

## Laryngeal stop systems in contact: Connecting present-day acquisition findings and historical contact hypotheses\*

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### Abstract

This article examines the linguistic forces at work in present-day second language and bilingual acquisition of laryngeal contrasts, and to what extent these can give us insight into the origin of laryngeal systems of Germanic voicing languages like Dutch, with its contrast between prevoiced and unaspirated stops. The results of present-day child and adults second language acquisition studies reveal that both imposition and borrowing may occur when the laryngeal systems of a voicing and an aspirating language come into contact with each other. A scenario is explored in which socially dominant Germanic-speaking people came into contact with a Romance-speaking population, and borrowed the Romance stop system.

Keywords: laryngeal phonology, voicing, aspiration, acquisition, Germanic, language contact

### 1. Introduction

The Germanic languages are known to vary considerably in terms of the laryngeal contrasts they maintain in their stop systems (Jansen 2004, Iverson & Salmons 2008). This variation has received a great deal of attention, both in historical linguistics and in the area of phonological theory. Whereas in phonological theory, the question around which a debate has emerged is whether languages with different laryngeal systems make use of different laryngeal features, the question addressed in historical linguistics is when and how the variation found in the Germanic languages emerged. This article approaches the present-day variation found in the Germanic languages' laryngeal systems from a second language acquisition (SLA) point of view and thereby aims to contribute to our understanding of the linguistic outcomes of laryngeal systems in contact. The assumption that the observation of present-day processes can shed light on processes operative in the past—in other words, that forces which are at work in language today are the same forces that played a role in the past—has been termed the 'uniformitarian principle' (see Christy 1983). On the uniformitarian assumption, the present article examines which linguistic forces are at work when the laryngeal systems of two languages come into contact with each other in language acquisition and discusses to what extent these forces can shed light on the linguistic outcomes of language contact in the past.

This article focuses on the emergence of Germanic languages which, unlike standard varieties of German and English, do not have aspirated stops. Instead, these languages share with Romance languages a contrast between prevoiced and unaspirated stops. The origin of Germanic languages with a Romance-like laryngeal system has been hypothesized to lie in language contact (see Iverson & Salmons 2003b, 2008 for references and discussion). Two different hypotheses on the historical contact situation are presented and discussed against the background of recent findings in SLA. The study then examines to what extent the different types of cross-linguistic interaction which result from language contact can be found in these present-day SLA studies on laryngeal contrasts.

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## 2. Laryngeal stop systems in the Germanic languages

### 2.1. 'Voicing' vs. 'aspirating' languages

Roughly two main types of laryngeal stop systems can be distinguished for different Germanic languages or language varieties.<sup>1</sup>

A first type, called 'aspirating languages', contrasts short-lag with long-lag stops: one series of stops is aspirated in foot-initial position, especially in stressed syllables, and the realization of the other series is variable, but it is usually realized without vocal fold vibration in initial position, and with vocal fold vibration in medial position (Docherty 1992). All North Germanic languages are reported to be of this type (i.e. Icelandic, Norwegian, Faroese, Danish and Swedish, though see n.1 for Swedish). The only attested East Germanic language is Gothic, which is generally thought to have been an aspirating language, though there is little evidence for this (Goblirsch 2005: 78, and Kortlandt 1988 argues that Gothic had no aspiration). In West Germanic, most varieties of English and German are aspirating languages (Docherty 1992, Braun 1996).

A second type, called 'voicing languages', has a two-way contrast between prevoiced and short-lag stops. In the non-Germanic language family, most Romance, Slavic and Baltic languages belong to this group (Jansen 2004:41). However, a number of West Germanic languages are also of the voicing type, namely Dutch, Afrikaans, Frisian, Scottish and Yorkshire English, Low German (Riparian, South Westphalian, South Eastphalian, North Thuringian and North Upper Saxon) and Rhineland German, East Swedish and most varieties of Yiddish (Jansen 2004, Vaux & Samuels 2005).

### 2.2. Phonetics or phonology?

One of the key questions in the literature on laryngeal stop systems is whether voicing and aspirating languages differ in the phonetic realization of their stops, or whether they also employ different phonological features. While some researchers argue that the contrastive feature is [voice] in both voicing and aspirating languages and that the difference lies in the phonetic implementation of the contrast (Kingston & Diehl 1994), others argue that the contrastive phonological feature is [voice] in voicing languages like Dutch, but [spread glottis] in aspirating languages like English (Avery & Idsardi 2001, Kager et al. 2007, Honeybone 2005, Iverson & Salmons 1995, 1999, 2003a, 2003b). The former approach has been called the 'Single Feature Hypothesis', the latter the 'Multiple Feature Hypothesis' (Kager et al. 2007).

One argument provided by Kingston & Diehl (1994) in favour of the Single Feature Hypothesis is that in voicing as well as aspirating languages, voicing starts earlier in one series of stops than in the other, and that the contrast between the two categories can hence be

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<sup>1</sup> Besides these two main types, at least three minor types have been proposed in the literature. Some Germanic languages, such as some Western Yiddish dialects, have been argued to have a three-way laryngeal system contrasting prevoiced, short-lag and long-lag stops (Herzog et al. 1992, in Iverson & Salmons 2008). Some also argue for the existence of type 4 Germanic languages, which contain a contrast between prevoiced and long-lag stops. Such a contrast is argued to occur in Swedish (Ringen & Helgason 2004), as well as in some varieties of English, such as those spoken by Shetland Island speakers (Scobbie 2002). Finally, type 5 language varieties have two series of stops which cannot be distinguished in terms of Voice Onset Time, but in terms of consonant length. This type is represented by some Alemannic and Bavarian dialects (Kraehenmann 2001, 2003).

expressed as a difference in onset of voicing in both types of languages. Another argument by Kingston & Diehl (1994) is that in both voicing and aspirating languages,  $F_0$  (fundamental frequency, the number of cycles of vocal fold vibration per second) is depressed next to prevoiced as well as phonetically voiceless, unaspirated stops. This is taken to mean that prevoiced and unaspirated stops share a common feature [voice] (see Kingston & Diehl 1994).

Arguments in favour of the Multiple Feature Hypothesis mainly come from patterns of laryngeal assimilation. An example is the English process of progressive devoicing in clusters (Iverson & Ahn 2007). Plural forms of nouns, such as *cats* [kæts], have an underlying /z/ as the plural marker (/kætz/), which is devoiced under the influence of the preceding stem-final voiceless stop. This assimilation process finds a natural explanation in a [spread glottis] approach, where the devoicing of the /z/ can be described as the result of a leftward spreading of the feature [spread glottis] from the preceding voiceless obstruent. Another example is the production of regressive voice assimilation by non-native speakers of English (Van Rooy & Wissing 2001). Van Rooy & Wissing argue that languages in which the feature [voice] is contrastive always display regressive voice assimilation of onset voiced stops onto preceding obstruents. They base this claim on L2 English data from native Tswana speakers. When speakers of Tswana, a voicing language in which only syllabic nasals are allowed in coda position, were asked to read English sentences containing possible regressive voice assimilation sites, they transferred not only the feature [voice], but also the process of regressive voice assimilation from Tswana into English. According to Van Rooy & Wissing (2001), this suggests that the presence of [voice] implies regressive voice assimilation. Since regressive voice assimilation is absent in native English (e.g. *hot bath* is realized with [t\_b] and not with [d\_b]), onset voiced stops in English cannot be specified for [voice]. It should be noted, however, that the production of voicing in the final obstruents can also be the result of a general constraint against obstruent clusters in which the members do not agree in voicing. Moreover, Ringen & Helgason (2004) argue that Swedish presents counterevidence for this claim, as by far the majority of stops produced by native speakers of Swedish in their experiment were produced with prevoicing, while Swedish has no process of regressive voice assimilation.

Evidence for the [spread glottis] approach has also been found in data from historical linguistics. Honeybone's (2005) argument for this approach comes from the *binnendeutsche Konsonantenschwächung*, a lenition process through which voiceless /p, t, k/ and voiced /b, d, g/ merge into one category of stops, /b, d, g/. The process is thought to have occurred after Middle High German and its effects are still present in many Central and Upper German Dialects. Honeybone argues that a merger of this type cannot be explained in a [voice] approach, as it implies a process through which an unmarked (/p, t, k/) and a marked (/b, d, g/) series merge into the marked series, leading to a language with only one, marked series of stops. However, he argues that the process can be explained in an approach distinguishing three types of stops in voicing and aspirating languages: [spread glottis] stops (the long-lag, aspirated stops in aspirating languages), [voice] stops (the voiced stops in voicing languages) and laryngeally neutral stops, which are underlyingly non-specified, and contrast with the [spread glottis] stops in aspirating languages and the [voice] stops in voicing languages. If it is assumed that [spread glottis] is active in aspirating languages, the German lenition process can be regarded as a process through which aspirated [spread glottis] stops and unaspirated, laryngeally neutral stops merge into the unaspirated, neutral series. A change from a laryngeally marked series of obstruents to a laryngeally neutral series is entirely natural, and hence these diachronic data are argued to provide evidence for an approach in which the phonological feature [spread glottis] is active in aspirating languages.

### 2.3. Implications for acquisition

Whether the difference between voicing and aspirating languages is phonetic or phonological obviously has implications for second language acquisition. If the difference is purely phonetic, i.e. if the languages employ the same phonological feature [voice] and differ only in the phonetic implementation of this feature, learners of a voicing language acquiring an aspirating language or vice versa need to shift the boundaries between the two members of the contrast in the direction of the target language. If, on the other hand, the difference lies in the phonological representations, then speakers of a voicing language acquiring an aspirating language also need to acquire a new phonological feature [spread glottis] for voiceless stops. By contrast, speakers of an aspirating language learning a voicing language need to learn not to specify voiceless stops for [spread glottis], but to specify voiced stops for [voice].

Brown (1998) argued that L2 learners cannot acquire a new L2 phonological feature, unless it is contrastive elsewhere in the learner's L1 system. In her study, L1 Chinese but not L1 Japanese speakers could acquire the English contrast between /r/ and /l/, which is distinguished by the feature [coronal]. That this feature is present in the phonology of Mandarin Chinese, but is not contrastive in Japanese, was held responsible for the observation that the Chinese, but not the Japanese could attain native-like perception of the /r/-/l/ contrast. However, it is important to note that, while the Japanese learners of English need to learn a new phonological feature ([coronal]) for a contrast which does not exist in their L1, native speakers of a voicing language learning an aspirating language or vice versa would need to replace the contrasting feature of their L1 with a new phonological feature. Another potential learning path would be to acquire a new L2 phonological feature ([spread glottis]), without losing the L1 feature ([voice]). In this case, the learners' L2 phonological system would be 'overmarked': voiced and voiceless stops would be distinguished from one another by [spread glottis] as well as by [voice].

Whether one or two phonological features are assumed for voicing and aspirating languages, it is clear that speakers of one type of language learning the other need to shift the phonetic boundaries between the two members of the contrast when perceiving or producing the L2. Pater (2003) examined the perceptual acquisition of the Thai voice contrast by native speakers of English. Thai has a three-way contrast between prevoiced, short-lag and long-lag stops and native speakers of English learning Thai thus also need to shift the boundaries between voiced and voiceless stops in order to discriminate between three categories. The results revealed that English speakers were better at discriminating the aspiration distinction than the voicing distinction (see also Abramson & Lisker 1970).<sup>2</sup>

Since both voicing and aspirating languages have a two-way laryngeal contrast in their stops, speakers of one type of language learning the other do not need to create an extra category or lose one. Flege (1987) called L2 sounds which have an identifiable counterpart in the L1 "similar phones" and gives the example of French and English /t/, which differ in Voice Onset Time (i.e. the time lag between the release of a stop and the onset of vocal fold vibration for a following sonorant, henceforth VOT) and place of articulation, yet are classified by learners as similar. In Best's Perceptual Assimilation Model (PAM, see Best 1994, 1995; Best, McRoberts & Goodell 2001) this type of correspondence between source and target language, i.e. when the number of categories in a contrast is the same in the source

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<sup>2</sup> The results in Pater (2003), a follow-up study to Curtin et al. (1998), diverge from those in Curtin et al., who found that L1 English speakers performed better on the voicing than on the aspiration contrast. Pater (2003) points out that one potential explanation for this finding may be that the participants in Curtin et al. were recruited in Montreal, where they must at least have overheard the French voicing contrast.

and the target language, is called a ‘two-category assimilation’. By contrast, when two categories in the target language are associated with only one category in the source language, as is the case for the English /r/-/l/ contrast acquired by L1 Chinese and Japanese learners discussed above, it is termed a ‘single category assimilation’. In Escudero (2005) it is argued that, although it is easier to learn to perceive a contrast in the L2 if it is already there in the L1 (which Escudero terms a ‘SIMILAR scenario’), it still poses a learning task, since the phonetic implementation of the contrast will be language-specific. While in a SIMILAR scenario learners can reuse their L1 categories, they need to shift the boundaries of the L1 perception in the direction of the L2 (Escudero 2005: 257ff.).

### 3. A diachronic perspective on Germanic voicing languages

The status of Germanic voicing languages has been given a fair deal of attention in the literature, most recently by Iverson & Salmons (2003b, 2008). In order to understand how language contact could have led to the laryngeal systems of Germanic voicing languages, we adopt van Coetsem’s (1988) framework. Van Coetsem argues that in any situation of language contact, there is a source language (SL) and a recipient language (RL). He distinguishes two processes involving transfer of elements from one language into another on the basis of whether the source or the recipient language speaker is the agent. If the recipient language speaker is the agent, who transfers elements from the source language when using the recipient language, the process is called ‘borrowing’. If, on the other hand, the source language speaker is the agent, the transfer of elements from the source into the recipient language is termed ‘imposition’ (van Coetsem 1988: 3). Van Coetsem further argues that some language components are more stable than others and that imposition is common in more stable domains and borrowing in less stable domains. Vocabulary, for instance, is argued to be less stable than phonology, because it is less resistant to change and lexical items are often borrowed from one language into the other. Phonology, by contrast, is argued to be more resistant to change and native speakers of one language speaking another will often transfer elements from their native language into the foreign language.

As Winford (2000:6) points out, the distinction between borrowing and imposition is based on the psycholinguistic notion of language dominance:

In borrowing, materials from a non-dominant source language are imported into an RL via the agency of speakers for whom the latter is the dominant or primary language, i.e., RL agentivity. ... In imposition, the source language is the dominant (usually the first or primary) language of the speaker, from which materials are transferred into an RL in which the speaker is less proficient, i.e., SL agentivity’.

An example of lexical borrowing would be the use of English words such as ‘computer’ in Dutch. The agents are native speakers of Dutch in Belgium and the Netherlands, who are dominant in Dutch, the recipient language and who borrow lexical items from English, the source language. Examples of imposition are numerous in the domain of second language phonology. Native speakers of German speaking English, for instance, are known to commonly substitute the English dental fricatives /θ/ and /ð/ by the German phonemes /s/ and /z/, such that *think* is realized as [sɪŋk] and *that* as [zæt] by beginning learners of English. These foreign language learners are dominant in their native language, German, which is the source language, and impose their German phoneme system onto the recipient language, English.

It should be noted that the term ‘dominant’ above denotes linguistic dominance, which is crucially different from social dominance: a language is linguistically dominant when the speaker has a greater proficiency in that language than in the other language involved in the

contact situation. A language is socially dominant, when for language-external reasons, it has a higher social status than the other language (van Coetsem 1988:13).

A potential approach to the observation that a number of West Germanic languages have a voicing rather than an aspirating laryngeal system is to assume that contact between a Germanic aspirating and a Romance or Slavic voicing language in the past led to the emergence of a Germanic language system with a number of non-Germanic characteristics, including the laryngeal stop system with its contrast between prevoiced and voiceless, unaspirated stops. One of the West Germanic voicing languages for which such an approach has been proposed is Yiddish. According to the most widely accepted account of the origin of Yiddish, proposed by Weinreich (1980, 2008), Jewish speakers of a Romance-like language came into contact with German, which heavily influenced their phonology, including their stop system. When large migration took place in the 11th century and the Jews living in the eastern areas of Central Europe moved eastwards, they came into contact with Slavic voicing languages.<sup>3</sup> As a result of this contact, they adopted the Slavic voicing system in their largely Germanic Yiddish language.

A different account has recently been proposed by Loudon (2000), who argued that Eastern Yiddish has more likely emerged as a large group of Knaanic-Slavic language speakers adopted the Yiddish aspirating language, but transferred their stop voicing contrast into Yiddish. The difference between Weinreich's (1980, 2008) and Loudon's (2000) accounts can be understood in van Coetsem's (1988) framework. In both accounts, the Slavic voicing language is the source language and the Yiddish aspirating language the recipient language. However, the two accounts differ in speaker agentivity: in Weinreich's account the recipient language speaker of Yiddish is the agent, who becomes bilingual with Slavic and borrows the voicing system from the Slavic language. In van Coetsem's framework, as interpreted by Winford (2000), the source language from which patterns are borrowed, in this case Slavic, is thus the non-dominant language and the recipient language, in this case Yiddish, is the linguistically dominant language. If we assume such a social setting, in which Slavic is the socially dominant language and Yiddish the weaker language, then this account fits well with the directionality of the influence: the Yiddish speaker borrowed the laryngeal stop system from the more prestigious Slavic language. By contrast, in the account proposed by Loudon (2000) the source language speaker of a Knaanic-Slavic language is the agent, who becomes bilingual with Yiddish and imposes the voicing stop system on the Yiddish language, or—in the terms of Thomason & Kaufman (1988)—the Slavic community 'shifts' to Yiddish and the voicing stop system is introduced in Yiddish as a result of interference, a process they term 'interference through shift'. Loudon argues that the traditional account, as proposed by Weinreich, involves borrowing in the domain of phonology, which according to van Coetsem (1988) is unlikely, as phonology is a stable domain. Loudon (2000: 98) claims that:

it is highly unlikely that Yiddish-speaking adults ... could effect such large-scale changes in their native Yiddish (recipient) language phonology, by introducing major new rules ... or altering their segmental inventory ... derived from Slavic or any other source language.

However, large-scale phonological borrowings are not unattested. An example is the occurrence of clicks as phonemic speech sounds (as opposed to paralinguistic speech sounds) in some Southern African Bantu languages, comprehensively discussed by Güldemann & Stoneking (2008:94). They note that two languages may share clicks as the result of (1)

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<sup>3</sup> A different view is expressed by Wexler (1991), who argues that Yiddish is in origin, i.e. from birth, a Slavic language, and became Germanized only in the course of its development.

inheritance from a proto-language which has clicks, (2) language contact between a click and a non-click language, or (3) independent innovation in two originally non-click languages. They argue that the clicks in Southern African Bantu languages are the result of contact between these languages and click languages, since click speech sounds cannot be reconstructed for Proto-Bantu (thereby excluding (1) above) and it is well known that there has been “frequent and intimate interaction over several centuries in several domains (e.g., trade, intermarriage)” between Bantu and local click languages (thereby excluding (3) above) (Herbert 1990: 298). Herbert (1990) discusses the case of Nguni, a Bantu language, in which clicks first entered the language in a special register used by Nguni women who were to linguistically disguise words that sounded similar to the names of male in-laws. Often, the women substituted the original consonants by clicks, which they heard in non-Bantu languages with which they came into contact. The clicks later spread from this marked speech register to the ‘normal’ lexicon, and even replaced native segments in native Nguni words. Güldemann & Stoneking (2008) point out that clicks, once borrowed, have “a life of their own”, as evidenced by the observation that some originally non-click Bantu languages now have more complex click systems than the languages they borrowed from or have click sounds not attested in any of the original languages (Güldemann & Stoneking 2008: 99). While borrowing in the domain of, for instance, vocabulary is known to be highly common, there is thus also considerable evidence that it can also occur in the domain of phonology.

A language contact account has also been proposed for the laryngeal system of Dutch (Kloeker 1954, discussed in Iverson & Salmons 2003b, 2008). The prevoiced-unaspirated stop system in Dutch is hypothesized to be the result of contact between speakers of a Germanic aspirating system and a Romance voicing system: the former Romance speakers became bilingual with a Germanic language, but imposed their Romance stop system onto the Germanic language. According to this hypothesis, which we will call the ‘Imposition Hypothesis’, the speakers of the Romance source language are the agents, who impose patterns or structures from their linguistically dominant language onto the language with which they become bilingual. In SLA terms, this would mean that the Romance speakers retain their prevoiced and voiceless unaspirated stops, and do not adopt the voiceless unaspirated and aspirated stops of the Germanic language.

However, like with Yiddish, an alternative account relying on recipient language agentivity is also possible. Again, it would be assumed that speakers of a Germanic aspirating language came into contact with a Romance voicing language. However, instead of the Romance speakers imposing their stop system on the Germanic language, an alternative hypothesis, which we will call the ‘Borrowing Hypothesis’, is that the Germanic speakers became bilingual with the Romance language and borrowed the voice system of the Romance language when speaking the Germanic language. Concretely, this means that the Germanic speakers abandoned their unprevoiced and voiceless aspirated stops in favour of the Romance prevoiced and voiceless unaspirated stops when speaking Germanic.

Both hypotheses thus assume that speakers of a voicing or aspirating language acquired a language of the other type and both make predictions about the linguistic outcomes of such an acquisition process. Since we do not have information on the social factors which were at play in the past and may have influenced the directions of language change, we cannot provide evidence for either of the two hypotheses to the exclusion of the other. However, we can test the plausibility of the hypotheses in structural terms by examining present-day studies which investigate the acquisition of laryngeal stop systems in voicing and aspirating languages. The next section reviews and presents a number of experimental studies on the acquisition of a voicing or aspirating language and discusses the linguistic outcomes of such bilingual and SLA processes.

#### **4. Acquiring laryngeal stop systems**

A number of studies have examined the acquisition of laryngeal stop systems by bilingual children acquiring the stop systems of two languages and by child learners acquiring a second language. We do not know how language acquisition took place — whether there was, for instance, a long period of bilingualism in which speakers were proficient in both Germanic and Romance, or whether the first immigrants quickly acquired the Germanic or Romance language with which they came into contact as adults. We will review and present findings from bilingual (§4.1) as well as adult (§4.2) and child L2 (§4.3) acquisition studies on laryngeal contrasts. These SLA findings will be connected to the diachronic hypotheses (§3) in §5.

##### **4.1. Simultaneous bilingual acquisition of a voicing and an aspirating language**

A number of studies have investigated the simultaneous acquisition of a voicing and an aspirating language. Two main findings are relevant to the present study.

First, studies on the acquisition of voicing and aspirating languages by simultaneous bilingual speakers have revealed that the prevoiced stops of the voicing language tend to be acquired late. Before they are acquired, speakers tend to produce short-lag stops instead. Deuchar & Clark (1996) conducted a longitudinal study with one child learning both Spanish and English from birth. They found that at age 2;3 the child had native-like VOT values in English, but not in Spanish. While the child started to differentiate between the two categories of the contrast, stops of both categories were produced with positive VOTs, i.e. the child had not yet learned to produce prevoicing. Similarly, Khattab (2000) reported on a VOT study with bilingual English-Arabic children, aged between 5 and 10, and found that prevoiced stops in Arabic were often replaced with short-lag stops. Kehoe, Lleó & Rakow (2004) examined the acquisition of stop consonant voicing in four Spanish-German bilingual children. They found that none of the children produced voicing lead in Spanish voiced stops at age 2;6. However, once prevoicing was acquired, some children produced German stops with prevoicing instead of in the short-lag region, and produced voiceless stops with aspiration. Finally, Macleod & Stoel-Gammon (2005) examined adult simultaneous French-English bilingual speakers in Canada and found that the VOT values produced by the bilinguals were similar to those produced by L1 speakers of the two languages, except for the production of short-lag stops in Canadian English, which were produced with prevoicing by the bilingual speakers.

Secondly, it has been reported that there is cross-linguistic influence in simultaneous bilinguals in the production of voiceless stops, in that the VOT values of the two languages move towards each other. Fowler et al. (2008) examined the production of word-initial /p, t, k/ by simultaneous English and French bilinguals. They found that the bilinguals produced these stops with significantly shorter VOTs than monolingual English speakers when producing them in English sentences and with significantly longer VOTs than monolingual French speakers when the words were embedded in French sentences. However, they still produced significantly longer VOTs in English than in French, which suggests that they did not create an intermediate category (in-between French short-lag and English long-lag), to serve for both languages.

##### **4.2. Adult L2 acquisition of an aspirating language**

When speakers of a Romance or Slavic language first came into contact with Germanic language speakers, or the other way round (see §3), we can imagine that they acquired this second language as adults. In order to get insight into the linguistic processes at work in adult



L2 acquisition of a laryngeal system, this section discusses the results of a recent production study on the acquisition of the laryngeal system of an aspirating language, English, by native speakers of a voicing language, Dutch (Simon 2009). In this study, the extent to which native Dutch speakers have acquired the English laryngeal contrast is measured by the extent to which they produce target-like VOT values in English. In the field of SLA, studies have reported that learners transfer VOT values from the L1 into the L2, both in perception (e.g. Curtin et al. 1998, Pater 2003) and in production (e.g. Flege et al. 1998, Suomi 1980). As a result, VOT values can provide information on how well learners have acquired the target language's laryngeal stop system. While VOT is only one of the many phonetic correlates of the laryngeal character of stops in these languages (besides, for instance, the length of vowels preceding final stops and the amplitude of the release burst in initial stops, Wright 2004: 41), Dutch and English can easily be distinguished on the basis of VOT in word-initial stops (Lisker & Abramson 1964). The stop system in Dutch is that of a typical voicing language<sup>4</sup>, in which voiceless stops are realized in the short-lag VOT region, roughly between 0 and 20 ms and voiced stops are produced with prevoicing, with VOTs roughly around -90 ms (Lisker & Abramson 1964, Flege & Eeftink 1987, Van Alphen 2004, Simon 2009). In English, on the other hand, both categories of stops are produced in the lag region and Wright (2004:40) indeed points out that VOT lag seems to be the primary cue for initial stops in English. Voiceless stops are typically produced with aspiration in initial position, with VOTs roughly between 60 and 90 ms and voiced stops are usually produced in the short-lag region, with VOTs between 0 and 25 ms (Lisker & Abramson 1964, Klatt 1975, Flege & Eeftink 1987, Docherty 1992, Simon 2009). Whichever approach one takes to the phonological features in Dutch and English (see §2.2.), it is clear that native speakers of Dutch learning English have to shift the boundary between prevoiced and short-lag stops in the direction of the English boundary between short-lag and long-lag stops. Hence, the aim of this production study was to examine to what extent advanced learners of English shift the boundary between the two categories from their native language into the second language.<sup>5</sup>

The participants were 16 native speakers of Dutch living in Flanders. They all studied English at the university level and were highly proficient speakers of English. While no independent measure of proficiency (in the form of a general comprehension or production task) was taken, all participants could express themselves fluently in English. Although they did not speak English on a daily basis, they came into contact with English through lectures and the media. Their pronunciation can be called 'advanced', which is defined by Fraser (2001:72) as "pronunciation [which is] easy for a person with moderate goodwill to understand, though with a noticeable foreign accent and the occasional mispronounced word". All participants had started learning English in school from around the age of 13, i.e. after childhood, though they may all have picked up some English vocabulary before that age, as a result of exposure to English via the media.

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<sup>4</sup> The fricative system in Dutch is more complex and there is some debate as to whether voiced and voiceless fricatives in Dutch are distinguished by [voice] or [spread glottis] (see Iverson & Salmons, 2003b, and Section 6 of this article).

<sup>5</sup> It should be noted that the production data will not provide an answer to the question whether the learners have acquired the target phonological representations, if these are different from the speakers' L1 representations (see §2.2). Insofar as we may assume that successful L2 production of VOT is necessarily preceded by successful perception, learners who produce target VOT values presumably perceive the values in a target-like way. However, additional lexical perception experiments would be needed for those cases in which learners do not produce target values. The learners may then still be able to perceive the category correctly, but fail to phonetically implement it in articulation.

The data were gathered through a Dutch and English word-reading task by the same informants.<sup>6</sup> The word reading task contained stop-initial words which were read from a computer screen at a comfortable rate (a new word appeared on the screen every 3 seconds). VOTs were measured in Praat (Boersma & Weenink 2010) on the basis of waveforms and spectrograms. Word-initial rather than word-medial or word-final stops were elicited and examined, because in word-medial, intervocalic position, stops are produced with vocal fold vibration throughout their production in voicing as well as in aspirating languages (Kingston forthcoming). In word-final position, however, there is laryngeal neutralization in Dutch, i.e. the contrast between voiced and voiceless obstruents is lost. Although word-final voiced stops in English are partially or fully devoiced, there is no laryngeal neutralization, since the vowel preceding the stop is consistently longer preceding voiced than preceding voiceless stops, and the duration of the vowel thus serves as a cue to the listener about the laryngeal category of the following stop (e.g. Cruttenden 2001: 96). In word-initial position, however, the contrast between the two stop categories is clearly maintained in aspirating as well as voicing languages.

Table 1 presents the mean VOTs in word-initial, bilabial, alveolar and velar voiceless stops produced by the Dutch-speaking participants in Dutch (leftmost column) and English (rightmost column). The middle column presents the VOT values produced by a control group of ten native speakers of British English in the same reading task.

	L1 Dutch (10 informants)	L1 English (10 informants)	L2 English (10 informants)
p	12	80	80
t	23	73	64
k	29	76	86
mean	21	76	77

**Table 1.** Mean VOT in word-initial /p, t, k/ in isolated words (in ms).

The average VOT in the English words produced by the Dutch-speaking informants in the reading task was 77 ms, compared to 21 ms in the Dutch words and 76 ms in the English stops produced by the native speakers of English. The L2 English results are in line with the findings of Flege & Eeftink (1987), in which nearly all Dutch-speaking learners of English produced longer VOTs in English than in Dutch words. Similar results for Dutch were found by Lisker & Abramson (1964) and Flege & Eeftink (1987).

The results for voiced stops are shown in Table 2.<sup>7</sup> This table presents the number of tokens produced with prevoicing by the participants, as it has been shown that it is the presence or absence of prevoicing rather than prevoicing duration which serves as a cue to the voice contrast in Dutch (van Alphen 2004: 73). However, the mean VOT durations of the prevoiced tokens are provided between brackets. Each of the participants produced ten words

<sup>6</sup> Participants were also engaged in spontaneous conversations in Dutch and English. Since most studies on VOT in English are based on laboratory speech (e.g. Lisker & Abramson 1964, Klatt 1975, Docherty 1992), the results of the analysis of the spontaneous data cannot be readily compared to values in L1 English and are therefore not discussed in the present article.

<sup>7</sup> The production of the velar stop /g/ was not examined, since Dutch does not have a voiced velar stop phoneme. (Some varieties of Dutch have velar stops, but only in loanwords, such as English *goal*).

with a word-initial voiced stop. Again, the results of L1 Dutch and L2 English are compared with those of the L1 English control group.

	L1 Dutch (10 informants)	L1 English (10 informants)	L2 English (10 informants)
b	95/100 (-130 ms)	29/100 (-82 ms)	95/100 (-113 ms)
d	91/100 (-117 ms)	26/100 (-79 ms)	90/100 (-105 ms)
mean	186/200 (-124 ms) (93%)	55/200 (-81 ms) (28%)	185/200 (-109 ms) (93%)

**Table 2.** Production of prevoicing in word-initial /b, d/ in isolated words.

Table 2 reveals that the overall majority of L1 Dutch and L2 English word-initial voiced stops (93%) were produced with prevoicing by the native speakers of Dutch. The mean VOT of the prevoiced tokens was -123 ms in the Dutch words and -109 ms in the English words. The 10 native speakers of English who participated in the reading task produced 28% of the tokens with prevoicing, more than half of which (30/55) were produced by only two speakers. If these two speakers are excluded from the analysis, only 26/160 (16%) tokens were produced with prevoicing by the remaining eight native speakers of English. Table 3 presents the number of short-lag tokens and their mean VOT produced by the remaining eight speakers.

	L1 English (8 informants)
b	65/80 (81%) (18 ms)
d	69/80 (86%) (21 ms)
mean	134/160 (84%) (20 ms)

**Table 3.** Production of short-lag stops in word-initial /b, d/ in isolated words.

Table 3 reveals that the remaining eight native speakers of English produced short-lag stops instead of prevoiced stops in 84% of the tokens, with a mean VOT of 20 ms.

The analysis thus showed that the participants had learned to produce aspiration, but had not learned to produce short-lag stops in English. Instead, they transferred prevoiced stops from Dutch into English. The learners thus displayed a mixed system, with prevoiced stops (as in Dutch) contrasting with long-lag stops (as in English).

One explanation for why participants acquired long-lag but not short-lag English stops may be that the learners had all taken an English pronunciation course, in which they received explicit instruction and were trained on the production of aspiration in English, but not on the absence of prevoicing. In order to examine the effect of formal pronunciation instruction on the acquisition of aspiration, Simon & Leuschner (2010) examined the VOTs of two groups of adult L1 Dutch learners of English: learners who were majoring in English at college level and who had received formal English pronunciation instruction, and learners who were not majoring in languages and who had not received formal instruction. The results of a word-reading task revealed that the ‘trained’ participants produced an average VOT of 81 ms,

which proved to be significantly higher than the average VOT of the ‘untrained’ participants, which was 59 ms. However, an average VOT of 59 ms is still situated around the target long-lag VOT region, which in English typically ranges from 60 to 90 ms (see §4.2). This suggests that explicit instruction may not be a necessary condition for the acquisition of long-lag stops by speakers of a voicing language, even though it should be kept in mind that all participants had started to learn English in a school setting (high school), where attention is paid to correct usage of English. The situation of the untrained listeners is hence still different from the naturalistic learning which took place in the presumed historical Germanic-Romance contact setting.

A second explanation for the learners’ acquisition of long-lag stops may be that aspiration is an important acoustic cue to the learner about the laryngeal category of the stop. We follow Wright in defining ‘cue’ in a narrow sense, as the “information in the acoustic signal that allows the listener to apprehend the existence of a phonological contrast” (2004: 36). Keyser & Stevens argue that spreading of the glottis, as it occurs during aspirated stops (and leads to a long VOT) may enhance the contrast between the two laryngeal stop categories in English. They argue that “... enhancement may take place whenever a given distinction can be made more salient than it might otherwise be” (2006: 42). Since word-initial phonologically voiced stops in English tend to be produced without vocal fold vibration, the contrast between these short-lag stops and the phonologically voiceless category of stops is enhanced by keeping the glottis spread till the time of release of the stops, resulting in a long VOT. The lengthened VOT of aspirated stops serves as an acoustic cue to the listener and may also explain why aspirated consonants are more easily acquired than voicing, as found by Pater (2003) (see §2.3).

Finally, Table 3 shows that there is variation in the realization of voiced stops in English. While these are produced with short-lag VOT by the majority of speakers, some speakers tend to produce them with prevoicing (cf. Docherty 1992). Learners are thus exposed to a variable input, which together with the presence of prevoicing in Dutch, may be responsible for the consistent production of prevoiced stops in the English speech of the Dutch-speaking adults.

In sum, the resulting system in the learners’ language contrasts prevoiced with long-lag, aspirated stops, meaning that the VOT difference between the two members is maximal. Such a system has been claimed to facilitate the perception of the distinct categories and even to become “more common over evolutionary time” as a result of this perceptual enhancement (Vaux & Samuels 2005: 410). In order to examine whether the prevoiced – long-lag contrast produced by L2 learners is typical of adult learners of an aspirating language only, the next section discusses a case of child L2 acquisition.

### **4.3. Child L2 acquisition of an aspirating language**

A number of studies have examined the acquisition of an L2 laryngeal contrast by young learners, and point to the importance of the linguistically dominant language in the acquisition process. Caramazza et al. (1973), for instance, examined VOT distributions in stop-initial French and English words produced by a group of adult monolingual Canadian French, monolingual Canadian English and bilingual Canadian French-English speakers. The results revealed that the bilinguals’ VOT values in French were closer to the French norm than their English values were to the English norm. The authors surmise that an explanatory factor for this may be that the participants were dominant in French. Even though they were fluent in both languages and used them on a daily basis, they had acquired the phonological system of French first, and had started learning English as their second language before they turned seven. Similarly, Hazan & Boulakia (1993) investigated the VOT production in the laryngeal systems of French and English by bilinguals. They also found that language dominance had

an important influence on the production of the stops, in that learners did not always produce monolingual-like values in their weaker language. There was a particular tendency for bilingual speakers whose dominant language was French to produce prevoicing in English /b/, even when those speakers were classified as ‘strong’ bilinguals, with a highly native-like accent in English.

Both Caramazza et al. (1973) and Hazan & Boulakia (1993) on child L2 (or consecutive bilingual) acquisition of laryngeal contrasts hence indicate that a child L2 speaker tends to produce more target-like VOT values in the linguistically dominant (native) language. Moreover, if the aspirating language is the speaker’s weaker language, this language’s short-lag stops tends to be replaced with prevoiced ones. This finding is interesting in light of a recent longitudinal case study with a three-year old Dutch-speaking child who was suddenly immersed in an English-speaking environment when he and his parents moved to the U.S (Simon 2010a). The aim of this study was twofold: (1) to find out how a young native speaker of Dutch acquires the laryngeal stop system of English and whether he develops two different laryngeal systems for Dutch and English or uses just one system for both languages, and (2) to investigate to what extent child L2 acquisition is different from adult L2 acquisition. Since this was a longitudinal study, it provides valuable information on the development of a young learner’s laryngeal systems in the two languages, on which little previous research has been carried out.<sup>8</sup> However, while case-studies of this type can substantially add to our knowledge of how a young learner’s L2 develops and to what extent the acquisition process affects the child’s L1, it should be kept in mind that we cannot generalize from one child to all children with a voicing language as their L1 acquiring an aspirating language as their L2.

The participant was a male native speaker of Dutch, who was 3;6 when the first recording took place. The child moved with his Dutch-speaking parents from Groningen, in the northern Netherlands, to the U.S. (Massachusetts) when he was 3;2. He was exposed to English as a second language only three months later, when he started attending an American preschool, i.e. seven weeks before the first recording took place. The child was recorded during 11 sessions over a period of seven months. The experiment consisted of a repetition and a picture-naming task and was conducted both in Dutch and in English with experimenters who were native speakers of these languages.

The results for the voiceless stops are shown in Figure 1, which presents the mean VOT for Dutch and English /p/ and /t/ in the eleven individual sessions.<sup>9</sup>

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<sup>8</sup> The reason why longitudinal early L2 studies are rare may be that there are several methodological difficulties involved. First, while monolingual and bilingual children can easily be recruited, finding informants who have been raised purely monolingually but start learning a foreign language at a very early age is harder. Secondly, since children who fulfil exactly this criterion are harder to find and it will usually be impossible to find more than one or two children with the same L1 learning the same L2, it is important that the child is repeatedly recorded from the very beginning of the learning process and over a period of several months. Longitudinal studies are more time consuming and require a longer collaboration of the parents, caretakers or schoolteachers and are therefore less frequent than studies examining a certain feature of the L2 phonology at one particular point in time.

<sup>9</sup> Again, the child’s velar stops were not examined, since Dutch lacks a voiced velar stop phoneme.

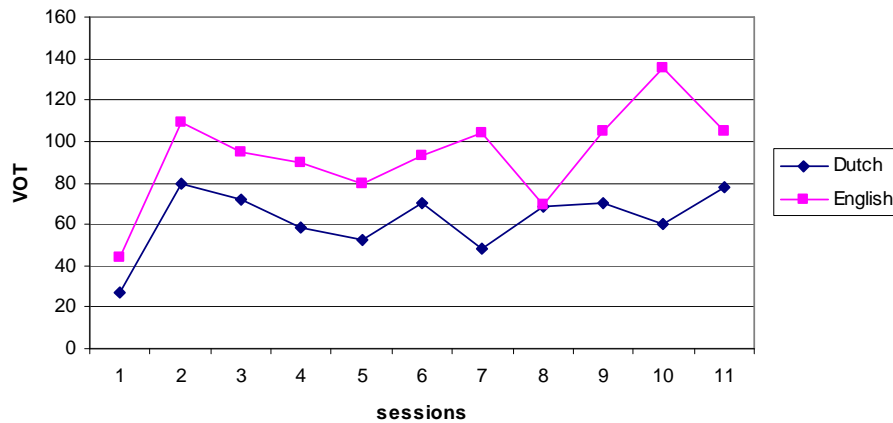


Figure 2. VOT in individual sessions (Simon 2010a)

Figure 1 reveals that the child acquired the production of long-lag aspirated stops in English, and produced a fairly long, but native-like average VOT of 100 ms in the last session. At the same time, however, the child gradually adapted his short-lag Dutch stops in the direction of long-lag aspirated stops. While the child started producing Dutch stops in the long-lag VOT region, with an average VOT of around 80 ms in the last session, Figure 1 shows that he maintained a subtle but significant contrast between Dutch and English voiceless stops by producing the English stops with slightly higher VOTs than the Dutch ones.

Figure 2 presents the production of prevoicing in the Dutch and English words produced by the child in the eleven recording sessions:

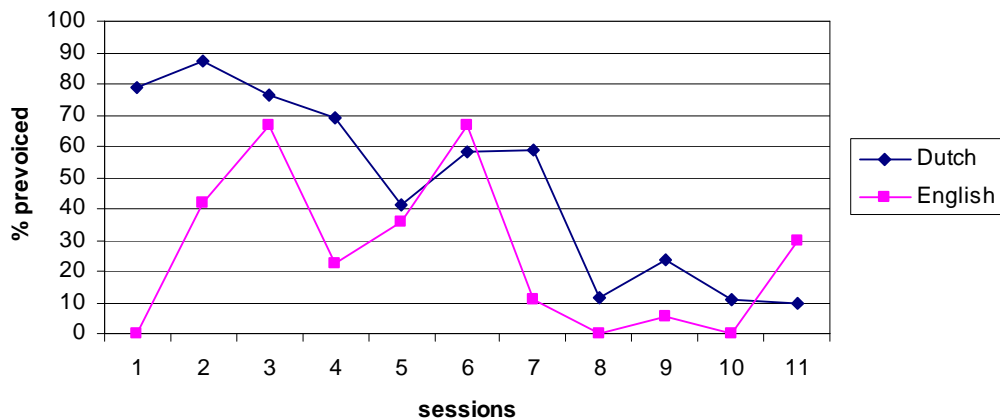


Figure 2. Percentage of voiced stops produced with prevoicing in the individual sessions (Simon 2010a).

Figure 2 shows that the child had acquired the production of prevoicing in Dutch at the outset of the study, since almost 80% of the tokens were produced with prevoicing in session 1. However, he did not transfer prevoiced stops into English to a great extent in most sessions, and even lost prevoicing in his Dutch voiced stops. In the last four sessions (8-11) few tokens were produced with prevoicing in Dutch or English.

With respect to the voiced stops, the child L2 learner in Simon (2010a) thus clearly differed from the adult L2 learners discussed in Simon (2009): whereas the adult learners transferred prevoiced stops from their native language into the second language to a great extent, the child learner acquired the target language's short-lag stops and did not transfer

prevoiced stops from his native language into the second language nearly as much as the adult learners.

One factor which may explain why the child did not transfer prevoiced stops as the adult learners did may be his lack of orthographic knowledge. The adult learners knew that, for instance, the word *ball* starts with the letter ‘b’ and might therefore be more likely to classify English voiceless [b] as equivalent to Dutch prevoiced [b̥]. The child, by contrast, had no knowledge of spelling and might have categorized the English short-lagged stops as voiceless ones, in which case he was not led to produce them with prevoicing. The influence of orthography in L2 acquisition of stops is corroborated by evidence on Mexican Spanish speakers’ adaptation of the English stop system, discussed by LaCharité & Paradis (2005: 251-253). They note that monolingual Mexican Spanish speakers classify English onset voiced and voiceless stops according to the VOT norms in their L1, i.e. they substitute English /b, d, g/ by Spanish /p, t, k/, as these are phonetically close in terms of VOT. However, when learners become more familiar with and proficient in English, they tend to identify word-initial English /b, d, g/ as Spanish /b, d, g/, even though the former set is voiceless unaspirated and the latter is prevoiced. These findings suggest that orthography may play an important role in advanced L2 learning and may even overrule the influence of phonetic approximation.

Recently, Lee (2009: 73ff.) examined the perception of initial /s/ + stop (sC) clusters in English by Korean listeners. Korean has a three-way laryngeal contrast between lax (e.g. [p]), tense (e.g. [p’]) and aspirated (e.g. [p<sup>h</sup>]) stops. Lee found that, when the input was purely oral, listeners categorized English voiceless stops in sC clusters (/sk, sp, st/), which are unaspirated in English, as unaspirated tense stops. However, when the input was mixed, i.e. oral and orthographic, and participants were asked to pay attention to orthography, they classified them as voiceless aspirated stops, again revealing the impact of orthographic information on the categorization of L2 sounds.

However, whereas knowledge of spelling has been shown to have an influence on the acquisition of L2 contrasts (e.g. Erdener & Burnham 2005, Escudero et al. 2008), more research is needed to determine just what role spelling plays in the acquisition process and to what extent different paths taken by adults and children in the acquisition of an L2 can be ascribed to (lack of) knowledge of spelling.

Another factor which may explain the difference between the child and the adult learners is the input. Moyer (2009) notes that two aspects of the input are important: the quantity and the quality. The quantity of the input can be measured by looking at the age at which a learner comes into contact with the foreign language, and the number of years of exposure to the target language s/he has had. The quality of the input, on the other hand, refers to whether the learner primarily uses the language with native or non-native speakers, and whether the interlocutors are peers/children or parents/adults. The child in Simon (2010a) started learning English before age 4 and was immersed in an English-speaking environment, where he spent at least as much time with English-speaking peers as with his Dutch-speaking parents. By contrast, the adult learners in Simon (2009) started acquiring English at around the age of 13 in an instructed language learning setting and were living in an area where the ambient language was Dutch.

In sum, the L2 acquisition results showed that both the child and the adult L2 learners acquired long-lag, aspirated stops in the second language. Short-lag stops in the target language, by contrast, were substituted by prevoiced stops from the native language by adult learners. The young learner who was immersed in an aspirating language was able to acquire short-lag stops in the target language and hence did not produce the maximally distinct

contrast between prevoiced and long-lag stops, as the adults did. As the acquisition process of English went on, the child started producing the English short-lag/long-lag contrast in his Dutch speech as well.

## **5. Discussion: Connecting findings from SLA and historical contact research**

This study set out to examine which linguistic forces are at work in present-day L2 and bilingual acquisition of laryngeal contrasts, and to what extent these can help us to get insight into the origin of the laryngeal systems in Germanic voicing languages like Dutch, with its contrast between prevoiced and unaspirated stops. Specifically, the aim was to investigate to what extent imposition and borrowing, van Coetsem's two types of language transfer resulting from language contact, occur when a voicing and an aspirating language come into contact in language acquisition. A laryngeal contrast between prevoiced and unaspirated stops is generally assumed to be a non-Germanic characteristic, which was introduced into Germanic languages as the result of contact between a Germanic aspirating and a Romance or Slavic voicing language. With respect to Dutch, two possible hypotheses of this contact situation were sketched in §3 and are now evaluated in light of the SLA findings presented in §4.

First, the Imposition Hypothesis assumes that the voicing system in Dutch is the result of a contact setting through which speakers of a Romance language became partially or fully bilingual with a Germanic language, but imposed their Romance voice contrast onto the Germanic language. This means that they transferred their contrast between prevoiced and unaspirated, short-lag stops from their native language into the Germanic language. In other words, they (1) did not start producing aspiration, and (2) transferred prevoicing. The presumed contact situation is thus linguistically comparable to the language contact in the L2 acquisition of the English contrast by native speakers of Dutch (Simon 2009, 2010a). The results of the adult L2 acquisition study (Simon 2009) confirm that native speakers of a voicing language show a strong tendency to transfer prevoicing into the target Germanic language. Hazan & Boulakia (1993) also found that child L2 English speakers with French as their native language often produced prevoicing in English. By contrast, the child in Simon's (2010a) case study did not transfer prevoicing into English to a great extent and even started to replace the prevoiced stops in his L1, Dutch, by short-lag stops. The difference between Hazan & Boulakia's (1993) child bilingual learners and the child in Simon (2009) may be the result of a different dominant language. The speakers in Hazan & Boulakia (1993) were dominant in French in that they had used it more than English in the course of their lives. The child learner of English in Simon (2010a), on the other hand, had Dutch as his native language, but was recorded at a time when he was immersed in an English-speaking environment. Of course, as noted in §4.3, we should be careful in drawing conclusions from one child's data: the observation that the child in Simon (2010a) did not transfer prevoicing does obviously not imply that no children would transfer prevoicing in a similar context.

With respect to the phonologically voiceless stop category, the L2 studies on the acquisition of English by native speakers of Dutch (Simon 2009, 2010a) revealed that child as well as adult L1 voicing language learners of an aspirating language acquired the target language's long-lag, aspirated stops. This is not in line with the Imposition Hypothesis, according to which speakers transferred their unaspirated stops into the Germanic language and did not adopt the Germanic aspirated stops. It is, however, clear that the learning context of the L1 Dutch speakers in Simon (2009), who had all received formal pronunciation instruction, cannot be compared to the naturalistic learning of the Romance speakers who became bilingual with Germanic (see §4.2). It remains to be investigated how well aspirated



stops are acquired by adult speakers of a voicing language in a naturalistic setting, when no attention is paid to form.

The Borrowing Hypothesis, on the other hand, assumes that speakers of a Germanic language came into contact with a Romance language and adopted the Romance voicing system in their Germanic language. This implies that they abandoned their native Germanic contrast between short-lag, unaspirated and long-lag, aspirated stops in favour of a contrast between prevoiced and unaspirated stops. While it has been argued that borrowing does not typically occur in the domain of phonology or phonetics (see §3), the case study on the L1 Dutch child learning English in a naturalistic setting provided an example of borrowing of an L2 laryngeal system. The analysis (§4.3) revealed that the Dutch-speaking child became bilingual with English and gradually adopted the English contrast between short-lag and long-lag stops in his native language, Dutch. In the presumed contact setting between speakers of a Romance and a Germanic language, the pattern of borrowing would have been the reverse: the Germanic speakers needed to (1) lose aspiration after voiceless stops, and produce them in the short-lag region, and (2) acquire prevoicing. The acquisition of a voicing language by speakers of an aspirating language has been investigated by Llama, Cardoso & Collins, who conducted a VOT study with L1 English speakers learning French. They found that the participants frequently produced aspiration in French (over 50% of the times), yet did not produce it in 100% of the tokens, indicating that “[a]lthough they had not achieved native-like values in their L2, [they] were able to reduce the length of VOT” (2008: 321). This finding makes it plausible that speakers of an aspirating language can indeed get rid of aspiration when becoming bilingual with a voicing language. However, the Borrowing Hypothesis also implies that the Germanic speakers borrowed the Romance prevoiced stops in their native language. With respect to prevoicing, the existing literature on the simultaneous bilingual acquisition of voicing and aspirating languages discussed in §4.1. indicates that prevoicing tends to be acquired late and is often initially replaced by short-lag stops. We have not found acquisition studies in which prevoiced stops were acquired before short-lag stops and were used not only in the voicing, but also in the aspirating language. More research on child L2 acquisition of a voicing language by speakers of an aspirating language is clearly needed to establish whether borrowing of prevoiced stops is possible and under which circumstances it would occur. Given the phonological plasticity of young children, one plausible historical scenario would be that socially dominant Germanic-speaking people came into contact with a Romance-speaking population and entrusted the care of their children to the Romance speakers. These children, who were raised by Romance-speaking caretakers, became linguistically dominant in the Romance language and adopted the Romance stop system in the Germanic language. Such an account thus assumes borrowing of the stop system from the linguistically dominant Romance language by socially dominant Germanic children, and explains how the change could have originated and transmitted from one generation to another. Since we do not have information on the social setting of the historical context, this account necessarily remains speculative, too, but seems plausible in light of the observation, once more demonstrated in Simon’s (2010a) case-study, that young children’s phonological systems are flexible and can be subject to interference from a second language.

## **6. Conclusions**

This article presented two alternative hypotheses on the origin of the laryngeal systems in Germanic voicing languages: one which assumes that the voicing system emerged as the result of imposition of a Romance or Slavic language onto a Germanic language (the Imposition Hypothesis) and one in which it is assumed to be the result of borrowing from a Romance or Slavic language (the Borrowing Hypothesis). The results of current bilingual and SLA studies were examined to find out to what extent borrowing and imposition are prevalent

when laryngeal contrasts come into contact with each other through acquisition. While we do not have conclusive evidence for or against either of the two hypotheses, analysis of present-day acquisition studies revealed that both imposition and borrowing may occur when the laryngeal systems of a voicing and an aspirating language come into contact with each other.

First, the bilingual and SLA studies revealed that prevoicing tends to be acquired late, something which may be ascribed to the aerodynamic difficulty involved in the production of vocal fold vibration during complete oral closure (Kingston in preparation). However, once it is acquired, it is frequently transferred into a second language. This finding is in line with the Imposition Hypothesis, according to which speakers of a former Romance language imposed their prevoiced stops onto a Germanic aspirating language.

Second, even though borrowing has been argued to typically not occur in the field of phonology, the longitudinal case-study (Simon 2010a) provided an example of just such a process: the young Dutch-speaking child acquired the English contrast between short-lag and long-lag stops in English, and borrowed this system when speaking his native language, Dutch. This borrowing may be the result of the fact that, even though the child was fluent in his native language, Dutch, the ambient language in the community he was living in at the time of the recordings was English. This confirms earlier findings that the community language may be more important than the home language in the production of VOT values by young children (Johnson & Wilson 2002). Given the plasticity of children's phonological systems and the resulting cross-linguistic influence between their L1 and an L2, an account in which Germanic-speaking children became increasingly bilingual with Romance through contact with Romance-speaking caretakers, and borrowed the laryngeal stop system of Romance into Germanic is plausible and would explain why a Germanic language like Dutch contains a contrast between voiced and unaspirated stops. However, more research on the early acquisition of a voicing language by speakers of an aspirating language is needed to examine whether child learners may borrow prevoiced stops from the L2 into their L1.

Finally, we would like to point out directions for further research.

First, most studies reviewed in this article address the acquisition of an aspirating language, English, by native speakers of a voicing language, Dutch. However, in order to assess the historical account in which the Dutch laryngeal system is the result of imposition, more data are needed on the reverse acquisition pattern, namely that of native speakers of an aspirating language acquiring a voicing language. While Llama et al.'s (2008) study addressed this issue, the main focus is on the influence of L2 status and typology on L3 acquisition. Therefore, a fruitful line for future research would be to examine the acquisition of a prevoiced/short-lag system by native speakers of a language with a short-lag/long-lag laryngeal contrast. Future studies should not focus solely on production, but also examine the perception of the Romance voice system by native speakers of a Germanic language. Perception experiments in which young speakers of a Germanic language who are immersed in a Romance-speaking environment are asked to categorize or discriminate between voiced and unaspirated Romance stops would to some extent simulate the presumed historical contact situation in which children of the socially dominant Germanic people came into extensive contact with the Romance language of their caretakers. Such studies would reveal whether or not learners who, for instance, borrow the prevoiced stops of the Romance language into their Germanic language in production are able to perceive the difference between prevoiced and short-lag stops. Previous studies on loanword phonology have shown that perception of a foreign language is often guided by phonology rather than by phonetic approximation (see §4.3), though more studies with young L2 learners would need to be carried out to examine to what extent this also holds for child learners, and to what extent bilingual children are able to have distinct phonological representations for their two

languages in perception, even when they have just one set of phonetic realizations in production (e.g. prevoiced and short-lag stops). Data from perception experiments with young learners in addition to more data from production tasks would make it possible to further test the hypothesis that the Romance stop system was borrowed into Germanic, leading to Germanic voicing languages like Dutch.

Secondly, an interesting question is how ‘mixed’ laryngeal systems arise and how common they are in the world’s languages. A finding in Simon (2009) was that the adult L1 Dutch learners of English displayed a mixed laryngeal stop system in their English interlanguage with a contrast between prevoiced and long-lag stops. This system is interesting in light of Iverson & Salmons’ (2003b) hypothesis that Dutch itself has a mixed laryngeal system, with Romance-like stops, but Germanic fricatives, with a contrast between unmarked and [spread glottis] fricatives. Further research is needed to confirm that the contrast between fricatives in Dutch is indeed one between unmarked and [spread glottis] ones (see Simon 2009). The lack of sonorant consonant devoicing after onset voiceless stops in Dutch (as in, for instance, the word *flink* “sweet, nice”) seems to indicate that the glottis is not spread in Dutch as it is in English (Simon 2010b). However, this phonetic observation does not provide evidence against the phonological specification of voiceless fricatives in Dutch. There is obviously great complexity in the phonetic cues to laryngeal distinctions, and more research on the trading relations between cues and the link between phonetic cues and phonological contrasts is needed. Moreover, while a system with a contrast between [voice] and [spread glottis] stops would seem to be ‘overmarked’, it may not be so exceptional in the world’s languages. Keating, Linker & Huffman (1983) closely examined stops in a sample of 51 languages from the UPSID database (Maddieson 1984). 29 of these 51 languages had a two-way laryngeal contrast and 14/29 seemed to have a contrast between prevoiced and aspirated stops. This observation confirms that the learners’ interlanguage, with its prevoiced/long-lag contrast is a natural grammar, which is also found in the grammars of native speakers. Again, more research is needed to examine to what extent the prevoiced/long-lag contrasts in natural languages are phonological or phonetic.

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## Zusammenfassung

Dieser Artikel untersucht, welche sprachlichen Kräfte im gegenwärtigen Zweitspracherwerb und bilingualen Spracherwerb wirksam sind und welche Einblicke sie uns verschaffen in den Ursprung der laryngalen Systeme in germanischen Sprachen wie dem Niederländischen mit seinem Kontrast zwischen 'prevoiced' und aspirierten Plosiven. Forschungsergebnisse zum gegenwärtigen Zweitspracherwerb bei Kindern und Erwachsenen zeigen, dass sowohl Imposition wie auch Entlehnung stattfinden können, wenn die laryngalen Systeme einer 'stimmhaften' Sprache und einer 'aspirierenden' Sprache miteinander in Kontakt treten. In dem vorliegenden Artikel wird ein Szenario dargelegt, bei dem sozial dominante Germanen mit einer Romanisch sprechenden Bevölkerung in Berührung kamen und das Plosivsystem des Romanischen entlehnten.

## Résumé

Cet article examine quelles forces linguistiques agissent actuellement au cours de l'acquisition de contrastes laryngiens bilingues et de seconde langue, et dans quelle mesure elles peuvent contribuer à expliquer l'origine des systèmes laryngiens des langues germaniques comme le Néerlandais et son contraste entre les occlusives sonores et sourdes non aspirées. Les résultats des études actuelles sur l'acquisition d'une seconde langue chez les enfants et les adultes montrent que tant l'imposition que l'emprunt peuvent se produire lorsque les systèmes laryngiens d'une langue 'sonore' et d'une langue 'aspirée' se rencontrent. On envisage un scénario dans lequel des populations germaniques socialement dominantes entraînent en contact avec des populations de langues romanes et empruntaient le système des occlusives propres à celles-ci.

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