

Reassessing maturational constraints through evidence of L1 attrition in the phonetic domain

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Abstract

Most research concentrates on how the first language (L1) influences the second language (L2), but some research has shown that it is possible for late consecutive bilinguals to perform deviantly from native speaker norms in L1 speech. This chapter deals with research in L1 attrition in the phonetic domain: definition, overview of research in late consecutive bilinguals (production and perception studies), and evidence of L1 phonetic attrition. These are discussed in terms of maturational constraints and the bilingual cognitive load theory.

Keywords L1 attrition, bilingualism, perception, phonetics, production

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1. Introduction

Most research concentrates on how the first language (L1) influences the second language (L2), but some research has shown that it is possible for late consecutive bilinguals to perform deviantly from native speaker norms in L1 speech. This chapter will deal with research in this area, here termed L1 attrition in the phonetic domain.

Initially, the definition of L1 attrition is discussed, followed by an overview of research findings pertaining to L1 attrition in the domain of phonetics in late consecutive bilinguals. Both production studies (examining segmental and prosodic analyses), and studies investigating the perception of foreign accented native speech are presented. The evidence for the existence of L1 phonetic attrition will be examined and discussed in terms of its support for maturational constraints. Finally, arguments will be made for an alternative explanation of the evidence, by means of the bilingual cognitive load theory.

1.1. L1 attrition

Very generally, L1 attrition can be described as a process characterised by changes in a native language (here used synonymously with L1) under the influence of the acquisition of an L2. More specifically, L1 attrition has been defined as the non-pathological loss of a native language within an individual (Köpke & M. Schmid, 2004), and in particular that which is not age-related. Studies of the elderly provide evidence that certain language skills can change or decline as individuals grow older (Endres, Bamback, & Flössler, 1971; Goral, 2004; Linville, 1996; Linville & Rens, 2001). Although age-related language loss is of relevance to research in L1 attrition, changes to the L1 in the context of bilingualism is the focus of research in L1 attrition (Köpke, 2004). Here, the term ‘bilingual’ is used to describe people who use two or more languages in their everyday lives (Grosjean, 1998, 2001).

This definition focuses on the functional use of languages rather than on the language competencies of an individual. Accordingly, “bilinguals do not necessarily need to have perfect knowledge of all the languages they know to be considered as such” (Fabbro, 2001, p. 201). Even Bloomfield, whose early definition was based on language competencies, conceded to the relativity of bilingualism. In 1933 he characterised bilingualism as the “native-like control of two languages”; however, “one cannot define a degree of perfection at which a good foreign speaker becomes a bilingual: the distinction is relative” (reprinted in 1984, pp. 55-56). Crucially, lack of “perfection” in language competencies does not undermine the functional use of more than one language on the part of a bilingual. It is arguably what Bloomfield may have considered to be a lack of “perfection” in the L1 of late consecutive bilinguals which is considered to be L1 attrition.

Within this broad context of bilingualism, the difference between functional and structural loss is highlighted in a definition of L1 attrition. Köpke (2004) defines language attrition as the “loss of the *structural* [my own use of italics] aspects of language, i.e. change or reduction in form of an individual’s L1, whilst ‘shift’ is a loss of *functional* [my own use of italics] aspects, i.e. the gradual replacement of one language by another with respect to language use” (p. 4). According to Köpke’s terminology, it is feasible that an individual may have a reduction in use of his or her native language without changes to its structure. It is the situation of migrants all around the world, who move to a new country, exposing themselves to a new language and a new culture in adulthood, to which research in L1 attrition is of relevance.

2. L1 attrition in the domain of phonetics

2.1 Production of L1 attrition in the domain of phonetics

In his publication “Losing English as a First Language”, Major (1992) investigated five female native speakers of American English who had been living in Brazil for 12 to 35 years in order to determine whether their L1 had undergone L1 attrition in the domain of phonetics. The earliest age of arrival to Brazil was 22 years of age, and the latest was 36, at which point contact with their native English was reduced. The late consecutive bilinguals in Major’s study were married to Brazilian nationals, raised

their children speaking Portuguese, and were highly integrated into the Portuguese speaking community in Brazil. In addition to their active use of Portuguese, his subjects used English on a daily basis, as they were all either English teachers or administrators in an English language institute. Major examined the VOT of the phonemes /p t k/ in the speech of the bilinguals because VOT in Portuguese is significantly shorter than in English (Major, 1987). His results revealed that “to a greater or lesser extent, all the subjects suffered loss of native English proficiency” (1992, p. 200), in that their VOT’s were significantly shorter than in English norms. In general, there was also a correlation between proficiency in the L2, measured according to the realisation of Portuguese-like VOT, and amount of changes in the L1. On average, the shorter the VOT (less native-like) in the English casual speech of his participants, the shorter their Portuguese VOT was (more native-like). However, this correlation was not displayed when the participants’ formal English speech was examined (he elicited formal speech through word and sentence lists whereas casual speech was taken from informal spontaneous conversations) and 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 nativelike English proficiency” (p. 193). For example, subject B3 and B4’s VOT realisations were significantly different from both English and Portuguese native speakers’ in formal and casual speech. Subject B1 and B2’s VOT realisations showed little loss of English in formal and casual speech and “produced Portuguese relatively poorly compared to the others” (p. 193). According to Major (1992), subject B5 was the most interesting because she produced formal English and Portuguese VOT precisely within their respective norms, yet showed severe loss in English casual speech. However, L1 loss was not *per se* mirrored by L2 acquisition in all of the bilinguals. For example, subject B3 performed poorly in English and Portuguese, whilst subject B5 performed within the monolingual norms of English and Portuguese, at least in formal speech. This suggests that other factors, aside from the acquisition of the L2, may have had an impact on L1 attrition in the domain of phonetics.

In addition, an early investigation by Flege (1987) similarly examined the VOT of the stop consonant /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. The English L1 bilinguals in his study had initially acquired their L2 in “late adolescence or

early adulthood” (p. 51), and the same is implied for the French L1 bilinguals (p. 52). “Most of them [the English native speakers] had children who spoke French as their principal language and attended French-speaking schools”, although they spoke English with their children to encourage bilingualism (p. 52). Much the same as Major (1992), Flege (1987) summarised the results of his study by suggesting that phonetic properties of similar L1 and L2 phones were “merged” in the late consecutive bilingual migrants (p. 62); in both of the bilingual groups, the characteristic VOT of their L1 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. In fact, Flege summarised that both L1 and L2 phonetic systems were deviant from, but intermediate to, the respective monolingual norms. Flege also found that the native French speakers, for whom English was clearly their principal language, produced a more fronted variant of the French vowel /u/ than monolingual French speakers did (in French words like ‘ou’). Specifically, the mean frequency of the second formant (F2) was higher (1333 Hz) in the French of the bilinguals than the value he obtained for his French monolingual subjects (1196 Hz). Moreover, in their English L2, the French native speakers approximated the English monolingual formant values of /u/ in words such as ‘shoe’ (p. 58). Although the results from the vowel analysis were not significant, they too suggested that the prolonged acquisition of an L2 phonetic system in a migrant setting affected the L1 phonetic system.

The focus of Flege’s (1987) investigation was on group trends, rather than on potential differences between the late consecutive bilingual migrants who comprised the group(s), in contrast to Major’s (1992) study. However, upon closer examination of the standard deviations obtained from Flege’s (1987) investigation, interpersonal variation in the late consecutive bilinguals is evident. Specifically, the standard deviation of the French L1 speakers in Chicago, in their French, overlaps with the French monolinguals’ standard deviation. Similarly, the standard deviation of the English L1 speakers in Paris, in their English, approaches the standard deviation of the English monolinguals. Such results suggest interpersonal variance within the late consecutive bilinguals, or that some French native speakers may have been more prone to L1 attrition than others, similar to the findings by Major (1991).

Similar research into the speech of late consecutive bilinguals has suggested that the acquisition of an L2 can have what has been termed 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 Dutch /t/ with shorter VOT values than a group of Dutch L1 speakers who were less proficient in English (Flege & Eefting, 1987). In the highly proficient participants, the Dutch /t/ moved away from both the typical English value and the typical Dutch value (becoming shorter). Flege and Eefting (1987) suggest that this may be a result of ensuring sufficient discrimination between the L1 and the L2 phonemes. Although this study did not deal with migrants, nor with individuals who had learned their L2 in adulthood, the results indicate that similar L1 and L2 phonemes may undergo polarisation effects, therefore augmenting the previously discussed ‘merging’ effects revealed in the studies presented beforehand. Moreover, they corroborate the findings from the previously discussed studies that the native speech of consecutive bilinguals, here those specifically characterised as highly proficient in their L2, can diverge from a monolingual norm.

More recent research investigated L1 attrition in the domain of phonetics as revealed by an analysis of the lateral phoneme /l/ in late consecutive bilinguals with German as an L1 and English as an L2 (de Leeuw, 2008; de Leeuw, Mennen, & Scobbie, forthcoming). In total, 30 participants were examined: 10 German L1, English L2 late consecutive bilingual migrants; 10 monolingual German controls; and 10 monolingual English controls. The bilinguals’ age of arrival in Canada from Germany ranged from 16 to 32 years of age and length of residence in Canada from 18 to 55 years (see Table 1). As none of the participants had been to Canada before they moved and all reported that their English was rudimentary, if existent at all, upon arrival to Canada, their age of arrival was taken to also represent the onset of English acquisition.

Table 1. *AOA (age of arrival), LOR (length of residence) 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	52	29	18	49	48	38	40
Sex	M	F	M	M	F	F	F	F	F	F

The primary aim of this study was to determine whether the realisation of the lateral /l/ in the bilinguals’ native German speech underwent L1 attrition after the bilinguals had moved from Germany to Canada, where they were immersed in the English language; the secondary aim was to determine what might have contributed to variation in the extent of phonetic L1 attrition, assuming that not all bilinguals would perform in the same way. In Canadian English, the back of the tongue is generally elevated during the realisation of word final laterals. This raising creates what can be termed a ‘velarised’ lateral, reflected in the acoustic signal in a decrease in the frequency of the second formant, or F2. When F2 frequency is low, the literature refers to a ‘dark’ /l/ (Gimson, 1989; Olive, Greenwood, & Coleman, 1993) which is expressed by the phonetic symbol [ɫ]. In Standard German, the back of the tongue is usually not elevated during the realisation of word final lateral (Kufner, 1970; Moulton, 1970; Wells, 1982). This flatter position of the back of the tongue is reflected in a higher F2 frequency; the phonetic symbol used to represent the realisation of the German lateral is [l]. When F2 is relatively high, which is generally the case in German, a ‘clear’ (Gimson, 1989) or ‘light’ /l/ is the preferred terminology (Olive et al., 1993). A constriction, or lack of constriction, in the back of the oral cavity may influence not only F2 in German and English, but potentially also the first formant, or F1, in the lateral segment (Neppert, 1999). If a constriction occurs towards the back of the oral cavity (as is the case in [ɫ]), F1 frequency may increase. Alternatively, if the constriction occurs in the front

half of the oral cavity, the frequency of F1 tends to be lower. However, high F1 frequency also corresponds with a wider jaw angle, or a more open oral cavity, whereas a lower F1 represents a more narrow jaw angle. Indeed, it is often assumed that F1 frequency is a robust correlate of jaw angle. In other words, a high F1 frequency may be caused by both a wider jaw angle and closure towards the back of the mouth. In terms of dark and light /l/, this means that in the former realisation one may expect a higher F1 frequency than in the latter, as constriction occurs towards the back of the mouth in dark /l/.

Formant frequencies of the lateral phoneme /l/ were measured in coda position in English words like ‘feel’, ‘real’ and ‘deal’ and in German words like ‘viel’ (=many), ‘Ziel’ (=goal) and ‘Kiel’ (=city in northern Germany). Both frequencies of the first formant (F1) and the second formant (F2) were measured in the monosyllabic words. Initially, the study revealed that the frequency of F1 in the lateral /l/ of the German control group was significantly lower, and the frequency of F2 significantly higher, than of the English control group. The findings revealed that the lateral /l/ of the German control group was ‘clear’ with a low F1 and a high F2 frequency whilst the lateral /l/ of the English control group was ‘dark’ with a high F1 and a low F2 frequency. Crucially, the results indicated that L1 attrition in the lateral /l/ was more clearly evidenced in the frequency of F1 than in the frequency of F2 (de Leeuw, Mennen & Scobbie, forthcoming). All statistical tests revealed L1 attrition in the frequency of F1 for female and male bilinguals whilst in contrast, the frequency of F2 between the female bilinguals and their respective control group did not significantly differ. Moreover, in the analyses of individual participants, F1 frequency of the lateral /l/ appeared to be less stable than the F2 frequency. Indeed, only two late consecutive bilinguals evidenced L1 attrition in the F2 frequency of the German /l/, whereas eight (the same two plus six more) did so in the frequency of F1, suggesting that place of constriction (as represented by F2 frequency) was less prone to L1 attrition than openness, (as represented by F1 frequency). Accordingly, in addition to intrapersonal variation, the results suggested a high degree of interpersonal variation: some late consecutive bilinguals were more susceptible to L1 attrition in the domain of phonetics than others. However, none of the predictor variables, such as age of arrival, length of residence, and amount and type of L1 contact,

correlated with L1 attrition in the domain of phonetics, as tested on the frequency of F1 (de Leeuw, 2008; de Leeuw et al., forthcoming).

In a further analysis of the same late consecutive bilinguals, the prosodic feature of tonal alignment, that is the alignment of pitch peaks in intonation contours, was examined. This study (de Leeuw, Mennen, & Scobbie, 2011) was based on findings by Atterer and Ladd (2004) who found that tonal alignment of the prenuclear rise (the peak in the intonation contour which occurs immediately before the most prominent intonation rise in an intonational phrase) occurs significantly later in German than English. Similar to the results from Atterer & Ladd's study, it was revealed that this cross-language difference in tonal alignment in the control groups was greater at the start of the prenuclear rise than at the end of the prenuclear rise. In terms of L1 attrition within the domain of phonetics, the group analyses indicated that the start of the prenuclear rise occurred significantly earlier in the German of the late consecutive bilinguals than in the German of the control group (see Figure 1). However, in the group analyses, the end of the prenuclear rise did not occur earlier in the German of the bilinguals than in that of the German control group (de Leeuw et al., 2011).

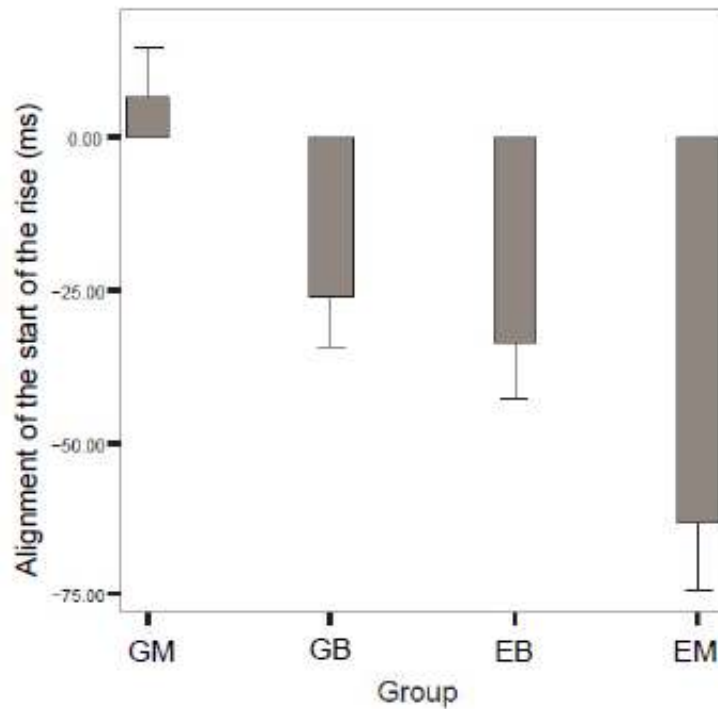


Figure 1. Bar chart of alignment of start of prenuclear rise (as measured from the onset of the vowel) in milliseconds (ms) against group (GM=German monolingual controls; GB=German of bilinguals; EB=English of bilinguals; EM=English of monolingual controls). Positive values indicate a prenuclear rise which started after the onset of the vowel whilst negative values indicate a prenuclear rise which started before the onset of the vowel.

When the late consecutive bilinguals were analysed individually, it was found that the alignment of both the start and the end of the prenuclear rise were similar in the L1 and the L2 of most bilingual migrants. In particular, two participants displayed a merged prenuclear rising accent in their native German and English which was within the English monolingual norm: these participants most clearly evidenced L1 attrition. In contrast, only one participant displayed a prenuclear rising accent which was conducive to the monolingual norms in both her German and English. Moreover, in the analysis of predictor variables, an earlier age of arrival significantly correlated with an earlier alignment of the prenuclear rise: late consecutive 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 to Canada at a later age, although all participants arrived between 16 and 32 years of age. In sum, these findings revealed L1 attrition in the native German speech of the late consecutive bilinguals most clearly in the start of the prenuclear rise, and this general finding was correlated with age of arrival.

These results concur with a study by Mennen (2004) who investigated “bidirectional interference” in the intonation of Dutch-Greek late consecutive bilinguals. Mennen examined native Dutch speakers who were described to be 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. She found that four out of five bilinguals were not only unable to realise Greek intonation as monolingual Greek speakers did, they also showed a change in their native Dutch intonation patterns under the influence of Greek. More specifically, the differentiation in the alignment of pitch peaks across Dutch long and short vowels, i.e. tonal alignment, was greatly reduced in their L1 speech. Only one speaker aligned her pitch peaks with native-like intonation contour values in both her L1 and L2. This study similarly indicated mutual effects of the L1 and L2 systems in late consecutive bilinguals at the level of prosody and interpersonal variation across the bilinguals with regard to deviations from a monolingual norm.

In sum, the findings unequivocally indicate that native speech, as acquired from birth onwards in a monolingual setting, can change and deviate from a monolingual native speaker norm when an L2 is acquired in adulthood. Whether such deviances, as measured through fine phonetic analyses of the acoustic signal, are perceived by monolingual speakers is a further question which will be examined in the following section.

2.2 Perception of L1 attrition in the domain of phonetics

It is possible that the previously discussed evidence for L1 attrition, as measured through fine phonetic analyses, is actually not perceived by native speakers of the L1. Interestingly, only two studies have approached the perception of foreign accented native speech, i.e. L1 attrition as revealed by the extent to which native speech is perceived to be foreign accented.

Sancier and Fowler's (1997) case study found that native Brazilian Portuguese speakers reported a stronger foreign accent in the pronunciation of a native Brazilian-Portuguese speaker after her extended stay in the United States in comparison to after a return to Brazil. Consistent with the findings by Flege (1987), Flege and Hillenbrand (1984) and Major (1992), Sancier and Fowler also observed that the VOT of the voiceless labial plosive ([p] in Brazilian-Portuguese and [p^h] in American-English) and the voiceless alveolar plosive ([t] in Brazilian-Portuguese and [t^h] in American-English) were generally longer in her US sessions than in the Brazil session. Crucially, their case study indicated that the Brazilian-Portuguese speaker's father *perceived* her native speech to be "so explosive" which was thought "to reflect an influence of the American-English speech that surrounds the speaker when she is in the United States" (pp. 421-22). Here, it appeared that at least one listener perceived VOT deviances from a monolingual norm in the speech of the late consecutive bilingual.

Similarly, a larger study reported in de Leeuw, Schmid, & Mennen (2010) investigated 57 German native speakers who had moved to either Anglophone Canada or the Dutch Netherlands in adulthood. The bilinguals' semi-spontaneous German speech was assessed for foreign accent by monolingual German speakers in Germany (1=definitely native speaker, 6=definitely non-native speaker). It was revealed that 14 bilingual migrants were perceived to be non-native speakers of their native German language. As displayed in Table 2, participants 11 and 6 had arrived in Canada at 32 years of age (FAR = 5.05 and 5.11 respectively) and participant 40 arrived at 43 years of age (FAR = 5.47).

Table 2. *Foreign accent rating (FAR), age of arrival (AOA) and L2 of those late consecutive bilinguals assessed to be non-native speakers of their native German.*

Participant	FAR	L2	AOA
13	4.53	English	22
16	4.58	English	21
36	4.84	English	27
11	5.05	Dutch	32
61	5.05	English	17
6	5.11	English	32
31	5.16	English	21
39	5.16	English	20

40	5.47	Dutch	43
21	5.53	Dutch	19
56	5.53	English	21
41	5.58	Dutch	23
25	5.68	Dutch	17
15	5.84	English	21

No significant difference was revealed between the foreign accent ratings of the English L2 and the Dutch L2 speakers; both L2 groups were just as likely to develop a foreign accent in their native speech. Instead, age of arrival to Canada or the Netherlands and contact with one's native language played the most significant roles in determining whether the German native speech of the bilinguals was assessed to be foreign accented. It appeared that not only the *amount* of contact, but also the *type* of contact influenced foreign accented native speech. German native speakers with both English and Dutch as an L2 who had a high amount of L1 contact in settings in which language mixing was not expected to occur were less likely to be perceived as non-native speakers in their L1 than those migrants who had less L1 contact in such "pure" settings. Moreover, this effect was more substantial in migrants who departed from Germany after the age of 22, in comparison to those who departed between 14 and 21 years of age. If the results from this study are applied more generally, it appears that late consecutive bilinguals who move abroad to a country where they speak their native language infrequently are more likely to maintain a native-like accent in their L1 if, when they do converse in their native language, these conversations require more activation of a monolingual language mode, i.e. one in which language mixing is reduced (Grosjean, 2001; de Leeuw et al., 2010).

In sum, these findings reveal that it is possible for phonetic L1 attrition to occur, and that late consecutive bilinguals can undergo L1 attrition to varying degrees as a function of different factors such as age of acquisition and type and amount of contact with the L1. Indeed, some late consecutive bilinguals who evidence phonetic L1 attrition can diverge from a monolingual native speaker norm to such an extent that they are no longer perceived to be native speakers of their L1 by fellow native speakers. The consequences of these findings for research on ultimate acquisition in an L2 will be discussed in the following section.

3. Highly proficient L2 learners

Some case studies suggest that it is possible for late L2 learners to achieve native speaker proficiency levels in their L2. For example, late learners of English as an L2 have been documented who perform within the range of English monolinguals (Bongaerts, van Summeren, Planken, & Schils, 1997; Muñoz & Singleton, 2007); as well as French L2 speakers (Schneiderman & Desmarais, 1988) and Arabic L2 speakers (Ioup, Boustagui, El Tigi, & Moselle, 1994) who perform within the range of monolinguals. Such findings suggest that, although it is generally the case that a language acquired early in life is done so more “successfully” (when compared with monolingual norms) than a language learned late in life, there is, in principle, nothing which categorically prevents a late L2 learner from achieving the same level of proficiency in an L2 as a native speaker. Interpretations of such findings tend to attribute more weight to social factors in explaining the observed childhood advantage, and emphasise that given ideal circumstances (e.g. frequent and diverse L2 input, exceptional motivation to learn the L2, etc.), it is indeed possible for late L2 learners to achieve the same proficiency standards as native speakers; it is simply the case that children are more likely to be exposed to such ideal circumstances.

In response to the evidence of such late L2 learners who perform within the same proficiency range of native monolingual speakers, a landmark study was undertaken by Abrahamsson and Hyltenstam (2009), who selected a small group of L1 Spanish speakers with Swedish as a late L2. Crucially, these late L2 Swedish speakers had all been perceived by Swedish monolinguals to be native Swedish speakers. Thereafter, Abrahamsson and Hyltenstam scrutinized the experimental participants’ late L2 Swedish speech in linguistic detail, comparing it with the speech of a control group of “true” Swedish native speakers, who had limited knowledge of other languages, i.e. were functional monolinguals. Their rigorous analysis revealed that, although the experimental group had previously been *perceived* to be native speakers of Swedish by Swedish monolingual listeners, their speech in fact deviated from that of the control group. Abrahamsson and Hyltenstam called such late L2 bilinguals “unperceivable non-native speakers” and concluded that, “nativelike ultimate attainment of a second language is, in principle, never attained by adult learners” (Abrahamsson & Hyltenstam,

2009, p. 250), because biologically determined maturational constraints prevent late L2 learners from actually ever attaining the level of competence achieved by true native speakers.

However, it is argued here that Abrahamsson and Hyltenstam's interpretation of their findings was premature. In order to determine whether maturational constraints impede late L2 acquisition, it would have been necessary to incorporate a second experimental group comprising unperceivable *simultaneous* bilinguals who learned both of their languages from birth onwards during the brain's maturation in childhood. Only if the unperceivable simultaneous bilinguals performed according to monolingual proficiency levels, whilst the unperceivable non-native speakers (aka in the L2 speech of the late bilinguals) did not, would it have been possible to ascertain that biologically determined maturational constraints impede L2 acquisition. If, on the other hand, both simultaneous and late consecutive bilinguals performed deviantly to monolingual norms, an alternative explanation would be required.

Indeed, some recent findings suggest that simultaneous bilinguals who have had balanced input from both languages from birth onwards, do in fact deviate from monolingual norms. Sundara, Polka, and Baum (2006) examined adults who had learned both English and French simultaneously at home from their parents from day one, with similar input throughout their lives and were perceived to be native speakers of French and English. Their study investigated interaction across the phonetic systems of the two languages as adults (both of which could be considered to be an L1), or whether they produced their languages like monolinguals of the respective languages and revealed that simultaneous bilingual adults did not differentiate coronal plosives, e.g. /t/ versus /d/, to the same extent that monolingual speakers of English and French did. As a result, Sundara et al. (2006) claimed that "even when [simultaneous] bilinguals sound like monolinguals, they differ from each other in implementation of phonetic segments, quite possibly to highlight perceptual differences or for articulatory ease" (p. 112). These findings contradict the interpretation by Abrahamsson & Hyltenstam (2009) that deviances from monolingual native speaker norms in the L2 speech of the unperceivable non-native speakers provide evidence for biologically determined maturational constraints (and therefore from really ever attaining native language proficiency in their late L2)

because the simultaneous bilinguals in Sundara et al.'s (2006) study, who *had* learned both of their languages during the brain's maturation in childhood, also deviated from monolingual norms.

Moreover, if the results from highly proficient late L2 learners are viewed in relation to the findings that L1 speech of some late consecutive bilinguals deviates from monolingual norms, as evidenced in the segmental and prosodic analyses of L1 attrition, it appears that rather than "nativelike" ultimate attainment of an L2 in principle never being able to be obtained by late L2 learners, it is in fact monolingual proficiency which is unattainable by bilinguals, even those who are unperceivable so by monolinguals. It may very well be the case that language is organised differently in the brain if acquired from birth onwards than after puberty; however, the point here is that deviances from a monolingual norm in L2 speech are insufficient in determining whether this is the case because evidence has been put forth that similar deviances are displayed in the L1 speech of late consecutive bilinguals, as observed through L1 attrition in the domain of phonetics, and in balanced simultaneous bilinguals, as observed through phonetic interaction.

An alternative theoretical framework which may explain the results from research indicating phonetic L1 attrition (Flege & Eefting, 1987; Flege & Hillenbrand, 1984; Flege, 1987; de Leeuw, 2008; de Leeuw et al., 2011, 2010; Major, 1992; Mennen, 2004), interaction across the phonetic systems of balanced simultaneous bilinguals (Sundara et al., 2006) and deviances from monolingual norms in highly proficient "unperceivable non-native speakers" (Abrahamsson and Hyltenstam, 2009) is potentially that of the increased bilingual cognitive load. Nested within the multicompetence framework (Cook, 2003), and the commonly accepted notion that bilinguals are not two monolinguals in one (Grosjean, 2001), the bilingual cognitive load theory predicts that bilinguals "recruit control processes to manage their ongoing linguistic performance" (Bialystok, Craik, Green, & Gollan, 2009, p. 89) which are not required of monolinguals. The languages of highly proficient bilinguals are in competition with one another, and this competition as such prevents them from attaining monolingual proficiencies, which may occur at any age of acquisition. It is thus arguably the case that bilinguals as such perform differently than monolinguals simply because bilinguals process and produce two languages (regardless of whether they acquire their languages simultaneously, i.e. both languages from birth onwards during the maturation of the brain in childhood; or as late consecutive bilinguals,

i.e. an L1 initially during the maturation of the brain in childhood and an L2 thereafter outside of the maturation of the brain in childhood). Accordingly, the “unperceivable non-native speakers” of Abrahamsson and Hyltenstam’s (2009) study may not have deviated from native speaker norms due to their having learned their L2 outside of the brain’s maturation, but rather due to their higher cognitive load in comparison to the monolingual control group.

Future research is necessary in order to determine the extent to which even highly proficient bilinguals deviate from monolingual norms in their L1 and L2, and factors which impact such intra- and interpersonal variation. Moreover, the relationship between proficiency levels in bilinguals’ L1 and L2, and the increased cognitive load in bilinguals in comparison to monolinguals is a potential line of fruitful research.

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