



Factors affecting degree of foreign accent in an L2: a review

Thorsten Piske

Department of English, University of Kiel, D-24098 Kiel, Germany

Ian R. A. MacKay

Department of Linguistics, University of Ottawa, Ottawa, Ontario, K1N 6N5 Canada

James E. Flege

*Department of Rehabilitation Sciences, University of Alabama at Birmingham,
Birmingham, AL 35205, U.S.A.*

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This article had two aims: to provide a thorough review of the existing literature examining overall degree of foreign accent in a second language (L2), and to present a new foreign accent experiment. The literature review suggested that a wide variety of variables influence degree of foreign accent. These variables include age of L2 learning, length of residence in an L2-speaking country, gender, formal instruction, motivation, language learning aptitude and amount of native language (L1) use. Age of L2 learning appears to be the most important predictor of degree of foreign accent. However, the relative importance of the other variables is uncertain. This is because many variables relating to subject characteristics tend to be confounded, and because of lack of adequate experimental control in some studies. The experiment presented here examined the influence of Italian-English bilinguals' age of L2 learning, length of residence in an L2-speaking environment (Canada), gender, amount of continued L1 (Italian) use and self-estimated L1 ability on degree of L2 foreign accent. As expected from the literature review, both age of L2 learning and amount of continued L1 use were found to affect degree of foreign accent. Gender, length of residence in an L2-speaking country and self-estimated L1 ability, on the other hand, were not found to have a significant, independent effect on overall L2 pronunciation accuracy.

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1. Introduction

For the last 30 years, beginning with the classic article by Asher & García (1969), the phenomenon of perceived foreign accent in the speech of L2 learners has been investigated in a large number of increasingly detailed experimental studies. As Thompson (1991)

points out, there are good reasons to study this phenomenon. For example, it may help resolve some theoretical issues regarding whether there are age-based constraints on L2 learning. In addition, identifying factors that influence degree of L2 foreign accent may be important for the teaching of second languages. The studies of overall degree of L2 foreign accent published so far differ greatly in terms of the nature of the subjects and languages examined, as well as in the procedures used to elicit and evaluate nonnative speech. To some extent at least, these methodological differences appear to be responsible for the often divergent results the studies have yielded. Major (1987), Long (1990) and Thompson (1991) have provided thorough reviews of previous research. However, many studies have been published since. Therefore, this paper will first provide a comprehensive review of the existing literature on degree of L2 foreign accent. In addition, it will report an experiment examining L1 use, a variable that has only been introduced into the literature more recently. Its effects on degree of L2 foreign accent and its relation to other factors that are likely to influence the pronunciation of an L2 will be examined.

2. Review of the existing literature

In this part of the present paper, we will first review important differences as well as similarities between the subject populations of earlier studies of L2 foreign accent and between the techniques that have previously been used to elicit and evaluate nonnative speech samples. Then we will discuss previous findings regarding those factors that have been claimed to affect degree of L2 foreign accent.

2.1. *Designs and methods used in previous research*

2.1.1. *Subject populations studied*

Overall degree of L2 foreign accent is likely to vary as a function of the characteristics of the subjects examined. As will be described below, the subjects examined in previous studies have differed in a number of potentially important ways, including target L2, native language, amount of experience with the target L2 and perhaps degree of motivation to pronounce the L2 well.

Most previous studies have examined English as the target L2 being learned. Other target languages examined include German (Olson & Samuels, 1973; Missaglia, 1999; Moyer, 1999), Hebrew (Seliger, Krashen & Ladefoged, 1975), Dutch (Snow & Hoefnagel-Höhle, 1977), French (Neufeld, 1979, 1980), Spanish (Elliott, 1995; Guion, Flege & Loftin, 1999, 2000) and Thai (Wayland, 1997). The native languages spoken by the participants in previous foreign accent studies have been far more diverse. They include Spanish (Asher & García, 1969; Flege & Fletcher, 1992); English (Olson & Samuels, 1973; Snow & Hoefnagel-Höhle, 1977; Neufeld, 1980; Elliott, 1995; Wayland, 1997; Moyer, 1999); Arabic, Japanese, Persian and Thai (Suter, 1976; Purcell & Suter, 1980); Italian (Oyama, 1976; Flege, Munro & MacKay, 1995; Flege, Frieda & Nozawa, 1997; Missaglia, 1999); Polish (Neufeld, 1980); Dutch (Neufeld, 1980; Bongaerts, Planken & Schils, 1995; Bongaerts, van Summeren, Planken & Schils, 1997); Mandarin and Taiwanese (Flege, 1988); Russian (Thompson, 1991); Swedish (Markham, 1997); and Korean (Flege, Yeni-Komshian & Liu, 1999b).

In some cases, subjects from different L1 backgrounds were examined in the same study (e.g., Suter, 1976; Purcell & Suter, 1980; Tahta, Wood & Loewenthal, 1981; Piper

& Cansin, 1988). It seems reasonable to assume that the accuracy with which nonnative speakers pronounce an L2 is, at least to some extent, dependent on their L1. Unfortunately, none of the studies cited above except Suter (1976) and Purcell & Suter (1980) have examined the effect of L1 background on degree of L2 foreign accent. In these two studies, native speakers of Arabic and Persian were found to have a better pronunciation of English than native speakers of Japanese and Thai. Overall, L1 background was identified as the most important predictor of degree of L2 foreign accent of the 20 variables considered by Suter (1976) and Purcell & Suter (1980). However, the subjects in those studies were not matched for other variables such as age of L2 learning (hereafter referred to as AOL), length of residence (LOR) in an L2-speaking country or amount of L2 use. The relative importance of L1 background, as compared to other variables, therefore remains uncertain.

The nonnative subjects in previous foreign accent studies differed in more than just L1 background. The subjects in some studies were highly experienced in the L2 (see, e.g., the studies by Flege and colleagues), whereas those in other studies had little experience in the L2 (e.g., Olson & Samuels, 1973; Snow & Hoefnagel-Höhle, 1977). Degree of motivation to speak an L2 well has also often been claimed to be an important determinant of degree of L2 foreign accent (see, e.g., Seliger *et al.*, 1975; Suter, 1976; Purcell & Suter, 1980; Elliott, 1995; Bongaerts *et al.*, 1995, 1997; Moyer, 1999).

A control group of native speakers was recruited in most of the studies cited so far in addition to groups of nonnative subjects. Unfortunately, not all studies have included a control group (e.g., Olson & Samuels, 1973; Fathman, 1975; Snow & Hoefnagel-Höhle, 1977; Tahta *et al.*, 1981; Elliott, 1995), which leads to two problems. It remains uncertain how native speakers would have performed under the specific circumstances of a particular experiment, and it also remains uncertain whether the raters recruited to evaluate speech samples would have been able to distinguish native from nonnative speech.

The fact that the subjects examined in previous research differed along the dimensions just described often makes direct comparisons across studies problematic. Assuming that such factors do indeed influence degree of L2 foreign accent, one would naturally expect to observe differences across studies. Thus, the observation that L2 foreign accent studies sometimes yield divergent results should not lead one to conclude that degree of L2 foreign accent cannot be scaled reliably and validly.

2.1.2. Elicitation techniques used

Studies of overall degree of L2 foreign accent have also differed in terms of the techniques used to elicit nonnative speech samples. In most studies, subjects have been asked to read sentences (e.g., Asher & García, 1969; Flege, 1988; Thompson, 1991; Flege & Fletcher, 1992; Bongaerts *et al.*, 1995, 1997; Moyer, 1999), paragraphs (e.g., Oyama, 1976; Neufeld, 1979, 1980; Tahta *et al.*, 1981; Piper & Cansin, 1988; Thompson, 1991; Bongaerts *et al.*, 1995; Moyer, 1999) or individual words (e.g., Bongaerts *et al.*, 1995; Elliott, 1995; Moyer, 1999). In a number of studies, subjects have also been asked to recount personal experiences or to describe pictures and, thus, produce samples of free (i.e., extemporaneous) L2 speech (e.g., Fathman, 1975; Oyama, 1976; Suter, 1976; Piper & Cansin, 1988; Thompson, 1991; Bongaerts *et al.*, 1995; Elliott, 1995; Moyer, 1999). And finally there have been studies in which subjects were asked to repeat speech materials after hearing a native speaker model. A direct repetition technique was, for example, used by Snow & Hoefnagel-Höhle (1977) or Markham (1997). Flege *et al.* (1995) and Flege *et al.*

(1999b), on the other hand, used a delayed repetition technique to elicit L2 speech samples.

Some researchers have used more than one elicitation technique (e.g., Oyama, 1976; Piper & Cansin, 1988; Thompson, 1991; Bongaerts *et al.*, 1995; Markham, 1997; Moyer, 1999). In most instances, analyses were carried out to determine if degree of L2 foreign accent varied as a function of type of elicitation. Both Oyama (1976) and Thompson (1991) reported that read speech was judged to be more strongly foreign-accented than extemporaneous speech samples. This may be due to differences in reading ability. For example, the readings skills of immigrants who moved to an L2-speaking country relatively late in life may be limited because they have received little education in the L2. Samples of extemporaneous speech may be problematic, too. This is because they may contain morphosyntactic and lexical errors influencing the foreign accent ratings given to nonnative speakers (Patkowski, 1990). In addition, subjects may be able to avoid difficult L2 sounds, sound sequences or even words if they are asked to talk about something freely. For these reasons, more reliable measures of degree of L2 foreign accent may be obtained if raters evaluate a fixed set of materials (e.g., sentences) that were elicited by using a delayed repetition technique (for details regarding this technique, see Section 3.1.2).

2.1.3. Rating techniques used

The listeners who evaluate L2 speech in foreign accent studies usually use a rating scale to indicate the degree of foreign accent they perceive in a speech sample. One end of the rating scale is reserved for one extreme category usually marked as “native-like pronunciation” or “no foreign accent”, whereas the other end of the scale is reserved for the other extreme category usually marked as “heavy foreign accent” or “definite foreign accent”. The space between the two endpoints of a scale symbolizes degrees of foreign accent between the two extremes.

The equal-appearing interval (EAI) scales used in previous studies have differed in resolution. A 5-point scale has been used most commonly (e.g., Olson & Samuels, 1973; Fathman, 1975; Oyama, 1976; Snow & Hoefnagel-Höhle, 1977; Piper & Cansin, 1988; Patkowski, 1980, 1990; Thompson, 1991; Bongaerts *et al.*, 1995; Elliott, 1995; Bongaerts *et al.*, 1997). Other types of scales that have been used include 3-point scales (e.g., Tahta *et al.*, 1981), 4-point scales (e.g., Asher & García, 1969), 6-point scales (e.g., Suter, 1976; Moyer, 1999) and 9-point scales (e.g., Flege *et al.*, 1999b; Guion, Flege & Loftin, 1999, 2000). Flege (1988), Flege & Fletcher (1992) and Flege *et al.* (1995) employed a continuous scale to evaluate foreign accent. The raters recruited for these studies were asked to move a lever on a response box over a 10 cm range. Depending on where the lever was positioned a value between 0 and 255 was returned. The authors used a continuous scale because, at the time, it was uncertain how many scale values were needed to capture listeners' full range of sensitivity to variations in L2 foreign accent. Studies that did not actually use rating scales were those of Neufeld (1979, 1980) and Markham (1997). In these studies, the raters were asked to classify subjects in terms of several native and nonnative categories.

In view of the fact that no standard scale for measuring degree of L2 foreign accent has been developed so far, the question arises whether all scales ensure equally valid and reliable measures of degree of L2 foreign accent. Southwood & Flege (1999) carried out research to determine whether foreign accent is a metathetic continuum (i.e., a con-

tinuum like pitch that can be divided into equal intervals ranging from high to low) or a prothetic continuum (i.e., a continuum like loudness that is not amenable to linear partitioning). They found that when judging native Italian speakers of English, native English listeners were able to partition L2 foreign accent into equal intervals. This indicated that foreign accentedness is a metathetic continuum, which means that it is appropriate to use an EAI scale in foreign accent studies (see also Fig. 1). With regard to the range of the scale values that are needed to exploit listeners' full range of sensitivity, Southwood & Flege (1999) found that a 9-point (or 11-point) scale should be used to rate L2 speech samples for degree of foreign accent.

The numbers of raters used in various L2 foreign accent studies have differed drastically, ranging from just 1 (Snow & Hoefnagel-Höhle, 1977) or 2 (e.g., Olson & Samuels, 1973; Fathman, 1975; Oyama, 1976) to 85 (Neufeld, 1979). It is not known at present how many raters are needed to provide a reliable estimate of degree of L2 foreign accent. The number of raters needed may depend on the range of foreign accents represented within a sample. For example, a larger number of raters may be needed to detect differences between groups of subjects representing only a small range of foreign accents.

One important methodological question pertains to the characteristics of the listeners called up to rate speech materials for degree of L2 foreign accent. In some studies, naïve raters were recruited to evaluate speech samples (e.g., Asher & García, 1969; Flege & Fletcher, 1992; Flege *et al.*, 1995). In other studies, "expert" raters such as linguists (e.g., Fathman, 1975) or ESL teachers (e.g., Piper & Cansin, 1988) have participated. Thompson (1991) reported that inexperienced raters generally perceived a higher degree of L2 foreign accent in nonnative speech than experienced raters. Bongaerts *et al.* (1997), on the other hand, found no significant differences between experienced and inexperienced raters. It appears, then, that a representative sample of raters should be recruited and not one particular type of rater.

2.2. Factors claimed to affect degree of L2 foreign accent

Given the large differences between studies in design and methodology, it is probably not surprising that L2 foreign accent studies have at times produced results that appear to conflict. This has led researchers to draw rather different conclusions about the influence that certain factors have on degree of L2 foreign accent. In the following paragraphs we will discuss the factors that have received the most attention in the literature. These are age of L2 learning, length of residence in an L2-speaking environment, gender, formal instruction, motivation, language learning aptitude and amount of L1/L2 use.

2.2.1 Age of L2 learning

It is often claimed that a critical period (CP) exists for human speech learning. According to the CP hypothesis, complete mastery of an L2 is no longer possible if learning begins after the end of the putative CP (e.g., Lenneberg, 1967; Scovel, 1969, 1988; Patkowski, 1980, 1990). A number of researchers have suggested that there may be several CPs, each affecting different linguistic abilities (e.g., Fathman, 1975; Seliger, 1978; Walsh & Diller, 1981; Long, 1990; Hurford, 1991). The first ability to be lost would be the one needed to develop a native-like pronunciation of an L2. Individuals who began learning an L2 before the end of the CP for speech learning would have a much better pronunciation than would individuals first exposed to the L2 after the end of the CP.

In many L2 foreign accent studies, subjects' age of first exposure to the L2, or what we refer to here as AOL, has been indexed as the age at which the subjects first arrived — often as immigrants — in a predominantly L2-speaking country. The results of these L2 foreign accent studies do, in fact, support the view that the earlier in life one learns an L2, the better it will be pronounced (Asher & García, 1969; Fathman, 1975; Seliger *et al.*, 1975; Suter, 1976; Oyama, 1976; Tahta *et al.*, 1981; Piper & Cansin, 1988; Flege, 1988; Patkowski, 1990; Thompson, 1991; Flege & Fletcher, 1992; Flege *et al.*, 1995; Flege *et al.*, 1999b; Moyer, 1999). CP effects have usually been attributed to an age-related loss of neural plasticity or to some sort of neurofunctional reorganization that occurs during development (e.g., Lenneberg, 1967; Scovel, 1969; Lamendella, 1977; Neville, Mills & Lawson, 1992). Alternatively, it has been suggested that age-related changes in degree of L2 foreign accent result from the nature and the extent of the interaction between a bilingual's L1 and L2 systems (e.g., Oyama, 1979; Flege, 1987, 1988, 1995, 1998a; Bialystok, 1997). According to this latter approach, age is an index of the state of development of the L1 system. The more fully developed the L1 system is when L2 learning commences, the more strongly the L1 will influence the L2.

A few studies have pointed to what now seems to be a paradoxical effect, that is, better performance by late than early learners of an L2 (e.g., Olson & Samuels, 1973; Snow & Hoefnagel-Höhle, 1977). Snow & Hoefnagel-Höhle (1977), for example, reported that older native English children and adults were better able to imitate Dutch sounds in individual words than were younger children when tested 6 weeks after arriving in the Netherlands. However, by 10–11 months after arriving in the Netherlands the younger children began to outperform the older learners in pronouncing at least some L2 sounds. From results like these, Long (1990) concluded that adult and adolescent learners might have an initial rate advantage over younger children in L2 pronunciation ability, albeit an advantage that is only temporary.

According to the CP hypothesis, there should be a clear difference between the foreign accent ratings obtained for individuals who began learning the L2 before *vs.* after the end of a CP (e.g., Lenneberg, 1967; Scovel, 1969, 1988; Patkowski, 1980, 1990). A number of studies have shown, however, that the relationship between AOL and degree of L2 foreign accent is linear without any sharp discontinuities near the beginning of adolescence (e.g., Oyama, 1976; Flege, 1995; Flege *et al.*, 1999b). The finding that there is a gradual increase in degree of L2 foreign accent led both Oyama (1976) and Long (1990) to suggest that there is a “sensitive” rather than a “critical” period for L2 learning. Unfortunately, the two terms “critical period” and “sensitive period” are often used interchangeably in the L2 literature. The differences between the two concepts should be noted, however.

Different suggestions have been made as to when the putative critical or sensitive period for L2 speech learning ends. Scovel (1988) suggested that a CP ends at the age of 12 years. According to Patkowski (1990), a CP ends at the age of 15 years. On the basis of a literature review, Long (1990) inferred that an L2 is usually spoken accent-free if it is learned by the age of 6 years. Foreign accents would, however, be present in most individuals who begin learning the L2 after the age of 12 years. Long's view (1990) that learners with an AOL of less than 6 years are much more likely to speak an L2 without a foreign accent than are adolescent or adult L2 learners is supported by the results of a number of studies (e.g., Tahta *et al.*, 1981; Flege & Fletcher, 1992; Flege *et al.*, 1995). However, a few studies have also shown that an AOL of less than 6 years does not automatically lead to accent-free L2 speech. For example, Flege *et al.* (1997) examined

the foreign accent ratings given to two groups of early Italian-English bilinguals that were matched for average AOL (*mean* = 6 yr) but that differed significantly in amount of L1 (Italian) use. Both groups of early bilinguals spoke English sentences with a detectable foreign accent. When a separate analysis was carried out for the subjects with the lowest AOL in the study (*mean* = 3.2 yr), even this group of subjects was found to have a detectable foreign accent in English. Similarly, Thompson (1991) reported that some of the raters recruited for her study detected a slight foreign accent in the L2 speech produced by two native speakers of Russian who had begun learning the L2 (English) at the age of 4 years.

Just as evidence accumulates that some early bilinguals will speak their L2 with a detectable foreign accent, a number of studies have provided evidence that some L2 learners with AOLs of over 12 years may avoid speaking their L2 with a detectable foreign accent. For example, Moyer (1999) identified a native English subject with an AOL of 22 years who obtained a mean rating in German that was higher than the rating given to one of four native German control subjects. In a study by Bongaerts *et al.* (1997), five adult learners of English were given ratings comparable to the ones obtained for native English control subjects. According to the authors, the subjects' first extensive exposure to British English had occurred at the age of 18 years or later. Flege *et al.* (1995) reported that 6% of 120 native speakers of Italian who had begun learning English after the age of 12 years performed in a native-like range. However, none of these had begun learning English after the age of 16 years.

In summary, previous foreign accent research has shown that early learners speak L2 with a lower degree of foreign accent than late learners. However, no study has as yet provided convincing evidence for the claim that L2 speech will automatically be accent-free if it is learned before the age of about 6 years and that it will definitely be foreign-accented if learned after puberty. It thus appears that factors other than AOL also have an influence on degree of L2 foreign accent. Moreover, as has been noted by Flege (e.g., 1987, 1998*b*), the age effects found in L2 studies are difficult to interpret because AOL is typically confounded with other variables that are likely to affect the pronunciation of an L2. These confounded variables include, for example, chronological age, length of residence in an L2-speaking environment and amount of L1 and L2 use.

2.2.2. Length of residence

The variable examined most frequently in studies of L2 foreign accent has been AOL. The next most frequently studied variable has been amount of L2 experience. In many L2 studies, this variable has been operationalized as "length of residence" (LOR), which specifies the number of years spent in a community where the L2 is the predominant language. Previous research has produced conflicting evidence concerning the importance of LOR for L2 pronunciation accuracy. The discrepancies across studies may be due, in part, to the fact that LOR only provides a rough index of overall L2 experience. Studies that have reported an influence of LOR on degree of L2 foreign accent include Asher & Garcia (1969), Purcell & Suter (1980), Flege & Fletcher (1992), Flege *et al.* (1995) and Flege *et al.* (1999*b*). However, there are also several studies that have not found an effect of LOR. These studies include Oyama (1976), Tahta *et al.* (1981), Flege (1988), Piper and Cansin (1988), Thompson (1991), Elliott (1995) and Moyer (1999).

Five studies by Flege and his colleagues (Flege, 1988; Flege & Fletcher, 1992; Flege *et al.*, 1995; Riney & Flege, 1998; Meador, Flege & MacKay, 2000) provided a basis for

understanding why some studies found an LOR effect, whereas others did not. Flege (1988) examined two groups of adult native Taiwanese learners of English differing in LOR (1.1 vs 5.1 yr). The foreign accent ratings obtained for these two groups did not differ significantly. Flege (1988) interpreted this as support for the hypothesis that after a rapid initial phase of learning, LOR does not affect the degree of L2 foreign accent of individuals who began learning the L2 as adults (see, e.g., Oyama, 1976; Tahta *et al.*, 1981). Flege & Fletcher (1992) investigated English sentences spoken by two groups of late Spanish–English bilinguals differing in LOR in the US (0.7 vs. 14.3 yr). The experienced subjects received significantly higher ratings than those with less experience. However, LOR was not identified as a significant predictor of degree of L2 foreign accent in a multiple regression analysis (which identified AOL as the most important predictor of degree of L2 foreign accent). Flege & Fletcher (1992) concluded that LOR is a less important determinant of degree of L2 foreign accent than AOL is. They also suggested that some previous studies probably did not find a significant LOR effect because the range of LOR values examined was too narrow. They suggested that their Spanish subjects, but not the native Taiwanese subjects examined by Flege (1988), showed an effect of LOR because the Spanish subjects had lived for a shorter period of time in the US than the inexperienced Taiwanese subjects (0.7 yr, S.D. = 0.3 vs. 1.1 yr, S.D. = 0.7).

Results obtained by Flege *et al.* (1995), Riney & Flege (1998) and Meador *et al.* (2000) supported the conclusion drawn earlier by Flege (1988, see also Oyama, 1976; Tahta *et al.*, 1981) that the size of LOR effects depends on whether subjects are still in an early phase of L2 learning or not. In the study by Flege *et al.* (1995), 10 native speakers of Canadian English used a continuous rating scale (see Section 2.1.3) to evaluate short English sentences that had been produced by 240 native Italian subjects. 62 of these 240 native Italian subjects were re-recorded by Meador *et al.* (2000) 4 years later. The 62 subjects had arrived in Canada at an average age of 11 years and had been living in Canada for an average of 35 years. Foreign accent ratings were obtained for these subjects by five new listeners, who used a 9-point scale ranging from “strongest foreign accent” to “native English-no accent”.

The two sets of foreign accent ratings obtained for the 62 native Italian subjects are shown in Fig. 1. The *y*-axis shows the mean ratings obtained using a 9-point scale by Meador *et al.* (2000), and the *x*-axis shows the mean continuous-scale ratings obtained for the same subjects by Flege *et al.* (1995). The strength of the correlation of the two sets of ratings ($r(60) = 0.94$, $p < 0.001$) is surprising, for two things were necessary. First, the two sets of listeners who evaluated recordings made at 2 times had to scale degree of foreign accent in a comparable way despite the fact that different scaling procedures and speech materials were used. Second, the subjects' relative degree of foreign accent had to remain constant across the 4 years that separated the recordings. The strength of the correlation shown in Fig. 1 should reassure those who have expressed skepticism that overall degree of perceived foreign accent can be scaled reliably (e.g., Markham, 1997). And it shows that, for subjects who are highly experienced in their L2, an additional 4 years of experience using the L2 are unlikely to alter degree of L2 foreign accent.

The finding just reported does not mean, however, that degree of foreign accent never changes. Riney & Flege (1998) recorded 11 native Japanese speakers at International Christian University in Tokyo during their freshman year (T1) and senior year (T2). T1 and T2 were separated by 42 months. English sentences produced by the students were rated by native speakers of English living in Birmingham, Alabama. Sentences spoken by three students received significantly higher ratings at T2 than at T1. Of these, two had

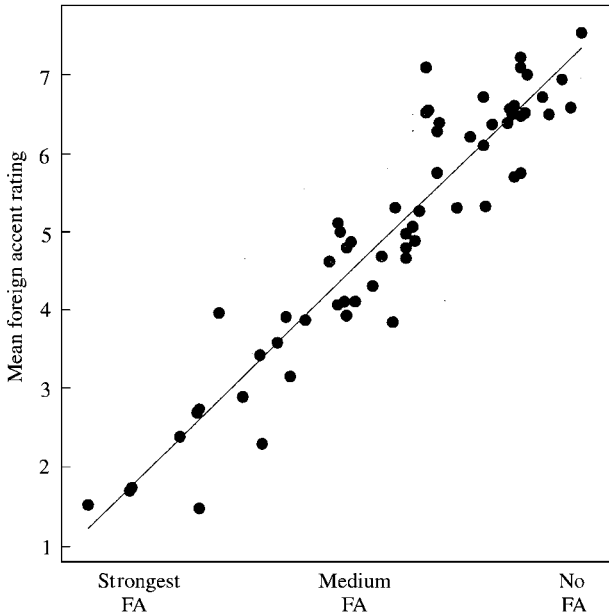


Figure 1. The mean foreign accent ratings obtained for 62 native Italian learners of English in 1992 using a continuous rating scale (see Flege *et al.*, 1995) and in 1996 using a 9-point rating scale (see Meador *et al.*, 2000).

resided in California for an academic year. The finding of Riney & Flege (1998) therefore supports the hypothesis that, in early phases of L2 learning, additional experience with the L2 may lead to a significant decrease in degree of L2 foreign accent.

In summary, not every study has shown a significant effect of LOR on degree of L2 foreign accent. In those studies where an LOR effect was found, LOR was a less important predictor of degree of L2 foreign accent than AOL. Apparently, an effect of LOR is much more likely to be found if the groups of L2 learners examined differ greatly in terms of mean LOR values. As shown by Flege & Fletcher (1992), adult learners may show an effect of LOR if a group of subjects with LORs of less than 1 year is compared to a group with LORs of several years. Moreover, for highly experienced subjects, additional years of experience in the L2 appear to be unlikely to lead to a significant decrease in degree of L2 foreign accent. In the early phases of L2 learning, on the other hand, additional experience in the L2 may well lead to less foreign-accented L2 speech. However, at present it is not possible to define precisely what is meant by “early phase”. This is because no study in the existing literature has examined changes in degree of foreign accent in a longitudinal design.

2.2.3. Gender

Previous research has provided divergent findings concerning the influence of gender on degree of L2 foreign accent. Asher & García (1969) found that female children and adolescents obtained higher ratings than age-matched males did. The effect of gender became weaker when AOL-defined subgroups were considered. The differences between

male and female learners were greatest for individuals with an AOL of 1–6 years. Asher & García (1969) also found that gender differences diminished as LOR increased. Tahta *et al.* (1981) examined subjects with AOLs of over 6 years. The authors identified gender as a significant predictor of degree of L2 foreign accent, with women receiving higher ratings than men. Analyses of AOL-defined subgroups indicated that the effect of gender was due to subjects who had begun learning the L2 after the age of 13 years. In a study by Thompson (1991), females also received higher ratings than males, with gender accounting for 11% of the variance in degree of L2 foreign accent.

Most studies have not identified gender as a significant predictor of degree of L2 foreign accent (e.g., Olson & Samuels, 1973; Suter, 1976; Snow & Hoefnagel-Höhle, 1977; Purcell & Suter, 1980; Flege & Fletcher, 1992; Elliott, 1995). Flege *et al.* (1995) found that gender effects differed depending on AOL. Female subjects with AOLs less than 12 years received higher ratings than males, whereas males with AOLs greater than 16 years received higher ratings than females. Flege *et al.* (1995) carried out ANOVAs examining the responses given to questionnaire items by female and male subjects matched for AOL, but were unable to provide a straightforward account of the gender–AOL interaction.

In summary, the results obtained for gender do not lead to any strong conclusions. Some studies reported a significant influence of gender, whereas others did not. The majority of the studies that identified gender as a significant predictor of degree of L2 foreign accent found that females usually received higher ratings than males. However, two studies (Asher & García, 1969; Flege *et al.*, 1995) suggested that the effect of gender may vary as a function of AOL and amount of L2 experience.

2.2.4. Formal instruction

Many studies examining the influence of formal instruction on degree of L2 foreign accent have not produced encouraging results for language teachers. Studies that did not identify instructional variables as significant predictors of degree of L2 foreign accent include Thompson (1991), Elliott (1995), Flege *et al.* (1995) and Flege *et al.* (1999b). Flege & Fletcher (1992) identified “number of years of English-language instruction” as a significant predictor of degree of L2 foreign accent but it accounted for only 5% of the variance in the foreign accent ratings obtained for native Spanish learners of English. Two instructional variables were identified as significant predictors of L2 pronunciation accuracy by Suter (1976). It is noteworthy, however, that one of these variables, i.e., total amount of formal classroom training in English, was found to be inversely related to L2 pronunciation accuracy.

L2 pronunciation receives little attention in most foreign language classrooms. This might explain why instructional variables seem to have had so little effect in the studies just cited. The results of three studies indicate that instructional variables may be found to have a larger effect on degree of L2 foreign accent if the subjects received special training in L2 pronunciation. Bongaerts *et al.* (1997) identified five late learners of English who received ratings in English that were comparable to those obtained for native speakers of English. According to the authors, these highly successful L2 learners had all received (unspecified) intensive training in the perception and production of English sounds. Moyer (1999) examined native English speakers of German. She found that those subjects who had received both suprasegmental and segmental training obtained ratings that were closer to the range of ratings obtained for native speakers of

German. The variable “segmental and suprasegmental feedback” was identified as one of three primary predictors of degree of L2 foreign accent.

Missaglia (1999) compared a group of inexperienced adult native Italian learners of German who had received “prosody-centered” phonetic training in the L2 to a group of inexperienced subjects who had received “segment-centered” phonetic training in German. The group who had received prosody-centered training was found to have improved its pronunciation of German significantly more than the group who had received segment-centered training. The group who had received prosody-centered training was found to perform better with regard to both suprasegmental as well as segmental production.

In summary, there is little evidence to date that amount of formal instruction as such affects degree of L2 foreign accent. However, if classroom teaching carried on in the L2 involves special training in the perception and the production of L2 sounds, it may well have a larger effect on L2 production accuracy.

2.2.5. Motivation

Several studies have examined the influence of motivation on degree of L2 foreign accent. Different procedures have been used to measure motivational variables. In most cases, the subjects have been asked to rate the importance of good L2 pronunciation for their work as well as for their social life on a scale ranging from, for example, “very important” to “not important at all” (e.g., Suter, 1976; Thompson, 1991; Moyer, 1999).

Oyama (1976) and Thompson (1991) found no evidence that motivation affects degree of L2 foreign accent, but other studies have shown an influence of motivational variables. In studies examining late L2 learners, Suter (1976), Purcell & Suter (1980) and Elliott (1995) identified strength of concern for L2 pronunciation accuracy as a significant predictor of degree of L2 foreign accent. Flege *et al.* (1995) identified factors designated “integrative motivation” and “concern for L2 pronunciation” as significant predictors of degree of L2 foreign accent, but these factors accounted for only 3% of the variance in males’ but not females’ foreign accent ratings. Flege *et al.* (1999b) reported that integrative and instrumental motivation accounted for less than 3% of the variance in the foreign accent ratings obtained for native Korean learners of English.

Bongaerts *et al.* (1997) and Moyer (1999) recruited highly motivated late L2 learners in order to determine if such subjects would receive pronunciation ratings comparable to those of native speakers. Bongaerts *et al.* (1997) examined a group of 11 late Dutch learners of English who had been identified as highly motivated and successful learners of English by university-based EFL experts. All but two of these subjects were university-level teachers of English who considered it necessary to speak English without a Dutch foreign accent. Five of the 11 did indeed receive ratings comparable to those obtained for a control group of native English speakers.

Moyer (1999) recruited 24 late native English learners of German. All were graduate students in German who had taught German to undergraduates. Moyer hypothesized that, primarily because of their high degree of professional motivation, these late learners would demonstrate native-like performance. A strong correlation was found to exist between the variable “professional motivation” and degree of L2 foreign accent. However, none of the subjects, except for one outlier, received ratings that fell within the range of ratings obtained for native speakers of German. In the case of both the Bongaerts *et al.* (1997) and the Moyer (1999) studies, it is difficult to assess how much L2 input the

subjects had really received and when they were first consistently exposed to the L2. Differences in amount of L2 experience and AOL may be responsible for why the Dutch–English bilinguals in the Bongaerts *et al.* (1997) study appear to have been more successful in L2 pronunciation than the English–German bilinguals examined by Moyer (1999).¹ Smaller typological L1–L2 differences in the Bongaerts *et al.* (1997) study may also account for the native Dutch subjects' apparently greater success. However, at present, it is not possible to gauge the overall “phonetic distance” between various L1 and L2 pairs.

In summary, most studies examining the effect of motivation on degree of L2 foreign accent have reported at least some influence of motivation on the outcome measures. On the whole, however, the results obtained so far clearly suggest that factors like professional motivation, integrative motivation or strength of concern for L2 pronunciation accuracy do not automatically lead to accent-free L2 speech. Apparently, they are rarely so strong that late learners will still be able to attain a native-like pronunciation of the L2. Finally, it is important to note that motivation has not been quantified very precisely in previous studies. For example, in most studies it is not clear to what extent the individual subjects really differed in terms of their motivation to pronounce an L2 well.

2.2.6. *Language learning aptitude*

Do some people have a special aptitude for producing unfamiliar speech sounds? Does musical ability influence nonnatives' L2 speech pronunciation? Some studies have addressed these questions, although it has to be noted that there is a paucity of studies examining aptitude factors in a controlled manner. It is thus impossible to draw any strong conclusions regarding these factors. To our knowledge, musical ability has as yet not been found to significantly affect degree of L2 foreign accent (e.g., Tahta *et al.*, 1981; Thompson, 1991; Flege *et al.*, 1995). However, all studies except for one (Flege *et al.*, 1995) have identified mimicry ability as a significant predictor of degree of L2 foreign accent

Suter (1976) asked his subjects to imitate stretches of speech containing unfamiliar sounds. Suter reported that “innate aptitude for oral mimicry” accounted for little variance in degree of foreign accent, but a later re-analysis (Purcell & Suter, 1980) identified this variable as more important, second only to L1 background. Subjects in the Thompson (1991) study self-rated their ability to mimic unfamiliar speech sounds using a 7-point scale. Their ratings accounted for a small amount (5%) of variance in degree of foreign accent. Finally, in the study by Flege *et al.* (1999b), “sound processing ability” (an amalgam of subjects' self-estimated mimicry ability, musical ability and ability to remember how English words are pronounced) accounted for 2% of the variance in degree of L2 foreign accent.

In summary, musical ability has as yet not been identified as one of those variables that have an important influence on degree of L2 foreign accent. The ability to mimic unfamiliar speech sounds, on the other hand, has repeatedly been identified as a significant and independent predictor of degree of L2 foreign accent. An important question

¹It should be noted that in the Netherlands many television programs are broadcast in English. This is why residents of the Netherlands may be exposed to a considerable amount of English from a very early age onwards.

that should be addressed in future research is whether some people are born with this ability, or whether it develops as a result of certain still-to-be-identified experiences.

2.2.7. Language use

The influence of language use patterns on degree of L2 foreign accent was first examined by Suter (1976) and Purcell & Suter (1980), who asked learners of English to estimate how much time they spent speaking English with native speakers at home, at work or at school, and how many months they had resided with native speakers of English. In the Purcell & Suter (1980) study, a composite variable combining years of residence in the US and number of months of cohabitation with native speakers was identified as the third most important predictor of degree of L2 foreign accent. Amount of conversation in English at work or school, on the other hand, was not found to be a significant predictor of degree of L2 foreign accent due to its correlation with LOR and L1 background. In the study by Tahta *et al.* (1981), amount of English use in the home accounted for 9% of the variance in degree of foreign accent. However, when just early bilinguals (i.e., subjects with AOLs of 7–12 years) were considered, 26% of the variance was accounted for.

Three other studies showed no apparent effect of L2 use or input. Flege & Fletcher (1992) reported that native Spanish subjects' degree of L2 foreign accent was not significantly correlated with percentage daily use of the L2 (English). Elliott (1995) reported that travel to Spanish-speaking countries and number of Spanish-speaking relatives had little or no effect on the pronunciation of Spanish by 66 intermediate students studying Spanish at Indiana University. Thompson (1991) asked native speakers of Russian to estimate the percent of time they used English (at work, at home and with friends). She found that English-language use showed a significant simple correlation with degree of L2 foreign accent, but was not identified as a significant predictor in a multiple regression analysis, because it was confounded with AOL. Thompson (1991) did not observe an influence of L2 use on the native Russians' pronunciation of English, but speculated about the possible influence of L1 use on L2 pronunciation. The native Russian subjects in her study had "professional speaking proficiency" in their L1, despite of LORs in the US ranging from 2 to 42 years. According to Thompson, the subjects' continued high level of L1 proficiency may have been responsible for the detectable presence of L2 foreign accent in the speech of two early bilinguals with AOLs of 4 years. She suggested that "a difference must be noted between subjects who have maintained their mother tongue and those who have lost it when it comes to estimating accent retention in the second language" (p. 200).

It seems reasonable to assume that a high level of proficiency in the L1 is much more likely to be maintained if L2 learners continue to use the L1 frequently, even after many years of residence in the L2-speaking country. A few studies have examined the effects of amount of L1 use on degree of L2 foreign accent. In the study by Flege *et al.* (1999b), native Korean subjects who used English relatively often (and Korean seldom) were found to have a significantly better pronunciation of English than AOL-matched native Korean subjects who used English relatively seldom (and Korean often). The authors concluded that the language use patterns exerted a significant, independent effect on degree of L2 foreign accent.

Native Italian immigrants to Canada estimated their percentage use of Italian and English at work, socially and at home in a study by Flege *et al.* (1995). AOL accounted for most of the variance in the foreign accent ratings obtained for these individuals

(59%). However, language use factors accounted for an additional 15% of the variance. Flege *et al.* (1997) selected two subsets of early bilinguals from the native Italian subjects examined previously by Flege *et al.* (1995). As already mentioned, the two subject groups were matched for AOL (6 years), but differed according to their self-reported use of Italian (3 vs. 36%). The subjects in both native Italian groups were found to have detectable foreign accents in English. However, the early bilinguals who spoke Italian frequently had significantly stronger foreign accents than did the early bilinguals who spoke Italian infrequently. An L1 use effect was also reported by Guion *et al.* (1999, 2000). They found that amount of L1 use affected the L2 but not the L1 speech of Quichua–Spanish bilinguals who used their L1 on a regular basis in a bilingual setting.

3. Foreign accent: an experiment

The literature just reviewed identified a wide range of variables that might be expected to influence overall degree of perceived foreign accent in an L2. One of the most recent variables introduced to the literature is amount of L1 use. So far, the only studies to have examined the influence of L1 use have focused on early bilinguals. The purpose of the experiment reported here was to determine whether the effect of L1 use previously observed for early bilinguals could be replicated, and to extend this work to late bilinguals. As in the study by Flege *et al.* (1997), the present study examined English sentences spoken by two groups of early Italian–English bilinguals who were matched for AOL but differed according to self-reported use of Italian. Unlike the earlier study, it also compared two groups of *late* bilinguals matched for AOL but differing in amount of L1 use. The view that an individual's ultimate attainment in the pronunciation of an L2 is not only influenced by age-related factors would strongly be supported if both early *and* late bilinguals were found to show an effect of amount of L1 use. Such a finding would suggest that language use patterns affect degree of L2 foreign accent regardless of a bilingual's age of L2 acquisition. Previous research has provided disparate findings regarding the effect of gender. Therefore, the present study included a comparison of male and female subjects.

3.1. Method

3.1.1. Talkers

Characteristics of the 43 male and 47 female subjects examined in this study are summarized in Table I.² The 18 native English control subjects had all been born and raised in Canada. The 72 native Italian subjects, who had all been born in Italy, were recruited based on their AOL and self-reported L1 use. Age of arrival in Canada was used to index AOL. The native Italian subjects who began to learn English as children will be referred to as “early bilinguals”, and those who began to learn English in late adolescence or early adulthood as “late bilinguals”. L1 use was the average of three separate self-estimates (use of Italian in the preceding 5 years, 5 months and 5 weeks),

²The 90 subjects participating in this study will only be described here in terms of those variables that will be examined in Section 3.2. For more details concerning these subjects see Flege, MacKay & Piske (under review).

TABLE I. Means characteristics of the 18 subjects in each of the five groups. Age = chronological age, in years; AOL = age of L2 learning as indexed by the subjects' age of arrival in Canada, in years; LOR = length of residence in Canada, in years; L1 Use = self-reported percentage use of Italian; L1 Ability = estimates of Italian ability on a scale ranging from "poor" (1) to "good" (7). S.D. are in parentheses

Group	Age	Gender	AOL	LOR	L1 Use	L1 ability
Native English	50 (5)	9m 9f	—	—	—	—
Early-low	50 (4)	8m 10f	7 (3)	42 (4)	7% (4)	4.3 (1.2)
Early-high	49 (6)	8m 10f	8 (4)	40 (4)	43% (15)	4.9 (0.9)
Late-low	51 (7)	10m 8f	20 (3)	31 (8)	10% (5)	6.5 (0.7)
Late-high	49 (8)	8m 10f	20 (3)	29 (9)	53% (13)	6.6 (0.6)
<i>M</i>	50 (5)	43m 47f	14 (7)	36 (9)	28% (23)	5.6 (1.3)

which were highly correlated with one another ($p < 0.01$). The subjects who reported using Italian seldom will be referred to as the "low-use" subjects, and those who reported using Italian often as the "high-use" subjects.

The early and late bilinguals were equally subdivided into subgroups of low- and high-use subjects. As intended by the design, the early-low and the early-high group were matched for average AOL (early-low-7 vs. early-high-8 yr) but differed significantly in L1 use (early-low-7 vs. early-high-43%). The late-low and the late-high group also differed significantly in amount of L1 use (late-low-10 vs. late-high-53%) but not in average AOL (late-low-20 vs. late-high-20 yr). The native Italian subjects were also asked to rate their ability to speak, understand, read and write Italian on a scale ranging from 1 ("poor") to 7 ("good"). The variable "L1 ability" was computed by averaging across each subject's four estimates.

3.1.2. Speech materials

The 90 subjects were tested in a quiet room in a Roman Catholic parish house located in Ottawa. A delayed repetition technique was used to elicit the three sentences examined here (viz., *Paul ate carrots and peas; I can read this for you; He turned to the right*). Two of these three sentences were drawn from previous studies (Flege & Eefting, 1987; Flege, 1988; Flege & Fletcher, 1992; Flege *et al.*, 1997). The sentences were presented in written form and also aurally, via a tape recording. Each sentence to be produced was preceded and followed on the tape by a context sentence, as in the following mini-dialogue:

Voice 1: *What did Paul eat?*
 Voice 2: *Paul ate carrots and peas.*
 Voice 1: *What did Paul eat?*
 subject: [repeats Voice 2]

Although the sentences were modeled on the tape, the delay between the model (i.e., Voice 2) and its repetition, as well as the intervening speech material, probably prevented direct imitations from sensory memory. Two tokens of each sentence were elicited. The sentences were not designed to be especially difficult for Italian speakers of English. They do not represent the full range of English allophones, nor do they include the full range of prosodic dimensions that distinguish English from Italian. The 90 subjects' productions of the three sentences were recorded on DAT tape. The second token of each sentence was digitized at 22.05 kHz on a PC, except in the few instances in which it was judged to be disfluent (in which case the first token was used).

3.1.3. *Raters*

Native speakers of Canadian English (four males, five females) were asked to auditorily evaluate the three sentences produced by each of the 90 talkers. All nine raters, who were between 22 and 46 years of age ($M = 31$ yr), were living in Birmingham, Alabama at the time of testing. They had grown up in four different Canadian provinces (Ontario-6, Alberta-1, British Columbia-1, Manitoba-1). Six of the raters had some knowledge of French, and one knew some Japanese. However, none of them was proficient in any language other than English. They all passed a pure tone hearing screening at octave frequencies between 500 and 4000 Hz (ref: 25 dB HL) before participating in the foreign accent rating experiment.

3.1.4. *Procedure*

The raters were tested individually in a sound booth. A total of 270 sentences (90 talkers \times 3 sentences) was presented over loudspeakers at a comfortable level. The three English sentences were presented separately in three randomized blocks, the order of which was counterbalanced across raters. Each block consisted of 300 trials, of which the first 30 were for practice (and were not analyzed). The purpose of the first 30 trials was to familiarize the raters with the range of foreign accents they would hear. The raters were told that they would hear sentences spoken by Italian immigrants to Canada or by native speakers of Canadian English. They were asked to rate each sentence for degree of foreign accent by pushing one of nine buttons representing a scale from 1 (very strong foreign accent) to 9 (no foreign accent). During the experiment, the raters were able to listen to each sentence as often as they wished, and were given the chance to correct their last judgment if they wanted. A 1-s interval occurred between each rating and the presentation of the next sentence. The raters heard each talker's production of a sentence 3 times. An average rating was obtained for each sentence, based on the final three judgments.

3.2. *Results*

First, inter-rater and inter-sentence consistency were investigated. A preliminary analysis revealed that much the same foreign accent ratings were provided by the nine raters. Overall mean ratings were obtained for each rater by averaging across the three sentences. When averaged over all 90 subjects, the mean ratings obtained for the nine raters (averaged across sentences) ranged from a low of 4.4 to a high of 7.0. The simple correlation was computed for all possible pairwise combinations of two raters. The lowest correlation was $r = 0.88$. The intraclass correlation for the scores obtained for the

nine raters was $\rho = 0.99$, $F(89,712) = 93.5$, $p < 0.001$, which indicated that there was a high degree of inter-rater agreement.

Next, an average rating was computed for each of the three sentences as judged by the nine raters. The average ratings obtained for the 90 subjects for the three sentences differed little (means of 5.7, 5.5 and 5.8). A high intraclass correlation for the sentence ratings, $\rho = 0.97$, $F(89,178) = 34.0$, $p < 0.001$ indicated that there was also substantial inter-sentence agreement. These results justified using a single average rating for each talker by averaging over raters and sentences.

An ANOVA was carried out to examine the foreign accent ratings obtained for the 72 native Italian subjects. AOL (early vs. late), amount of L1 use (high vs. low), and gender served as between-subjects factors. This analysis revealed that the mean ratings obtained for the 34 male and 38 female subjects (means = 4.9 and 5.2) did not differ significantly ($F(1,64) = 0.6$, $p > 0.10$). Nor did the gender factor interact significantly with AOL ($F(1,64) = 2.1$, $p > 0.10$), amount of L1 use ($F(1,64) = 1.6$, $p > 0.10$), or enter into a significant three-way interaction ($F(1,64) = 0.0$, $p > 0.10$).

As shown in Fig. 2, lower mean ratings were obtained for the late bilinguals than for the early bilinguals (means = 6.6 vs. 3.5). This difference, which indicated a stronger foreign accent for the late bilinguals, was significant ($F(1,64) = 88.2$, $p < 0.01$). Also as shown in the figure, the mean ratings obtained for the high-use bilinguals were lower than those obtained for the low-use bilinguals (means = 4.5 vs. 5.6). This difference, which

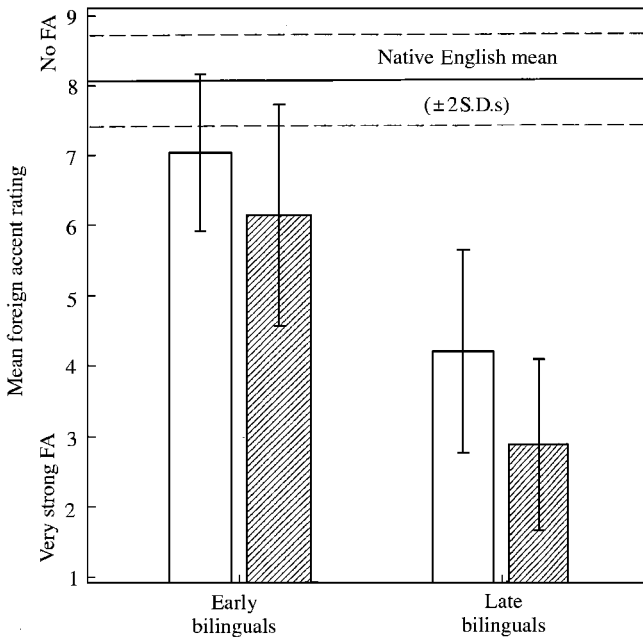


Figure 2. The mean ratings given by Canadian listeners to English sentences spoken by native English subjects or by Italian-English bilinguals who spoke Italian frequently or infrequently. The error bars bracket ± 1 S.D. The solid horizontal line indicates the mean ratings obtained for sentences spoken by the native English speakers ($M = 8.1$). The dashed horizontal lines indicate the native English range (native English mean ± 2 S.D.s). low % use of Italian; high % use of Italian.

TABLE II. Simple and partial correlations with the native Italian subjects' degree of foreign accent in English. AOL = age of L2 learning as indexed by the subjects' age of arrival in Canada, LOR = length of residence in Canada; L1 use = self-reported use of Italian; L1 ability = estimates of Italian ability on a scale ranging from "poor" (1) to "good" (7)

	Simple correlation	1 variable removed	2 variables removed	3 variables removed
(A) AOL	-0.83*	(B)-0.78*	(B,C)-0.80*	(B,C,D)-0.71*
(B) LOR	0.47*	(A)-0.18	(A,C)-0.21	(A,C,D)-0.21
(C) L1 use	-0.41*	(A)-0.47*	(A,B)-0.48*	(A,B,C)-0.46*
(D) L1 ability	-0.66*	(A)-0.17	(A,B)-0.16	(A,B,C)-0.06

indicated a stronger foreign accent for the bilinguals who used Italian relatively often, was also significant ($F(1,64) = 11.3$, $p < 0.01$). The lack of a significant interaction between AOL and amount of L1 use ($F(1,64) = 0.5$, $p > 0.10$) indicated that the effect of variation in use of the L1 on the pronunciation of English was comparable for the early and the late bilinguals.

A series of F -tests was carried out to determine if the scores obtained for any of the four native Italian groups were significantly lower than those obtained for the native English speakers' sentences (native English *mean* = 8.1). In all four instances, the native Italian groups' ratings were significantly lower (early-low: $F = 13.9$, early-high: $F = 25.7$, late-low: $F = 123.2$, late-high: $F = 307.3$, $df = 1,34$, Bonferroni $p < 0.001$).

As shown in Table II, there were significant simple correlations between the native Italian subjects' overall degree of L2 foreign accent and AOL, LOR in Canada, use of Italian, and self-reported ability in Italian. The first two correlations were expected from the ANOVA already presented (which yielded significant differences between groups selected on the basis of AOL and self-reported L1 use). It was of interest, therefore to further explore the relation between the four variables just mentioned and degree of L2 foreign accent.

Table II also presents partial correlations in which the effects of one, two, or three variables have been removed. It is interesting to note that the correlation between degree of L2 foreign accent and AOL remained significant when the effect of LOR was partialled out, when the effects of LOR and L1 use were partialled out, and even when the effects of AOL, L1 use, and self-reported ability in Italian were partialled out. Similarly, the correlation between L2 foreign accent and L1 use remained significant when the effect of AOL was partialled out, when the effects of AOL and LOR were partialled out, and even when the effects of AOL, LOR and self-reported ability in Italian were partialled out. It appears, then, that AOL and L1 use are independent predictors of the native Italian subjects' degree of foreign accent in English. This finding is consistent with the ANOVAs reported earlier, as well as with the results of a regression analysis by Flege *et al.* (1995).

But what about LOR and self-reported ability in Italian? The correlation between degree of L2 foreign accent and LOR remained significant ($p < 0.05$) when the effects of L1 use and L1 ability were partialled out separately. However, the correlation became non-significant when the effect of AOL was removed. This finding suggests that the apparent effect of LOR on L2 foreign accent is not due to the ameliorative effect of added years of speaking English but, rather, is an indirect consequence of the relation between LOR and AOL ($r(70) = -0.66$, $p < 0.01$).

The correlation between degree of L2 foreign accent and L1 ability remained significant when the effect of LOR was partialled out ($r(69) = -0.57, p < 0.01$), and when the effects of L1 use were partialled out ($r(69) = -0.40, p < 0.01$). However, as shown in Table II, the correlation between foreign accent and L1 ability became non-significant when the effects of AOL were partialled out (and also when AOL and LOR were partialled out, as well as AOL, LOR, and L1 use). L1 ability and AOL showed a strong positive correlation ($r(70) = 0.72, p < 0.01$), indicating that the later the native Italian subjects arrived in Canada, the stronger was their Italian. It thus appears that, unlike L1 use, L1 ability is not a significant predictor of degree of L2 foreign accent independently of its connection to AOL.

To assess their relative contribution to degree of L2 foreign accent, the four variables shown in Table II were submitted to a step-wise multiple regression analysis. This analysis accounted for a significant 76% of the variance in the foreign accent ratings ($F(1,70) = 151.5, p < 0.01$). AOL accounted for 68% of the variance at step 1, and L1 use accounted for 7% more variance at step 2. As expected from the partial correlations just reported, neither LOR nor L1 ability accounted for a significant additional amount of variance.

4. General discussion

The results of the experiment reported here replicated the finding by Flege *et al.* (1997) that native speakers of Italian who continue to speak their L1 frequently have significantly stronger foreign accents in English than do individuals who speak their L1 infrequently. This L1 use effect was shown to exist in much the same way for early and late bilinguals. When speculating about the basis of this effect, one could, of course, suggest that the subjects in the high-use groups simply did not get enough “practice” in English. This, however, is very unlikely, because subjects in all four native Italian groups had been living in Canada for an average of 36 years. Another result obtained by Flege *et al.* (1997) was replicated here. AOL was found to have a greater effect on degree of L2 foreign accent than L1 use. Future research is needed to determine if amount of L1 use will account for more variance than AOL when the differences in AOL are smaller than in the present study (e.g., groups having AOLs of 10 and 16 years).

Gender was not found to have a significant effect on the native Italian subjects' L2 foreign accent, nor did it interact with AOL. This agrees with the results of some studies (Olson & Samuels, 1973; Suter, 1976; Snow & Hoefnagel-Höhle, 1977; Purcell & Suter, 1980; Flege & Fletcher, 1992; Elliott, 1995) but not others. Flege *et al.* (1995) found, for example, that early female bilinguals received higher foreign accent ratings than early male bilinguals, whereas late female bilinguals received lower foreign accent ratings than late male bilinguals. Although the trend in this study went in the same direction, the effect did not reach significance. This may have been due to lack of statistical power. In the study by Flege *et al.* (1995), the cell sizes were larger than in the present study (96 *vs.* 72 subjects) and a larger number of ratings was available for each subject (150 *vs.* 81).

The simple correlation between degree of L2 foreign accent and LOR, as well as the correlation between degree of L2 foreign accent and self-estimated L1 ability were found to be significant here. However, the results of partial correlation analyses were interpreted to mean that neither LOR nor L1 ability accounted for variance in L2 foreign accent independently of AOL. As regards the effect of LOR, this study appears to

support the view that after L2 learners have spent a certain amount of time in a predominantly L2-speaking environment, increases in LOR will cease to have a further ameliorative effect on L2 pronunciation (e.g., Oyama, 1976; Tahta, *et al.*, 1981). Note, however, that longitudinal research is needed to determine more precisely at what point in L2 learning, if any, subsequent experience in the L2 ceases to have an ameliorative effect on the pronunciation of an L2.

One somewhat surprising finding of the study was that the native Italian subjects' amount of self-reported use of Italian, but not self-reported ability in Italian, was an independent predictor of degree of L2 foreign accent. There was a significant simple correlation between L2 foreign accent and both L1 use and L1 ability. However, the correlation with L1 ability became non-significant when other variables were partialled out, whereas the correlation with L1 use remained significant.

The data now in hand does not permit us to explain this finding. However, a tentative account might be offered as a stimulus for future research. We speculate that the effect of L1 use observed here was related to the nature of the phonetic input the native Italian speakers received and how that input influenced the structure of certain "composite" representations in their phonetic inventory. By composite representation, we mean representations that were used in processing vowels and consonants from both the L1 and the L2. An example of such a composite vowel representation for native speakers of Italian who do not establish a new category for English /ʌ/ might be a vowel that encompassed English /ʌ/ and the closest Italian vowel, presumably /a/ (see Flege, MacKay & Meador, 1999a). For the subjects who used Italian frequently, the input tokens that defined a composite representation would probably be skewed towards the norm for the Italian vowel or consonant, leading to an Italian-like target that, when implemented in production, would sound foreign-accented to native English-speaking listeners. Alternatively (or in addition), the subjects who used Italian frequently might have heard more frequent tokens of Italian-accented English vowels and consonants than the subjects who used Italian only infrequently. If so, this might have influenced the nature of their vowel representations. According to this tentative account, "ability" in the L1 plays a less powerful role in determining the structure of bilinguals' composite representations. To assess this account, additional research will be needed to establish the nature of the phonetic input received by low L1 use and high L1 use bilinguals and its relation to the degree of foreign accent with which these bilinguals speak the L2.

Results obtained by Sancier & Fowler (1997) suggest that even a temporary change in language use patterns and input conditions may affect a bilingual's production of both L1 and L2 sounds. The authors examined English and Portuguese sentences produced by a single Portuguese-English bilingual after a 2.5-month stay in Brazil and after a 4-month stay in the US. According to native Portuguese listeners, Portuguese sentences produced by the native Portuguese subject sounded significantly more American-accented after several months of exposure to American English than Portuguese sentences produced after a stay in Brazil. To more specifically examine the changes in the subject's production of L1 and L2 sounds, Sancier & Fowler (1997) measured Portuguese and English tokens of /p/ and /t/ occurring in the sentences that had been recorded. The authors found that the VOT values in both Portuguese and English stops were longer after a stay in the US than after a stay in Brazil. As a result of a "gestural drift" towards the VOT norms of the ambient language, her L1 stops became less authentic after exposure to American English, whereas her L2 stops became less authentic after recent experience with Brazilian Portuguese.

Future research is needed to determine more precisely which conditions may induce a measurable drift towards the phonetic norms of the ambient language in a bilingual's speech production. In the study by Sancier & Fowler (1997), such a drift was observed in a single bilingual subject after several months of extensive exposure to the ambient language. Grosjean (1997, 2000) has suggested that a bilingual's language behavior is strongly influenced by the "language mode" she/he happens to be in at a given moment in time. According to this view, the language mode (e.g., a monolingual mode *vs.* a bilingual mode) a bilingual operates in at a given point in time is primarily dependent on the immediate communicative situation, i.e., on a bilingual's current interlocutors. On such an account, bilinguals' language behavior in an experiment will not only be determined by the conditions under which they had been exposed to their L1 or L2 in the months preceding the experiment but also by the conditions under which they had been exposed to the L1 and the L2 in the hours or even minutes preceding the experiment.

It could be argued, of course, that AOL and L1 use cannot be claimed to be independent predictors of degree of L2 foreign accent, because the possible influence of motivation was not assessed here. There are two reasons why motivational variables were not considered here. First, a thorough literature review showed that motivation has little general effect. In the study by Bongaerts *et al.* (1997), for example, only five of the 11 highly motivated late bilinguals received ratings comparable to those obtained for native English speakers. Second, we assumed that motivation would play a less important role at the time we tested the subjects than when they first arrived in Canada 36 years (on average) earlier. Also, the subjects in this study were immigrants engaged in a wide range of professions, whereas all but two of the subjects tested by Bongaerts *et al.* (1997) were university-level teachers of English who considered it very important to speak English without a noticeable Dutch accent. Motivation may be a potent factor for groups of subjects who are required by their profession to speak an L2 without a foreign accent, but not so much for ordinary immigrants. Not one of the late-arriving immigrants examined here received ratings comparable to those obtained for the native English speakers. Eleven of the early bilinguals, on the other hand, did. Nine of these belonged to the early-low group and two to the early-high group.³ Two possibilities that need to be evaluated in future research are (a) that early learners are more motivated to speak an L2 well than are late L2 learners, and (b) that an immigrant's motivation to speak an L2 well may decrease as his/her LOR in an L2-speaking community increases.

Two other variables apart from motivation that were discussed in the literature review, but that were not examined in the experiment presented here, are formal L2 instruction and language learning aptitude. Flege *et al.* (under review) found that the amount of education that the subjects of the present study had received in Canada was very strongly correlated with their AOL, but did not independently predict degree of L2 foreign accent. As indicated by the literature review, only instructional variables that relate to specific training in the perception and the production of L2 speech sounds appear to have an effect on degree of L2 foreign accent. Variables relating to language aptitude such as mimicry or musical ability were not discussed here, because they have usually been found to have no or just a small effect on degree of L2 foreign accent. Moreover, the

³Flege *et al.* (1995) and Bongaerts *et al.* (1997) considered their bilingual subjects to have spoken English sentences without a foreign accent if they received a mean rating that fell within 2.0 standard deviations of the mean rating obtained for the subjects in the native English control groups. This criterion of native-like performance was also used here to determine which subjects spoke English without a foreign accent.

contribution of a factor such as mimicry ability is difficult to interpret because of uncertainty as to the basis of such an ability.

The phonetic parameters contributing to the perception of a foreign accent in nonnatives' speech were not examined here. When asked, native speakers usually report that they perceive nonnative speech as foreign-accented because of both segmental as well as suprasegmental errors produced by bilinguals. In addition, the degree of foreign accent perceived in nonnative speech will probably also be determined by the fluency with which bilinguals produce an L2, i.e., by pause and hesitation phenomena such as silent and filled pauses, repetitions, false starts, and rate of speech (e.g., Hieke, 1980). As yet, however, the empirical evidence does not allow one to quantify the relative contribution of segmental parameters, prosodic parameters and fluency to degree of foreign accent in an L2. Moreover, it has to be noted that segmental and suprasegmental aspects of speech are very closely related, so that in many cases it is difficult to draw a clear distinction between the two. The close relationship between segmental and prosodic parameters is also indicated by the finding by Missaglia (1999) that prosody-centered phonetic training had an ameliorative effect on both prosodic and segmental aspects of native Italian speakers' pronunciation of German. One of the few studies examining the contribution of both segmental and suprasegmental parameters to the perception of foreign accent was conducted by Wayland (1997). She found that adult native English learners of Thai were less successful in learning Thai tones and the quality of Thai vowels than in learning temporal aspects of certain Thai consonants and vowels.

On the whole, the role of prosody in L2 speech learning has only been investigated in a relatively small number of studies (e.g., Leather, 1990; Munro, 1995; Marcus & Bond, 1999; Kondo, 1999; Jilka, 2000). Most foreign accent studies have examined segmental aspects of L2 speech, i.e., the production and perception of L2 vowels and consonants. The results of many of these studies can be interpreted as supporting some of the basic hypotheses of Flege's Speech Learning Model (SLM; Flege, 1995). According to this model, the degree of success with which L2 sounds can be learned is largely dependent on the perceived phonetic similarity between L1 and L2 sounds. The SLM hypothesizes that category formation is more likely for L2 sounds that are very different from the closest L1 sound than for L2 sounds that resemble the closest L1 sound. If a new phonetic category is not formed for an L2 vowel or consonant, the phonetic properties of the L2 sound and the corresponding L1 sound will be merged into a "composite" L1-L2 category, which will result in an accented production of the L2 sound (see also Sancier & Fowler, 1997). Studies carried out by McAllister, Flege & Piske (1999, under review) and Mennen (1999) have shown that the SLM can also be applied to the study of prosodic aspects of L2 speech. Two questions that should be addressed in future research are (a) whether the relative importance of segmental *vs.* prosodic parameters for L2 speech learning may change over the course of L2 acquisition, and (b) to what extent the relative contribution of prosodic *vs.* segmental parameters to degree of L2 foreign accent varies as a function of the L1-L2 pairing.

In summary, the results of this study do not disprove the existence of a critical or a sensitive period for L2 speech learning. They rather support the finding of previous research that AOL is the single most important predictor of degree of L2 foreign accent. However, the results of this study also strongly corroborate the view that ultimate attainment in the pronunciation of an L2 is dependent on various factors, not just on the state of neurological development at the age of first intensive exposure to the L2. It was shown here for the first time that amount of L1 use has much the same effect on early *and*

late bilinguals' L2 pronunciation. All other variables apart from AOL and L1 use examined here, i.e., gender, LOR and self-estimated L1 ability, were not found to independently predict degree of L2 foreign accent. More research is needed to determine the basis of the L1 use effect observed here, e.g., whether it reflects a difference in the nature of the L2 input that high L1 use and low L1 use learners receive, or whether this effect is based on the way the L1 and the L2 systems interact in these groups of bilinguals.

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