SECOND LANGUAGE PHONOLOGY:
ACQUISITION THROUGH GRADUAL CONSTRAINT DEMOTION

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This paper discusses so-called 'emergence of the unmarked' phenomena in first and second language acquisition. We follow the standard OT-assumption that the emergence of the unmarked in first language acquisition is due to highly ranked markedness constraints and that the acquisition of a first language involves the gradual demotion of these constraints below faithfulness constraints (Tesar & Smolensky 1998). The central question that we address in this paper is: what happens to markedness constraints that are vacuously satisfied in the first language and for which the language learner consequently does not find evidence to crucially rank them with respect to faithfulness constraints in its native grammar. We demonstrate that these constraints remain highly ranked in the first grammar and that they are responsible for emergence of the unmarked phenomena in loan-word phonology and second language acquisition. We focus specifically on the phenomena of syllable-final devoicing and the lack of complex onsets in first language acquisition of English speakers and in second language acquisition of Zulu speakers learning English.

1 INTRODUCTION

A typical finding from research on interlanguage phonology is that three forces contribute to its shape: universal principles, the properties of the native language of the learner and the properties of the target language that the learner tries to acquire (Archibald 1998). The challenge that this poses to linguistic theory is to establish a unified framework for understanding all of these properties. Interest in universals in interlanguage phonologies originates with the work by Eckman (1977), who proposes the Markedness Differential Hypothesis (MDH) which incorporates typological markedness into the theory to account for the direction of difficulties that learners may experience when acquiring a target language that differs from the native language in some respect. Eckman's (1977) insights were soon incorporated within the Interlanguage Hypothesis (ILH). The ILH was proposed because of the finding that the languages of learners have properties that are independent from both the native and target languages of the learners (Selinker 1972; Adjemian 1976; Eckman 1981, 1991; Bley-Vroman 1983; Major 1998).

In a recent study, Broselow, Chen & Wang (1998) demonstrate that Optimality Theory (OT see McCarthy & Prince 1993, 1994, 1995; Prince & Smolensky 1993) provides a solution to the problem of incorporating universals into interlanguage phonologies. In addition, they provide

evidence for emergence of the unmarked-phenomena in interlanguage phonologies. Where Archibald's (1998) study on stress systems, from the perspective of principles and parameters-theory, can incorporate universals in the domain of stress, Broselow *et al*. (1998) show that it is possible to incorporate all kinds of universals, including phonotactic, segmental and suprasegmental properties in a single framework. They also suggest that second language (phonology) acquisition take place through constraint demotion, but do not elaborate on this hypothesis or test it directly.

Within OT, first language acquisition is conceived as a process through which a set of universal constraints in Con gradually moves towards the actual ranking order of a particular native language through minimal demotion of constraints (Tesar & Smolensky 1993, 1998). If interlanguages are natural languages, as is commonly assumed by proponents of the ILH (e.g., Adjemian 1976; Eckman 1981, 1991; Bley-Vroman 1983), then their acquisition must of course also show similarities with natural (first) language acquisition, abstracting away from differences in acquisitional context and power relations in society. However, where first language acquisition proceeds from a constraint set in which markedness constraints outrank faithfulness constraints (see Gnanadesikan 1996), second language acquisition is likely to proceed from the ranking already established for the first language.

A phenomenon that has been subject to a lot of study from the perspective of interlanguage phonology is syllable-final devoicing (FD) (e.g., Eckman 1977, 1981; Flege, McCutcheon & Smith 1987; Flege 1989; Flege & Wang 1989; Edge 1991; Yavas 1994; Major & Faudree 1996; Broselow *et al*. 1998). This phenomenon is of interest to interlanguage phonology in cases where neither the native language, nor the target language, has FD, but FD emerges during the acquisition process. This is typical in cases where the phonotactics of the native language disallows syllable-final obstruents, and the target language maintains the distinction between voiced and voiceless obstruents in syllable-final position. This situation is the one observed for Black South African speakers of English, whose first languages are from the Sotho or Nguni branches of the Southern Bantu language family (Jacobs 1994; Van Rooy & Wissing 1996; Van Rooy 2000). The Sotho (Tswana, Southern Sotho and Northern Sotho) and Nguni languages (Zulu, Xhosa, Swati and Ndebele), spoken in South Africa (also Tswana in Botswana and Ndebele in Zimbabwe), disallow consonants from syllable codas. However, when speakers of these two languages learn English, they exhibit FD. These facts are complicated by the existence of a more widespread velar stop devoicing by speakers of Zulu-English (Jacobs 1994), but not by speakers of Xhosa-English (Hundleby 1964) or Tswana-English (Van Rooy 2000).

The question that we want to address in this paper is therefore: how is the distribution of distinctive obstruent voicing in Zulu-English acquired? We draw on OT (McCarthy & Prince 1993, 1995; Prince & Smolensky 1993), and particularly the understanding of first language acquisition as constraint demotion (Tesar & Smolensky 1993, 1998) to answer this question. We propose the following hypothesis as an answer to the question: a universal constraint set is ranked in a language specific way for a first language. Markedness constraints which are not demoted in the first language account for the emergence of the unmarked in the second language. For instance, a highly ranked markedness constraint against obstruent voicing in codas in the initial setting (which is transferred from the native language) may be held responsible for the fact that Zulu and Tswana learners of English exhibit FD.

The paper is organised in the following way. In the next section, we discuss emergence of the unmarked phenomena in child phonologies, loan-word phonologies and interlanguage phonologies of English and Dutch and we provide an OT account of these phenomena.

Thereafter, the basic phonetic and phonological facts on Zulu obstruents are reviewed. Subsequently, the constraint ranking for the grammar of Zulu is established, focussing on evidence from the loan-word phonology of Zulu, which provides important evidence about the ranking of constraints relevant to vowel insertion and velar stop devoicing. This is followed by a presentation and analysis of the relevant data from Zulu-English. This leads to the evaluation of the validity of the hypothesis, after which we conclude by identifying the implications of our findings for research into interlanguage phonology.

2 THE EMERGENCE OF THE UNMARKED IN FIRST AND SECOND LANGUAGE ACQUISITION

This section discusses three cases of 'the emergence of the unmarked' in first and second language acquisition: (i) the omission of coda obstruents, (ii) the lack of complex onsets and (iii) syllable-final devoicing.

First consider that most children begin with systems that lack codas (see Bernhardt & Stemberger 1998: 382 for English). We illustrate this point here by data from Dutch and German child speech, respectively.

(1) **Dutch acquisition** (data from Fikkert 1994)

a.	adult form	*poes*	[pu:s]		'pussy-cat'
	child's realisation		[pu:]	(Jarmo 1;5.02)	
b.	adult form	*paard*	[pa:rt]		'horse'
	child's realisation		[pa:]/[pɑ]	(Tom 1;1.07)	

(2) **German acquisition** (data from Grijzenhout & Joppen-Hellwig to appear)

a.	adult form	*Ball*	[bal]		'ball'
	child's realisation		[ba]	(Naomi 1;5.01)	
b.	adult form	*Mond*	[mo:nt]		'moon'
	child's realisation		[mo:]	(Naomi 1;5.21)	

We may formulate the initial state in child language acquisition as 'no consonant in coda position'. A restriction on codas is also found in adult languages. In Zulu, for instance, no coda consonants are allowed at all (Khumalo 1984) and in Mandarin, coda consonants include glides, /n/ and /ŋ/, but not obstruents (see Broselow *et al.* 1998 and references therein). Just like most English, Dutch and German children go through a phase in which they do not produce coda consonants, most Mandarin adult learners of English go through a phase in which they avoid coda obstruents in the target language (see Broselow *et al.* 1998). Conversely, English speakers do not have any difficulties in producing coda-less syllables when they learn Mandarin. In the process of second language acquisition, we usually witness a gradual change from an unmarked syllable structure to a more marked one and not the other way round.

Another example of the emergence of the unmarked in child speech is the simplification of onset structure. The data below from English and German child speech, respectively, illustrate that onset clusters are simplified by deletion of one of its members:

(3) **English** (data from Bernhardt & Stemberger 1998, Ingram 1989,Velten 1943)

a.	adult form	*black*	[blæk]	
	child's form		[bak]	(Joan 1;10)
b.	adult form	*bread*	[brɛd]	
	child's form		[but]	(Joan 1;10)

(4) **German** (data from Grijzenhout & Joppen-Hellwig to appear)

a.	adult form	*Blätter*	[blɛtɐ]		'leaves'
	child's form		[bɛ:ta]	(Naomi 1;7.09)	
b.	adult form	*Brot*	[bro:t]		'bread'
	child's form		[bo:t$^{\varsigma}$]	(Naomi 1;6.12)	

Some adult languages, e.g. Zulu, are also characterised by the lack of complex onsets like /bl-/ or /br-/. When Zulu borrows words from English, obstruent-sonorant clusters in onset position are adjusted by means of vowel epenthesis (see section 3.1).

A third example of the emergence of the unmarked in language acquisition is syllable-final devoicing. Adult English does not display syllable-final devoicing, but we do find final devoicing in English child speech (see 5a). Another strategy in child speech (though less favoured) to avoid voiced obstruents in coda position is to add a final vowel, so that the consonant in question is resyllabified as an onset (see 5b):

(5) **English** (data from Bernhardt & Stemberger 1998:424, Smith 1973)

a.	adult form	*egg*	[ɛg]	*rub*	[ɹʌb]
	child's realisation		[ɛk]		[wʌp]
b.	adult form	*bird*	[bɻd]		
	child's realisation		[baba]	(Morgan 1;1-1;3)	

Note that English and German children never spontaneously voice final consonants:

(6) **Non-attested (or very rare) English child data**

adult form	*back*	[bæk]
child's non-form		*[bæg]

(7) **German (Grijzenhout & Joppen-Hellwig to appear)**

adult form	*Weg*	[we:k]	'path'
child's realisation		[wɛ:k]/*[wɛ:g] (Naomi 1;8.04)	

The unmarked situation ‘no voiced obstruent in coda position’ is found in English child language and in some adult grammars (e.g., Afrikaans, Dutch, German, Polish, Russian). The expectation is that speakers of a language in which no voiced coda obstruents occur (unmarked situation) will have difficulties in learning a language in which coda obstruents may be voiced (marked situation). If final devoicing were a phonological rule, we might explain the emergence of final

devoicing when Afrikaans, Dutch, German, Polish and Russian speakers learn English by transfer of the rule from the first language to the interlanguage. Now note that there is no overt evidence for a rule of syllable-final devoicing in languages such as Mandarin and Zulu (because of the lack of final obstruents) and we therefore do not expect final devoicing to show up when these speakers learn English. Contrary to the expectation of a rule-based approach, however, the phenomenon of final devoicing is frequently found with Mandarin and Zulu second language learners of English (see Broselow *et al*. 1998 and section 4, respectively).

Below, we will first elaborate on our idea that the failure of constraint demotion in a first language will have an effect in loan-word adaptations and in second language acquisition. Next, in section 2.2, we will provide a constraint-based account of the emergence of syllable-final devoicing in second language acquisition of Dutch speakers learning English and in section 4, we present an OT-account of the emergence of final devoicing in Zulu speakers learning English.

2.1 HIGH-RANKED MARKEDNESS CONSTRAINTS IN INTERLANGUAGE PHONOLOGY AND LOAN-WORD PHONOLOGY

Within Optimality Theory, the common assumption is that a grammar involves a set of universal constraints which are ranked in a language-specific way. At the initial state of language acquisition, markedness constraints outrank faithfulness constraints (Gnanadesikan 1996) and the acquisition of a grammar involves the gradual demotion of markedness constraints below faithfulness constraints (Tesar & Smolensky 1993, 1998) on the basis of positive evidence only (Grijzenhout & Joppen-Hellwig to appear). The interesting question that arises is: what happens to markedness constraints for which the language learner does not find evidence to rerank them because there are no contexts in which they would apply? The logical assumption is that they remain highly ranked. Our goal here is to find evidence for this assumption.

The evidence is found in second language acquisition and loan-word phonology. If a child is not exposed to structural forms to which a certain constraint refers, that constraint remains highly ranked in its grammar. For instance, if a child learns a language in which no consonant clusters occur, the child is never faced with evidence to demote the markedness constraint NOCOMPLEXONSET below relevant faithfulness constraints. When that same child learns a second language at a later age, we expect to find effects of markedness constraints which are highly ranked in the first language. In this particular case, we expect that onset clusters in the target language are simplified or otherwise adjusted in order to satisfy highly ranked NO COMPLEXONSET.

Similarly, we also expect to find effects of highly ranked constraints in loan-word phonology. Consider in this respect that English does not allow /kn/-clusters in onset position. When words are borrowed from a language in which these clusters are attested, the clusters are modified:

(8) **English loan words** (data from Green 1997:28)

a.	*Knopf*	[kənɔf] /*[knɔf]/*[nɔf]	proper name
b.	*Knesset*	[kənɛsɛt] /*[knɛsɛt]/*[nɛsɛt]	‘Parliament’

Green (1997:25-28) accounts for the modification as follows. In English, the markedness constraint against /kn/-clusters is ranked highly and there is no compelling reason to demote it to

a position below the faithfulness constraint which says that a vowel in the output should have a correspondent in the input (DEPVOWEL). With this constraint ranking, an input form with a /kn/-cluster will have an output form with Schwa-epenthesis.[i]

The difference between loan-word phonology and second language phonology is that loan words are adjusted to the first language grammar, whereas it is the grammar that has to be adjusted when learning a second language. Under OT, the task of the second language learner is to establish the constraint ranking of the target language (e.g., Broselow *et al*. 1998). If second language acquisition is based on first language constraint ranking, we expect that certain markedness constraints which are always vacuously satisfied in the first language, will have an effect in the production of the second language. We illustrate this point below for the phenomenon of final devoicing.

2.2 SYLLABLE-FINAL DEVOICING IN SECOND LANGUAGE ACQUISITION

To explain the phenomenon of syllable-final devoicing in second language acquisition, we draw on the following universal constraints:[ii]

(9) **Markedness constraints**

a.	NOVOICE:	Obstruents are voiceless
b.	NOCODA:	Syllables do not have coda consonants (Syllables must be open)
c.	NOVOICEDCODA:	Syllable codas may not contain voiced obstruents (Syllable-final obstruents are voiceless)

(10) **Faithfulness constraints**

a.	MAX-IO:	Every segment in the input has a correspondent in the output ('No deletion')
b.	DEP-IO:	Every segment in the output has a correspondent in the input ('No epenthesis')
c.	IDENT-F	Every segment in the output has identical values for a feature F as the corresponding segment in the input

English displays a voicing contrast in final obstruents (cf. *bad – bat* and *bed – bet*). To account for this variation, the constraint which says that a voicing specification of an input consonant should be preserved in the corresponding output consonant (IDENT(VOICE)) must outrank the

[i] In the history of English, the constraint *kn at one time outranked the constraint which says that a segment in the input should have a correspondent in the output (MAX-IO), so that kn-initial words such as /kni:/ 'knee' were realised without initial /k/. Subsequent generations assumed that the input was a form without /k/. For later generations, the grammar changed in such a way that *kn no longer outranked MAX-IO. We refer the reader to Green (1997) for a detailed discussion of historical change in OT.

[ii] Lombardi (1999) suggests that the phenomenon of syllable-final devoicing is best explained by the interaction of a general constraint against voicing (*LARYNGEAL) and a faithfulness constraint which says that obstruents in onset position should be faithful to their input specification for laryngeal features (IDENTONSET(LARYNGEAL)). At this stage, we prefer to use a constraint against obstruent voicing in coda positions, but nothing crucial hinges on this for the point we want to make here, viz. the emergence of the unmarked in second language acquisition.

constraint which says that final obstruents are voiceless (NOVOICEDCODA). Moreover, the voiced obstruent in the input is not deleted and no vowel is inserted to avoid a violation of the constraint NOVOICEDCODA. This implies that MAX-IO and DEP-IO outrank NOVOICEDCODA (see candidates 11d and 11e respectively). In (11) and the tableaux below, the pointing finger ☞ marks the optimal candidate and *! marks the fatal constraint violation.

(11) **English grammar: IDENT (VOICE) >> NOVOICEDCODA, NOVOICE**

Input: /bæd/	IDENT (VOICE)	MAX-IO	DEP-IO	NOVOICEDCODA	NOCODA	NOVOICE
a) ☞ bæd				*	*	**
b) bæt	*!				*	*
c) pæt	*!*				*	
d) bædæ			*!			**
e) bæ		*!				*

Dutch is one of the languages that does not have a final voicing contrast. Dutch obstruents that are voiced in word-internal position are voiceless in syllable-final position (see 12b):

(12) a. *petten* [pɛtə] 'caps' *pet* [pɛt] 'cap'
b. *bedden* [bɛdə] 'beds' *bed* [bɛt] 'bed'

Hence, in the grammar of Dutch, the constraint which requires final obstruents to be voiceless outranks the constraint IDENT(VOICE):

(13) **Dutch grammar: NOVOICEDCODA >> IDENT (VOICE) >> NOVOICE**

Input: /bɛd/	NOVOICEDCODA	MAX-IO	DEP-IO	IDENT (VOICE)	NOVOICE	NOCODA
a) bɛd	*!				**	*
b) ☞ bɛt				*	*	*
c) pɛt				**!		*
d) bɛdɛ			*!		**	
e) bɛ		*!			*	

The interesting question is: how do children arrive at the adult ranking? First observe that Dutch and German children first omit final obstruents (see 1a-b, 2a-b) and once they realise final obstruents, they always devoice syllable-final consonants and never make mistakes in final voicing (*[pu:z]/*[we:g]). From this observation, we conclude that (i) the initial ranking in which the markedness constraint NOCODA outranks the faithfulness constraint MAX-IO is changed to one in which NOCODA is demoted and (ii) the initial state in which NOVOICEDCODA outranks the faithfulness constraint IDENT(VOICE) does not need to be changed to arrive at the adult grammar in (13).

Now consider that English-speaking children disfavour voiced obstruents in coda position and often exhibit syllable-final devoicing (see the data in 5a). After an initial stage where no

codas are allowed at all, these children proceed from the same unmarked constraint ranking as Dutch or German children (NOVOICEDCODA >> IDENT(VOICE)):[iii]

(14) **Unmarked constraint ranking English-learning child**

Input: /ɛg/	NOVOICEDCODA	IDENT (VOICE)
a) ɛg	*!	
b) ☞ ɛk		*

We follow the standard OT-assumption for first language acquisition, i.e. minimal demotion of markedness constraints (Tesar & Smolensky 1993, 1998) on the basis of attested adult forms (Grijzenhout & Joppen-Hellwig to appear). On the basis of positive evidence (the presence of words with final voiced obstruents in the adult language) English-speaking children gradually demote the markedness constraint NOVOICEDCODA until they arrive at the adult ranking (see 11). That is to say, at some stage, the English child is "forced" to demote the markedness constraint NOVOICEDCODA below the faithfulness constraint IDENT(VOICE). Dutch and German children, on the other hand, are never exposed to forms which would force demotion of NOVOICEDCODA, i.e. in Dutch and German adult grammars NOVOICEDCODA is highly ranked.

What will happen when Dutch and German speakers learn English? We predict that if they use their native grammar (in which MAX-IO and DEP-IO outrank NOCODA and NOVOICEDCODA outranks IDENT(VOICE), see 13), they will make mistakes in the pronunciation of final consonants:[iv]

(15) **Initial constraint ranking Dutch adult learning English**

Input: /ɛg/	NOVOICEDCODA	MAX-IO	DEP-IO	IDENT (VOICE)	NOVOICE	NOCODA
a) ɛg	*!				*	*
b) ☞ ɛk				*		*
c) ɛ		*!				
d) ɛ.gɛ			*!		*	

We now have to explain why *deletion* of a syllable-final consonant or of one member of a complex onset cluster is frequently attested in early child speech (see 1a-b, 2a-b and 3a-b, 4a-b, respectively) and relatively rare in second language acquisition, whereas *epenthesis* of a vowel to save a consonant is a repair strategy frequently found in loan-word phonology (see 8) and in second language acquisition, but hardly ever at the initial stage of first language acquisition. This

[iii] A less preferred option in child speech is to insert a vowel (see 5b). This option emerges when the markedness constraint NOVOICEDCODA outranks the faithfulness constraint against epenthesis (DEP-IO).

[iv] The task of an English-speaking adult learning Dutch or German is different. We expect that they will first assume that all syllable-final obstruents are voiceless in input representations, so that for them, IDENT(VOICE) is not violated. They will then make mistakes when producing the word in a longer context. For instance, we expect that they will assume that the underlying representation for the word meaning 'bed' in Dutch (see 12b) is /bɛt/ and they will incorrectly pronounce the plural form with a voiceless consonant, i.e. as *[bɛtə]. Antony Dubach Green (p.c.), whose first language is English, reports that he made such mistakes when he first learned German.

discrepancy poses a potential problem for the traditional OT-assumption that at the initial stage all markedness constraints outrank all faithfulness constraints, i.e. under this assumption, we expect that children have the option to either delete a consonant (in violation of the faithfulness constraint MAX-IO), or to insert a vowel (in violation of the faithfulness constraint DEP-IO), so that the consonant in question resyllabifies as a single onset. A possible explanation (outside OT) may be that children disfavour uninterpretable structure. Young children prefer to have less structure (and leave some segments unrealised to meet a markedness requirement) to inserting material to meet a markedness requirement. To obey markedness requirements, their best strategy is to not realise segments that cause "bad prosody" (i.e. they delete coda obstruents and one member of a complex onset). A possible consequence for OT is that at the initial stage in first language acquisition, DEP-IO outranks MAX-IO. Adults are better able to interpret structure. To repair disfavoured prosodic structure (obstruents in coda position, complex onsets, etc.) they preserve input segments and add unmarked segments. A possible consequence of this proposal is that DEP-IO is ranked lowly in adult grammars.

We pointed out that under the assumption of acquisition through constraint demotion, we predict that learners of a language with final devoicing will also exhibit final devoicing when learning a different language. A further prediction is that learners of a language that does not have final consonants will make mistakes in the voicing of final consonants when they learn English. In their first language, they didn't encounter evidence to demote NOVOICEDCODA, because there are no final obstruents to devoice. Under the assumption that they use their native grammar when learning a second language, the prediction is that we find effects of highly-ranked NOVOICEDCODA. We will elaborate on this proposal for Zulu speakers who learn English in section 4. First, we will discuss the structure of Zulu in more detail.

3 SOME ISSUES ON THE PHONOLOGY OF ZULU

In order to test the hypothesis that second language acquisition proceeds from the basis of first language acquisition, it is necessary to first establish the ranking of the first languages in question. In this section, we focus on the phonology of Zulu, where we draw on a detailed examination of Zulu loan-word phonology by Khumalo (1984). The discussion of loan-words is particularly useful because it displays the effect of constraints during alternations from the original loan word to its adjusted form in Zulu, providing positive evidence of constraints and their ranking. Such evidence would only be available indirectly if the native vocabulary of Zulu would be considered, since no alternations would take place.

Where applicable, we also refer to aspects of Tswana and Xhosa phonology, since we will concentrate on Zulu-English in subsequent discussions, but compare it to Tswana-English and Xhosa-English where applicable. Our choice of these three languages is motivated largely by the availability of relevant data (see Van Rooy 2000 for a comprehensive review of the consonantal phonology of the various forms of Black South African English).

Zulu (L1) has the following oral stops, as classified by Khumalo (1984):

(16) **Zulu oral stops**

Lenis, voiceless:	p^h, t^h, k^h	(Orthogr. ph, th, kh; phonetically aspirated, voiceless plosives)
Fortis, voiceless:	p', t', k'	(Orthogr. p, t, k; phonetically voiceless ejectives)
Fortis, voiced:	b, d, g	(Orthogr. bh, d, g; phonetically plain voiced plosives)
Lenis, voiced:	ɓ, ɟ	(Orthogr. b, phonetically voiced implosive) and the so-called "problem sound k".

In a detailed acoustic-phonetic study of Xhosa, a language with stops similar to Zulu, Jessen (1999) proposes to use the following feature classification:

(17) **Feature classification of Xhosa stops**

Aspirated voiceless:	[+tense, -voice, -checked]
Ejectives:	[-tense, -voice, +/-checked]
Plain voiced:	[-tense, +voice, -checked]
Implosive:	[-tense, +voice, +checked]

The so-called "problematic /k/" does not occur in Xhosa. Where it occurs in Zulu, it is frequently related to the Xhosa ejective /k'/. It is restricted in terms of where it occurs in Zulu as well - mostly in affixes, never in stem-initial position, and only occasionally elsewhere in stems (Khumalo 1984). Gustafson (p.c.) agrees with the label "voiced lenis plosive" for this sound, based on spectrographic evidence of low frequency voicing, but does not agree with its co-classification with the implosive /ɓ/. In any case, some variability occurs in the realisation of the /k/ as voiced and lenis or as ejective and voiceless according to Gustafson. Khumalo (1984:213) points out that the Lower Natal Coast and South Western Natal dialects have a preference for ejective [k'], while the standard dialect and other Natal dialects prefer the lenis voiced [k]. How to incorporate this sound into Jessen's feature representation is not clear at present, and awaits future research.

Since Zulu has a voicing contrast for obstruents, we may tentatively conclude that, as in English and Dutch, the constraint IDENT(VOICE) (or, perhaps more appropriately IDENT(LAR)) outranks NOVOICE (or, more properly NOLAR):

(18) **Zulu grammar: IDENT(LAR) >> NOLAR**

Zulu has a substantial number of loan words taken from English and Afrikaans. These loan words undergo some rather thorough restructuring due to differences in phonotactics between Zulu, a CV-language, and English and Afrikaans, allowing closed syllables and more complex consonant clusters. These loan words are thoroughly integrated into Zulu and arguably provide very revealing evidence about the productive phonology of Zulu. Section 3.1 provides a short introduction to syllabic processes, before turning to restructuring of stops in section 3.2.

3.1 BASIC BACKGROUND: SYLLABLE RESTRUCTURING IN LOAN WORDS

Zulu does not allow complex consonant clusters. According to Khumalo (1984), no codas are allowed. In onsets, only nasal + fortis obstruents[v] and non-labial obstruents + the glide [w] are allowed apart from single consonants. His examples of fortis obstruents only include the ejective and plain voiced stops, and the affricates [pf] and [dʒ]. No fricatives are given, but according to Batibo (2000: 193), the fricatives /f, v, s, z, ɬ, ɮ, h/ occur in Zulu.

When English or Afrikaans words are adopted into Zulu, two kinds of restructuring are required. In the first place, word-final consonants have to be adjusted to obtain open syllables. Khumalo (1984) identifies two strategies - coda deletion and final vowel epenthesis, but mentions that coda deletion is extremely rare, while vowel epenthesis is very common.[vi] Examples are the following:[vii]

(19) **Final consonant deletion**

English	Zulu
garden	i.nga.di
location	i.lo.ki.shi

(20) **Final vowel epenthesis**

English/*Afrikaans*	Zulu
canteen	i.nka.nti.ni
carpet	i.kha.phe.the
tea-pot	i.thi.pho.thi
nommer ('number')	i.no.mbo.lo
hotel ('hotel')	i.hho.te.la
ketting ('chain')	i.ke.ta.ngo

Secondly, word-internal consonant clusters must conform to the onset requirements of Zulu. If they do, then no adjustments are made, as in the adoption of the English word *cucumber*, which

[v] These are not pre-nasalised stops, since the same cluster structure, nasal + obstruent, is applicable to plosives and fricatives alike.

[vi] A possible explanation for the preference of deletion *vs*. epenthesis in the second-language phonology of Mandarin-L1 speakers of English as L2 is suggested by Broselow *et al*. (1998). They argue that speakers of Mandarin, a language with phonotactics very similar to Zulu, select epenthesis for monosyllabic words and deletion for disyllabic words, in both cases driven by a constraint to obtain outputs that are minimal words- disyllabic, single footed words. Within the framework of Optimality Theory, they argue that this provides evidence for the emergence of the unmarked in second language phonology. Unfortunately, this explanation does not hold for Zulu loan-word adaptation. There is no obvious drive to obtain disyllabic forms, or even disyllabic stems if one excludes the nominal prefix from consideration. In section 2, we suggested that the preference for epenthesis in loan-word adaptation and second language phonology may be related to the fact that adults are better able to interpret structure than children and thus show a greater tendency to preserve input structure and to add unmarked structure (i.e. MAX-IO >> DEP-IO). To simplify the discussion slightly, and in the absence of detailed evidence on the occurrence of coda-deletion, we will concentrate only on the vowel epenthesis-option in this article.

[vii] Here and in subsequent examples, we present the orthographic representations. Syllable boundaries are indicated by a dot.

becomes *i.khu.khu.mba*. However, when the consonants form impermissible clusters, they are restructured by vowel insertion again. Examples are:

(21) **Epenthetic vowels to break up clusters**

English/*Afrikaans*	Zulu
bible	i.bha.yi.bhe.li
flag	i.fu.le.gi
school	i.si.ko.lo
skrop ('temporary job')	i.si.ko.lo.bho
knoop ('button')	i.nki.no.bho

In terms of the terminological apparatus of Optimality Theory, the treatment of consonant clusters and coda-obstruents in loan words from English and Afrikaans can be cast as follows. The following violable constraints are required, and these need to be ranked in terms of each other:

(22) **Constraints**

NOCODA:	Syllables must be open
NOCOMPLEXONSET:	Consonant clusters do not occur in onset position
MAXCONS:	All consonants in the input must have a correspondent in the output
DEPVOWEL:	All vowels in the output must have a correspondent in the input

Given that syllables are always open, the constraint NOCODA is undominated. Faithful parsing of input consonants is the overwhelmingly preferred option, indicating that MAXCONS is unviolated as well. As a consequence, insertion takes place in violation of the constraint DEPVOWEL.[viii] Consequently, we propose the following ranking to account for the syllable-restructuring in Zulu loan words:

(23) **Zulu grammar: NOCODA, MAXCONS >> DEPVOWEL**

Input: CV.CVC 'tea pot'	NOCODA	MAXCONS	DEPVOWEL
a. i.thi.pho		*!	
b. i.thi.phot	*!		
c. ☞ i.thi.po.thi			*

Obstruent-sonorant clusters do not occur in Zulu and are adjusted in loan words by means of epenthesis. From this fact, we conclude that NOCOMPLEXONSET and MAXCONS outrank DEPVOWEL:

[viii] Khumalo (1984) presents a detailed consideration of the relevant factors influencing the epenthetic vowels, which do not concern us here. Suffice to say that there is no simple option, such as schwa-insertion. In general, the high vowels [i] and [u] are most frequently selected, but under various circumstances, the mid-vowels [e] and [o] are also used. Various phonological and analogical issues are at stake in the selection of the epenthetic vowels.

(24) **Zulu grammar: NOCOMPLEXONSET, MAXCONS >> DEPVOWEL**

Input: CCVC 'flag'		NOCOMPLONS	MAXCONS	DEPVOWEL
a.	i.fle.gi	*!		
b.	i.fe.gi		*!	
c. ☞	i.fu.le.gi			*

3.2 STOPS IN ZULU LOAN-WORD PHONOLOGY

The phonology of stop alternations in Zulu loan-word phonology is rather interesting. A number of constraints regulate these alternations. Although Khumalo's research (1984) predates optimality theory by a decade or so, his description of his date is cast strongly in terms of constraints, which he regards as tendencies. One could just as well interpret his notion of "tendencies" embodied by the constraints as violability.

There is a syntagmatic constraint on the oral stops allowed in post-nasal position: only plain voiced and ejective stops are allowed here, implosives, aspirated stops and the lenis voiced /k/ are not allowed here. This observation is best expressed as a syntagmatic constraint on distinctive features allowed in post-nasal position. According to the acoustic evidence about ejectives in post-nasal position in Xhosa (Jessen 1999), closure and VOT-durations are much reduced compared to initial and post-vocalic positions, indicating less likelihood of ejective articulation. Only plain voiced and voiceless plosives are allowed in this position, and no aspirated, ejective or implosive articulations. However, this process does not play a role in subsequent discussions, and will not be considered in the remainder of the paper.

A further constraint on native Zulu words, identified by Khumalo (1984) is what he terms a type of consonant harmony within stems: stops tend to agree in terms of the opposition fortis/lenis, and within the fortis group, in terms of the opposition voiced/voiceless (in his terminology, given above). Thus, the aspirates, ejectives/voiceless stops and plain voiced stops tend to co-occur in the same word. Examples are:

(25)

Word	**Gloss**	**Khumalo's stop category** (more general labels in brackets)
u.ku.khe.tha	to choose	voiceless lenis stops
u.ku.ki.ta.za	to tickle	voiceless fortis stops (ejectives/plain voiceless)
u.ku.gi.da	to dance	voiced fortis stops (plain voiced)

A constraint to account for these data can be formulated as a domain-specific agreement constraint, such as:

(26) AGREE(STEMSTOPS): Laryngeal features of stops agree within the same stem

This constraint is outranked by a further constraint termed the "velar stop condition" by Khumalo (1984). When the velars /k', k^h, g/ occur in environments where they are not permitted, that is, in non-root-initial positions, then they are replaced by the lenis voiced /k/. This constraint is formulated as follows:

(27) VELARSTOPCONDITION (VSC): Velar stops /k', k^h, g/ are only permitted in stem-initial positions

This constraint suggests that the voiced lenis velar /k/ is the least marked velar stop, the one that occurs when velar stops generally are not allowed. It therefore has to incur fewer markedness violations than the others. Data to illustrate the interaction of the above two constraints are the following:

(28) **Data for VSC and consonant harmony**[ix]

English form	Zulu form	Comments
carpet	i.kha.phe.the	harmony of aspirated voiceless stops; velar root-initially
tea-pot	i.thi.pho.thi	harmony of aspirated voiceless stops
ticket	i.thi.ki.thi	harmony of aspirated voiceless stops; velar non-root-initial
bucket	i.bha.ke.de	harmony of plain voiced stops; velar non-root-initial

Afrikaans (gloss)	Zulu form	Comments
dokter 'doctor'	u.do.ko.te.la	harmony of fortis stops, but not of voicing; velar non-root-initial
ouboet 'elder brother'	u.bhu.ti	harmony of fortis stops, but not of voicing
botter 'butter'	i.bho.te.la	harmony of fortis stops, but not of voicing

As far as the stops are concerned, the constraint AGREE(STEMSTOPS) is dominated by the VELAR STOP CONDITION. Faithfulness is ranked lower than these constraints. Such a faithfulness constraint pertains to the features [voice], [tense] and [checked], and will be abbreviated to a constraint IDENT(LAR). The relevant ranking for these constraints is as in (29a). For completeness' sake, we also present the constraint ranking established in section 3.1 for Zulu syllable structure in (29b).

(29) **Zulu L1 Grammar**

a. VSC >> AGREE(STEMSTOPS) >> IDENT(LAR) >> NOLAR
b. NOCOMPLEXONSET, NOCODA, MAXCONS >> DEP VOWEL

In the phonologies of Xhosa and Tswana, the constraints and their rankings are similar to Zulu, with the exception that the VSC is not ranked highly. It appears as if this constraint is more morphological in nature, and as such a language-specific constraint. It can be assumed to be completely absent from the phonologies of Tswana and Xhosa. Therefore, the relevant constraints in these two languages are ranked as follows:

(30) **Tswana and Xhosa L1 Grammar**

a. AGREE(STEMSTOPS) >> IDENT(LAR) >> NOLAR
b. NOCOMPLEXONSET, NOCODA, MAXCONS >> DEP VOWEL

Now that we have established the constraint ranking of Zulu L1, let us turn to the effects of highly ranked constraints in second language acquisition and to the learners first steps in second language acquisition.

[ix] Recall from section 3 that the plain voiced stops /b,d,g/ are represented by <bh, d, g>, respectively.

4 THE OBSTRUENTS OF ZULU-ENGLISH

There are a couple of voicing phenomena that affect the obstruents of Black South African English (BSAE, see Hundleby 1964; Jacobs 1994; Van Rooy 2000). Although there is some internal variation in BSAE along the lectal continuum ranging from basilect through mesolect to acrolect (see Schmied 1991:47 for this classification in African Englishes generally), the focus of this paper is on the mesolect only, which is that form of BSAE spoken by teachers with typically a two year post-school qualification, but no university education. The relevant phenomena are the following:

(31) **Consonantal phenomena in Black South African English**

a. Simplification of consonant clusters in syllable codas, but not in onsets.
b. Final devoicing.
c. High frequency of velar stop devoicing in onset positions in Zulu-English, medium frequency in Tswana-English and almost complete absence of velar stop devoicing in Xhosa-English.

This list is abstracted from Van Rooy (2000), who considers consonants in all forms of BSAE. He provides new data on Tswana-English in particular, and reconstructs BSAE on the basis of all available evidence. Hundleby (1964) treats Xhosa-English in detail, while Jacobs (1994) focuses on Zulu-English consonants in particular.

The devoicing processes identified by Jacobs concern the obstruents [b, d, z] in word-final position, and the plosive [g] and affricate [dʒ] in initial, medial and final positions. The [dʒ] substitution in initial and medial positions is rather puzzling, since this affricate occurs in Zulu as well, but not in contrast to a voiceless [tʃ]. It may be an optional kind of devoicing that is not opposed in the language system because in Zulu it will not create minimal pairs. Van Rooy (2000) finds that the realisation of English affricates is problematic and full of random variation in BSAE generally. Given the possibility of random variation, no detailed exploration of the voicing component will be undertaken in this article, since the variation also involves manner and place of articulation, and therefore a consideration of the voicing dimension in isolation will not do justice to the complexities involved. The devoicing of [g] in positions other than final is interesting though, and will be discussed in more detail in section 5.

One striking omission from the list in Jacobs (1994) is consonant deletion and vowel epenthesis. Looking through the various examples she gives throughout her paper, not a single example of vowel epenthesis is observed and a single case of deletion of a coda consonant is observed in the example *jump*, which is pronounced without the final [p] as [tʃam] (illustrating devoicing of /dʒ/ in the context of the argument). However, Van Rooy (2000) finds that while single consonants are allowed in syllable codas, consonant clusters are subject to simplification. In particular, plosives are deleted from consonant clusters in syllable codas. He also notes that this aspect has not been studied thoroughly by previous researchers.

We need to consider a number of facts about the English pronunciation of the Zulu speakers studied by Jacobs (1994):

(32) **Facts relevant to Zulu-English voicing alternations**

a. Coda consonants are permitted.
b. Final devoicing takes place consistently.
c. Velar /g/ devoices in positions other than final as well.

Considering only the first two of the above observations for the time being, it seems as if the following constraints are relevant to an adequate account:

(33)

NOCODA:	Syllables must be open
MAXCONS:	All consonants in the input must have a correspondent in the output
DEPVOWEL:	All vowels in the output must have a correspondent in the input
NOVOICEDCODA:	Syllable-final obstruents are voiceless.
IDENT(LAR):	The obstruent voicing specification of the input corresponds to the voicing of the output.

We pointed out in section 2.2 that in English (the target language), MAX and DEP are ranked higher than NOCODA (see 11 and 34a below). Moreover, in section 3.1, we established that in Zulu, NOCODA outranks DEPVOWEL (see 23 and 34b below) and this ranking explains why no coda obstruents are found in loan words from English and Afrikaans. Let us now turn our attention to the ranking of these constraints in second language phonology. The data collected by Jacobs (1994) reveal that these Zulu-English mesolect speakers have successfully demoted the constraint NOCODA below the constraint MAXCONS, as well as the constraint DEPVOWEL, since insertion is not attested at all in the data presented by Jacobs (1994):

(34) **Partial constraint rankings (Zulu-English)**

a. Target language (English): MAXCONS, DEPVOWEL >> NOCODA
b. First language (Zulu): NOCODA, MAXCONS >> DEPVOWEL
c. Interlanguage: MAXCONS >> DEPVOWEL >> NOCODA

If Van Rooy's (2000) finding about cluster simplification is incorporated, then a constraint such as the following has to be formulated to account for the Tswana-English data at least:

(35) NOCODACLUSTER: Plosives are not allowed in coda clusters.

This constraint is also implicitly satisfied by Zulu, since the constraint NOCODA is unviolated in Zulu L1 phonology, as indicated in section 3. By default, then, coda clusters are also prohibited in the phonology of Zulu. To account for this, the following rankings must be assumed for BSAE in general:

(36) **Revised constraint rankings (BSAE)**

a. Target language: MAXCONS, DEPVOWEL >> NOCODA, NOCODACLUSTER
b. First languages: NOCODA, NOCODACLUSTER, MAXCONS >> DEPVOWEL
c. Interlanguage: NOCODACLUSTER >> MAXCONS >> DEPVOWEL >> NOCODA

The constraint NOCODACLUSTER has the effect of reducing the number of plosives actually occurring in syllable codas. However, it does not prevent all plosives from occurring in codas,

and does not affect fricatives at all. Therefore, we can ignore the effect of this constraint on the voicing phenomena. When obstruents do appear in codas, they remain subject to the ranking in (34c), and we will assume that this ranking applies to BSAE generally.

The sudden emergence of the effects of the constraint NOVOICEDCODA is not predictable on the basis of first language data, or loan-word adaptations for that matter. Since NOCODA, undominated in Zulu L1, ensures that no obstruents find themselves in syllable-coda positions (see 34b), Zulu L1-speakers have no evidence on the basis of which to rank the constraint NOVOICEDCODA. However, by assumption, phonological constraints are universal and therefore present in the ranking of the learner (a morphological constraint like the VSC may be an exception to this). Since no evidence to demote this constraint exists in Zulu-L1, it remained undominated during L1-learning, if invisible. The moment that the constraint NOCODA is demoted minimally to allow for coda obstruents, they are devoiced, because the constraint NOVOICEDCODA has always outranked faithfulness to obstruent voicing in the phonologies of these speakers. That NOCODACLUSTER remains high in the constraint ranking does not result in all coda obstruents being ruled out, and consequently, the effects of NOVOICEDCODA are seen.

There is no direct evidence pertaining to the ranking of NOVOICEDCODA and MAXCONS relative to each other. However, NOVOICEDCODA is completely free from violations, while MAXCONS must be dominated by NOCODACLUSTER. The ranking of IDENT(LAR) and NOCODA cannot be determined on the basis of the data surveyed here, though, but there is evidence on the relationship between DEPVOWEL and IDENT(LAR). When faced with a form like /bæd/, the form [bæt] is more harmonious than [bæda][x] for the Zulu-English speaker, which suggests that the constraint DEPVOWEL must outrank IDENT(LAR). Final vowel epenthesis is not a strategy to avoid voiced final obstruents, rather devoicing takes place. We therefore have the ranking in (37c) at this stage:

(37) a. **Adult English Grammar**

MAXCONS, DEPVOWEL, IDENT(LAR) >> NOVOICEDCODA, NOCODA, NOLAR, (NOCODACLUSTER)

b. **Adult Nguni or Sotho Grammar**

MAXCONS, NOVOICEDCODA, NOCODA, (NOCODACLUSTER) >>DEPVOWEL >>IDENT(LAR) >>NOLAR

c. **Interlanguage Grammar of BSAE**

NOVOICEDCODA (NOCODACLUSTER) >> MAXCONS >> DEPVOWEL >> NOCODA, IDENT(LAR) >> NOLAR

The correctness of this analysis is illustrated in tableau (38):

[x] The identity of the epenthetic vowel is irrelevant here, since this candidate can never be optimal, given the constraint hierarchy postulated here.

(38) **BSAE grammar: NOVOICEDCODA >> IDENT (LAR) >> NOLAR**

Input: /bæd/ 'bad'	NOVOICEDCODA	MAX CONS	DEP VOWEL	NOCODA	IDENT(LAR)	NOLAR
a) bæd	*!			*		**
b) ☞ bæt				*	*	*
c) pæt				*	**!	
d) bæda			*!			**
e) bæ		*!				*

In summary, we established the following constraint ranking of Zulu L1 in section 3.1 on the basis of loan word phonology:

(39) **Zulu L1 constraint ranking**

MAXCONS, NOVOICEDCODA, NOCODA>> DEPVOWEL
IDENT(LAR) >> NOLAR
Effects: no obstruent is realised in syllable-final position
loan words are adjusted by means of final-vowel epenthesis

This ranking is also valid for the other Nguni and the Sotho languages.

Broselow *et al*. (1998) suggest that in learning a second language, the ranking of constraints will initially be as in the native language. As the learner becomes more proficient, an interlanguage grammar will develop in which the ranking of constraints more closely approximate the target-language ranking. In the case of Zulu speakers who learn English, an interlanguage is developed in which NOCODA is successfully demoted below DEPVOWEL:

(40) **Interlanguage ranking** (minimal demotion of NOCODA below DEPVOWEL)

NOVOICEDCODA >> MAXCONS >> DEPVOWEL >> NOCODA, IDENT(LAR) >> NOLAR
Effect: final obstruent is always voiceless

Why is NOCODA demoted first in language acquisition and NOVOICEDCODA only later? A possible answer may be that a more specific constraint like NOVOICEDCODA cannot be dominated by less specific constraints like NOCODA and/or NOLAR (cf. the discussion on "Local Conjunction" by Smolensky 1993, 1995 and Itô & Mester 1998). A possible implication is that NOVOICEDCODA can only demote once NOCODA has been demoted first. This is obviously also the case for NOCODACLUSTER. Moreover, the prevailing view in OT-literature is that language acquisition proceeds by means of minimal constraint demotion and not by maximal demotion. To closer approximate the target language, NOCODA is first demoted to a position below DEPVOWEL. Subsequently, NOCODA may demote further down the constraint hierarchy and finally, on the basis of positive evidence in the target language, NOVOICEDCODA is demoted in the constraint hierarchy below IDENT(LAR) to obtain the required result. Hence, a late step in language acquisition is a relatively big one, viz. the demotion of NOVOICEDCODA below IDENT(LAR):

(41) **More advanced ranking** (minimal demotion of NOCODA and, subsequently of NOVOICEDCODA below IDENT(LAR))

MAXCONS >> DEPVOWEL >> IDENT(LAR) >> NOVOICEDCODA, NOCODA, NOLAR
Effect: final obstruent remains faithful to its input specification for voicing

There is evidence that this development from the ranking in (40) to the one in (41) is a possible phase of development. When speakers of Afrikaans learn English, they start with (40) as their L1 ranking, and then proceed to (41), since they do learn to retain the voicing of final obstruents, even though their first language is characterised by final devoicing (see Van Rooy & Wissing 1996 for a comparison between Afrikaans and Tswana learners of English).

A next question relates to the position of the harmony condition and the velar stop condition specifically in Zulu-English, identified in the preceding section. This issue will be addressed next.

5 THE CURIOUS CASE OF K

Clearly, the condition on velar stops (27) and the constraint that says that obstruents within a stem must agree in laryngeal features (AGREESTEMSTOP, see 26) must outrank the constraint IDENT(LAR) in Zulu loan-word phonology, since they are responsible for adaptations of the laryngeal features in English and Afrikaans loan word when incorporated into Zulu-English (see the data in 28 and the constraint ranking in 29). Jacobs (1994) provides a wealth of data on second language acquisition, but very little concerning the status of the harmony constraint. Most of her examples are mono- or disyllabic, and the relevant data point to two types of words - those with initial voiced and final voiceless stops, and those with only voiceless stops:

(42) **Evidence on consonant harmony (constraint AGREE(STEMSTOPS)) in Zulu L2**

Voiced/voiceless		Voiceless/Voiceless	
those	[dos]	cab	[kap]
bad	[bat]	code	[kot]
bag	[bak]	Jews	[ʃus]

What this shows, is that the AGREE(STEMSTOPS)-constraint is ranked below NOVOICEDCODA, since codas are voiceless independent of the voicing of the initial stop. AGREE(STEMSTOPS) is also ranked below IDENT(LAR), since initial voiced plosives are rendered faithfully in the output, and do not convert to voiceless ones. There is no relation between AGREE(STEMSTOPS) and NOCODA as far as can be determined, so NOCODA and IDENT(LAR) can remain at the same level. In terms of the ranking in (40), we can simply add AGREE(STEMSTOPS) to the right of that ranking. It is clear that some acquisition has taken place in the English of these Zulu-speakers, in that they have successfully demoted this constraint from its higher position in the first language to a lower one in the second language.

(43) a. **Zulu L1 ranking**

NOVOICEDCODA >> MAXCONS >> DEPVOWEL >> NOCODA, IDENT(LAR) >> NOLAR

b. **Interlanguage ranking**
NOVOICEDCODA >> MAXCONS >> DEPVOWEL >> NOCODA, IDENT(LAR) >> AGREE (STEMSTOPS)

Second language learners are confronted with abundant examples with disharmonic stops in English. They are thus easily prompted to demote AGREE(STEMSTOPS).

The exception to the ranking in (43b) occurs in the case of velar stops. Jacobs (1994) observes that the velar stops are more prone to devoicing in initial and medial positions. She provides examples such as the following:

(44) **Evidence on velar stop devoicing**

a.	game	[kam]
b.	girl	[kil]
c.	grew	[kru]
d.	bigger	[bika]

Although the overall frequency of occurrence of the velar stops is lower in her data corpus, Jacobs (1994) observes that devoicing is highly regular here. This seems to suggest that the VELAR STOP CONDITION is not entirely inactive, although its result in the L2-English of Zulu speakers is a voiceless [k]. No phonetic data is given in Jacobs' study, but one could assume that the velar stop produced here is phonetically very similar to the one labelled voiced, lenis by Khumalo (1984). If the voicing is weak, then this stop could be perceived as being a plain voiceless stop, without aspiration or ejection, by the researcher doing a broad phonemic transcription. Although this is speculative, it seems at least that one has to recognise the phonological effects of the VSC in Zulu-L2 English. A consequence of the VSC, then, is the neutralisation of an opposition, irrespective of the exact phonetic qualities of the velar stop occurring in these neutralised positions. The VSC, ranked highly in Zulu-L1 (see 29) retains its high ranking in Zulu-English, and outranks faithfulness.

We arrive at the following ranking of the relevant constraints to account for all three observations taken as the focus of this article:

(45) **Interlanguage Grammar of Zulu-speakers learning English**
VELAR STOP CONDITION, NOVOICEDCODA, NOCODACLUSTER>> MAXCONS >> DEPVOWEL >> IDENT(LAR), NOCODA>> NOLAR, AGREE(STEMSTOPS)

The validity of this constraint ranking is illustrated by the following tableaux:

(46) **Zulu L2 grammar: NOVOICEDCODA >> DEPVOWEL >> IDENT (LAR)**

Input: /kab/ 'cab'		NO VOICED CODA	MAX CONS	VSC	DEP VOWEL	NO CODA	IDENT (LAR)	AGREE (STEM STOPS)	NO LAR
a)	gab	*!		*		*	*		**
b)	☞ kap					*	*		
c)	kab	*!				*		*	*
d)	kaba				*!			*	*
e)	ka		*!						

(47) **Zulu L2 grammar: VSC >> IDENT (LAR) >> AGREE(STEMSTOPS)**

Input: /biga/ 'bigger'		NO VOICED CODA	MAX CONS	VSC	DEP VOWEL	NO CODA	IDENT (LAR)	AGREE (STEM STOPS)	NO LAR
a)	biga			*!					**
b)	☞ bika						*	*	*
c)	pika						**!		
d)	piga			*!			*	*	*
e)	bia		*!						*

It is also clear from existing evidence (Hundleby 1964; Van Rooy 2000) that this process is specific to Zulu-English. Hundleby (1964) observes the opposite process, intervocalic voicing of voiceless plosives as an optional phonetic variation in Xhosa-English, and no evidence of velar plosives being devoiced in onsets. Van Rooy (2000) observes the occasional devoicing of all plosives in onsets, and that velar plosives are subject to devoicing far more frequently than others. However, it is not a process that is completely regular, as is the case with Zulu-English. A possible account for the Tswana-English data is possible by invoking the markedness of the voicing opposition in velar obstruents generally. Many languages, like Afrikaans and Dutch, allow a voicing contrast between labial and coronal obstruents, but not among velar ones (with the exception of some southern Dutch dialects that still allow voiced velar fricatives). At any rate, it is clear from the data that the velar plosives of Zulu-English behave differently from the ones in Xhosa-English and Tswana-English. The VSC that operates in the first language phonology of Zulu speakers, and not in Tswana or Xhosa, appears to be the best available interpretation of the data.

6 FINDING

Although first-language interference is often regarded as the prominent cause of second-language pronunciation, the data examined in this article suggests that a more refined understanding is required. Within the framework of OT, constraints are assumed to be universal, while ranking is language specific. It is possible to provide an account of the voicing phenomena in Black South African English by assuming the universal constraint set and deriving the

description of Black South African English by means of the process of constraint demotion, taking the L1-ranking as starting point.

During the course of the analysis, a typical interference phenomenon such as the devoicing of velar stops in Zulu-English is shown to follow from a high-ranked constraint (the VSC) in Zulu-L1 which is not demoted during the process of second-language acquisition. However, another phenomenon, final devoicing, which does not occur in Zulu-L1 or English-L1, appears in Zulu-English, as well as other forms of BSAE. This process is the consequence of a universal constraint, NOVOICEDCODA, that remains undominated during the L1-acquisition of Nguni and Sotho languages, but whose effects are invisible due to the high ranking of another constraint, NOCODA. Once NOCODA is properly demoted to produce closed syllables in the second language, the effects of NOVOICEDCODA become visible in Black South African English.

It emerges that both apparent first-language interference and universal trends of second language acquisition follow from the same explanation, with universal constraints and a language-specific constraint ranking which has to be adapted in a way similar to L1-acquisition. It thus seems possible to propose a more unified picture of first and second language acquisition. The difference between the two seems to be in the initial ranking of constraints: first language acquisition may start from a set of constraints in which markedness constraints outrank faithfulness constraints, while second language acquisition takes the ranking of the constraints in the first language as starting point.

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