed to this position is the view that, regardless of AoA, first and second language acquisition are not qualitatively different. On this view, it is not changes in the neural substrate or reduced accessibility to general principles of grammar which are responsible for diverging behaviour in late second language learners, who are able to establish fully target-like underlying knowledge of the rules and grammar of their L2 but fail to apply it deterministically due to the complex demands of negotiating two competing systems at the same time in on-line language production and comprehension (e.g. Frenck-Mestre, Foucart, Carrasco & Herschensohn 2009; Prévost & White 2000). Such approaches assume that, in order to use her weaker language, a bilingual has to expend a great deal of effort at inhibiting the deeply entrenched routines used by her stronger one, and that this mechanism of inhibition can sometimes fail, allowing the output from underlyingly intact rules to show influence from the L1.[2]

In view of data demonstrating late L2 speakers' failure to consistently apply some target-language rule, a highly controversial question is thus whether they are *underlyingly* or

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[2]   It is not always acknowledged that the process of crosslinguistic influence between a bilingual's language systems is uncontested. The question is thus not whether bilinguals experience crosslinguistic influence (CLI) *or* have a representational deficit, but whether the deficit exists *in addition to* CLI.

superficially different from natives and what the role of AoA is in this context. This is difficult to establish conclusively, partly due to the variability in bilingual ultimate attainment pointed out above: not all L2 learners attain very high to near-native proficiency levels. While the level of proficiency is usually a better predictor of truly native-like behaviour than AoA (highly proficient L2 speakers who started learning the language across a range of ages appear to apply the same processing mechanisms as natives, see e.g. Herschensohn 2009), the two factors are often difficult to disentangle, as proficiency invariably correlates with AoA in representative populations. Furthermore, it has been suggested that highly proficient late L2 learners may have a special aptitude for language learning –while they may appear native-like on a range of tasks, they are underlyingly different, but use superior compensatory strategies (Abrahamsson & Hyltenstam 2008).

The potential contribution of L1 attrition research

Most studies which attempt to ascertain whether late L2 learners can ever attain true native-like L2 knowledge do so by comparing an L2 population against a monolingual baseline. Arguably, however, such a comparison is inherently flawed, as there are many indications that the mere fact of becoming a (proficient) bilingual has ramifications across all language subsystems. For example, Flege (1987) demonstrated that bilinguals have an intermediate pronunciation of some phonemes in both their languages, and Dussias (2004) found a similar bidirectional interference effect with respect to grammatical processing strategies. This implies that the monolingual norm may be something that bilinguals can never fully attain, not necessarily because of a limit to their acquisitional potential but simply by virtue of being bilingual.

It may thus be more appropriate to measure the performance of late learners in their L2 against that of other, similarly fluent and proficient bilinguals, who share the effects of crosslinguistic influence but who have acquired the language under investigation from birth. In order to separate out the superficial, online effect of managing two linguistic systems (which all bilinguals share) and any potential underlying deficit (which, if it exists at all, should only be present in the L2 of late bilinguals), comparisons between L1 attriters and L2 acquirers can therefore provide more insight than the traditional investigations of monolinguals vs. bilinguals (Grosjean 2008).

However, to date, there are very few such studies. Gürel (2002), investigating the L2 acquisition and L1 attrition of binding properties of Turkish pronouns, concludes that there are indeed similarities between the two groups, distinguishing them from unattrited controls.

Similar findings are reported on the distribution of overt vs. null pronouns between near-native L2ers and L1 attriters by Tsimpli et al. (2004) and Sorace and Filiaci (2006). On the other hand, Schmid (2009) finds that attriters consistently outperform a highly advanced L2 speaker on a range of grammatical features.

It is also often difficult or impossible to compare the results from existing investigations of L2 acquisition and L1 attrition due to methodological differences. However, there is one study on advanced L2 learners of German (with English and Dutch as their L1) which allows a tentative comparison with some of the data collected by Schmid (2007): Hopp (2007) describes an investigation of 40 advanced L2 learners of German with English (n=20) and Dutch (n=20) as their L1. In the initial recruitment, participants were self-selected for high L2 proficiency, and their global L2 skills were tested by means of a C-Test[3]. Schmid (2007) also uses a C-Test to study L1 attriters of German in a Dutch (n=53) and an English (n=53) environment, and while the two studies do not employ the same texts, the results seem to suggest that the two populations are similar in terms of overall language skills. As is evident from Table 1, group means are the same for the control groups in the two studies, suggesting that the difficulty level of the two tasks was comparable. Schmid's monolingual participants have a somewhat wider range of results, which may be the result of a larger and/or less homogenous sample size.

Table 1: Results from a C-Test reported by Hopp (2007:200) on L2 learners and Schmid (2007) on L1 attriters of German

		Hopp 2007			Schmid 2007		
	Proficiency level	n	mean	range	n	mean	range
Control group (monolinguals)		20	83	76-93	53	83	59-99
English-German/German-English bilinguals	Near-native	10	71	67-81	53	77	48-95
	Advance	10	53	43-61			
Dutch-German/German-Dutch bilinguals	Near-native	10	76	67-89	53	78	40-99
	Advanced	10	54	46-62			

Hopp's near-native bilingual participants achieve average results on this task that are roughly comparable to those of Schmid's attriting groups, while his advanced speakers lag behind at group level (although there are individuals in the attriting group that fall into the range of the less proficient L2ers). An investigation of perceived nativeness of these speakers, while revealing a minority of the L2ers (37.5%) and a majority of the L1 attriters (72.5%) to be

perceived within the monolingual range, showed that 80% of all L2ers fell into the range delimited by the attriters (Hopp & Schmid, forthc.). This seems to suggest that, on overall proficiency measures and global accent ratings, a sizeable proportion of L2 learners can indeed become as successful as bilingual natives, while monolinguals outperform both, at least at the group level.

In order to see whether such levels of success are attained by the L2ers across the full range of grammatical features, a further task from the two studies was compared: Hopp (2007) elicited samples of free speech by means of a picture description, while Schmid (2007) employed a film retelling. By means of this task, Hopp elicited samples that were on average 1.5 to 2.5 minutes long, while Schmid's samples were somewhat longer (5-6 minutes). Hopp reports the incidence of four error categories per group, lexical and syntactic as well as two morphological categories, case and gender. Fig. 1 shows the distribution of errors per minute across these categories for the attriters, the near-natives and the advanced L2ers.

/ insert Fig. 1 here /

The findings from this comparison have to be treated with caution, firstly because it is not clear whether the two tasks (picture description and film retelling) are actually comparable in terms of their level of difficulty and complexity, and secondly because the samples elicited by Hopp are rather short (approximately one third of the amount of data per person than in Schmid's sample). It would have to be established whether the L2ers can maintain the same low levels of errors in longer stretches of text.

Keeping these limitations in mind, some interesting observations can be made: The L2ers appear to be less successful than the attriters with respect to their lexical and semantic knowledge (this, however, may be an outcome of the task which requires them to be more specific than the film retelling). On the other hand, the near-native L2ers are extremely accurate with respect to their use of German word order patterns, and appear closer to the native controls in this respect than the attriters. Where the two morphological features are concerned, however, the attriters outperform the near-natives, with the exception of the English group which is doing very well on grammatical case. Gender appears to be the most problematic feature for all L2 groups. Even the Dutch near-native group, whose L1 has a

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3   The C-Test is a fill-in test where missing parts of words have to be completed, see e.g. Grotjahn 2010.

system of gender marking that is quite similar to that of German, have perceptibly more errors in this domain than the attriters or the native controls.

The finding that German gender is relatively unproblematic for attriters, but difficult for L2ers is in line with the results from a gender priming study by Scherag et al. (2004), who conclude that "the full acquisition of at least some syntactic functions may be restricted to limited periods in life while semantic and morpho-syntactic functions seem to be relatively inured to loss due to non-use" (B97). These findings support Montrul's argument that L1 attrition will only affect interpretable features, while fossilization in SLA can impact on both interpretable and uninterpretable (formal) features (Montrul 2008:261).

Is attrition an underlying or a superficial phenomenon?

The question of what constitutes emprical evidence for an underlying deficit vs. a target-like representation is anything but trivial. Traditionally, many studies of L2 learning have set criterion levels of accuracy, assuming that a structure should be considered acquired if it is supplied correctly in 80-90% of all obligatory contexts (Ellis 1994:75). Such critical production rates, however, have become highly controversial and rarely employed any more. Many studies assume

> that as L2 acquisition proceeds (and eventually stabilizes), the courses of syntactic and morphological development are independent; that the mapping between them is indirect, and that it may be this mapping itself [...] which is imperfectly acquired, and from which the status of syntactic phrase structure might therefore not be reliably inferred. (Lardiere 1998:2)

On this view, a high error rate on a certain feature does not in itself license the conclusion that the underlying grammatical structure has not been acquired. We should therefore presumably be equally cautious in assuming that a high number of errors made by an attriter means that she has lost the corresponding rule or structure. On the other hand, proponents of the representational deficit account have argued that "apparent target-like L2 performance" should not be interpreted to constitute "evidence for the acquisition of underlying properties of grammar" (Hawkins & Hattori 2006:298). Representational deficit accounts assume that L2 acquirers can learn how to *use* certain grammatical properties, but that they cannot acquire grammatical representations which are identical to those of native speakers, and in their absence, rely on compensatory (non-grammatical) strategies. [4]

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[4] Some researchers have interpreted the predictions of the representational deficit account differently, claiming that nontargetlike representations of grammar should lead to "poor performance across a variety of tasks" and imply "across the board effects" (White, Valenzuela, Kozlowska–Macgregor & Leung 2004: 111f.). These interpretations were explicitly addressed by Hawkins & Tsimpli (2009), who argue that "this confuses performance with competence": apparent accuracy may *either* mean that the underlying feature has been acquired *or* that compensatory strategies (e.g. context-dependencies in the Vocabulary) allow the learners to "look like they are performing in a target-like way".

Where language attrition is concerned, error rates – particularly in free speech – are typically extremely low. Montrul (2008) compares a number of investigations of mature attriters and finds that "[a]t the morphosyntactic level – a highly vulnerable area for both temporary and permanent incomplete acquisition in L1 and L2 – adults under attrition made very few errors, well below 5%" (264f.). This low incidence of error rates in a range of grammatical phenomena appears consistent across attriting populations. Schmid (2010) compares the errors reported by two independent investigations of free speech by German speakers in the US: a longitudinal corpus of eight interviews (total ca. 40,000 words) conducted with a long-term migrant across a period of nearly five years, reported on by Stolberg & Münch (2010), and a cross-sectional corpus of 35 interviews (total ca. 175,000 words) with German Jews who had fled from Germany in the 1930s, collected in the 1990s (Schmid 2002). The incidence of errors on a variety of morphosyntactic phenomena reported in these studies, related to the total number of spoken words, show an astonishingly similar distribution (see Fig. 2).

/ insert Fig. 2 here /

Another investigation of German attriters, described e.g. in Schmid (2007) and Schmid & Dusseldorp (2010), also collected similar autobiographic interviews (total ca. 475,000 words) with long-term German migrants in Canada (n=53), the Netherlands (n=53) and an unattrited control group in Germany (n=53). An analysis of the error categories found in those data confirms the impression that their distribution is relatively similar across attrition groups, except for the fact that the Dutch L2 speakers have fewer word order rule violations than the English L2ers (see Fig. 3).

/ insert Fig. 3 here /

Moreover a comparison of the proportions of errors in the various grammatical categories investigated here made by each speaker group suggests that the relative distribution of agreement errors in the NP has not changed from the native speaker norm: the proportion of errors occuring in the domain of case, gender and plural marking are very similar across attriting and control groups. The most clearly perceptible difference, on the other hand, again concerns word order placement errors: while for the controls and for the Dutch L2 speakers, only ca. 15% of all errors fall into this category, they account for 35% among the English

L2ers. The latter finding is not surprising, since German and Dutch have almost identical word order rules, but both are quite different from English (see Fig. 4).

/ insert Fig. 4 here /

These results indicate that attrition is to some extent influenced by typological factors concerning the two contact languages, appears quite consistent across migration groups who share the same L1 and the same L2 environment, but does not necessarily lead to a distribution of errors that is dramatically different from what we can observe in unattrited native speakers – the number of errors increases, but the domains of errors do not change, at least where morphology is concerned. Furthermore, while all attriting groups have an error rate that appears higher than that of the unattrited natives, the total number or errors is hardly dramatic, with between .13 and 1.5 errors/1,000 words per category and group.

None of the studies above attempts to calculate errors as a proportion of obligatory contexts. However, Schmid (2002) performed a count of sentence constituents and clause types of 20% of her corpus. Taking these numbers as a baseline and extrapolating the total number of obligatory contexts for each of the corpora, it was possible to estimate the proportion of contexts for each grammatical category that had been affected by errors in each corpus. As is evident in Fig. 5, error rates rarely exceed 1% of all obligatory contexts.

/ insert Fig. 5 here /

Error rates and representational deficits
As was pointed out above, neither high nor low error rates can trivially be translated into the conclusion that there is, or is not, a representational deficit. In the studies reported here, all bilingual groups made more morphosyntactic mistakes than the unattrited control group, but still had a vastly higher number of correct than of incorrect instances of all categories (roughly, 99% correct vs. 1% incorrect). In line with the assumptions outlined above, there are two possible accounts for this: On the one hand, the speakers may have underlyingly intact representations but fail to apply these correctly in every single case due to the high cognitive demands of speaking a language that they might not have used for a long time and of inhibiting the language that they are more accustomed to speaking. On the other hand, it might be possible that the underlying knowledge has indeed attrited, but that the speakers have acquired compensatory strategies.

In the context of L1 attrition, the latter explanation appears highly unlikely, for two reasons. Firstly, it has to be assumed that perfecting compensatory, non-grammatical strategies that allow a speaker to mask deviant underlying knowledge is dependent on a large amount of (reliable) input and rehersal – and it is precisely the absence of these two factors which characterizes the process of L1 attrition. A migrant who has lived in an L2 environment for 60 years with little opportunity to read, hear or speak her L1 simply does not have the opportunity to develop and practice strategies that might mask emerging gaps in her underlying grammatical knowledge[5].

Secondly, the ability to develop such highly efficient strategies is presumably not something which all speakers share. L2 acquisition studies typically find only a very limited number of learners who have attained native-like behaviour (most investigations estimate the proportion below 5%, see Hopp & Schmid, forthc.). However, the results shown above point to consistently low error rates across several attriting populations: among close to 150 attriters, not a single speaker has an error rate of more than 6% for any one of the phenomena investigated here. This is in line with the findings from other studies reported by Montrul (2008), which also consistently report average error rates of 5% or lower. Furthermore, Schmid (2004, 2009) has demonstrated that the language used by attriters is not in any way less complex in terms of the distribution of morphosyntactic patterns than that of the non-attrited controls.

Based on these considerations, we have to conclude that in the process of L1 attrition, crosslinguistic interference can, in some instances, lead to the use of non-targetlike structures. These deviances are, however, confined to the surface of the utterance and the result of problems with the on-line integration of knowledge from various linguistic levels, as well as the differential activation and inhibition of the speaker's linguistic subsystems. This is in line with Montrul's conclusion that "languag erosion in a variety of grammatical areas is very unlikely in adulthood, at the level of linguistic competence" (2008: 164).

Attrition vs. incomplete acquisition: the age factor

The argument made so far that L1 attrition effects at the level of morphosyntax are relatively minor and do not affect underlying representations does, however, need to be amended in an important way: a range of studies on L1 loss did indeed find dramatic structural reduction or

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[5] It should be added that, on such a scenario, one would expect a strong impact of external factors linked with L1 rehearsal and use on attrition and maintenance of the L1, but it has been demonstrated by Schmid (2007) and Schmid & Dusseldorp (2010) that such factors exert little, if any, influence on individual results.

even total erosion of grammatical categories. However, all instances in which such 'true' loss has been documented relate to cases where the onset of the attritional process took place before puberty, whereas the studies cited above all deal with post-puberty migrants.

It has therefore become common to draw a distinction between the phenomenon called 'L1 attrition' on the one hand and 'incomplete acquisition' on the other (Köpke & Schmid 2004, Montrul 2002, Polinsky 1997). L1 attrition is taken to be the process that takes place in late bilinguals who emigrated above an age that is commonly set around ten to twelve years, while incomplete acquisition refers to younger migrants or heritage speakers who grew up using a family language and were then exposed to the environmental language, e.g. when they started school.

It should be pointed out here that the term 'incomplete acquisition' may to some extent be misleading, as it suggests that the process of loss affects features that were never fully mastered. In many instances, however, the onset of attrition took place at an age where both monolingual *and* early/simultaneous bilingual children do use a certain grammatical feature in a targetlike fashion, both in terms of accuracy and distribution.

A case in point is Schmitt's (2010) investigation of five Russian-English bilingual young adults who emigrated from Russia to the US in the company of their parents when they were between 8 and 10 years old. Her analysis of free speech samples produced by these speakers focusses on case marking and shows that, while the nominative is target-like in 96% of obligatory contexts, oblique cases are used correctly only 66% of the time. In particular the Instrumental case appears to have been affected by loss, and is on target only in a third of all contexts. These numbers are quite dramatically different from the findings among the late bilinguals presented above, where case was estimated to be used correctly in 99% of all obligatory contexts in German L1 attrition.

However, Schmitt's participants were well above the age at which even irregular case forms have been shown to be acquired in Russian when they left the Russian-speaking environment: Polinsky (2006:12) sets this age at six years. The speakers thus had between two and four years of 'on-target' experience with the Russian case system prior to their migration, but this apparently was not enough to prevent its loss later on. Similarly, Polinsky (2010) reports on a study of the comprehension of Russian relative clauses among monolingual and heritage learners (aged 6;0) and adult monolingual and heritage speakers. She finds no difference between the two child populations and the adult monolinguals. The adult heritage speakers, on the other hand, are outperformed by all other groups, indicating that they had, in fact, mastered this grammatical structure in childhood but lost it later on.

These findings might suggest that after a grammatical feature has been acquired in childhood, a certain period of use is required to render it immune to attrition effects. That conclusion, however, appears doubtful in the light of a number of studies of language loss among pre-pubescent migrants which consistently seem to indicate that the age range of ten to twelve is a watershed in terms of a protective effect against attrition – and these studies deal with linguistic features that are acquired at quite different ages. For example, Yeni-Komshian, Flege & Liu (2000) investigate perceived foreign accent of 240 Korean-English bilinguals with varying ages of onset, and conclude that those speakers who emigrated above age 12 are generally rated within the monolingual range in their Korean, while speakers with AoAs < 12 are not perceived to be natives. Hakuta and d'Andrea (1992) assess global proficiency in Spanish (calculated on the basis of tests measuring productive vocabulary, GJTs and cloze tasks) among Spanish-English high school pupils. They find a correlation between Spanish proficiency and the age at which participants began to speak English for subjects for whom this had occurred below age ten, but no such correlation above that. Finally, Silva-Corvalán (1994) investigates the Spanish Tense-Mood-Aspect distinction, which according to Montrul (2008:108) is mastered around age 3, and also finds that speakers who arrived in the US above age 11 retain around 98% of target-like usage of the subjunctive, while younger arrivals and heritage speakers show a dramatic reduction. (These and other studies with similar results are discussed in more detail in Bylund 2009.)

This cumulative evidence that a range of features which are acquired at varying ages between 3 and 10 appear to stabilize to the point where they become immune to L1 attrition all at more or less the same age – the onset of puberty – seems to be more in accordance with a maturational view than with explanations that depend purely on rehearsal and entrenchment. This implies that, whether or not there is a certain age above which L2 acquisition changes in a qualitative manner, early exposure to a language alone is not enough to attain a stable native speaker status: the age at which full exposure to a language *ceases* is at least as important as the age at which it *starts*.

International adoption: the impact of L1 exposure

Some of the strongest evidence for the claim that native language knowledge is rendered invulnerable to loss through continued use and exposure up to the onset of puberty derives from a number of studies of international adoptees. Such cases are arguably in a different league from other attrition contexts, as they represent the only situation where the amount of continued input from and exposure to L1 can be reliably quantified, if only in a negative way,

as adoptees usually experience a complete break from their birth language. Interest in this topic was first sparked by an investigation of young French adults who were adopted from Korea between the ages of 3 and 9 (Pallier et al. 2003). This study finds no trace left of the birth language, not even recognition of highly familiar series such as the numbers from 1 to 10, and no differential brain activation when the participants were exposed auditorily to spoken Korean. Pallier et al. do not interpret these findings as evidence for a Critical Period, but suggest instead that it is the total cessation of L1 input that is responsible for this reversal. They hypothesize that in additive bilingualism, it is the presence of the L1 that acts as a block to L2 acquisition, and that when all contact to that language ceases, the neural network can be 're-set' to allow sequential monolingualism.

Pallier et al. thus explicitly predict that one "might obtain similar results if we could study a population of subjects who had been delocalized to a new country and severed from their home language late in life, after puberty" (160). This prediction was put to the test in a recent study on German Jews who were rescued from Nazi Germany in 1939 on the so-called *Kindertransporte* – a concerted effort by international charity organizations to rescue 10,000 Jewish children between the ages of 2 and 17 – and placed with English-speaking foster families. Accounts and memoirs from the survivors of these traumatic events suggest that in these situations, language replacement happened as swiftly and completely as it commonly does in other cases of international adoption. If anything, the transition to the new language, and the abandonment of the old one, was speeded along by the outbreak of World War II, after which German became the language of an enemy who was despised and feared. However, an investigation of seven *Kindertransport* survivors who were between 11 and 15 years old when they were thus severed from their first language does not show them to be detectably different in terms of their L1 proficiency from a group of speakers (n=9) who left Germany at the same age and in the same time range, but in the company of their families (Schmid forthc.).

Other investigations have challenged Pallier et al.'s conclusions by attempting to establish whether adoptees might have a re-learning benefit when they attempt to acquire their birth language again later in life (Hyltenstam, Bylund, Abrahamsson & Park 2009, Ventureyra 2005, Zhou 2010, as well as an ongoing research project conducted at the Max Planck Institute Nijmegen by Mirjam Broersma). So far, the findings from these investigations do not unambiguously support either the theory of total language replacement (sequential monolingualism) or of retention and a re-learning benefit. This is clearly one of the areas of

investigation that will be of crucial importance to language attrition studies in the coming years.

Conclusion

In 1982, at the very onset of interest in language attrition, Roger Andersen wrote that "[l]anguage attrition is a special case of variation in the acquisition and use of a language or languages and can best be studied, described, documented, explained, and understood within a framework that includes all other phenomena of language acquisition and use" (Andersen 1982:86). What language attrition studies have revealed in the 30 years following this bold statement is that attrition is probably not that special a case: it is governed by the same processes and mechanisms that are at work in all other aspects of the acquisition and use of languages.

More importantly, however, cumulative evidence has shown that, while Andersen was certainly correct in assuming that attrition can only be studied and understood within a comprehensive approach, it can also be used to evaluate and validate our models and understandings of bilingual acquisition, use and processing. It is not the purpose of the present paper to come to hard conclusions on maturational limitations of L2 learning, which the nature of the data considered here would not allow in any case. What I hope to have illustrated is that investigations of bilingualism which include both L1 attriters and L2 learners can provide significant added value over the more traditional comparisons of L2ers and monolinguals alone. They can help identify those areas where deviances are due to crosslinguistic interference and online problems, and maybe also help us find evidence for or against the controversial representational deficits of late L2 learners.

In particular, L1 attrition can provide an invaluable added perspective on questions of whether bilingualism is constrained by maturational effects during the first decade of human life, and whether there is a qualitative difference between languages learned during and after this period. To date, all evidence derived from language attrition studies points towards an affirmative answer to this question.

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	LEX	CAS	GEN	SYN2
■ CG	0.01	0.04	0.05	0.04
■ ATTNL	0.21	0.11	0.11	0.20
▨ ATTEN	0.28	0.11	0.06	0.20
▢ L2NNNL	1.08	0.42	0.96	0.06
◩ L2NNEN	0.66	0.08	0.29	0.12
◪ L2NLADV	1.12	0.56	1.44	0.31
◪ L2ENADV	0.94	0.39	1.33	0.72
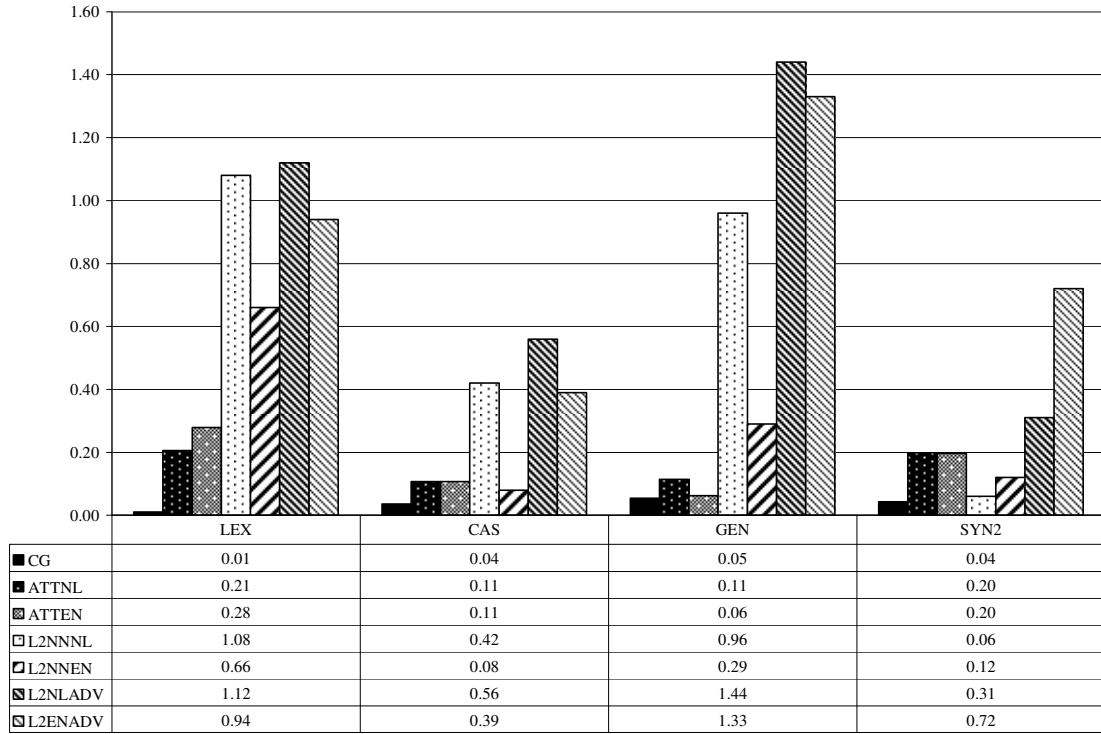
Fig. 1: Errors per minute in Hopp (2007:202) and Schmid (2007)

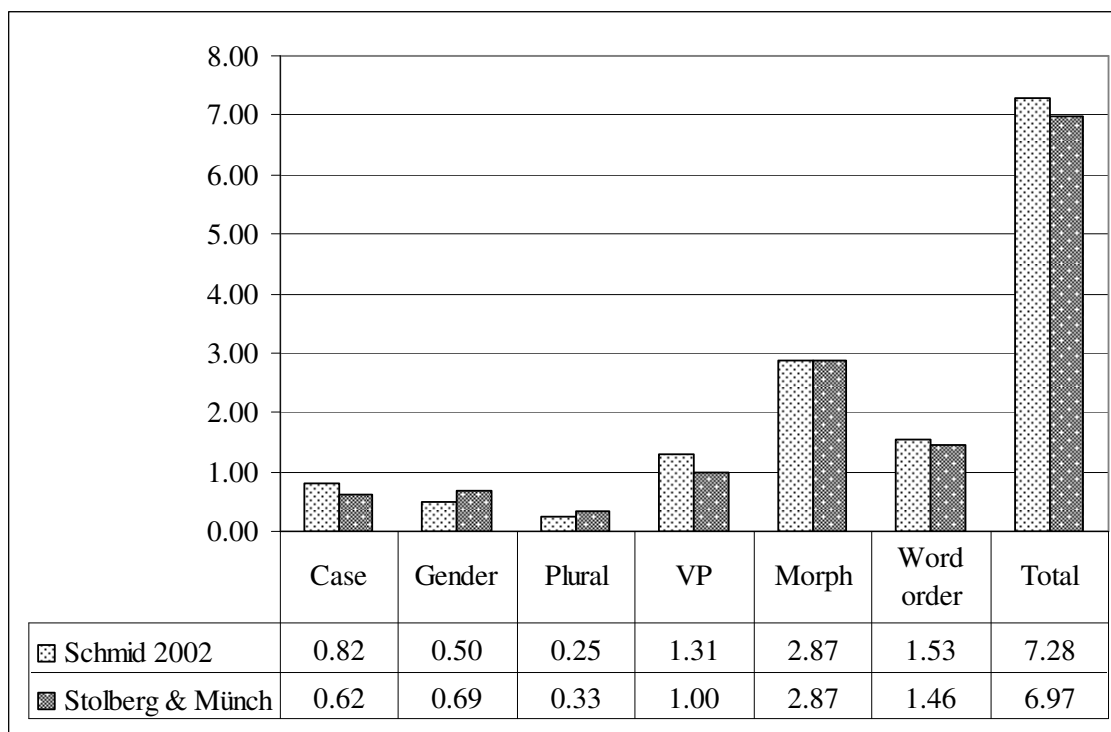|	Case	Gender	Plural	VP	Morph	Word order	Total
⊡ Schmid 2002	0.82	0.50	0.25	1.31	2.87	1.53	7.28
▨ Stolberg & Münch	0.62	0.69	0.33	1.00	2.87	1.46	6.97

Fig. 2: A comparison of morphosyntactic errors per 1,000 words of spoken data, reported by Schmid (2002) and Stolberg & Münch (2010) (Schmid 2010, her Fig. 1, used by permission of Cambridge University Press)

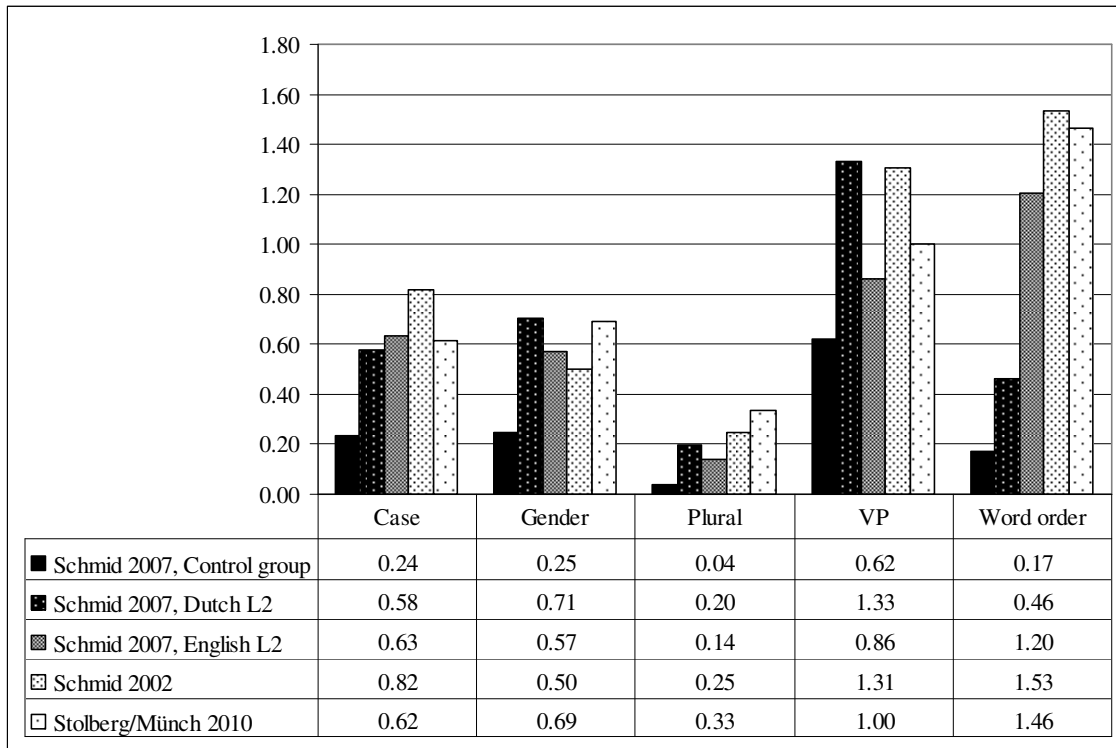|	Case	Gender	Plural	VP	Word order
■ Schmid 2007, Control group	0.24	0.25	0.04	0.62	0.17
▨ Schmid 2007, Dutch L2	0.58	0.71	0.20	1.33	0.46
▨ Schmid 2007, English L2	0.63	0.57	0.14	0.86	1.20
⊠ Schmid 2002	0.82	0.50	0.25	1.31	1.53
⊡ Stolberg/Münch 2010	0.62	0.69	0.33	1.00	1.46

Fig. 3: A comparison of morphosyntactic errors per 1,000 words of spoken data, reported by Schmid (2007), Schmid (2002), Stolberg & Münch (2010) (Schmid 2010, her Fig. 1)
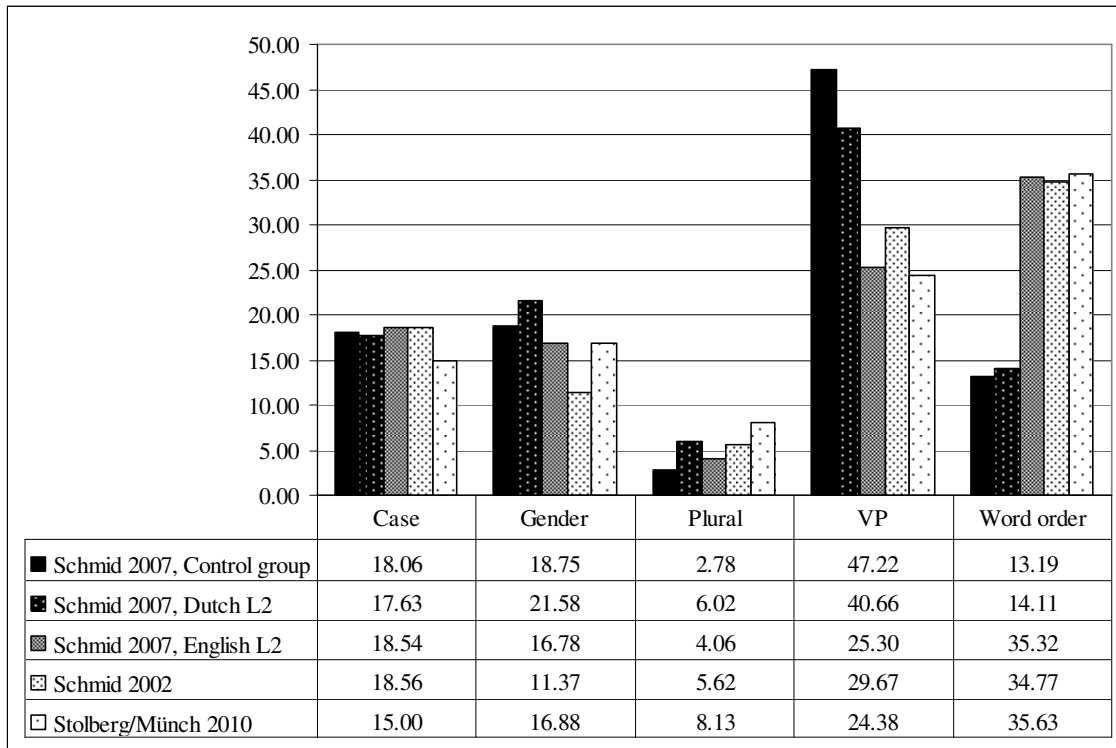
	Case	Gender	Plural	VP	Word order
■ Schmid 2007, Control group	18.06	18.75	2.78	47.22	13.19
▨ Schmid 2007, Dutch L2	17.63	21.58	6.02	40.66	14.11
▨ Schmid 2007, English L2	18.54	16.78	4.06	25.30	35.32
⊠ Schmid 2002	18.56	11.37	5.62	29.67	34.77
⊡ Stolberg/Münch 2010	15.00	16.88	8.13	24.38	35.63

Fig. 4: Percentage of total errors across grammatical domains

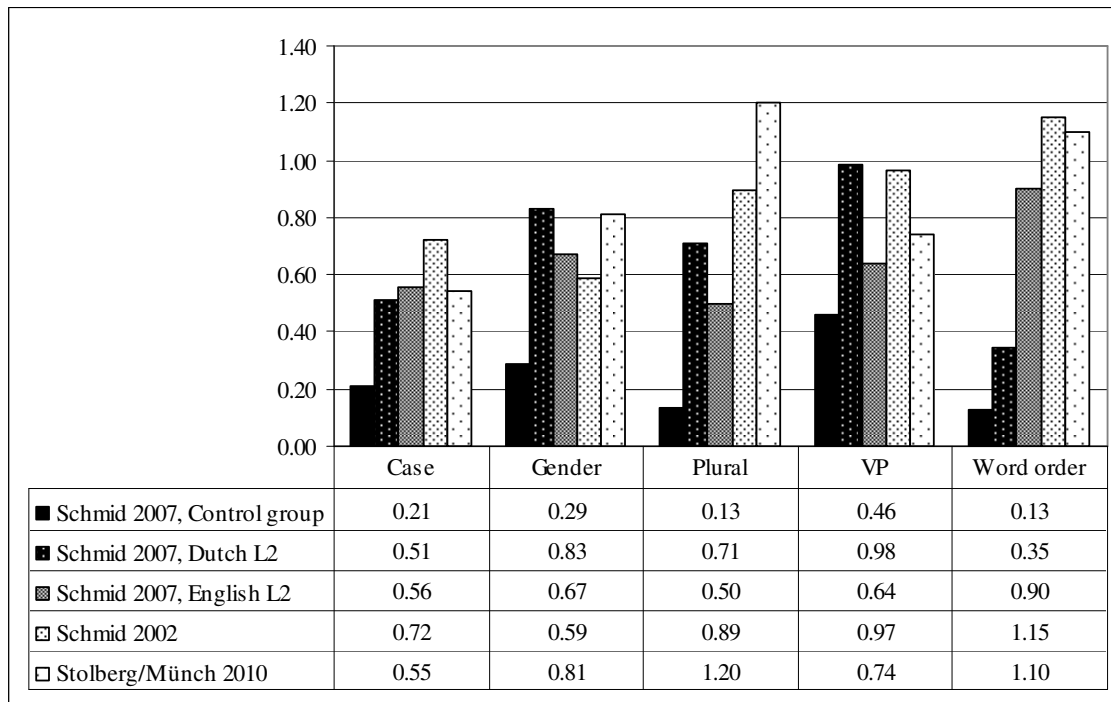|	Case	Gender	Plural	VP	Word order
■ Schmid 2007, Control group	0.21	0.29	0.13	0.46	0.13
■ Schmid 2007, Dutch L2	0.51	0.83	0.71	0.98	0.35
▦ Schmid 2007, English L2	0.56	0.67	0.50	0.64	0.90
⊡ Schmid 2002	0.72	0.59	0.89	0.97	1.15
☐ Stolberg/Münch 2010	0.55	0.81	1.20	0.74	1.10

Fig. 5: Proportion of errors per obligatory context, estimated on the basis of a count of sentence constituents and clause types for 20% of the corpus investigated by Schmid (2002)