Contact x time: external factors and variability in L1 attrition

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Abstract

Investigations of the language behaviour of immigrant communities usually find that the degree of maintenance of the heritage language or shift to the language of the host country differs both between immigrant communities and between individuals. On the one hand, group comparisons between migrants and controls typically show signs of attrition among the experimental populations. On the other, investigations of individual linguistic development within one group of immigrants also show great variation between speakers where the degree of L1 maintenance or deterioration is concerned.

Two decades ago, an explanation for such differences in L1 proficiency was proposed which invoked an interaction of two factors: time spent in emigration and amount of contact with the L1. In a study of Dutch migrants in France, De Bot, Gommans & Rossing (1991) established that there was a correlation between attrition effects in free speech and length of residence, but that this effect was only apparent for those speakers who had very little contact with their L1.

The present investigation attempts to replicate this finding in a large-scale study of the attrition of L1 German in an L2 English and an L2 Dutch setting. It finds that, while length of residence has no explanatory validity when assessed across the entire population, a differential investigation of subgroups of speakers with different amounts of contact does show an impact of time with respect to performance on formal tasks, perceived foreign accent, and accuracy in free speech. Interestingly, with the exception of accuracy measures, this correlation obtains not only for those migrants who have the least contact with L1, but also for those with the most. It is argued that both very frequent and very infrequent use of the L1 can accelerate attrition, either through contact-induced change within a bilingual migrant community, or through lack of rehearsal.

Introduction

For most of the 20th century, research on bilingualism was characterized by the perspective of the monolingual native speaker as the norm. Achievement in second languages was measured against this yardstick, and mature first language competence was assumed to be the stable and unchanging baseline. Weinreich pointed out as early as 1953 that 'interference' between two language systems, "those instances of deviation from the norms of either language which occur in the speech of bilinguals" (Weinreich 1953:1), is a phenomenon which can affect both second language (L2) and first language (L1). However, the recognition that a bilingual is not two monolinguals represented within the same mind/brain (Grosjean 1982) did not become widely accepted until much later. It was not until psycholinguistic investigations were able to demonstrate that all of a bilingual's language systems are, to some degree, active and in competition with each other at all times (e.g. Grosjean 2001) that the 'multicompetence' view of a wholistic and interconnected system of knowledge and use of more than one language was formulated (Cook 2003).

This perspective implies that the way in which linguistic development has been investigated may fall short of capturing many of aspects of the change in knowledge and processing it entails. Crucially, development – even among adult speakers – is not confined to the L2 system and may not be linear or even unidirectional. In other words, a developing linguistic system does not invariably change towards higher, or more native-like, values in factors such as complexity, accuracy and fluency, but may exhibit signs of changes away from the native norm. Furthermore, the wide-spread and pervasive concept of a 'native speaker' may in itself be an idealization (for an overview of definitions and problems relating to the 'native speaker' construct see Dostert 2009).

This view entails that the development of the second language has ramifications throughout the overall system of multicompetence, and that one should therefore also expect the knowledge and use of the first language to be involved in this development. A bilingualism effect in the L1 – behavior and processing which differs to some degree from that of monolingual native speakers – is therefore to be expected for all speakers of more than one language. In this vein, it has been demonstrated that there is crosslinguistic interaction in the area of the mental lexicon (a facilitating effect for cognates and delayed access for non-cognates, e.g. Dijkstra & Van Heuven 2002), in sentence processing (Dussias 2004) and in the structuring of phonetic space (Flege 1987; Fowler, Sramko, Ostry, Rowland and Hallé 2008; Sundaraa, Polkaa, & Genesee 2006).

Such effects are usually very subtle and not readily apparent in naturalistic interaction. In order to detect them, sophisticated techniques and measurements, such as reaction-time paradigms for the mental lexicon or highly sensitive auditory analyses in the case of phonetics, have to be applied. However, among speakers who have experienced language dominance reversal, i.e. who speak their second language almost exclusively in their daily lives and only rarely have occasion to use their L1, the L2 impact on the native system can become more immediately visible. Lexical retrieval difficulties can eventually impair communication and cause a rise in disfluencies (Schmid & Beers Fägersten 2010), the interaction between grammatical systems can lead to an increase in non-targetlike structures (Tsimpli, Sorace, Heycock & Filiaci 2004), and a foreign accent can develop which is perceptible in communication with other native speakers (De Leeuw, Schmid & Mennen 2010, Hopp & Schmid, forthc). When the L1 has changed to such an extent, for example in the case of migrants, this development is commonly referred to as first language attrition.

Attrition research has often wrestled with the problem of whether it is possible to establish a distinction between ‘normal’ L2 influence on L1 and L1 attrition ‘proper’. On this

view, all bilinguals experience 'normal' cross-linguistic influence (CLI) to some degree, as is suggested by, among others, Cook (2003). The problem for attrition research is then if and how this type of CLI can be distinguished from the (consequently to some degree 'abnormal') process of L1 attrition, which is confined to migrants. It has recently been suggested that this distinction is not only impossible to draw, but also unhelpful, as "bilinguals may not have one 'normal' language (in which they are indistinguishable from monolinguals [...]) and one 'deviant' one (in which knowledge is less extensive than that of monolinguals, and also tainted by interference from L1 in SLA and from L2 in attrition)" (Schmid & Köpke 2007: 3). Rather, while L1 attrition may be the most clearly pronounced end of the spectrum of multicompetence, and therefore a more satisfying object of investigation than the L1 system of a low-proficiency L2 learner (which may not show substantial and noticeable signs of change), attrition is undoubtedly part of this continuum, and not a discrete and unique state of development.

Attrition and variability

Quantitative investigations of L1 attrition typically find differences in group averages between migrants[1] and non-attrited controls. In particular, L1 attriters are usually outperformed on measures such as

a. performance on controlled tasks
b. lexical diversity (range of vocabulary used) in free speech
c. complexity, accuracy and fluency in free speech
d. perceived native-likeness in pronunciation

Furthermore, differences between attriters and controls are usually found not only for group averages but also in the standard deviations: the range of scores attained by attriters are more varied than those of the controls (e.g. Schmid 2007; Keijzer 2007). Individual performance, too, is less consistent than in control populations: while some attriters perform within the native range on some tasks but clearly fall outside this range on others, other speakers appear to have retained native proficiency across the full spectrum, and others still fail to attain this norm on any task.

Findings on interindividual variability raise the question of what (external) factors may condition the development of the linguistic system in L1 attrition. One framework which has been proposed in this respect is the *Activation Threshold Hypothesis* (ATH, e.g. Paradis 2004, 2008). This neurolinguistic approach to bilingualism assumes that all items of linguistic knowledge which reside in the mind have a certain activation threshold associated with them. This threshold determines the amount of neural stimulation necessary to activate the linguistic item in question, and is a function of the *frequency* and *recency* with which the item has previously been called upon. Every time an item is accessed the activation threshold is lowered, so that less stimulation is needed subsequently to access it again. However, during the time which elapses between those two points of access, the activation threshold gradually increases, so that items which have not been accessed for a long time require more effort.

Very broadly speaking, the ATH therefore predicts that L1 attrition may be affected by *time* (the length of residence (LOR) in the migration environment) and *contact* (the amount of use which the attriter makes of his or her L1). This prediction dovetails exactly with results from an investigation reported by De Bot, Gommans and Rossing (1991). For this study, 30 Dutch migrants in France were rated for their L1 proficiency on the basis of naturalistic speech samples elicited by means of a method known as the *Foreign Service Interview* (FSI,

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[1] Following the argument made above that it is impossible to draw a clear line between non-attrited bilinguals and attriters,

Clark 1979, Jones 1979). The authors present evidence for an intriguing interaction of the two factors *time* and *contact*, in particular with respect to the holistic score speakers achieved on a range of linguistic features such as pronunciation, vocabulary, grammar etc. De Bot et al. conclude that

> The relation between FSI scores, 'contact' and 'time' is a complex one: there is only a linear relation between 'time' and attrition when there is little contact with the first language. [...] An implication of this finding is that in measuring language contact as used in language loss research, 'time elapsed since emigration' and 'amount of contact' should not be used as independent measures: 'time' only becomes relevant when there is not much contact with the language (De Bot et al. 1991: 94).

A similar interaction between the two factors *time* and *contact* is found in an investigation of response times on a picture naming task among adult Dutch immigrants living in Israel (Soesman 1997). In line with the findings by De Bot et al. (1991), Soesman concludes "that *contact* affected attrition only under the condition of long time since emigration and that *time* affected it only under the condition of low L1 contact" (1997: 190).

Both these studies therefore suggest that the frequency and recency effect predicted by the ATH may be operative in L1 attrition only in conjunction with each other: attrition effects may become visible only after a long span of time during which there has been little contact with the L1. Such an interaction effect may have played a role in results from other investigations which have found low or no correlations between degrees of performance on the one hand and amount of L1 use on the other (e.g. Schmid 2007; Schmid & Dusseldorp 2010) or a lack of impact of length of residence (for an overview see Köpke & Schmid 2004).

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the terms ‘migrants’ and ‘attriters’ will henceforth be used interchangeably.

It certainly merits further investigations, particularly given the fact that the studies by De Bot et al. (1991) and Soesman (1997) are limited in scope and do not compare the performance from their attriters to that of an unattrited control population. The present paper will apply the hypothesis that there is an interaction effect between *time* and *contact*, which will lead to more pronounced attrition effects in long-term attriters who have little or no occasion to use their first language, to a large corpus of data from the attrition of L1 German.

The study

Participants

The present paper reports on an investigation of German migrants in Canada (n = 53) and the Netherlands (n = 53). The data collected from these speakers are compared against a control group (n = 53) of speakers who lived in Germany all their lives and have relatively minimal competence in and exposure to other languages. Participants in all three groups were recruited through a combination of advertisements in local newspapers and other media, personal contacts and word of mouth. All of the data were collected in 2004 and 2005 in the country of residence of the speakers; for a concise overview of participant characteristics see table 1.

Table 1

Overview of participant characteristics

	bilingual speakers (attriters)				reference group (controls)	
	GECA: Germans in Canada (n=53)		GENL: Germans in NL (n=53)		GECG (n=53)	
	mean	stdev	mean	stdev	mean	stdev
Age at experiment	63.23	10.92	63.36	9.55	60.89	11.60
Age at migration (min. 17 yrs)	26.13	7.15	29.08	7.53	-	-
Length of residence (LOR)	37.09	12.37	34.28	11.13	-	-

minimum LOR	9	14
maximum LOR	54	58

Measuring factors such as language contact and attitudes is always problematic, since they cannot be independently and objectively elicited and observed. This study, like others attempting to gauge the impact of frequency of contact, therefore had to rely on self-assessments despite the fact that these may not always be accurate or reliable. A sociolinguistic questionnaire (SQ) containing a total of 78 items on L1 use in a variety of situations, attitudes towards the L1, to the native and the host culture, and towards language maintenance and transmission to the next generation, was used (the questionnaire is available in a range of languages on www.let.rug.nl/languageattrition and discussed in detail in Schmid & Dusseldorp 2010 and Schmid, forthcoming).

Measures of attrition

The degree of proficiency which each individual attriter retained in her/his L1 was tested through a combination of formal tasks, self-assessments and an analysis of lexical richness and complexity, overall accuracy, and perceived foreign accent in free speech. Specifically, all participants completed the following tasks:

Formal data

1. An untimed GRAMMATICALITY JUDGMENT TASK (GJT) in which participants were presented with sentences on a laptop computer in written and audio format simultaneously. The overall test consisted of 48 items, of which 22 were ungrammatical. The ungrammatical items were classified into various grammatical categories, based on mistakes that had frequently occurred in the data from a previous investigation of L1 attrition of German (Schmid 2002). Ungrammatical sentences were either used exactly as

they had occurred in that corpus or semantically adapted in order to achieve a more neutral context. Here are two examples of ungrammatical sentences:

(1) Das Gymnasium in Düsseldorf war **nicht eine* besonders gute Schule.

"The gymnasium in Düsseldorf was not a particularly good school."

(standard German requires synthetic negation, where the negator *nicht* and the indefinite article *eine* are contracted to *keine*)

(2) Ein Mann, **mit dem ich war* an der Universität, ist jetzt Bundestagsmitglied.

"A man *with whom I was* at university is now a member of parliament.

(German word order requires a verbal bracket, with the prepositional phrase *an der Universität* appearing between the personal pronoun *ich* 'I' and the verb *war* 'was')

Speakers were asked to indicate if the sentence was grammatically correct or incorrect (there was also the option to indicate that they were uncertain, this, however, was used in only an extremely small number of cases). If the subject had identified a sentence as ungrammatical, s/he was then asked to indicate what the correct alternative should be. Every target-like response on an ungrammatical item was awarded one point, so that the maximum total score on this task was 22, reflecting a faultless performance. This score was then recalculated to a score between 0 (0% correct) and 1 (100% correct).[2]

2. A C-TEST (CT, see Grotjahn 1987). The C-TEST is a fill-in test in which the subject is presented with a text from which parts of words have been removed following a pre-determined schema and asked to complete the missing parts. The test consisted of five texts between 80 and 100 words in length, each of which contained 20 gaps. The C-TEST score was computed as the number of times a gap was filled in correctly, a high score on

[2] There has recently been much debate on the validity of the GJ in general (Altenberg & Vago 2004), the use of binary vs. scaled discriminators (Bard, Robertson & Sorace 1996; Weskott & Fanselow 2008) and the importance of timed vs. untimed reactions (Köpke 1999; Köpke & Nespolous 2002). We opted for a format which invited binary responses and untimed reactions, since many of the participants were relatively old and unfamiliar with using computers. Requiring them to interact with computers under time pressure did not seem a responsible choice.

the C-TEST reflects good performance, with a possible range of 0-100. (Sample texts are available on www.let.rug.nl/languageattrition.)

Two SEMANTIC VERBAL FLUENCY TASKS (VFT), where participants are asked to name as many items in a specific lexical category as they can within the space of 60 seconds (Roberts & Le Dorze 1997). The two stimuli used were 'animals' on the one hand and 'fruit and vegetables' on the other. The final VFT measure was an averaged measure of the score on the two individual tasks. A high score on the VFT task reflects good performance.

Free speech

3. A set of controlled, largely monological, speech samples was elicited by means of the Charlie Chaplin film retelling task described by Perdue (1993), which involves watching and then narrating a 10-minute excerpt from the silent movie *Modern Times*. The following variables were established on the basis of these samples:

   LEXICAL RICHNESS: the diversity of the vocabulary used by the speakers was determined on the basis an adjusted type-token measure[3] referred to as D. D is based on random sampling of stretches of 50 words, i.e. it is not sensitive to variation in text length (see McKee, Malvern & Richards 2000). A high score reflects low type-token ratios, i.e. more lexical diversity. Since there is some doubt on the validity of type-token based measures, in particular among advanced speakers (Vermeer 2000), two further measures were established. These were based on a lemmatized count of all lexical items (adjectives, nouns and verbs). For each speaker, it was then determined which proportion (%) of the total lexical items s/he had used in the re-telling consisted of items which were among the 50 most frequent in the entire corpus (MOSTFREQ), and which proportion (%)

[3] The type-token ratio of a text is the total number of words, divided by the total number of different lexical items. Since language contains a large number of very high-frequency function words, longer texts will automatically have a lower type-token ratio.

consisted of words which were unique, that is, had been used only once in the entire corpus (UNIQUE).

FLUENCY: the incidence of filled pauses (FP), empty (or silent) pauses (EP), repetitions (RP) and self-corrections or retractions (RT), standardized per 1,000 words (for a detailed description of the procedures adopted see Schmid & Beers Fägersten 2010).

NON-TARGETLIKE LANGUAGE USE: total violations of grammatical rules, such as case, gender, tense and word order (dialectal variants and colloquialisms were not counted as errors), standardized per 1,000 words (ERR)

FOREIGN ACCENT RATING (FAR): for a subset of those interviews which were of sufficient quality (n=77), foreign accent ratings on a 6-point Likert-scale were elicited from 19 native German judges (the experimental procedure is described in detail in De Leeuw, Schmid & Mennen 2010). A high score reflects the judgment that the rater was certain that the speaker was not a native speaker of German, a low score indicates certainty that s/he was.

Results

Indications of attrition

Group differences on the measures of attrition described above were established by means of One-way ANOVAs, which revealed poorer performance of the migrants on some, but not all, measures (see Table 2). Effect sizes (η^2) were rather small, suggesting that the group differences were hardly dramatic.

Table 2

Group differences on experimental tasks (One-way ANOVA with Tukey Post-Hoc procedure)

			GECA	GENL	GECG	F (2, 156)	p	η^2
Controlled tasks								
	Grammaticality judgments	mean	0.82	0.83	0.84	.661	.518	.01
		sd.	0.12	0.10	0.11			
	C-Test	mean	75.26*	77.21	82.21	5.025	<.01	.06
		sd.	11.61	13.86	8.90			
	Verbal Fluency Task	mean	20.24*	20.91*	25.09	16.943	<.001	.18
		sd.	4.62	4.68	4.67			
Free speech								
Lexical diversity								
	D	mean	72.65	71.84	77.69	1.654	.195	.02
		sd.	17.71	17.59	6.32			
	% of most frequent lexical items	mean	63.44	65.56*	61.08	3.485	<.05	.04
		sd.	8.40	8.48	8.20			
	% of unique lexical items	mean	3.82	2.72*	4.92	7.099	<.01	.09
		sd.	2.50	2.42	3.76			
Fluency								
	filled pauses/1,000 words	mean	38.67	58.30**	36.61	6.962	<.01	.08
		sd.	29.52	39.49	27.13			
	empty pauses/1,000 words	mean	16.17**	16.23**	6.32	9.003	<.001	.11
		sd.	15.79	15.12	9.64			
	repetitions/1,000 words	mean	4.88**	3.58**	2.23	4.430	<.05	.06
		sd.	5.71	3.50	2.94			
	retractions/1,000 words	mean	16.96*	16.98*	12.38	5.157	<.01	.06
		sd.	9.45	9.71	8.10			
Accuracy								
	errors	mean	9.11**	9.30**	1.80	18.070	< .001	.19
		sd.	5.91	1.99	2.56			
Perceived foreign accent		mean	3.32**	3.06**	1.89	8.048	<.01	.18
		sd.	1.23	1.51	0.60			
		n	36	24	17			

GECA: German migrants in Canada, GENL: German migrants in the Netherlands, GECG: German controls; *: difference from control group < .05, **: difference from control group < .01 (Tukey)

These findings indicate a reduced proficiency among the attriting groups for the productive controlled tasks, but not for the GJT. In free speech, the type-token ratios appear unaffected by attrition in this sample. However, the attriters in the Netherlands use a larger proportion of

very frequent lexical items and a lower proportion of unique lexical items than the controls. A similar trend can be observed for the attriters in Canada, but this difference is not significant ($p = .219$ for MOSTFREQ and .098 for UNIQUE). On fluency, accuracy and pronunciation, all attriters are outperformed by the controls (with the exception of filled pauses, where the difference is significant only for the attriters in the Netherlands).

The impact of external factors

Contact

Schmid & Dusseldorp (2010) conducted regression analyses in order to establish to what degree external predictors relating to the amount of use the speakers made of their L1 might account for the variance among the attriting groups – in other words, to what degree frequent or infrequent L1 use would make a speaker attrite more or less. Surprisingly, the amount of use which the speakers made of their first language had very low impact on any of the outcome variables, and some factors, such as the use of the L1 with friends, did not impact on performance on any of the tasks. In particular, all of the fluency measures appeared entirely unaffected by any of the predictors. In addition, De Leeuw, Schmid & Mennen (2010) established that perceived foreign accent was influenced to some degree by the amount of use the speakers made of their L1, but only in formal situations or in contact with other monolingual speakers. Use of L1 in bilingual mode – that is, in informal conversations with other bilingual speakers – was not significantly related to the degree of perceived foreign accent.

Since 'amount of L1 exposure' is typically and intuitively taken to be the strongest predicting factor for L1 attrition, these results were very unexpected. However, a number of ongoing investigations of the attrition of other languages, using the same experimental design,

have come to corroborate these findings (Cherciov 2010; Dostert 2009; Keijzer 2007; Yilmaz, in prep), indicating a much lower importance of the frequency of L1 use for L1 maintenance, particularly in informal, everyday situations, than had previously been assumed.

For the purpose of the present investigation, a cumulative variable *contact* was established for the attriters, based on all items in the sociolinguistic questionnaire which related to the frequency of interactive L1 use. This variable averaged participants' responses to questions about their use of German with their partner (5 questions), children (4 questions), grandchildren (4 questions), friends (3 questions), at church or in clubs (3 questions), in contact with speakers back in Germany (2 questions), for professional purposes (1 question) and the total amount of use they made of their L1 (2 questions). All questions were on a 5-point Likert scale, with 1 indicating very frequent use of German in this situation, and 0 indicating very little or no use of German. Table 3 shows the distribution of this variable for both groups; the difference between the attriters in Canada and the attriters in the Netherlands was not significant ($t(104) = .788$, $p = .897$).

Table 3

Distribution of CONTACT across attriting groups

	Migrants in Canada	Migrants in the Nehtherlands
mean	0,37	0,39
sd	0,21	0,22
max	0,87	0,90
min	0,02	0,06

Correlations of this variable with the outcome variables showed a significant interaction with the C-Test results ($r = .210$, $p < .05$) and the foreign accent rating ($r = -.377$, $p < .01$). No other correlations were significant (see Appendix, table 1).

Time

For the purpose of the present investigation, a correlation between the scores achieved by the attriters and their LOR in Canada or the Netherlands was then calculated. There were significant negative correlations between LOR and the scores on the formal tasks (grammaticality judgment task: $r^2 = -.259$, $p < .01$; C-Test: $r^2 = -.257$, $p < .01$; Verbal Fluency Task: $r^2 = -.229$, $p < .05$), but no significant correlations were found for any of the free speech measures (see Appendix, table 1).

On the surface, it therefore appeared that a longer migration period might impact negatively on performance on controlled tasks, but not on free speech. There is, however, an alternative explanation related to the particular sociohistorical situation which obtained in the second half of the 20th century. Migration from Germany to both Canada and the Netherlands in the 1950s was particularly attractive for skilled laborers with a relatively low degree of formal education, while later migrants were often more highly educated. This hypothesis was tested by comparing average LOR among the four educational groups represented in this sample.

Table 4

Average LOR for different levels of education represented in the sample

Educational level	GECA		GENL		GECG
	n	LOR (mean)	n	LOR (mean)	n
Volksschule/Hauptschule (8-10 years of school, in preparation for an apprenticeship)	13	43,46	9	31,56	13
Realschule/Mittlere Reife (10 years of school, in preparation for clerical work)	22	41,27	21	39,14	23
Fachabitur/Abitur (12-13 years of school, in preparation for university training)	5	30,40	6	32,00	6
Higher education (university or polytechnic degree)	13	26,23	17	30,53	11

This overview shows a tendency for speakers with a longer LOR span to have fewer years of formal education – a factor which can be expected to influence performance on formal or

controlled tasks. In order to assess the impact of this factor, analyses of covariance were performed on the data from the attriters for those outcome variables for which correlations with LOR had previously been found (the formal tasks). The data were examined with level of education as the main factor and LOR as a covariable. The results confirm the hypothesis that the differences observed are due to education level, which is a significant variable for all outcome variables except verbal fluency, and not to LOR, which is not significant for any of the tasks.

Table 5

ANCOVA by Edu with LOR

		p	η^2	Edu	p	LOR	p
Grammaticality judgment task	F (4. 101) = 5.149	< .01	.169	F = 4.151	< .01	F = 2.813	.097
C-Test	F (4. 101) = 10.547	< .001	.267	F = 10.905	< .001	F = .308	.580
Verbal Fluency Task	F (4. 101) = 3.188	< .05	.112	F = 2.257	.086	F = 2.571	.112

The interaction of CONTACT and TIME

In order to assess a potential interaction effect between the total amount of L1 use and LOR (that is, an interaction between *contact* and *time*), linear regressions were conducted on the attriters' scores of the outcome variables presented above. The variables were entered in three blocks, beginning with education, which had already been demonstrated to impact on some of the scores (in particular for the controlled experimental tasks). The second block contained the variables CONTACT and LOR.[4] The third block contained an interaction variable which was calculated as the product of CONTACT and LOR.

[4] Since in the case of *contact* it was predicted that the correlation with attrition would be a negative one (more contact is assumed to be conducive to maintenance), while LOR was assumed to correlate positively with attrition (a longer time in migration entails more attrition), LOR was multiplied with (-1) for the purpose of this regression, and also for the calculation of the interaction variable.

The full results from these regressions are presented in Appendix 1 table 2 (for the controlled tasks) and 3 (for the free speech measures). The only outcome variable for which the interaction of LOR and contact becomes significant is the score on the Verbal Fluency Task, for which both variables individually are also significant predictors. In all other cases, neither CONTACT or LOR alone nor their interaction has significant predictive value.

These findings imply that, if there is an interaction between time and contact, it is not a straightforward or linear one. This assumption is in line with the findings by De Bot et al. (1991) and Soesman (1997), who found an interaction effect *only* in those cases where there had been little contact for a long time. In order to assess whether such a selective effect might apply in the data at hand, the attriters were divided into four subgroups of similar size on the basis of their total amount of contact (see table 6 below).

Table 6

Groupings of attriters according to total interactive L1 use

	Total amount of interactive L1 use			
	very little use	rare use	some use	frequent use
n	26	27	26	27
mean L1 use	0,12	0,27	0,45	0,67
sd	0,06	0,04	0,06	0,10

For each of these subgroups, the correlation between LOR and each of the outcome variables was then calculated separately. The findings from these correlations are summarized in table 7.

Table 7

Correlations between LOR and outcome variables per amount of contact (the full statistics are summarized in the Appendix, table 4)

	very little use r^2	rare use r^2	some use r^2	frequent use r^2
GJT	-.483*	-.032	-.142	-.331
CT	-.368(*)	.004	-.103	-.463*
VF	-.454*	-.124	-.020	-.142
D	-.210	-.035	-.048	-.324
MOSTFREQ	.189	.143	-.066	-.229
UNIQUE	-.149	-.140	.089	.188
EP	-.075	-.011	-.286	.185
FP	-.147	.046	.285	.539**
RT	.216	.184	.338	-.115
RP	-.060	.110	.062	.415*
FAR	.680*	-.103	-.268	.597*
ERR	.423*	.153	.108	.084

(*): p = .065, *: p< .05, **: p < .01

There are several interesting observations to be gained from this analysis. Firstly, LOR does not play a role for the two intermediate CONTACT groups at all. On the other hand, it is striking that for the scores on the formal tasks and for perceived foreign accent in free speech, both the group with the *lowest* and with the *highest* amount of contact appear to show some impact of LOR. Fluency and lexical diversity in free speech appear unaffected by LOR for all groups (except for filled pauses, which have already been shown to behave rather differently in the context of attrition than the other fluency measures, see also Schmid & Beers Fägersten 2010). Accuracy, on the other hand, is affected by LOR for only those speakers who have very little contact with their L1.

Discussion

The findings presented above illustrate that the process of language attrition represents a diverse and complex development. Investigations of the population as a whole reveal some clear attrition effects among the migrants: they are outperformed by the controls on formal

tasks, such as a C-Test and a verbal fluency task (although not on an untimed grammaticality judgment task). In free speech, too, some differences were found between attriters and controls: while overall lexical diversity, as measured by the TTR-based variable D, was unaffected, a tendency was found among the attriters to overuse very frequent lexical items and to underuse the rather infrequent ones. The attriters' speech was also different from that produced by the controls in terms of fluency (there were more frequent hesitation phenomena, such as pauses, repetitions and self-corrections), accuracy (the attriters had a higher incidence of non-targetlike structures) and native/foreign accent (the attriters were perceived by native listeners to be less native-like than the controls).

These indications of changes in the performance of L1 attriters on different tasks are apparently affected differentially and non-linearly by a variety of external factors. The analysis presented above has demonstrated the importance of taking all of these factors into account in investigations of L1 attrition.

This can firstly be illustrated on the basis of collinearity which was found in the data at hand for education and length of residence. A significant correlation was established between LOR on the one hand and the attriters' scores on formal tasks (but not on any of the free speech variables) on the other. At the surface, such a correlation might indicate that the ability to complete formal tasks, such as grammaticality judgments or a C-Test, might deteriorate over time in migrant populations. However, further investigations demonstrated that among the sample investigated here, those attriters with a lower level of formal education had a longer average emigration span. This composition of the experimental population is the outcome of the sociohistorical conditions of migration from Germany during the 2nd half of the 20th century. A further analysis which controlled for education found no impact of LOR on performance on the formal tasks.

The conclusion that LOR is not a significant predictor of attrition in the sample at hand has two possible implications. Firstly, since the minimum LOR in the sample at hand is 9 years, it is possible that attrition takes place largely within the first decade of residence in a foreign country, and then either slows down or stops entirely. This is in line with findings from earlier studies, such as De Bot & Clyne (1994), who found little change in L1 proficiency among long-term migrants over a period of several years (see also Köpke & Schmid 2004: 12). On the other hand, it is also possible (and even likely) that there is some further deterioration of the L1 system, but that this process takes place at different rates and therefore affects the subcomponents of language proficiency differentially in different speakers.

The finding that the total amount of use which speakers make of their L1 does not have a measurable effect on their performance on any of the tasks investigated here is surprising, but not entirely unexpected, as it confirms a number of prior analyses on these and other similar data, collected from various migrant populations (Keijzer 2007; Cherciov 2010; Yilmaz, in prep.). This implies that the *frequency* and *recency* effect predicted by the Activation Threshold Hypothesis may not be as powerful as expected with respect to knowledge of the native language. Schmid (2007) has proposed that with respect to a mature L1 system, a kind of saturation effect might apply: an L1 user who has spoken his or her language monolingually in daily life until early adulthood might have achieved such a deep entrenchment of that knowledge that its rehearsal and reactivation is no longer a necessary factor for its maintenance (see also the discussions of the long-term retention of L2 skills and Neisser's 1984 Critical Threshold hypothesis discussed in Hansen, this volume and Murtagh, this volume). This would then indicate that the differences which can be observed between attriting and control populations are due not so much to problems with the *activation* of the L1, but with the *inhibition* of the L2. This conclusion is further validated by the fact that the

one variable which seems to be a consistently significant predictor of attrition effects across a variety of populations is the use of the L1 for professional purposes – that is, in relatively formal settings. In such contexts, code-switching or code-mixing is typically not considered appropriate, and speakers who use their L1 in this mode on a regular basis are therefore presumably more practiced at inhibiting their L2 system.

Lastly, the present investigation has found a non-linear interaction of the factors CONTACT and LOR which to some degree corroborates the earlier findings by De Bot et al. (1991) and Soesman (1997). Intriguingly, the effect found here does not only apply to the group who had *least* contact with their L1, but in equal measure to the speakers who use it *most*: an (inverted) u-shaped curve for the correlation coefficient was found for the formal tasks, but also for the perceived foreign accent. Where accuracy was concerned, on the other hand, it was indeed only those speakers with very little L1 use for whom LOR played a significant role.

These findings suggest that L1 change under conditions of migration may be affected by two different processes: speakers who hardly ever their L1 may, over time, develop a foreign accent and become less accurate, both in free speech and on formal tasks. By contrast, those speakers who use the L1 a lot may show accelerated signs of linguistic change, as their speech adapts more to the norms of the L1 variety which is used among the immigrant community. This process of the evolution of a contact variety echoes Grosjean & Py's (1991) notion of a 'vicious circle' of language change within migrant communities, where the linguistic input from other bilingual speakers, which has already changed under the influence of L2 contact, is taken as a source of corroborating evidence by those attriters who have become uncertain of their own L1 proficiency.

The last aspect that should be noted does not concern the finding of a significant predictor, but rather the absence of such a finding in relation to the measures of fluency

presented above. It has repeatedly been shown that fluency in free speech is one of the characteristics of native language which are not only most difficult to attain in L2 acquisition, but also most vulnerable to L1 attrition (see Schmid & Beers Fägersten 2010). However, so far all attempts to establish how this development is influenced by external predictors have failed, and this failure has been faithfully replicated in the present study. What it is that does or does not make an attriter disfluent remains a tantalizing question for future investigations.

Conclusion

The Activation Threshold Hypothesis predicts that language attrition effects should be governed by the *frequency* and *recency* with which the L1 has been used. Some previous findings have demonstrated a non-linear interaction effect between those two factors: the length of residence in an L2 environment was shown to play a role for complexity, fluency, accuracy and pronunciation in free speech and for reaction times in a naming task only for those speakers who reported that they had very little opportunity to use their L1 (De Bot et al. 1991; Soesman 1997).

The present investigation has been able to corroborate this finding to some degree. Based on a large-scale investigation of the attrition of German as an L1 in an L2 English and an L2 Dutch setting, it has found a correlation between length of residence and performance on formal tasks, as well as accuracy and perceived foreign accent for a subgroup of attriters who use their L1 extremely infrequently. However, similar correlations were found for the subgroup with the highest frequency of L1 use (with the exception of accuracy, which was unrelated to length of residence for this group). For the groups with intermediate L1 use, no

correlations were found. Lexical diversity and fluency in free speech were unrelated to length of residence irrespective of the amount of L1 use.

These findings suggest that the change and deterioration of the L1 which may be witnessed among migrant populations may be determined by two opposite poles: speakers who do not use their L1 at all may experience some degree of 'atrophy', while those who live in a bilingual migrant community where L1 and L2 are used frequently alongside each other and mixed to some degree may find themselves sharing in a language with accelerated signs of contact-induced change.

This conclusion might suggest that it is important for a migrant, in order to perfectly preserve native-likeness, to strike the right balance of L1 use. On the other hand, maybe the right question to ask is why it should be important to remain native-like in the first place?

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Appendix

Table 1

Pearson correlations of free speech measures with LOR and CONTACT

	LOR		CONTACT	
	r	p	r	p
D CC	.164	.100	.072	.473
MOSTFREQ	-.229	.294	-.104	.303
UNIQUE	.188	.391	.118	.240
EP CC	.044	.663	-.036	.719
FP CC	.172	.083	-.054	.588
RT CC	.190	.055	-.104	.298
RP CC	.172	.085	.028	.777
FAR	.217	.095	-.377	.003
ERR	.159	.109	-.061	.542

Table 2

Linear regression for scores on controlled tasks (predictors: education, contact, LOR, and interaction between contact and LOR)

	GJ		CT		VFT		CANDO	
	β		β		β		β	
Edu	.278	t = 2.756 p = .007	.519	t = 5.763 p = .000	,187	t = 1,850 p = ,067	,293	t = 3,026 p = ,003
Contact	.287	t = 1.424 p = .158	.211	t = 1.171 p = .245	,538	t = 2,665 p = ,009	-,052	t = -,270 p = ,787
Time	-.172	t = -.592 p = .555	-.162	t = -.625 p = .533	-,522	t = -1,801 p = ,075	,407	t = 1,464 p = ,146
Interaction	-.262	t = -.908 p = .366	-.333	t = -1.288 p = .201	-,692	t = -2,394 p = ,019	,107	t = ,384 p = ,702
Full model	F = 4.086 p < .01		F = 11.507 p < .001		F = 4.041 p = .004		F = 6.595 p = .000	
R^2	.139		.313		.138		.207	

Table 3

Linear regression for scores on free speech data (predictors: education, contact, LOR, and interaction between contact and LOR)

	D		%MOSTFREQ		%UNIQUE		EP		FP		RT		RP		FAR		ERR	
	β		β		β		β		β		β		β		β		β	
Edu	.183	t = 1.691 p = .094	-,210	t = -1,955 p = ,054	.015	t = .139 p = .889	.042	t = .384 p = .702	-.004	t = -,039 p = ,969	,074	t = ,681 p = ,497	-,062	t = -,572 p = ,569	,026	t = ,192 p = ,848	-,144	t = -1,331 p = ,186
Contact	-.027	t = -.125 p = .901	-,334	t = -1,577 p = ,118	.291	t = 1.346 p = .182	.295	t = 1.355 p = .179	.083	t = ,387 p = ,700	-,324	t = -1,508 p = ,135	,057	t = ,268 p = ,790	-,218	t = -,791 p = ,432	-,420	t = -1,974 p = ,051
Time	.195	t = .648 p = .519	,511	t = 1,719 p = ,089	-.344	t = -1.132 p = .261	-.434	t = -1.413 p = .161	-.385	t = -1,269 p = ,207	,133	t = ,438 p = ,662	-,263	t = -,870 p = ,386	-,214	t = -,534 p = ,595	,471	t = 1,568 p = ,120
Interaction	.176	t = .581 p = .563	,668	t = 2,224 p = ,028	-.502	t = -1.631 p = .106	-.409	t = -1.318 p = .191	-.412	t = -1,345 p = ,182	,193	t = ,631 p = ,530	-,376	t = -1,235 p = ,220	,137	t = ,327 p = ,745	,525	t = 1,732 p = ,086
Full model	F = 1.584 p = .185		F = 2.224 p = 072		F = 1.017 p .403		F = .560 p = .692		F = 1.222 p = .307		F = 1.227 p = .304		F = 1.464 p = .219		F = 2.616 p = .045		F = 1.725 p = .151	
R^2	.061		.085		.041		.023		.048		.048		.057		.160		.066	

Table 4

Correlations between LOR and outcome variables by amount of contact

	very little use		rare use		some use		frequent use	
	r^2	p	r^2	p	r^2	p	r^2	p
GJT	-.483*	<.05	-.032	.875	-.142	.488	-.331	.092
CT	-.368	.065	.004	.984	-.103	.618	-.463*	<.05
VF	-.454*	<.05	-.124	.537	-.020	.923	-.142	.481
D	-.210	.313	-.035	.864	-.048	.816	-.324	.123
MOSTFREQ	,189	,366	,143	,475	-,066	,750	-,229	,294
UNIQUE	-,149	,478	-,140	,485	,089	,666	,188	,391
EP	-.075	.721	-.011	.955	-.286	.157	.185	.388
FP	-.147	.483	.046	.818	.285	.158	.539**	<.01
RT	.216	.300	.184	.358	.338	.091	-.115	.592
RP	-.060	.775	.110	.586	.062	.762	.415*	<.05
FAR	.680*	<.05	-.103	.665	-.268	.334	.597*	<.05
ERR	.423*	<.05	.153	.445	.108	.601	.084	.696