

Singing a different tune in your native language: First language attrition of prosody

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Abstract

First language attrition refers to the changes which a first language (L1) undergoes when a second language (L2) is acquired in a context in which L1 use is reduced (Cook 2003, Köpke 2004). This study comprises a fine phonetic analysis of prosody in ten late consecutive German-English bilinguals and belongs to genre of studies in which L1 intelligibility remains largely, or completely, unaffected (de Leeuw et al. 2007, Mennen 2004, Major 1992, Flege & Eefting 1987, Flege 1984; in contrast to studies of complete L1 loss, as in cases of initial language loss after adoption, Pallier et al. 2003, Ventureyra et al. 2004). In general, the results indicate L1 changes in the intonational alignment of prenuclear rise. However, interpersonal variation was also evidenced: two bilinguals performed clearly within the English monolingual norm in their German whilst one bilingual evidenced no L1 attrition. Intrapersonal variation occurred in the form of the start of the prenuclear rise appearing to undergo more L1 attrition than the end. Processes of L1 attrition, transfer and interference are discussed in relation to these results.

Keywords L1 attrition, bilingualism, prosody, intonation, prenuclear tonal alignment, German, English

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L1 attrition in the domain of phonetics

Building upon previous studies, the definition of L1 attrition as applied in this article is the non-pathological, non-age related, structural change of an L1 within a late consecutive bilingual, assuming that the acquisition of the L1 precedes this change (see Köpke & Schmid, 2004 and Cook, 2003 for discussions related to the definition of this term).

In line with this definition, there has to date been only one study which explicitly explored L1 attrition within the domain of phonetics. Major (1992) examined the voice onset time (VOT) of the phonemes /p t k/ in the speech of late consecutive bilingual migrants in Brazil who were L1 American English speakers. His results revealed that “to a greater or lesser extent, all the subjects suffered loss of native English proficiency” (Major, 1992, p. 200). In general, Major suggested that there was a correlation between proficiency in the L2, measured according to the realisation of Portuguese-like VOT, and rate of attrition in the native language: the lower the VOT (less native-like) in the English casual speech of his participants, the lower the Portuguese VOT (more native-like). However, this correlation was not displayed when the participants’ formal English speech was examined. Moreover, when individuals were explored, “the results of the bilingual speakers showed a variety of patterns in their relative mastery of Portuguese and their ability to retain natively like English proficiency” (p. 193). For example, speakers B3 and B4’s VOT realisations were significantly different from both English and Portuguese native speakers’ in formal and casual speech. B1 and B2’s VOT realisations showed little loss of English in formal and casual speech and they “produced Portuguese relatively poorly compared to the others” (p. 193). According to Major, B5 was “perhaps the most interesting” because she produced formal English and Portuguese VOT precisely within the respective monolingual norms, yet showed “severe loss in English casual speech” (p. 194). In sum, Major’s bilingual migrants showed a high degree of both inter- and intrapersonal variation with regard to L1 attrition in

the domain of phonetics. Moreover, L1 attrition was not *per se* mirrored by L2 acquisition in all of the bilinguals, suggesting that other variables, aside from the acquisition of the L2, may have had an impact on L1 attrition in these late consecutive bilingual migrants.

A similar study by Flege (1987) investigated the VOT of the voiceless plosive /t/ in both American English native speakers who had been immersed in a French-speaking community in France and in French native speakers who had been living in the United States for over a decade. As in Major's study, Flege's (1987) English L1 migrants had initially acquired their L2 in "late adolescence or early adulthood" (p. 51), the same being implied for the French L1 migrants (p. 52). In terms of L1 attrition in the domain of phonetics, Flege (1987) summarised that phonetic properties of similar L1 and L2 phones were "merged" in the late consecutive bilingual migrants (p. 62). In both of the L1 migrant groups, he suggested that the characteristic VOT of their native language became more like the VOT of their L2, decreasing for the American English native speakers living in Paris, and increasing for the French native speakers living in Chicago. Indeed, according to Flege (1987) both L1 and L2 phonetic systems were deviant from - but intermediate to - the respective monolingual norms.

However, upon closer examination of Flege's results, high standard deviations were evidenced, indicative of interpersonal variation in the late consecutive bilinguals and suggesting that not all bilinguals displayed "merging". More specifically, the distribution of the French L1 speakers in Chicago, in their French, overlapped with the French monolinguals' distribution. Similarly, the distribution of the English L1 speakers in Paris, in their English, approached the distribution of the English monolinguals. These results suggest that, in fact, the general trend to merge within an intermediate L1 and L2 phonetic space was not applicable to all late consecutive bilinguals (see Markham, 1997 and Birdsong, 2007 who similarly discuss the issue of presenting group means and hence failing to reveal interpersonal variation).

In addition to “merging” effects, similar research into the speech of consecutive bilinguals has suggested that the acquisition of an L2 can have a polarisation effect on the phonetic systems of the L1 and L2. In a study of Dutch native speakers who were highly proficient in English as an L2, which they began learning at 12 years of age in the Netherlands, bilinguals produced their Dutch voiceless plosive /t/ with *shorter* VOT values than a group of Dutch L1 speakers who were less proficient in English (Flege & Eefting, 1987). In the native speech of the highly proficient L2 speakers, the Dutch /t/ moved away from both the typical English value and the typical Dutch value. Flege and Eefting (1987) suggest that these polarisation effects (in essence, “overshooting” a Dutch monolingual norm) may be a result of ensuring sufficient discrimination between the L1 and the L2 segment in the bilinguals’ two languages (see also Scobbie, 2005, who found similar results in speakers in a cross-dialectal English context). In relation to the previously discussed studies, Flege and Eefting’s results (1987) widen the scope of changes which may occur in the L1 of consecutive bilinguals.

To date, only one investigation has studied changes within the intonation of native speech in consecutive bilinguals (Mennen, 2004). Mennen investigated native Dutch speakers who were at a near-native level in their acquisition of Greek as an L2. Her participants had learned Greek in early adulthood, and were teaching Greek at university level in the Netherlands (Mennen, 2004). She found that four out of five of her speakers were not only unable to realise Greek tonal alignment authentically, they also showed a change in their native Dutch tonal alignment patterns under the influence of Greek. More specifically, the differentiation in the alignment of pitch peaks in prenuclear rises across Dutch long and short vowels was greatly reduced in their L1 speech. Only one speaker in her study produced tonal alignment with native-like values in both the L1 and L2.

The results of Mennen's (2004) study give reason to investigate interpersonal differences within a seemingly homogenous group of L2 learners, particularly because one participant produced both Dutch and Greek tonal alignment according to native speaker – monolingual - norms. In the case of this late consecutive bilingual, L1 loss did not mirror L2 acquisition, and neither merging nor polarisation was evidenced. As such, to a certain degree, this participant resembled the patterning displayed by the late consecutive bilingual migrant (B5) of Major's (1992) study who realised VOT in both her L1 of English and her L2 of Portuguese according to the monolingual norms in formal speech. Such findings challenge the inevitability of interactional effects between the phonetic systems of late consecutive bilinguals. They moreover give reason to explore interpersonal, as well as intrapersonal, variation of L1 attrition in the domain of phonetics.

Present study

The primary aim of this study was to investigate whether L1 attrition occurred within the prosody of a group of German native speakers who had moved to Anglophone Canada in late adolescence to adulthood. The phonetic variable chosen for this analysis was that of prenuclear tonal alignment.

A secondary aim was to determine whether L1 attrition within this prosodic variable was related to L2 acquisition in the same phonetic variable. As just discussed, prior research suggests that there may be a relationship between L1 attrition and L2 acquisition (Flege & Eefting, 1987; Flege, 1987; Major, 1992). With reference to late consecutive bilingualism, it has even been stated that “[t]he more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from the L1 phonetic norm” (Flege, Schirru & MacKay, 2003, p. 470). However, as already mentioned, particularly the studies by Major (1992) and Mennen (2004) suggest that

late consecutive bilinguals may in fact differ in the extent of phonetic interaction between the L1 and L2. In order to investigate this second question, the speech of two control groups comprising German monolinguals in Germany and English monolinguals in Canada was also elicited.

A further aim focused on the extralinguistic variables of age of arrival and length of residence (henceforth respectively AOA and LOR). These variables were specifically investigated with the aim of exploring interpersonal variation in the bilingual migrant group which may not have been directly associated with L2 acquisition. It is often suggested that AOA influences rate of attrition, or “the younger the child is when the language of her environment changes, the faster and deeper she will attrite” (Köpke & Schmid, 2004, p. 10). LOR was explored because of a potential non-linear relationship between LOR and rate of attrition (Schmid, 2002; Köpke & Schmid, 2004). More precisely, the initial years after migration may be pivotal in determining L1 attrition, thereafter the effects of LOR may lessen (de Bot & Clyne, 1994). On the whole, interest in these variables stems from the theoretical claim that they tend to be associated with L2 acquisition (Piske, MacKay & Flege, 2001). Hence if L1 attrition is associated with L2 acquisition (L1 attrition resulting from L2 acquisition or *vice versa*), these variables may very likely be correlated with L1 attrition.

Finally, the last aim addressed the question of whether intrapersonal variation occurred within the late consecutive bilingual migrants. This question was of relevance in part due to the segmental findings by Major (1992), whose study indicated that within the same bilingual migrant, L1 attrition in the domain of phonetics may vary in different circumstances.

Prenuclear tonal alignment in German and English

Generally speaking, tonal alignment is defined as the “temporal coordination of fundamental frequency (F0) with phonetic segments” (Atterer & Ladd, 2004, p. 177). In their study, Atterer and Ladd (2004) found that in pre-nuclear rising accents, the alignment of the pre-nuclear rise occurs earlier in (British) English than it does in German. For example, when measured from the start of the stressed syllable’s initial consonant, the start of the rise occurred approximately 60 ms earlier in English than in German and when measured from the start of the following syllable’s vowel the end of the rise occurred approximately 22 ms earlier in English than in German, at a normal speech rate. Atterer and Ladd reported that in particular the start of the pre-nuclear rise in the German L1 speakers was “strikingly divergent” (2004, p. 185) from previous English results and that this was more so in southern than in northern varieties of German, although both varieties aligned their pre-nuclear accents later than English speakers (Atterer & Ladd, 2004; Ladd, Faulkner, Faulkner & Schepman, 1999). Moreover, German L1 speakers carried over their relatively late pre-nuclear tonal alignment into their English L2 speech. The participants of Atterer and Ladd’s study were all living in Germany, where the recordings took place. “All studied English in school and all use it to one extent or another in their professional life” (p. 189), but none are described as having had long-term exposure to the English language. Atterer and Ladd reported that “on identical English speech material, the German speakers align the accentual rise later than the native English speakers” (p. 191). The question therefore arose, given the long-term exposure to English which the bilinguals of the present study had undergone, whether L1 attrition would be evidenced in the bilinguals’ native German speech. If so, the alignment of their pre-nuclear tonal rise would be earlier than in the German control group.¹

An additional point which is of importance in the interpretation of Atterer and Ladd’s study is that of rate of speech: “To describe a given F0 target F as occurring x milliseconds

before segmental landmark S may mean something different depending on whether the speaker’s average segment duration is 50 or 80 ms” (p. 194). Particularly if speed of speech slows down, as it may do in L2 speech (Wiese, 1984; Guion, Flege, Liu, & Yeni-Komshian, 2000), or conceivably as one undergoes L1 attrition, and / or as one ages (Linville, 1996), absolute calculations may be inadequate. For this reason, in addition to space limitations, only relative calculations are included in the present article. Accordingly, an overall objective of this research was to determine whether and to what degree relative tonal alignment patterns varied in the German of the experimental group in comparison to that of the German control group.

Method

Participants

Thirty participants were examined: 10 German L1, English L2 bilingual migrants; 10 monolingual German controls; and 10 monolingual English controls.²

As can be seen in Table 1, the bilinguals’ AOA ranged from 16 to 32 years of age and their LOR from 18 to 55 years. As none of the participants had been to Canada before they migrated and all reported that their English was rudimentary upon arrival to Canada, we consider that their AOA also represented the onset of English acquisition. This means that the possibility of the L2 influencing the L1 began at the earliest in late adolescence, and that L1 acquisition was, at least in terms of a narrow interpretation of the critical period hypothesis (Lenneberg, 1967; Scovel, 2000), complete upon the onset of L2 acquisition.

Table 1: AOA, LOR and sex of bilingual migrants. “EX” stands for experimental participant.

Participant	1EX	2EX	3EX	4EX	5EX	6EX	7EX	8EX	9EX	10EX
AOA	16	19	24	21	32	29	20	32	23	23
LOR	48	22	55	53	29	18	49	48	38	40
Sex	M	F	M	M	F	F	F	F	F	F

We matched the control group for age at recording (AAR), education, sex, as well as regional accent, although no participant reported a strong regional accent in his / her speech. More specifically regarding regional accent, participants were matched with a control participant from a similar geographical and dialectal background. Each group consisted of three males and seven females giving a total of 9 males and 21 females.

Table 2: The age at recording (AAR) of the bilingual experimental group and the control groups (in years). “GC” stands for German monolingual control participant and “EC” for English monolingual control participant.

Participant	1EX	2EX	3EX	4EX	5EX	6EX	7EX	8EX	9EX	10EX
AAR	72	41	79	73	61	47	69	80	61	63
Participant	1GC	2GC	3GC	4GC	5GC	6GC	7GC	8GC	9GC	10GC
AAR	74	37	76	67	57	38	82	71	64	58
Participant	1EC	2EC	3EC	4EC	5EC	6EC	7EC	8EC	9EC	10EC
AAR	68	41	72	71	67	55	77	81	67	65

Procedure

The experimental procedure was divided into two sessions: English and German, with counter-balanced presentation across participants. The languages were strictly separated during these sessions. In each, native speakers of the respective language, who were familiar with the other language, conducted the interview (English was spoken with the interviewer (first author) and German was spoken with an interviewer specifically recruited for this purpose). The participant was led to the recording room by the appropriate interviewer for the session. The next interviewer entered once the first interviewer had already left and the participants never saw nor communicated with the interviewers at the same time, until the interview was over. This separation of languages was enforced in order to ensure to the greatest extent possible that the speakers were in a monolingual rather than a bilingual mode (Grosjean, 2001). Once the total interview with the participants was complete, the participants were informed that in fact each interviewer spoke the other language. In all cases,

the participants expressed surprise as they openly admitted that they had been under the impression that the interviewers were proficient in only German or English but not both.

Each language session consisted of two main parts; a questionnaire about the participants' language background and an experimental part. The experimental part comprised recordings of the current experiment as well as two other experiments not reported here (see de Leeuw, 2009 for a full explanation of the entire experiment; and/or de Leeuw, Schmid & Mennen, 2007, 2010). Participants were presented with single sentences which appeared on a monitor every 12 seconds. They were asked to speak naturally in a way in which they felt comfortable and to read each sentence to themselves before saying it out loud. If the participant mispronounced his or her first attempt, the decision to repeat a sentence was left up to the participant. It was thought that this created a more relaxed atmosphere. In the case that more than one token syllable was elicited for a particular sentence, the most fluently produced sentence (as judged auditorily by the first author) was chosen for the analysis. If more than one sentence was produced fluently, the first attempt was chosen for the analysis.

Both the German and the English tonal alignment tasks commenced with a practice session of three sentences. In the German part, 11 target sentences interspersed with 16 fillers followed the practice sentences (see Appendix Ia). In the English part, 14 target sentences interspersed with 20 fillers followed the practice sentences (see Appendix Ib). The filler sentences were created specifically for this study and focused on topics which were considered to be somewhat culturally specific. This was again done to enhance the respective language mode (Grosjean, 2001).

Given that the target sentences, containing prenuclear rising accents, were for the most part the same as those used in the study by Atterer and Ladd (2004), the sentences also met the same criteria as those in the original study. In order to prompt a prenuclear rising accent, the test word was either an adjective followed by a noun, or a noun followed by a

genitive construction, e.g. “There was a **minimal** fee for his services”, or “Bei **Längengrad Null** wird die Universalzeit bestimmt” (Universal time is decreed at zero degrees longitude.). This helped to ensure that a prenuclear rising accent was put on the test syllable, which was followed by a nuclear accent on the following noun. Moreover, the prenuclear syllable was flagged by one or two unstressed syllables. This decreased the likelihood of tonal crowding (Arvaniti, Ladd & Mennen, 2000). The test syllable also always contained a phonologically short vowel, in order to decrease the probability of differences in vowel length affecting tonal alignment patterns, such as those found by Ladd, Mennen and Schepman (2000). Finally, the consonants which flagged the vowel in the test syllable were always sonorants (either nasals or laterals) which ensured a continuous F0 contour (Atterer & Ladd, 2004).

Annotation

As was the case in the original study, within each test syllable the following segmental landmarks were identified (Atterer & Ladd, 2004, pp. 183 - 184): C0 marked the onset of the initial consonant of the test syllable; V0 marked the onset of the vowel of the test syllable; C1 marked, in line with the Maximal Onset Principle, the onset of the first consonant in the following syllable; and V1 marked the onset of the vowel of the following syllable (see the example of “minimal” in Figure 1). All labels were inserted at the lowest point of the cycle in the waveform. Although small deviations of a single cycle would probably not have impacted the overall results of the study, this was done to ensure consistency. As for tonal landmarks, the marker ‘L’ was inserted at the beginning of the F0 rise in the prenuclear rising syllable and ‘H’ was marked at the end of the F0 rise (see Figure 1), corresponding to phonological L and H tones respectively.

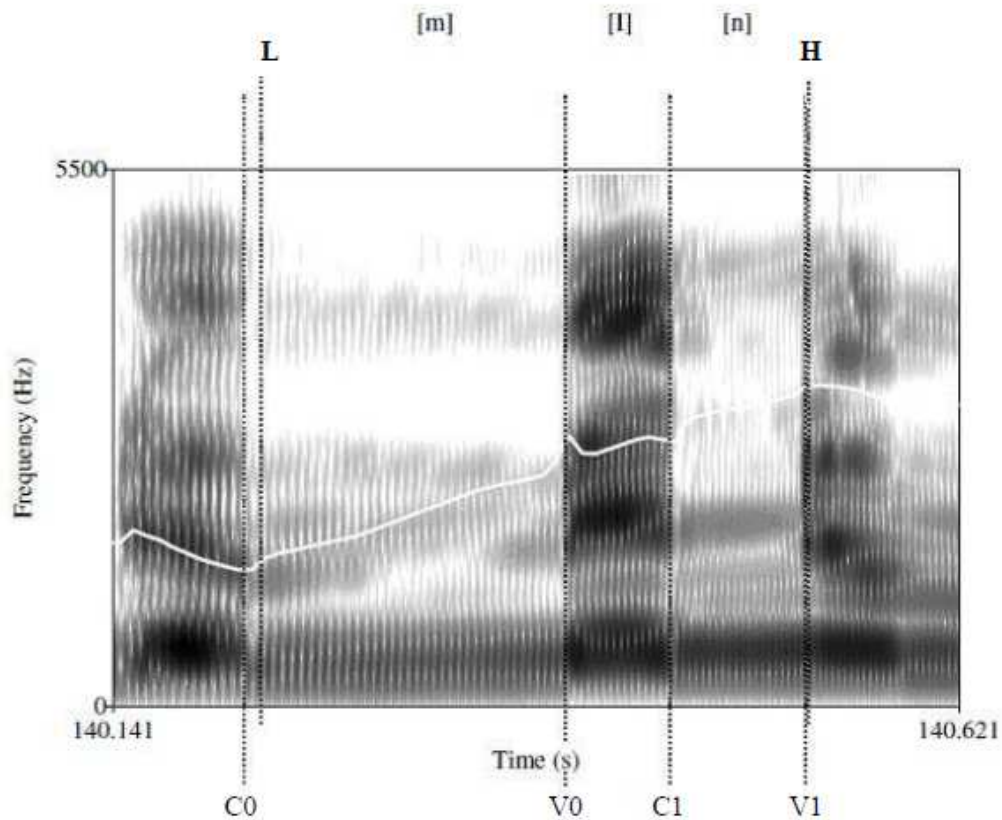


Figure 1: Figure 2: Spectrogram of a portion of the word ‘minimal’ in the phrase “There was a minimal fee for his services”, spoken by a female English control participant. A fundamental frequency (F0) contour is superimposed in white on the spectrogram. In this example, the pitch minimum (‘L’) occurs as expected close to the beginning of the first nasal and the pitch maximum (‘H’) occurs at the end of the second nasal. Changes in microintonation are particularly noticeable at C0, V0 and C1. N.B. the frequency scale of the y-axis is appropriate for the spectrogram, not the fundamental frequency contour.

The F0 minima and maxima were generally easy to locate, but in some cases, it was unclear where the F0 rise began (L) and ended (H). When there was an obvious change in slope, no problem arose, but if there was only a gradual change in slope, annotation became problematic. In these cases, the most prominent change of slope was estimated by eye, as done by Atterer and Ladd (2004). Another problem was that of “minor F0 discontinuities” or “blips” (Atterer & Ladd, 2004, p. 184), such as those occurring in transitions from nasals to vowels (or *vice versa*). When these occurred, we systematically selected the immediately preceding or following pitch point for L and H respectively. Some test items had to be

discarded because of creaky voice or a very monotonous intonation pattern, making the location of L and H problematic. On average, in the German of the bilinguals, 9.0 tokens per participant were included in the analysis, and in the German of the control group, an average of 9.1 tokens per participant were included. In comparison, in the original study an average of 11.6 utterances per speaker were used in the analysis (Atterer & Ladd, 2004, p. 184). Given that three sentences from the original study were not included in the present investigation, the rate of inclusion in the present analysis was in fact quite similar to that of the original study.

Measurements

Durational measurements were obtained from the six labels mentioned above (C0, V0, C1, V1, L and H). From these the following relative alignment measures were obtained:

- **Alignment of L:** a ratio, based on the temporal distance (in ms) of L after the onset of the accented test syllable (L minus C0), divided by the duration of the stressed syllable (i.e. C0 to C1).
- **Alignment of H:** a ratio, based on the temporal distance (in ms) of H after the end of the accented vowel of the test word (H minus C1), divided by the duration of the stressed syllable (i.e. C0 to C1).

Hypotheses

- Hypothesis 1: Tonal alignment of both tonal elements of the prenuclear rise will occur significantly later in the German control group than in the English control group.
- Hypothesis 2: Tonal alignment of both tonal elements of the prenuclear rise will occur significantly earlier in the native German speech of the bilingual migrants than in the German speech of the monolingual control group.

To test Hypothesis 1 and 2, one-way ANOVA tests were performed on each dependent variable (e.g. separately for alignment of L and H) between the three groups of German monolinguals, English monolinguals and the bilingual migrants in their German. Unless otherwise specified, assumptions for ANOVAs were verified for each dependent variable, such as normal distributions and homogeneity of variance. MANOVAs were not conducted on the alignment of L and H because they were highly correlated with one another.

An additional analysis examined whether there would be significant differences between the languages of the bilinguals. To test this question, dependent t-tests were used, in addition to the descriptive analyses of the individual bilinguals.

Results

Group results

The alignment of L in the German control group was on average later than that of the English control group, respectively 54% in comparison to 19%. This is to say that, as described previously in the measurements section, given a total relative duration of the syllable from CO to C1, L occurred roughly in the middle of the syllable in German whilst in English L occurred at roughly one-fifth of the total syllable duration. As a group, the bilinguals performed intermediate to these averages. In their German, L was on average 35% whilst in their English it was approximately 37%. There was a highly significant effect of group on L, $F(2,303) = 57.91, p < .0001$. As predicted in the hypotheses, planned contrasts revealed that the German control group aligned the start of the prenuclear rise significantly later than the English control group, $t(303) = -10.75, p < .0001$ (one-tailed), and that L occurred significantly earlier in the German of the bilinguals than in the German control group $t(303) = -5.37, p < .0001$ (one-tailed).³

There was no significant difference between the alignment of the start of the prenuclear rise in the languages of the late consecutive bilinguals, $t(89) = -1.42$, $p = .16$, suggesting that L1 attrition in the German of the bilingual migrants was evidenced as a merging effect in the bilinguals' L1 and L2.

As expected, the alignment of the end of the prenuclear rise, H, was on average later in the German control group (approximately 150% relative to the start of the stressed syllable) than in the English group (approximately 128%). With regard to the bilinguals, the alignment of the end of their rise was just over 146% in German whilst in their English it was just under 130%. There was a highly significant effect of group on H, $F(2,303) = 14.93$, $p < .0001$. The first hypothesis was verified in the planned contrast: the German control group aligned the end of the prenuclear rise significantly later than the English control group, $t(303) = -4.97$, $p < .0001$ (one-tailed). However, the second hypothesis was not verified, e.g. H did not occur significantly earlier in the German of the bilinguals than in the German control group $t(303) = -0.74$, $p = .46$ (one-tailed). Moreover, there was a significant difference between H in the German and English of the bilinguals, $t(89) = 3.80$, $p < .0001$, suggesting that in contrast to L, neither attritional nor merging effects were evidenced in the end of the prenuclear rise.

Individual results

When individual bilingual participants were descriptively examined (see figures 2 and 3), in order to determine whether the previously described group results consistently occurred across all bilinguals, it appeared that there was a general trend for L to be similar in both the L1 and L2. Specifically, the bilingual participants 1EX, 2EX, 3EX, 4EX, 5EX, 6EX, 7EX and 8EX all performed similarly in their German and English with regard to L. The question therefore became whether the start of the “merged” prenuclear rising accent was more within the German or English monolingual norm, or whether it was intermediate to these languages. Participants 1EX and 4EX performed in both of their languages within the English monolingual norm, clearly indicating German L1 attrition. Participants 2EX, 3EX, 5EX, 7EX and 9EX, appeared to merge L intermediate between the monolingual norms, although this was less evident for 5EX and 9EX than for the other bilinguals. Participants 6EX and 8EX evidenced a merged L which was within the norm of the German monolingual control group, hence did not evidence L1 attrition on this intonational feature.

In clear contrast to this group trend for merged patterning, participant 10EX performed within the monolingual norms with regard to L in both her L1 and L2. She was the *only* bilingual who evidenced neither merging nor L1 attrition with regard to the start of the prenuclear rise.

Interestingly, although clear merging was not evident in participant 9EX, L1 attrition did seem to occur: this participant realised her German L within the English range, whilst her English L was closer to the German range.

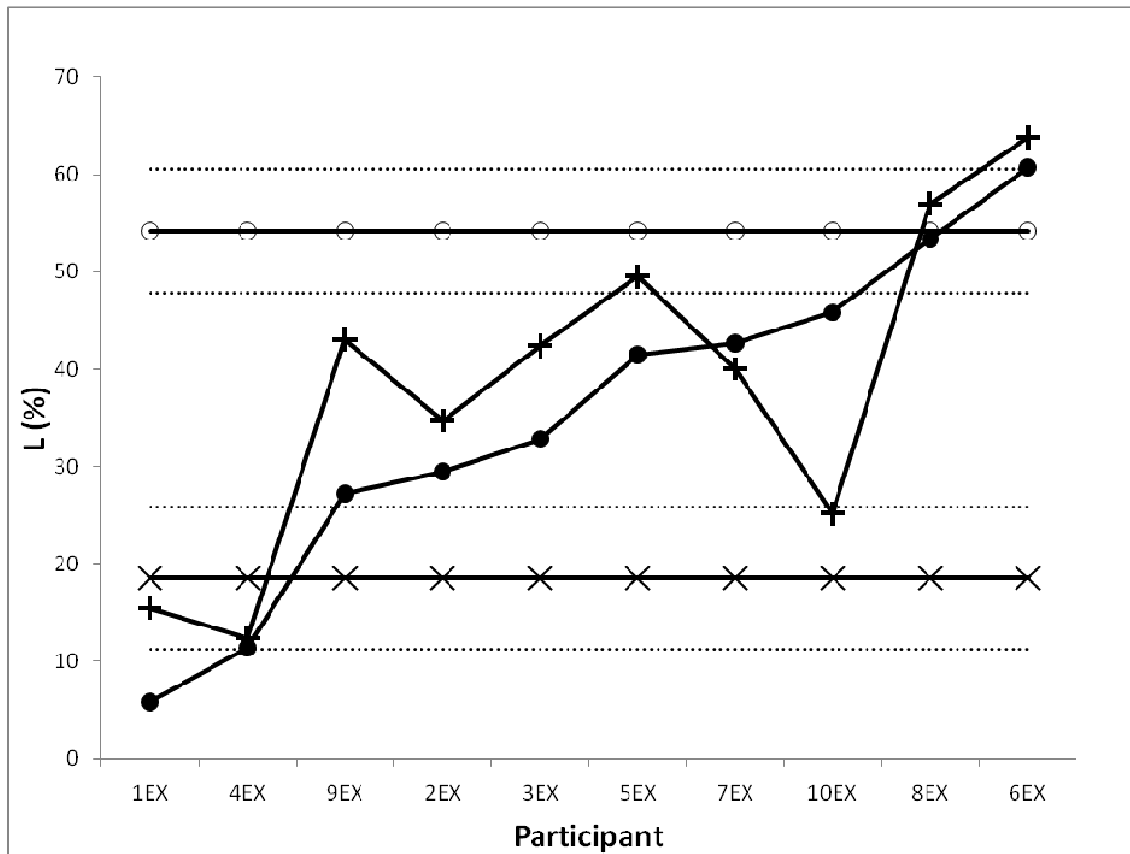


Figure 3: Relative alignment of the start of the prenuclear rise (L) in the German and English of the bilinguals. ●=German speech of bilinguals; ○=German monolingual average (horizontal dotted lines are standard deviation); +=English speech of bilinguals; ×=English monolingual average (horizontal dotted lines are standard deviation).

As already mentioned in the group analysis, the monolingual norms of H were more similar to one another than the monolingual norms of L, the relevance of which will be discussed shortly. Merging on the part of the bilinguals was also displayed in the end of the prenuclear rise, H, but to a lesser extent than in L. Specifically, participants 1EX, 2EX, 3EX, 4EX, 5EX and 9EX appeared to merge H in their German and English. Again, the question was whether this merged variable was more consistent with the German or the English monolingual norms. Participants 1EX, 3EX and 4EX appeared to perform within the English range in both of their languages; participants 2EX and 5EX more within the German range. Alternatively, participant 9EX evidenced a merged H which was rather intermediate to both languages.

In contrast, participants 7EX and 10EX performed within or very close to the monolingual norms in both their German and English. Finally, for participants 6EX and 8EX, H was noticeably later in German than in English. These latter participants may have “overshot” the German monolingual norm of H, perhaps due to polarisation effects. In fact, their very late alignment of H may have contributed to the finding that no attritional effect was found in the group analysis of H.

Moreover, participants 7EX and 10EX performed within the monolingual norms in both their German and English, hence they were in fact only two participants who verified the group results indicating no merging and no L1 attrition of H.

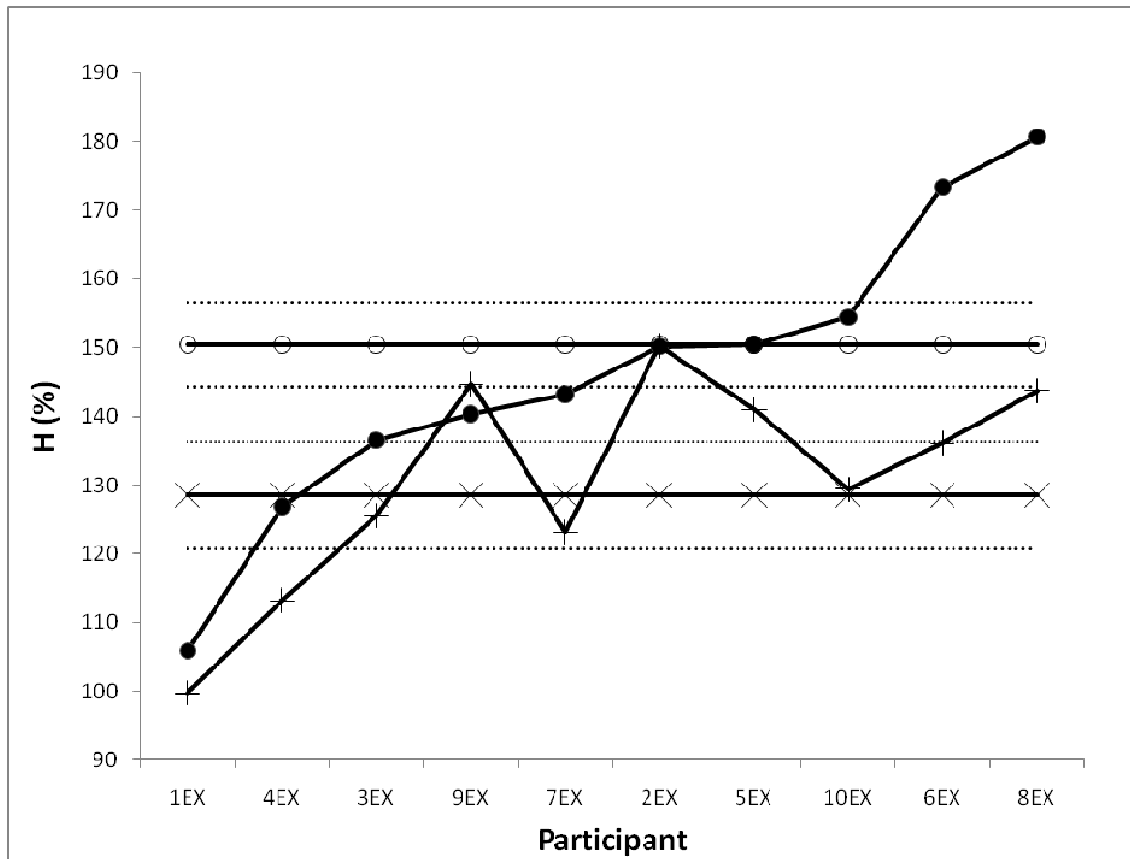


Figure 4: Alignment of the end of the prenuclear rise (H) in the German and English of the bilinguals. ●=German speech of bilinguals; ○=German monolingual average (horizontal dotted lines are standard deviation); +=English speech of bilinguals; ×=English monolingual average (horizontal dotted lines are standard deviation).

Predictor Variables

Given that the bilinguals displayed a high degree of interpersonal variation regarding L1 attrition of prenuclear tonal alignment, predictor variables were examined to see whether these may have influenced the individual results of the participants. The mean of each bilingual participant (in German) went into these Pearson's correlation tests. As predicted, a significant relationship between L and AOA was reported, $r = .73$, $p < .01$ (one-tailed). The earlier the AOA, the earlier the start of the prenuclear rise aligned, or, in terms of L1 attrition, the more L1 attrition was evident in the prosody of the native German speech of the bilinguals. Thereafter, LOR was investigated, the prediction being that a higher LOR would correlate with more L1 attrition, or an earlier L. This test was not significant, $r = -.43$, $p = .11$ (one-tailed). In a final analysis, the alignment of the end of the prenuclear rise was examined. Here the prediction was the same as that for the alignment of the start of the prenuclear rise. Similarly, there was a significant relationship between H and AOA, $r = .77$, $p < .01$ (one-tailed). This positive correlation again suggested that the earlier the bilinguals arrived in Canada, the more likely they were to undergo L1 attrition in the prosody of their native German language.

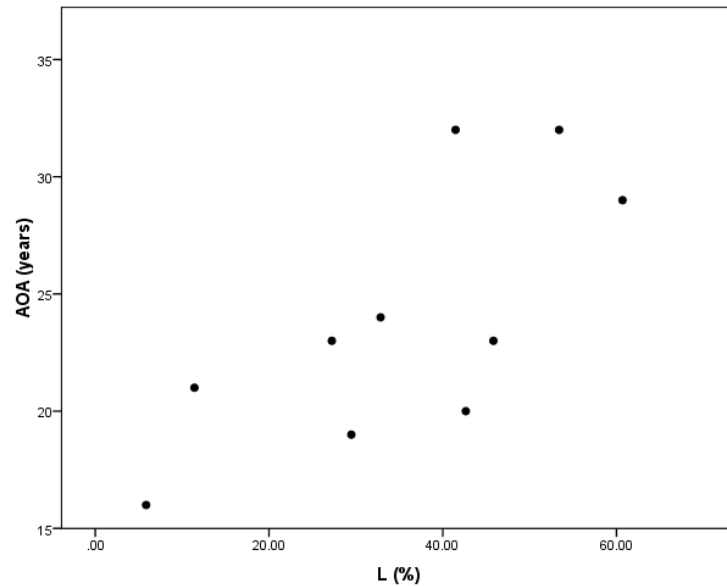


Figure 5: Scatterplot of the start of the prenuclear rise, L (%) in the German of the bilinguals against AOA.

Summary

We found that in the intonational systems of the base languages, prenuclear tonal alignment is earlier in Canadian English than in German. Canadian English and Southern British English are therefore similar, and our results can be compared to those of Atterer and Ladd (2004), verifying the first hypothesis.

The second hypothesis was partly verified. In the group analyses, L occurred significantly earlier in the German of the late consecutive bilinguals than in the German of the control group; however, H did not occur earlier in the German of the bilinguals than in the German control group overall. This meant that there was a general trend for L1 attrition to be evident in the prosody of the bilingual migrants regarding the start of the prenuclear rise, but not consistently with regard to the end of the rise. However, in the individual descriptive analyses, *clear* L1 attrition was evidenced in some participants regarding L, the start (1EX,

4EX, 9EX) and H, the end of the rise (1EX, 3EX, 4EX), because they were realised within the English monolingual norm; and *no* L1 attrition was evidenced in others regarding the start (6EX, 8EX, 10EX) and the end (7EX, 10EX) of the rise, hence realised within the German monolingual norm. Interestingly, two bilinguals may have “overshot” the German monolingual norm in the H of their German (6EX, 8EX).

In addition, when intrapersonal variation was considered, the group results suggested that L1 attrition was more likely to be evidenced in the start of the prenuclear rise than in its end. Similarly, in the individual analyses, it appeared that L1 attrition was more clearly displayed in L. L1 attrition in H was less obvious, partly as a result of “overshooting” of H on the part of participants 6EX and 8EX. Insofar as this “overshooting” is similar to the process of polarisation, it may be considered as evidence for L1 attrition. Conceivably, polarisation may be more likely to occur in variables which are close to one another in an L1 and L2, such as H in German and English in comparison to L, so that contrastive discrimination is maintained across the two languages (Flege & Eefting, 1987). Arguably, such effects may too represent L1 attrition, although not evidenced in the form of “merging”.

Moreover, in the group analysis, merging effects were revealed for the alignment of the start, but not of the end, of the prenuclear rise in the late consecutive bilingual migrants. When merging was examined individually, it appeared that indeed most bilinguals displayed a merged alignment of the prenuclear rising accent in their German and English. In particular, participants 1EX and 4EX displayed a merged prenuclear rising accent in German and English which was within the English monolingual norm, hence for these participants, L1 attrition was most clearly evidenced, supporting the assumption that “[t]he more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from the L1 phonetic norm” (Flege et al., 2003, p. 470). In contrast, one participant, 10EX, displayed a prenuclear rising accent which

was conducive to the monolingual norms in both her German and English, thereby contradicting the aforementioned assumption.

Such results suggest a high degree of interpersonal variation across a rather homogenous group of late consecutive bilinguals, which may in part have been explained by AOA. Bilinguals who moved to Canada at a younger age were more likely to perform within the English monolingual norm in their German than those who arrived at a later age. These results go against findings from previous research, given that the participants had all moved to Canada after the “small gradual decline in attrition susceptibility during the maturational period followed by a major decline at its end (posited at around age 12)” (Bylund, 2009, p. 709). Indeed, they support a dynamic view of L1 attrition as a potential characteristic of language development (De Bot, 2007).

Conclusion

When interpreting these results, it may be argued that transfer and / or interference are at the heart of L1 attrition. Here, however, the argument put forth is that L1 attrition describes processes beyond the two dimensional framework offered by the terms transfer and interference. Dorian (1982) emphasised this dimension in her study of Gaelic language death in Scotland: “Perhaps the errors in a half-forgotten language have a logic of their own too ... and are not simple interference phenomena” (p. 57). Following this line of thought, L1 attrition may result in phenomena within the L1 which resemble *neither* the L1 nor the L2. If this argument is taken a step further, one can even question whether “gaps” in a native speaker’s L1 were there first, and then “filled” with L2 elements, or whether the L2 elements intruded upon the L1 system initially (Schmid, 2002). In other words, although phenomena in the L1 may resemble the L2, they may not actually have been *caused* by the L2 (Seliger & Vago, 1991). In relation to the results at hand, when polarisation, or “overshooting”, effects

are taken into account, L1 attrition may incorporate processes beyond interference and transfer (assuming that merging is characteristic of these latter processes but that polarisation is not). This is not to say that *no* changes in an L1 may be caused by interaction from the L2, but rather that such changes may only in part contribute to the dynamics of language change and development over time.

For example, in a recent study, the Regression Hypothesis was tested in relation to the loss of morphology and syntax in Dutch migrants to Anglophone Canada, the prediction being that the order of L1 loss is the reverse of L1 acquisition (Keijzer, 2010). Her results indicated that L1 attrition, as it would occur according to the predictions of the Regression Hypothesis, was most evident in the domain of morphology, but not in syntax, which was mostly characterized by L2 influences from English. Solely L2 induced change could not explain the changes in the L1.

In sum, language transfer and interference focus around a more two dimensional view of language (either that of the L1 or that of the L2), whilst it may be a third, or even higher dimension arising within the bilingual which develops (Kramsch, 1993) and is a characteristic of L1 attrition. Such thinking is congruent to a dynamic system theory of bilingualism, in which the emergent system is greater than its components (De Bot, 2007; Herdina & Jessner, 2002). Transfer and interference, as understood by Grosjean (this issue), depict interactional effects between the L1 and the L2, whereas L1 attrition may be congruent to dynamic developments in the L1 beyond the sub-systems of the L1 and the L2.

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¹Atterer and Ladd's (2004) analysis involved British English, while Canadian English was the L2 of the German migrants here. In case Canadian English tonal alignment did not pattern in the same way as British English, a second control group of Canadian English monolinguals was included.

²We use the term "monolingual" to describe individuals with limited knowledge of additional languages.

³Crucial for the purpose of the present investigation, neither the syllable duration of the German control group and the German of the bilinguals was significantly different, nor the vowel duration (both absolute and relative measurements in relation to syllable duration, see de Leeuw 2009, p. 157 – 163 for more information on these measurements) and yet the start of the prenuclear rise aligned significantly earlier in the German of the bilinguals than in the German control group. This is a relatively clear indication of L1 attrition at the level of prosody within the German of the late consecutive bilingual migrants. In other words, earlier alignment of the start of the prenuclear rise on the part of the bilinguals was not caused by differences in syllable duration because the syllable duration of the German control group and the bilinguals in their German was the same.