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ACQUISITION OF MARKED CONSONANT CLUSTERS IN GERMAN AS A FOREIGN LANGUAGE

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1. Introduction

The study takes the perspective that L2 data are important for testing general linguistic theory and models of acquisition. Specifically, the purpose of the present study is to test whether the interlanguage phonology of consonant clusters behaves according to universals in phonetics and phonology, such as those described by Greenberg (1978) and explicated by Eckman (1991), Carlisle (1994) and Major (1996) for L2 acquisition. The phenomena under investigation here mainly concern hierarchical relationships of consonant clusters with two members.

2. Methodology

The present study is intended to test whether acquisition of consonant clusters patterns according to (implicational) universals and universal tendencies in markedness theory.

2.1. Subjects and speech materials

The data were collected during several sessions in the first half of the year 2000. The **tested subjects** were 11-13 year old Slovene children (48 children: 23 girls and 25 boys), learning German as a foreign language at different schools (11 girls and 13 boys from the 5th grade vs. 12 girls and 12 boys from the 7th grade of four elementary schools in two different regions of Slovenia). The number of children tested in the second, third and fourth reading test are subsets of the first reading test. The children from the Elementary School IC Maribor have been learning German as a foreign language since the 3rd grade of elementary school, whereas the children from the other three elementary schools (Griže, Prebold, Vransko) have been learning German as a foreign language since the 4th grade of elementary school. However,

some of the tested children took German classes before the 3rd or 4th grade of elementary school (in a private language institute or as one of their facultative school subjects, but only up to 30 hours per year).

The speech materials were designed to elicit speech samples with varying degrees of formality: word list, short text, and conversation on a picture (cf. Major 1996: 78). However, the data from other reading tests, a short dialogue and a description of a picture have not been included yet, therefore only the results of the three word list reading tests and the sentence reading test will be presented and discussed in the present paper. The initial and final consonant clusters included are those not occurring in native Slovene or rarely occurring in native Slovene (ie. in loanwords and foreign words) – English glosses of the German speech materials can be looked up in the appendix of the article.

Table 1. Words used for the word lists.

	syllable onset	syllable coda
1st + 2nd Test	Pferd, Fluss, schreiben, Schlüssel, Schmutz, Schneider, schwarz, Pflaume, Pfriem	**Akt**, **Abt**, Kopf, Gi**ps**, hübsch, Fu**chs**, Gift, mischt, echt, acht, Schafs, Dachs, Hals, falsch, Kelch, Dorf, durch, Samt, Wurms, Amts, Ramsch, Senf, Mensch, manch, ka**lt**, Schal**k**, elf, stolz, Lump, Hand, eins, Halm, Inseln, Garn
3rd Test	Pfahl – fahl, Flug – Pflug, schmecken – Schnecken – schwenken, Pfriem – Friede	Tropf – troff, Gift – Gischt – Gicht, Licht – lacht, Schafs – traft, Schiffs – Spitz, Hals – Holz, Kölsch – hübsch – Ramsch, Kelch – durch, Dorn – Dorf, Worms – O**lms**, Amts – Kranz, Mensch – manch, Lump – Da**mpf**, Köln – Holm
Note: The consonant clusters in **bold** print occur only in the 1st and 2nd test or the 3rd test respectively.		

Table 2. German consonant clusters included in speech materials.

	syllable onset	syllable coda
1st + 2nd Word List Test	[pf, fl, ʃr, ʃl, ʃm, ʃn, ʃv, pfl, pfr]	[**kt**, **pt**, pf, **ps**, pʃ, **ks**, ft, ʃt, çt, xt, fs, xs, ls, lʃ, lç, rf, rç, mt, rms, mts, mʃ, nf, nʃ, nç, **lt**, **lk**, lf, lts, mp, nt, ns, lm, ln, rn]
3rd Word List Test	[pf, **f**, fl, pfl, ʃm, ʃn, ʃv, pfr, **fr**]	[pf, f, ft, ʃt, çt, xt, fs, ft, fs, ts, ls, lts, lʃ, pʃ, mʃ, lç, rç, rn, rf, rms, **lms**, mts, nts, nʃ, nç, mp, **mpf**, ln, lm]
Note: The consonant clusters in **bold** print occur only in the 1st and 2nd test or the 3rd test respectively.		

Table 3. German consonant clusters included in sentences (4th reading test).

Petras Ko**pf** tut weh. – Auch Ingrid hat Ko**pf**weh. – Der A**rzt** legt seinen **Arm** in Gi**ps**. – Ma**nche Schlang**en haben **starke**s Gi**ft**. – Die Wolle des Scha**fs ist** sehr wei**ch**. – Die Augen des Wu**rms** sehe ich ni**cht**. – Ma**nche** Me**nsch**en essen keinen Se**nf**. – Essen **Pf**erde auch **Pfl**aumen? – Wir **schr**eiben heute einen A**ufsatz**. – Tri**nkst** du deinen Kaffee **schwarz**?

Some of the German phonemes or phoneme variants included in the speech materials do not occur in the Slovene standard language: (a) there is no voiceless palatal fricative [ç], but there is a voiceless velar fricative [x]; (b) there is no labiodental affricate [pf], but both sounds of the affricate are phonemes of the Slovene standard language; (c) the German variants of the phoneme /r/ provided as target sounds in all tests (viz. the velar fricative [ʁ] and the uvular liquid [ʀ]) do not occur in Slovene either; however, the third variant of the German phoneme /r/, the alveolar liquid [r], is part of the Slovene phoneme set as well. In some words of the speech material a morpheme boundary occurred between the members of a consonant cluster (ex. *misch+t, Schaf+s, Dach+s, Wurm+s, Amt+s, Insel+n*) due to my assumption that the children would not be able to analyze the structure of the mostly unknown morpheme constructions and regard them (holistically) as simple words. On common consonant clusters in German and Slovene cf. Petrič (1996) and Petrič (2000).

2.2. Procedure

The words selected in the first and second word list reading test were recorded in the same session and read in the same sequence as can be seen in Table 1. In the first test the children listened to the target pronunciation of each word, while they simul-

taneously had the opportunity to read silently a printed version of the word. Immediately after having heard the target pronunciation of a word for the first time, each subject had to pronounce the word. Subsequently, after having heard the target pronunciation of a word for the second time, each subject had to pronounce the word again. In the second test some of the above mentioned available subjects read the same word list again, but this time without having the opportunity to listen to the target pronunciation another time. The subjects had to recall the target pronunciation provided previously in the first reading test or could follow the printed version of the words. The words selected in the third test were (near) minimal pairs in order to control for phonological environment and read in the same sequence as can be seen in Table 2. Immediately after listening to the target pronunciation of a minimal pair of words twice, each subject had to produce two tokens of the minimal pair. Most of the words included in the word lists were unknown to them. In the fourth test a subset of the subjects were to read the sentences in Table 3. Immediately after listening to the target pronunciation of a sentence twice, they had the task of reading the target sentence twice.

The phenomena under investigation were categorized as target-like or non–target-like; this latter category was further subcategorized (cf. Major 1996: 78) as transfer (directly attributable to Slovene phonology) or developmental (not directly attributable to native phonology but rather due to universal factors or eventually other factors, ie. the reading capacity of the test subjects). Transfer phenomena include the substitution of the German target phoneme variants which do not occur in the Slovene standard language: (a) the voiceless palatal fricative [ç], (b) the labiodental affricate [pf], (c) the uvular liquid [ʀ] or velar fricative [ʁ] (replaced by an English tap, approximant or retroflex liquid) and (d) voicing of syllable-final voiceless obstruents (in the fourth test only). Developmental substitutions usually include consonant cluster simplification processes, such as deletion of a consonant, vowel or consonant epenthesis or metathesis. In the speech of the Slovene learners there were several syllable modifications that were categorized as developmental phenomena: (a) the substitution of a consonant (or consonant feature) due to assimilation, (b) the deletion of a consonant, (c) the deletion of a nasal consonant with accompanying nasalization of a vowel, (d) the epenthesis of a consonant, (e) the epenthesis of a vowel, (f) resyllabification due to change and of accent (g) the metathesis of consonants. More details on particular cases will be provided in section 4.2.

The various consonant clusters were further categorized (cf. Major 1996: 78-79) into the following cluster types (Table 4). The total number of tokens in the first reading test was 4128, in the second 2834, in the third reading test 3588, and in the fourth reading test 1782.

Table 4. Cluster Types used for the word lists.
(S=Stop, F=Fricative, L=Liquid, N=Nasal)

	syllable onset	syllable coda
1st + 2nd Test (Word List 1)	#SF, #SFL, #FF, #FL, #FN	LNF#, LN#, NSF#, NF#, FF#, LF#, **LS#**, FS#, NS#, LSF#, SF#, **SS#**
3rd Test (Word List 2)	#FF, #FL, #SFL, #SF, #FN	LF#, LNF#, LN#, NF#, FS#, NSF#, FF#, LSF#, NS#, SF#
4th Test (Sentences)	#FL, #FS, #SF, #SFL, #FF	SF#, LSFS#, LN#, SF#, NF#, FS#, FF#, LNF#, FL#, NSFS#, LSF#
Note: The consonant clusters in **bold** print occur only in the 1st and 2nd test or the 3rd test respectively.		

3. Hypotheses

Researchers have noted that there is a universal tendency for a Universal Canonical Syllable Structure (UCSS) based on sonority (Selkirk 1984, Vennemann 1988 and others). Structurally, sonority is often defined in terms of the probability of co-occurrence of certain segment types (ie. vowels, liquids, nasals, fricatives, plosives) in the syllable structure. Onsets and codas abide by the UCSS if there is a continuous rise in sonority from the most peripheral members of both structures through the nucleus of the syllable. A strong tendency for a syllable profile abiding by the UCSS can be observed in different language types though there are languages (e.g. English, German, Slovene and others) with language specific syllable structures that violate the UCSS (e.g. *st* in English, German and Slovene onsets, *pf* in German codas, *str* in English, German and Slovene onsets, ...). Some linguists (cf. Carlisle 1994: 236-237 and Dziubalska-Kołaczyk 2001: 23) have introduced the measure of sonority distance (SD) to compare the distance in sonority between the consonants of a syllable margin. Researchers use different sonority scales to measure the sonority distance. The main differences between the sonority scales concern the sequencing of obstruents (fricatives vs. plosives) and to a lesser degree the sonority sequencing of sonorants (nasals vs. liquids). It is assumed that there is a tendency for onsets and codas that abide by the UCSS to be less frequently modified than those that do not conform to it (Tropf 1987). Vennemann (1988) has pointed out a preference in language change for codas that display a greater drop in sonority from the member closest to the nucleus to the peripheral member. Thus a coda containing a consonant sequence conforming to the UCSS should be less marked than a coda not abiding by it. The Sonority sequencing principle (Davidson 2000: 2; influenced by the Dispersion Principle of Clements 1990) or the Principle of Maximizing the Contrast between the onset and the rhyme of a syllable (Maas 1999: 186) suggest that the sonority profile of a syllable displays an asymmetry between onset and coda.

On the basis of the samples of the Slovene learners of German as a foreign language the following assumptions related to the preferential sonority profile of a syllable and the sonority distance between the consonants of the onset or coda of a syllable will be examined:

(I) Two-member syllable margins will be less often modified if the sonority distance between the most peripheral and the inner consonant is positive and greater than zero (SD > 0) and more often modified if the sonority distance between the most peripheral and the inner consonant is zero or even negative (SD ≤ 0). In other words, two-member margins with a greater sonority distance value (SD) will be less often modified than two-member margins with a smaller sonority distance value: ie. (1) in an onset a fricative stop sequence (#FS with SD = –1) or a stop stop sequence (#SS with SD = 0) should be more often modified than a stop fricative sequence (#SF with SD = +1) or (2) an onset consisting of a stop liquid sequence (#SL) with SD = 2 should be less modified than a fricative liquid sequence (#FL) with SD = 1.

Especially with three-consonant syllable margins there is a well-known theoretic issue with "extrasyllabic" consonants which obviously violate the sonority principle. But in principle one can expect similar outcomes as with two-member syllable margins.

(II) Three-member onsets or codas will be less often modified if the sonority distance between each consonant pair is positive and greater than zero (SD > 0) and more often modified if the sonority distance between each consonant pair is zero or negative (SD ≤ 0). The sonority distance should increase more sharply between the interior and the middle consonant in the syllable margin than between the outmost and the middle consonant: ie. in an onset a stop fricative liquid sequence (#SFL with SD1 = 1, SD2 = 2; SD2 > SD1) should be less often modified than a fricative stop liquid sequence (#FSN with SD1 = –1, SD2 = 2; SD2 > SD1, but SD1 is negative) or a stop fricative nasal sequence (#SFN with SD1 = 1, SD2 = 1; SD2 = SD1).

Due to the polarity between onset and rhyme the sonority distance between the onset and the nucleus of the syllable should be maximized, whereas the sonority distance between the coda and the nucleus need not be maximized (Maas 1999: 186). According to the Sonority Sequencing Principle (SSP) of Davidson (2000: 2) the sonority distance should increase sharply in the onset and fall gradually in the coda (on codas cf. also Eckman 1994: 254).

(III) According to the SSP a preference for creating open syllables out of closed syllables (resyllabification) or a preference for codas with fewer obstruents should be observed in the available interlanguage data. This means that deletion of consonants or vowel epenthesis between consonants should occur more often in codas than in onsets.

There is some evidence from other studies that the ratio of epenthesis to deletion will be higher in more formal styles (ie. in context-free list tasks) and that it will be reduced in oral dialogue (context-bound tasks) because other factors in the context allow an interlocutor to repair what has been lost through deletion (cf. Major 1987, Weinberger 1987).

(IV) Epenthesis will be used more often to modify syllable structures than deletion in more formal style (e.g. word lists, reading sentences or texts) and vice versa.

According to Riney (1990; cited in Carlisle 1994: 228) epenthesis should occur more often with elder children, whereas deletion should occur more often with younger children.

(V) Epenthesis will be used more often by the (elder) Slovene children in the 7th grade and less often by the (younger) Slovene children in the 5th grade.

Many studies on the syllable structure have found that the markedness of both onsets and codas increases with length (cf. Greenberg 1965, Kaye and Lowenstamm 1981, Vennemann 1988). Some studies in interlanguage phonology have revealed that shorter onsets and codas are preferred over longer onsets and codas. If the length of consonant clusters is modified, less marked clusters result.

(VI) Three-consonant clusters will be more often modified than two-consonant clusters.

Due to the available data in these four tests the hypotheses (I) and (II) will be examined in more detail (with emphasis on coda clusters) than hypotheses (III) – (VI).

4. Results and discussion

4.1. Examination of the hypotheses

Let us now examine the agreement of the above described hypotheses (I) – (VI) and our L2 data. The numbers and percentages of target-like and non–target like pronunciations of the four above described tests are subsumed in the Tables 5, 6, 7 and 8 respectively. In Tables 9, 10, 11 and 12 the results of the first and second test (using word list 1) were summed up and used for more detailed evaluation of the hypothesized markedness relationships.

Table 5. Word list 1, Test 1 – ratio of (non-)target consonant cluster production.

CL-Type	C	Words	Productions			
			% [+target]	% [–target]	[all]	[all] %
LNF#	3	Wurms	58.33	41.67	96	100
LN#	2	Garn, Halm, Inseln	65.97	34.03	288	100
LF#	2	Dorf, durch, elf, falsch, Hals, Kelch	69.44	30.56	576	100
NF#	2	eins, manch, Mensch, Ramsch, Senf	76.67	23.33	480	100
FS#	2	acht, echt, Gift, mischt	80.99	19.01	384	100
NSF#	3	Amts	85.42	14.58	96	100
FF#	3	Dachs, Schafs	93.23	6.77	192	100
LS#	2	kalt, Schalk	95.83	4.17	192	100
NS#	2	Hand, Lump, Samt	97.92	2.08	288	100
LSF#	3	stolz	97.92	2.08	96	100
SF#	2	Fuchs, hübsch, Gips, Kopf	98.44	1.56	384	100
SS#	2	Abt, Akt	100.00	0.00	192	100
#SF	2	Pferd	87.50	20.83	96	100
#SFL	3	Pflaume, Pfriem	83.33	16.67	192	100
#FF	2	schwarz	95.83	4.17	96	100
#FL	2	Fluss, Schlüssel, schreiben	97.92	2.08	288	100
#FN	2	Schmutz, Schneider	98.96	1.04	192	100

Table 6. Word list 1, Test 2 – ratio of (non-)target consonant cluster production.

CL-Type	C	Words	Productions			
			% [+target]	% [–target]	[all]	[all] %
LNF#	3	Wurms	51.52	48.48	33	100
FF#	3	Dachs, Schafs	53.03	46.97	66	100
LN#	2	Garn, Halm, Inseln	56.57	43.43	99	100
NF#	2	eins, manch, Mensch, Ramsch, Senf	63.03	36.97	165	100
LF#	2	Dorf, durch, elf, falsch, Hals, Kelch	63.13	36.87	198	100
NSF#	3	Amts	63.64	36.36	33	100
FS#	2	acht, echt, Gift, mischt	65.91	34.09	132	100
LSF#	3	stolz	81.82	18.18	33	100
SF#	2	Fuchs, hübsch, Gips, Kopf	84.85	15.15	132	100
LS#	2	kalt, Schalk	90.91	9.09	66	100
NS#	2	Hand, Lump, Samt	96.97	3.03	99	100
SS#	2	Abt, Akt	100.00	0.00	66	100
#SFL	3	Pflaume, Pfriem	62.12	37.88	66	100
#SF	2	Pferd	84.85	15.15	33	100
#FN	2	Schmutz, Schneider	93.94	6.06	66	100
#FF	2	schwarz	96.97	3.03	33	100
#FL	2	Fluss, Schlüssel, schreiben	97.98	2.02	99	100

Table 7. Word list 2, Test 3 – ratio of (non-)target consonant cluster production.

CL-Type	C	Words	Productions			
			% [+target]	% [–target]	[all]	[all] %
LF#	2	Dorf, durch, Hals, Kelch, Kölsch	52.17	47.83	460	100
LNF#	3	Olms, Worms	57.61	42.39	184	100
LN#	2	Dorn, Holm, Köln	61.96	38.04	276	100
NF#	2	manch, Mensch, Ramsch	62.32	37.68	276	100
FS#	2	Gicht, Gift, Gicht	65.22	34.78	552	100
NSF#	3	Amts, Dampf, Kranz	74.28	25.72	276	100
FF#	3	Schafs, Schiffs	76.63	23.37	184	100
LSF#	3	Holz	77.17	22.83	92	100
NS#	2	Lump	88.04	11.96	92	100
SF#	2	hübsch, Spitz, Tropf	94.20	5.80	276	100
LS#	2	–	–	–	–	–
SS#	2	–	–	–	–	–
#FF	2	schwenken	90.22	9.78	92	100
#FL	2	Flug, Friede	90.76	9.24	184	100
#SFL	3	Pflug, Pfriem	93.48	6.52	184	100
#SF	2	Pfahl	94.57	5.43	92	100
#FN	2	schmecken, Schnecken	95.65	4.35	184	100

If the substitutions of the voiceless palatal fricative [ç] and the labiodental affricate [pf] are categorized as transfer phenomena from Slovene phonology, the non–target-like productions of the consonant clusters in the three word list tests yield the following results (Table 8):

Table 8. Word list 1, test 1 and 2 – ratio of (non-)target cluster production (only subjects providing 3 tokens per cluster, without such containing [ç] or [pf]).

CL-Type	C	Words	Productions			
			% [+target]	% [–target]	[all]	[all] %
LNF#	3	Wurms	56.57	43.43	99	100
LN#	2	Garn, Halm, Inseln	62.29	37.71	297	100
FF#	3	Dachs, Schafs	78.28	21.72	198	100
NSF#	3	Amts	78.79	21.21	99	100
NF#	2	eins, manch, Mensch, Ramsch, Senf	84.34	15.66	396	100
LSF#	3	stolz	91.92	8.08	99	100
SF#	2	Fuchs, hübsch, Gips, Kopf	92.12	7.88	330	100
FS#	2	acht, echt, Gift, mischt	92.26	7.74	297	100
LF#	2	Dorf, durch, elf, falsch, Hals, Kelch	93.69	6.31	396	100
LS#	2	kalt, Schalk	95.96	4.04	198	100
NS#	2	Hand, Lump, Samt	97.31	2.69	297	100
SS#	2	Abt, Akt	100.00	0.00	198	100
#SFL	3	Pflaume, Pfriem	77.91	22.09	258	100
#SF	2	Pferd	81.75	18.25	137	100
#FF	2	schwarz	96.12	3.88	129	100
#FN	2	Schmutz, Schneider	97.67	2.33	258	100
#FL	2	Fluss, Schlüssel, schreiben	97.93	2.07	387	100

Table 9. Sentences, test 4 – ratio of (non-)target consonant (cluster) production.

Order of appearance	Cluster Coda Onset	Cluster or Cons. Type	C	Words or Phrases	Productions			
					% [+target]	% [–target]	[all]	[all] %
17	n.ç	N$F	1+1	manche	0.00	100.00	66	100
6	n.ç	N$F	1+1	manchel	1.52	98.48	66	100
8	ŋ	N	1	Schlangen	7.58	92.42	66	100
14	ç	F#	1	weich	12.12	87.88	66	100
16	çt	FS#	2	nicht	15.15	84.85	66	100
13	st.z̥	FS#F	2+1	ist sehr	18.18	81.82	66	100
23	f.z̥	F$F	1+1	Aufsatz	31.82	68.18	66	100
25	ŋkst.d̥	NSFS#S	4+1	trinkst du	37.88	62.12	66	100
3	tst	LSFS#	4	Arzt	43.94	56.06	66	100
12	fs	FF#	2	Schafs	62.12	37.88	66	100
19	nf	NF#	2	Senf	69.70	30.30	66	100
2	pf.v̥	SF$F	2+1	Kopfweh	71.21	28.79	66	100
4	ʁm	LN#	2	Arm	72.73	27.27	66	100
10	ʁ.k	L$S	1+1	starkes	77.27	22.73	66	100
15	ʁms.z̥	LNF#F	3+1	Wurms sehe	77.27	22.73	66	100
11	ft	FS#	2	Gift	87.88	12.12	66	100
1	pf.t	SF#S	2+1	Kopf tut	90.91	9.09	66	100
24	ts	SF#	2	Aufsatz	90.91	9.09	66	100
5	ps	SF#	2	Gips	95.45	4.55	66	100
27	ʁts	LSF#	3	schwarz	95.45	4.55	66	100
18	n.ʃ	N$F	1+1	Menschen	98.48	1.52	66	100
21	pfl	#SFL	3	Pflaumen	54.55	45.45	66	100
20	pf	#SF	2	Pferde	57.58	42.42	66	100
9	ʃt	#FS	2	starkes	81.82	18.18	66	100
7	ʃl	#FL	2	Schlangen	95.45	4.55	66	100
26	ʃv̥	#FF	2	schwarz	96.97	3.03	66	100
22	ʃʁ	#FL	2	schreiben	100.00	0.00	66	100
					60.89	**39.11**	**1782**	**100**

The consonant cluster types listed in Table 4 were categorized according to their markedness values (based on sonority distances). Then statistical analyses calculating the Index of difference (in short: DI; Pavlić 1971) between samples were performed on the percentages of the target-like and non–target-like productions of the consonant cluster types listed in Table 10. In general, only the results of the first and second test (based on word list 1) greatly favour the markedness relationships hypothesized in phonology and are mostly confirmed cross-linguistically, whereas the results of the third test (based on word list 2, containing (near) minimal pairs of words) do not show much agreement with the hypothesized markedness relationships. In the fourth test only a smaller proportion of the hypotheses concerning the modification of consonant clusters with an unfavourable sonority distance could be tested. In the following section the results of the first and second reading of word list 1 will be summed up and described in markedness terms (Table 10).

The hypotheses (I) and (II) predicting that syllable margins with a greater sonority distance value (SD) will be less often modified than clusters with a smaller sonority distance value were confirmed in word list 1 (test 1 and 2) for many coda clusters (cf. Table 10; onsets clusters were excluded from comparison):

> Markedness relationships of the coda clusters in the first two tests: m (LF#, NF#), m (LF#, LN#), m (LS#, LN#), m (NF#, LN#), m (NS#, LN#), m (NS#, NF#), m (NS#, FS#), m (NS#, SF#), m (LSF#, NSF#).

The more marked consonant clusters were more frequently modified by the Slovene foreign language learners than the less marked consonant clusters.

Table 10. Markedness relationships among consonant cluster types in word list 1 (1st +2nd test) (only subjects providing 3 tokens per cluster, but without clusters containing [ç] or [pf]).

	[–marked]		[+marked]			[–marked]		[+marked]		
	LF#	**%**	**NF#**	**%**	**DI**	**LSF#**	**%**	**NSF#**	**%**	**DI**
[+target]	371	93.69	334	84.34	**4.20**	91	91.92	78	78.79	**2.61**
[–target]	25	6.31	62	15.66		8	8.08	21	21.21	
Sum	396	100.00	396	100.00		99	100.00	99	100.00	
	FS#	**%**	**FF#**	**%**	**DI**	**FS#**	**%**	**SF#**	**%**	**DI**
[+target]	274	92.26	155	78.28	**4.48**	274	92.26	274	92.26	0.00
[–target]	23	7.74	43	21.72		23	7.74	23	7.74	
Sum	297	100.00	198	100.00		297	100.00	297	100.00	

Table 10. Continued

	[–marked]		[+marked]			[–marked]		[+marked]		
	NS#	**%**	**FS#**	**%**	**DI**	**LN#**	**%**	**LNF**	**%**	**DI**
[+target]	289	97.31	274	92.26	**2.77**	185	62.29	56	56.57	1.01
[–target]	8	2.69	23	7.74		112	37.71	43	43.43	
Sum	297	100.00	297	100.00		297	100.00	99	100.00	
	LF#	**%**	**SF#**	**%**	**DI**	**NS#**	**%**	**SF#**	**%**	**DI**
[+target]	371	93.69	274	92.26	0.73	289	97.31	274	92.26	**2.77**
[–target]	25	6.31	23	7.74		8	2.69	23	7.74	
Sum	396	100.00	297	100.00		297	100.00	297	100.00	
	SF#	**%**	**FF#**	**%**	**DI**	**LF#**	**%**	**FS#**	**%**	**DI**
[+target]	274	92.26	155	78.28	**4.48**	371	93.69	274	92.26	0.73
[–target]	23	7.74	43	21.72		25	6.31	23	7.74	
Sum	297	100.00	198	100.00		396	100.00	297	100.00	
	LF#	**%**	**LN#**	**%**	**DI**	**LS#**	**%**	**LN#**	**%**	**DI**
[+target]	371	93.69	185	62.29	**10.27**	190	95.96	185	62.29	**8.56**
[–target]	25	6.31	112	37.71		8	4.04	112	37.71	
Sum	396	100.00	297	100.00		198	100.00	297	100.00	
	LS#	**%**	**LF#**	**%**	**DI**	**FS#/ SF#**	**%**	**SS#**	**%**	**DI**
[+target]	190	95.96	371	93.69	1.14	466	94.14	198	100.00	–3.48
[–target]	8	4.04	25	6.31		29	5.86	0	0.00	
Sum	198	100.00	396	100.00		495	100.00	198	100.00	
	NS#	**%**	**NF#**	**%**	**DI**					
[+target]	289	97.31	334	84.34	**5.60**					
[–target]	8	2.69	62	15.66						
Sum	297	100.00	396	100.00						
	NF#	**%**	**LN#**	**%**	**DI**	**NS#**	**%**	**LN#**	**%**	**DI**
[+target]	334	84.34	185	62.29	**6.63**	289	97.31	185	62.29	**10.63**
[–target]	62	15.66	112	37.71		8	2.69	112	37.71	
Sum	396	100.00	297	100.00		297	100.00	297	100.00	

One of Greenberg's implicational universals is that, if a language has a word- final two-member coda consisting of two stops, then it will also have one consisting of a fricative and a stop: m (FS#, SS#). A second implicational universal is that, if a language has a word-final coda consisting of two fricatives, then it will also have have one consisting of a fricative and a stop or a stop and a fricative. The marked status of two-member codas containing two fricatives or two stops is predicted by hypothesis (I). The first implicational universal is not confirmed by our L2 data, but the second one is:

m (FS#, FF#), m (SF#, FF#).

The two-member codas containing two fricatives were more frequently modified by the Slovene foreign language learners than such codas containing one fricative and one stop.

The UCSS is not an absolute universal, but rather a universal tendency. Language specific syllable structures of German that violate the UCSS should be more frequently modified by L2 learners, ie. codas containing a SF# sequence should therefore be even more frequently modified than codas containing a FS# sequence or two fricatives or two stops. But this is not confirmed by our L2 data. The percentage of non–target-like productions of codas containing SF# or FS# consonant clusters was nearly the same, and codas containing two fricatives were more often modified (see above). The more marked status of codas containing a stop-stop sequence (m = (SF / FS#, SS) was not confirmed by our data: the words containing a stop-stop coda were least modified. Word-final two-member codas consisting of a liquid-fricative or a liquid-stop should be less frequently modified than those consisting of a stop-fricative, a structure which violates the UCSS (Tropf 1987): m (LF / LS#, SF#) / coda (Carlisle 1994: 236). But this markedness relation was not confirmed by our L2 data either, as there are significant differences between the relevant error percentages.

If two cases of consonant cluster modification (the substitution of the voiceless palatal fricative [ç] and the labiodental affricate [pf]) are categorized as transfer from Slovene phonology, the non–target-like productions of the consonant cluster types in the first three tests yield the rankings shown in Table 11.

Coda clusters consisting of LNF# / LN# were more frequently modified than clusters consisting of FF# / NSF# / NF#, the latter more frequently than clusters consisting of LSF# / SF# / FS# / LF# / LS#, and those more frequently than clusters containing NS# > SS#. The percentage of modification of a consonant cluster broadly correlates with its markedness status. Transfer heavily influenced the syllable structure in codas containing the voiceless palatal fricative [ç] and the voiceless labiodental affricate [pf]. Therefore these consonant clusters had been excluded before testing the validity of the hypotheses (I) and (II). There is some evidence from our data that three-member codas consisting of a LSF# sequence are less often mod-

ified than the more marked NSF# and LNF# codas (the former conforms more to the UCSS than the latter two codas).

Onset consonant clusters containing #SFL / #SF > were more frequently modified than those onsets consisting of #FF / #FN / #FL. In the few onsets included in the reading tests transfer from Slovene phonology played the dominant role in modifying the structure. There was no evidence from our data for one of Greenberg's implicational universals (1965) that the more marked obstruent-nasal onsets were more often modified than the less marked obstruent-liquid onsets: m (OL#, ON#).

Table 11. Ranking of non-target-like productions of cluster types in codas not containing the fricative [ç] and the affricate [pf] categorized as causing transfer errors.

	Onset	Coda
1st Test	#SF > #SFL > #FF > #FL > #FN	LNF# > LN# > NSF# > NF# > FF# > LF# > LS# > FS# / NS# / LSF# / SF# > SS#
2nd Test	> #SFL > #SF > #FN > #FF > #FL	LNF# > FF# > LN# > NF# / LF# / NSF# > FS# > LSF# > SF# > LS# > NS# > SS#
1st + 2nd Test	#SFL / #SF > #FF / #FN / #FL	LNF# / LN# > FF# / NSF# / NF# > LSF# / SF# / FS# / LF# / LS# > NS# > SS#
3rd Test	#FF > #FL > #SFL > #SF > #FN	LF# > LNF# > LN# > NF# > FS# > NSF# > FF# > LSF# > NS# > SF#
Note: error percentages are decreasing from left to right		

Hypothesis (III) predicting more non-target-like consonant clusters in codas and less in onsets was fully confirmed in the first, second and third test (consisting of word lists), but insignificantly in the fourth test (consisting of sentences).

Table 12. Ratio of modification of consonant clusters (all clusters included).

		1st Test	2nd Test	3rd Test	4th Test	Sum1%	Sum2%	Sum3%	Sum4%
Onsets	[+target]	800	260	774	363	92.59	87.54	93.48	68.75
	[–target]	64	37	54	165	**7.41**	**12.46**	**6.52**	**31.25**
Codas	[+target]	2714	1066	1807	521	83.15	75.12	67.86	65.78
	[–target]	550	353	856	271	**16.85**	**24.88**	**32.14**	**34.22**
Sum	Sum	**4128**	**1716**	**3491**	**1320**	**200.00**	**200.00**	**200.00**	**200.00**

Hypothesis (IV) predicting more epenthesis than deletion in formal style was confirmed in certain types of consonant clusters. When reading the word lists, the tested children showed much more awareness of the linguistic form than in some other tasks (ie. describing in their own words what they could see in a picture). Coda clusters containing a liquid and a nasal (LNF# and LN#) were more frequently modified through vowel epenthesis than through deletion. The ratio of vowel epenthesis to deletion in such coda clusters was about the same in both age groups (both grades), namely about 90% vowel epenthesis and about 10% deletion of one of the sonorants in the coda.

Table 13. Epenthesis deletion relationship.

	5th Grade	%	7th Grade	%	DI
Epenthesis	70	89.74	52	89.66	0.02
Deletion	8	10.26	6	10.34	
Sum	78	100.00	58	100.00	

Overall, hypothesis (V) could not be confirmed (cf. Table 13), but there were some minor differences between the younger and the older group modifying certain consonant clusters. In comparison to the children of the 5th grade, those of the 7th grade used vowel epenthesis more frequently when modifying codas with a LNF# sequence (ie. *Wurms* → *Wur*[ə]*ms*). The subjects of the younger group (5th grade) had more difficulties with the coda FF# (*Dachs, Schafs*), LSF# (*stolz*) and NSF# (*Amts*). These difficulties seem to have been influenced by German orthography.

Table 14. Ratio of consonant clusters modification (all clusters included).

		1st Test	2nd Test	3rd Test	4th Test	Sum1 %	Sum2 %	Sum3 %	Sum4 %
2-C Onsets	[+target]	640	219	602	327	95.24	94.81	93.48	70.78
	[–target]	32	12	42	135	**4.76**	**5.19**	**6.52**	**29.22**
2-C Codas	[+target]	2576	1028	1425	445	83.85	75.98	67.50	67.42
	[–target]	496	325	686	215	**16.15**	**24.02**	**32.50**	**32.58**
3-C Onsets	[+target]	160	41	172	36	83.33	62.12	93.48	54.55
	[–target]	32	25	12	30	**16.67**	**37.88**	**6.52**	**45.45**
3-C Codas	[+target]	138	38	382	76	71.88	57.58	69.20	57.58
	[–target]	54	28	170	56	**28.13**	**42.42**	**30.80**	**42.42**
4-C Onsets	[+target]								
	[–target]								
4-C Codas	[+target]				54				40.91
	[–target]				78				**59.09**
Sum	Sum	**4128**	**1716**	**3491**	**1452**				

Hypothesis (VI) predicting more non-target-like consonant clusters in three-member clusters than in two-member clusters was fully confirmed in the first and second test (consisting of a simple word list) as well as in the fourth test (consisting of sentences), whereas it was not confirmed in the third test (consisting of minimal pairs or near minimal pairs) – cf. Table 14.

3.1. Particular cases of modified consonant clusters

Let us now highlight how some of the target consonant clusters occurring in the speech material were changed in the interlanguage of the Slovene learners and how the cluster productions of the learners were categorized into transfer and developmental phenomena. Transfer phenomena include the substitution of German phoneme variants which do not occur in the Slovene standard language: (a) the voiceless palatal fricative [ç], (b) the labiodental affricate [pf] and (c) the uvular liquid [ʀ] or velar fricative [ʁ], (d) voicing of syllable-final voiceless obstruents (in the fourth test only).

(a) The voiceless palatal fricative [ç] was most often replaced with the voiceless velar fricative [x] familiar from the L1 of the test subjects (Table 15). Some of the children tried to imitate the target fricative, but rather produced one of the variants of the voiceless postalveolar fricative [ʃ] familiar from their L1 or intermediate

sounds resembling both, the postalveolar fricative [ʃ] and the palatal fricative [ç]. The production of neither the target nor the native sound, but rather the production of intermediate sounds is predicted by the Interlanguage hypothesis. The Slovene learners usually pronounced a variant of the (more salient) postalveolar fricative instead of the (less salient) velar fricative (as default substitute) when they became aware of the higher main peak in the frequency spectrum of the target fricative. All these deviations from the target fricative were counted as transfer substitutions.

Table 15. Target and non–target productions of [ç] in coda consonant clusters.

Productions	1st Test	2nd Test	3rd Test	4th Test	Sum	Sum%
[ç]-like	89	14	20	19	**142**	**11.45**
[x]-like	248	94	368	193	**903**	**72.82**
[ʃ]-like	43	19	53	48	**163**	**13.15**
other	4	5	19	4	**32**	**2.58**
Sum	**384**	**132**	**460**	**264**	**1240**	**100.00**

The proportion of target-like productions of the fricative [ç] was higher (immediately) after palatal vowels (<*Gicht, Licht, weich, echt*>) (16.40%) than in other environments (<*Kelch*, *manch*, *durch*>) (11.77%). This outcome (cf. Table 16) can be explained by the greater effort of producing a palatal fricative in non-palatal environments. The proportion of target-like productions of the fricative [ç] was lower in the target item <*Kelch*> (after a lateral liquid) than in other environments (<*Gicht, Licht, weich, echt, manch, durch*>). Due to the lowering of the lateral rims of the tongue when articulating a lateral liquid [l], it should be easier to pronounce a velar fricative [x] or a postalveolar fricative [ʃ] than a palatal fricative [ç] with raised lateral rims of the tongue.

Table 16. Ratio of target and non–target productions of [ç] in coda clusters.

Test 1-4						
	[ɛ], [ɪ]	Sum%	other	Sum%	Sum	Sum%
[ç]-like	73	**16.40**	73	**9.18**	**146**	**11.77**
[x]-like	352	**79.10**	549	**69.06**	**901**	**72.66**
[š]-like	6	**1.35**	155	**19.50**	**161**	**12.98**
other	14	**3.15**	18	**2.26**	**32**	**2.58**
Sum	**445**	**100.00**	**795**	**100.00**	**1240**	**100.00**

The proportion of the velar fricative [x] as the default substitute for the target fricative [ç] was in all environments (<*Gicht, Licht, weich, echt, Kelch, manch, durch*>) higher than the proportion of the postalveolar fricative [ʃ]. This outcome can be explained by the influence of the native language of the learners. The proportion of the postalveolar fricative [ʃ] as a substitute for the target fricative [ç] (cf. Tables 17-20) was higher in the target item <*manch*> (after an alveolar nasal consonant [n]) than in other environments (<*Gicht, Licht, weich, echt, Kelch, durch*>). The articulatory effort when producing a postalveolar fricative [ʃ] after an alveolar nasal consonant [n] should be smaller than in other tested environments (even after the lateral liquid [l] which makes the synchronization of two operations necessary when a postalveolar fricative [ʃ] should follow: first, a slight backward movement of the tongue blade and secondly, the raising of the lateral tongue rims).

The proportion of target-like productions of the fricative [ç] was highest in the first test and lowest in the third and fourth test: Test 1 (23%) > Test 2 (11%) > Test 3 (5%) / Test 4 (8%). This outcome (cf. Table 15) correlates with the complexity of the task: the first test is the easiest because the test subjects had to process only one target item in a given time period, the second test was a little bit more difficult because the test subject had to recall the target pronunciation of the lexical items they had heard some minutes ago or had to use their reading capacities, the third test was more difficult because the test subjects had to produce similar sounding target items (minimal pairs), and the fourth test was more difficult because the test subjects had to process several items in sentences. The probability of producing a non–target sound rises with the complexity of the environment.

Table 17. Ratio of target and non–target productions of [ç] in coda clusters.

1st Test						
	durch	echt	Kelch	manch	Sum	Sum%
[ç]-like	22	29	14	24	**89**	**23.18**
[x]-like	62	66	74	46	**248**	**64.58**
[š]-like	11	0	8	24	**43**	**11.20**
other	1	1	0	2	**4**	**1.04**
Sum	**96**	**96**	**96**	**96**	**384**	**100.00**

Table 18. Proportion of target and non-target productions of [ç] in coda clusters.

2nd Test						
	durch	echt	Kelch	manch	Sum	Sum%
[ç]-like	3	8	2	1	**14**	**10.61**
[x]-like	26	23	30	15	**94**	**71.21**
[š]-like	3	0	0	16	**19**	**14.39**
other	1	2	1	1	**5**	**3.79**
Sum	**33**	**33**	**33**	**33**	**132**	**100.00**

Table 19. Proportion of target and non–target productions of [ç] in coda clusters.

3rd Test							
	durch	Gicht	Kelch	manch	Licht	Sum	Sum%
[ç]-like	4	8	0	2	8	**22**	**4.78**
[x]-like	78	71	85	48	84	**366**	**79.57**
[š]-like	5	4	5	37	0	**51**	**11.09**
other	5	9	2	5	0	**21**	**4.57**
Sum	**92**	**92**	**92**	**92**	**92**	**460**	**100.00**

Table 20. proportion of (non-)target productions of [ç] in consonant clusters.

4th Test						
	weich	nicht	manche (6)	manche (13)	Sum	Sum%
[ç]-like	10	10	1	0	**21**	**7.95**
[x]-like	52	56	40	45	**193**	**73.11**
[š]-like	2	0	25	21	**48**	**18.18**
other	2	0	0	0	**2**	**0.76**
Sum	**66**	**66**	**66**	**66**	**264**	**100.00**

(b) The labiodental affricate [pf] was mostly simplified to the more salient (more sonorous) labiodental fricative [f] or in some cases to the less salient (less sonorous), but first occurring part of the affricate (the bilabial plosive [p]).

Table 21. Proportion of (non-)target productions of [pf] in 2-member onsets.

	1st Test	2nd Test	3rd Test	Sum Test 1-3	Sum% Test 1-3	4th Test	Sum% 4th Test	Sum Test 1-4	Sum% Test 1-4
[pf]	76	28	87	191	**86.43**	38	**57.58**	229	**79.79**
[f]	20	5	3	28	**12.67**	28	**42.42**	56	**19.51**
[p]	0	0	0	0	**0.00**	0	**0.00**	0	**0.00**
[pfx]	0	0	2	0	**0.00**	0	**0.00**	2	**0.70**
Sum	96	33	92	221	**100.00**	66	**100.00**	287	**100.00**

Note: [pf] → [pfx] probably is motivated by orthography and subsequent metathesis (due to orthographic conventions familiar from the L1 of the learners, <h> in the target <*Pfahl*> [pfɑ:l] was pronounced [x] and received through metathesis a position immediately after the affricate.

Table 22. Proportion of (non-)target productions of [pf] in 2-member-codas.

	1st Test	2nd Test	3rd Test	Sum Test 1-3	Sum% Test 1-3		4th Test	Sum% 4th Test	Sum Test 1-4	Sum% Test 1-4
[pf]	96	30	84	210	**95.02**	[pf.t/ɣ]	108	**81.82**	318	**94.64**
[f]	0	1	2	3	**1.36**	[f.f]	1	**0.76**	4	**1.19**
[p]	0	0	3	3	**1.36**	[p.t]	6	**4.55**	9	**2.68**
[rp]	0	1	0	1	**0.45**	[pf.f/h/w]	3	**2.27**	1	**0.30**
[ps]	0	0	3	3	**1.36**	[b.v/vh]	14	**10.61**	3	**0.89**
[fs]	0	1	0	1	**0.45**	other	0	**0.00**	1	**0.30**
Sum	96	33	92	221	**100.00**	Sum	132	**100.00**	336	**100.00**

Note: [pf] → [rp] in the 2nd test cannot be straightforwardly motivated by orthography, but it might rather be motivated by the activation of a lexical item <*Korb*> that looked similar to the target item <*Kopf*> and was familiar to the learner; [pf] → [ps] in the 3rd test cannot be motivated by orthography, but it might rather be the result of (a) activating the lexical item <*Gips*> that the learners knew from the first word list in a previous reading session and also familiar from the L1 of the learners and (b) mixing <*Gips*> up with the unfamiliar target item <*Tropf*> in the minimal pair <*Tropf*> vs. <*troff*>; [pf] → [fs] cannot be motivated by orthography, but it might rather be influenced by mixing up the target item <*Kopf*> with the target item <*Schafs*> (with a fricative) appearing some lines later in word list 1. All three cases show loss of concentration.

Table 23. Proportion of (non-)target productions of [pf] in 3-member-onsets.

	1st Test	2nd Test	3rd Test	Sum Test 1-3	Sum% Test 1-3		4th Test	Sum% 4th Test	Sum Test 1-4	Sum% Test 1-4
[pfl], pfr]	160	41	172	373	**84.39**	[pfl]	36	**54.55**	409	**80.51**
[fl], [fr]	18	13	7	38	**8.60**	[fl]	15	**22.73**	53	**10.43**
[pl], [pr]	4	2	0	6	**1.36**	[pl]	4	**6.06**	10	**1.97**
[f]	1	1	1	3	**0.68**	[f]	0	**0.00**	3	**0.59**
[pf]	0	5	0	5	**1.13**	[pf]	0	**0.00**	5	**0.98**
metath.	0	1	0	1	**0.23**	metath.	2	**3.03**	3	**0.59**
met.+del.	0	0	0	0	**0.00**	met.+ del.	8	**12.12**	8	**1.57**
epenth.	0	2	1	3	**0.68**	epenth.	0	**0.00**	3	**0.59**
other	9	1	3	13	**2.94**	other	1	**1.52**	14	**2.76**
Sum	192	66	184	442	**100.00**	Sum	66	**100.00**	508	**100.00**

Note: [pfʁi:m] → [pfirm] metathesis of [r] and the following vowel [i] in the 2nd test; [pfʁi:m] → [fpri:m] metathesis of [f] and [p] in the 4th test; [aox pflao.mən] → [aof plau.m ...] deletion of [x] in <auch> and metathesis of [f] over a morpheme boundary in the 4th test; [aox pflao.mən] → [aof plau.m ...] deletion of [x] in <*auch*> and deletion of [p] in <*Pflaumen*> in the 4th test; [pfʁi:m] → [pfəri:m] epenthesis of [ə] in the 2nd test and [pfʁi:m] → [pəfri:m] epenthesis of [ə] in the 2nd and 3rd test.

An unexpected outcome of the four tests is that the German affricate [pf] was more often modified by the Slovene learners in onsets than in codas (cf. Tables 21-23). The fourth test displays an even higher proportion of modified onsets and codas, again with a preference for modifying onsets containing [pf]. According to hypothesis (III) codas should be more often modified than onsets. According to the hypotheses (I) or (II) the codas containing [pf] display an unfavourable SD and should therefore be modified more often than the corresponding onsets. Overall, the fricative part [f] of the affricate [pf] was more often retained by the learners whereas the plosive part [p] was more often abandoned. This can be explained by the greater salience (sonority) of the fricative [f] over the plosive [p]. But in non-target productions of the affricate [pf] the fricative [f] was often retained in onsets and rarely in codas, whereas the plosive [p] was more often retained in codas and rarely in onsets. Due to the greater salience of the last position in a structure over the first position, the plosive [p] was possibly better perceived in the coda than in the onset so that the proportion of the target productions of the affricate was higher in codas than in

onsets. The varying proportion of deletion of the plosive and the fricative part of the affricate in onsets and codas might be interpreted as evidence for the bisegmental status of the affricate in the interlanguage of the Slovene learners.

The simplification processes ([pf] → [f] or [p]) seem to have a parallel in L1 German if one compares the results of an investigation in which 2-6 year old Austrian children replaced the affricate [pf] with a single fricative or plosive (cf. Schaner-Wolles and Tonelli 1988; cited in Ramers and Vater 1995: 80). The results of the above mentioned investigation are used as evidence for the monophonemic status of the affricate in L1 German (Ramers and Vater 1995: 80). Since the affricate [pf] is not an element of the Slovene phoneme inventory and since the phonological behaviour of beginners in a foreign language is usually heavily influenced by the phonological structure of the L1, one might conclude that the simplification of the affricate should not count as evidence for its monophonemic status in the interlanguage of the Slovene learners.

Concerning the monophonemic or biphonemic status of the affricate, some of the outcomes of the fourth reading test (with sentences containing words with consonant clusters) are interesting. In the sentence *Essen Pferde auch Pflaumen* (for reasons of easier pronunciation, the verb *fressen* "to feed on" – usually used with animals – was replaced by the verb *essen* "to eat" – usually used with humans) another phonological process occurred, namely the metathesis of the two sounds of the affricate (with or without accompanying deletion). Several learners replaced the sequence *auch Pflaumen* with *auch fplaumen* (with metathesis only) or *auf plaumen* (metathesis over a morpheme boundary after deletion of the velar fricative in the coda of the former syllable creating the preposition *auf* "on", probably better known in the interlanguage than the particle *auch* "also, too, as well"). In the case of metathesis without accompanying deletion (*auch fplaumen*) a consonant cluster existing neither in German nor in Slovene and not complying with the unmarked sonority profile of a syllable is produced, for the sonority distance between the members of the onset calculated from the outmost consonant should be positive and greater than zero. But such cases of metathesis are known from aphatic speech (ie. German *Apfel* "apple" → *Afpel*; cf. Dressler 1973: 10; cited in Ramers and Vater 1995: 78) and used as evidence for the bisegmental (biphonemic) status of the affricate in German (Ramers and Vater 1995: 78). In the case of metathesis over a morpheme boundary after deletion of the velar fricative [x] in the coda of the former syllable of the prosodic unit (*au*[x] *pflaumen* → *au_ pflaumen* → *auf plaumen*) the phonotactic simplification could not directly be attributed either to Slovene or to German phonology. The deletion of the velar fricative can be motivated in two respects: first, with the tendency to produce a syllable shape that complies to a greater extent with the sonority hierarchy (the sonority distance between the members of the onset and the coda calculated from the outmost consonant should be positive and greater than zero: #FS = –1 in the reversed homorganic onset cluster *[fp]*laumen* and FF# = 0 in the non-homorganic – and universally non-existent – coda cluster **au*[xf], but with #SL = +2 in the interlanguage onset cluster [pl]*aumen* – this comparison leads me to the conclusion that zero or negative sonority distances are more critical if non-homorganic clusters are involved), and second, with the rule that a diphthong may not be followed by more than one consonant within the boundaries of a morpheme (because there is no spare C-position in the coda of the German syllable) (*au*[x] *[fp]*laumen*, **au*[xf] [p]*laumen* → *au*[f] [p]*laumen*). In returning to the above asked question of the biphonemic or monophonemic status of the affricate in the interlanguage of the Slovene learners, I would like to claim that the deletion processes [pf] → [f] and [pf] → [p] and the metathesis processes (with or without accompanying deletion of a consonant in the coda of the former syllable) in the interlanguage of the Slovene learners show that [p] and [f] are not treated as parts of an affricate /pf/, but rather as two distinct phonemes, /p/ and /f/, familiar to the learners from their native language. Therefore at this stage of the investigation, in order to prevent too heavy influence of these processes on the statistical outcome of the investigation, all pronunciations differing from the target affricate [pf] were counted as transfer phenomena though one could argue (at least) about those cases of metathesis as being rather developmental processes.

(c) The target variants of the German phoneme /r/ (viz. the uvular liquid [ʀ] and the velar fricative [ʁ]) received different pronunciations in the interlanguage of the Slovene learners. Some children managed to produce the common target variants ([ʀ] and [ʁ]), but mostly they were substituted by the alveolar vibrant [r] more familiar to the learners from their L1. This kind of substitution was not counted as transfer error because the alveolar vibrant is one of the possible allophones of German /r/. However, in trying to imitate the target variants some learners produced an English tap [ɾ], retroflex liquid or approximant instead. These sounds are neither a sound of the L1 nor of the L2 of the test subjects. On one hand this is an outcome one could match with the predictions of the Interlanguage hypothesis, but on the other hand this pronunciation behaviour could be attributed to a third language, for nearly all test subjects learn English as second foreign language at elementary school. In opposition to the alveolar vibrant productions these substitutions were counted as transfer errors.

(d) Another typical transfer phenomenon was voicing of syllable-final voiceless obstruents in the fourth test (containing sentences). Generally, Slovene learners of German tend to voice syllable-final voiceless obstruents when occurring before voiced consonants (regressive assimilation instead of progressive assimilation common in German: e.g. *Aufsatz* L1 German [aof.z̥ats] → L2 German [aʊv.zats].

Developmental substitutions usually include consonant cluster simplification processes, such as deletion of a consonant, vowel or consonant epenthesis or metathesis. In the speech of the Slovene learners there were several syllable modifications that were categorized as developmental phenomena: (a) the substitution of a consonant due to assimilation, (b) the deletion of a consonant, (c) the deletion of a nasal consonant with accompanying nasalization of a vowel, (d) the epenthesis of a

consonant, (e) the epenthesis of a vowel, (f) resyllabification caused by change of accent and (g) the metathesis of consonants.

(a) A typical case of consonant substitution in a coda cluster is the labialization of a dental nasal before a labial fricative due to assimilation: ie. *Senf* [zɛnf] → [zɛɱf]. This kind of cluster modification is known from L1 German as well.

(b) Consonant deletion could be especially observed in two member codas (ie. *Gift* → *Gif*; *Holz* [hɔlts] → [xols]) and three member codas (ie. *Arzt* [aʁtst] → [aʁts_]), an expected outcome of the markedness relationships <m (C, CC) and <m (CC, CCC) predicting that a two-member cluster is reduced to a single consonant and that a three-member cluster is reduced to a two-member cluster. Note that the consonant sequence [ts] in the German words *Holz* and *Arzt* could be categorized as a monophonemic affricate in the interlanguage of the Slovene learners since it is part of the Slovene phoneme set (e.g. Slovene *cena* ['tse:.na] "price" vs. *pena* ['pe:.na] "foam"; cf. Toporišič 1991).

(c) In the pronunciation of the German word *Senf* with some of the test subjects one could observe the deletion of a nasal consonant and the nasalization of the preceding vowel: ie. *Senf* [zɛnf] → [zɛ̃f]. On the one hand nasalized vowels are marked in comparison with oral vowels (the phoneme inventories of the Slovene and the German standard languages lack nasalized vowels, if we look at native words and phonetically adapted loanwords), but on the other hand the nasalization of a vowel in front of a nasal consonant is a less marked option and outrules the former mentioned context-free markedness relationship (cf. Wurzel 1994, who mentions the development of such nasalized vowels in Polish and in some Slovene dialects in Austrian Carinthia under such circumstances).

(d) In the corpus there were some cases of consonant epenthesis (ie. *Mensch* [mɛnʃ] → [mentʃ]; *Hals* [hals] → [halts]); The plosive [t] is a transitional sound which is inserted in order to make the pronunciation of the cluster containing a sonorant fricative sequence easier (ie. subsequent movements of the individual articulators instead of (synchronized) movements of two articulators at the same time). This kind of consonant epenthesis can be observed in L1 German as well.

(e) In all four tests vowel epenthesis was quite common in codas with two sonorants and occasionally it occurred in the first three tests in coda sequences consisting of a sonorant and the fricative [ç]. Vowel epenthesis is a phonological process for the simplification of the syllable structure. It decreases the markedness of a syllable structure by reducing the number of members in consonant clusters and creating an unaccented weak syllable. In double sonorant sequences often the centralized vowel [ə] (which can be called the default epenthetic vowel) was inserted (e. g. *Halm* → *Hal*[ə]*m, Dorn* → *Dor*[ə]*n*) , but in the phonological environment of the high palatal consonant [ç] more often [i] was added instead (ie. *man*[ç] → *man*[ix] or *man*[iç], *Kel*[ix] or *Kel*[iç], *du*[ʁç] → *du*[rix] or *du*[riç]). The majority of epenthetic vowels with the quality of [i] was inserted after the lateral liquid [l] and the alveolar nasal consonant [n] (25 of 30), to a lesser degree after the vibrant [r] (5 of 30).

Table 24. Vowel epenthesis in coda clusters with sonorant and target fricative [ç].

i-Epenthesis	Sum	Schwa-Epenthesis	Sum
dur[ix]	5	dur[əʃ]	1
Kel[iç]	1	dur[əx]	1
Kel[ix]	11	Kel[əx]	2
man[iç]	4	man[əç]	0
man[ix]	9	man[əx]	0
Sum	**30**	Sum	**4**

The reason why the vowel [i] was inserted more often than [ə] between a sonorant and the target fricative [ç] could be the splitting up of the segment features of the fricative [ç] in the interlanguage of the Slovene learners: when the test subjects tried to imitate a target-like fricative [ç] (i.e. a fricative with a main spectral peak about as high in frequency as the second formant of the vowel [i]), they most often produced [x] instead (i.e. a fricative with a much lower main peak about as high in frequency as the second formant of the vowel [a]); in order to compensate for this discrepancy in the perception of the two fricatives, a high vowel (with a high second formant) was inserted. In semiotic terms the high vowel could be called an index of the (absent) fricative spectrum features of [ç]. Vowel epenthesis can be observed with some Slovene speakers in sonorant coda clusters of Standard Slovene (e.g. *film* "film" → *fil*[ə]*m*). In the loanword *kelih* "goblet, chalice" from German the vowel [i] is obligatorily inserted. On the other hand, some Slovene native words occur with sonorant clusters (e. g. *holm* "little hill", *grm* "bush", *drn* "turf, sod"). In syllable codas with two sonorants it may not be perfectly clear if vowel epenthesis is directly attributable to universal factors. But given the fact that vowel epenthesis can occur even in such sonorant clusters familiar from the Slovene standard language (ie. *film*), all instances of vowel epenthesis were nevertheless classified as developmental substitutions.

(f) In the case of double sonorant sequences in codas one could observe that some children used neither epenthesis nor deletion to restructure such syllables but rather changed the accent structure of the target word: e.g. in the interlanguage of some Slovene children the German Plural *(die) Insel+n* "island" consisting of the two syllables *In-seln* ['ɪn.zəln] (with a double sonorant coda) received a secondary stress on the nasal in the coda so that one got the impression of three syllables instead of two *In-sel-n* ['ɪn.zɛl.n̩]. This kind of "overpronunciation" could be observed in the word lists only (ie. in formal style).

(g) The rare metathesis cases in the corpus were categorized as developmental processes, except those metathesis processes involving the affricate [pf] which were categorized as transfer phenomena in this stage of the investigation.

There was only a smaller proportion of pronunciation errors arising from orthographic incapability when reading words from the first word list instead of listening to the offered target pronunciation (some examples are in the tables 21-23). Reading errors occurred more often when reading the minimal pairs in the third test and especially when reading the sentences in the fourth test. So reading capacities were less important in the first two tests (because the children had to remember only one target word), more in the third test (because the children had to remember two similar sounding target words) and most in the fourth test (because the sentences consisted of several words), i.e. the importance of the reading capacities rises with the length of the target. At this stage of the investigation the pronunciation errors arising from orthographic incapability were counted as developmental errors because they did not have enough impact on the outcome of the first and second test.

4. Conclusion

The results of this study seem to support the notion that interlanguage phonology behaves in a similar fashion to natural language phonology in terms of universal hierarchical relationships involving markedness. However, the results also show an extreme sensitivity of the markedness relationships for certain kinds of tasks.

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APPENDIX

English glosses for the German speech materials

Word list 1 (first and second test):

Syllable Onset: Pferd "horse", Fluss "river", schreiben "to write", Schlüssel "key", Schmutz "dirt", Schneider "tailor", schwarz "black", Pflaume "plum", Pfriem "awl"

Syllable Coda: **Akt** "act", **Abt** "abbot", Kopf "head", Gi**ps** "plaster", hübsch "pretty", Fu**chs** "fox", Gift "poison", mischt "to mix" 3rd P. Sg. Pres. Ind., echt "genuine", acht "eight", Schafs "sheep" Gen. Sg., Dachs "roof" Gen. Sg., Hals "throat", falsch "wrong", Kelch "goblet, chalice", Dorf "village", durch "through", Samt "velvet", Wurms "worm" Gen. Sg., Amts "office" Gen. Sg., Ramsch "junk", Senf "mustard", Mensch "man", manch "many a(n)", kal**t** "cold", Schal**k** "rogue",

elf "eleven", stolz "proud", Lump "scoundrel, rogue", Hand "hand", eins "one", Halm "stalk, stem", Inseln "island" Nom. Pl., Garn "yarn"

Word list 2 (third test):

Syllable Onset: Pfahl "post"- fahl "pale", Flug "flight" – Pflug "plough", schmecken "to taste" – Schnecken "snail" Nom. Pl. – schwenken "to swing", Pfriem "awl" – Friede "peace"

Syllable Coda: Tropf "moron" – troff "drip" 3rd P. Sg. Pret. Ind., Gift "poison" – Gischt "foam" – Gicht "arthritis", Licht "light" – lacht "to laugh" 2nd P. Pl. / 3rd P. Sg. Pres. Ind., Schafs "sheep" Gen. Sg. – traft "to hit, meet" 2nd P. Pl. Pret. Ind., Schiffs "ship" Gen. Sg. – Spitz "spitz", Hals "throat" – Holz "wood, timber", Kölsch "Cologne dialect, beer brewed in Cologne" – hübsch "pretty" – Ramsch "junk", Kelch "goblet, chalice" – durch "through", Dorn "thorn" – Dorf "village", Worms "name of a German town" – **Olms** "olm, proteus" Gen. Sg., Amts "office" Gen. Sg. – Kranz "wreath, garland", Mensch "man" – manch "many a(n)", Lump "scoundrel, rogue" – Da**mpf** "steam", Köln "name of a German city" – Holm "bar, little hill, little island"

Isolated Sentences (fourth test):

Petras Ko**pf** tut weh. "Petra's head is aching." – Auch Ingrid hat Ko**pfweh**. "Ingrid has a headache, too" – Der **Arzt** legt seinen **Arm** in Gi**ps**. "The doctor puts his arm in plaster." – Ma**nche Schlange**n haben **starke**s Gi**ft**. "Some snakes have strong poison." – Die Wolle des Scha**fs ist** sehr wei**ch**. "The wool of the sheep is very soft." – Die Augen des Wu**rms** sehe ich ni**cht**. "I cannot see the eyes of the worm." – Ma**nche Mensche**n essen keinen Se**nf**. "Some people do not like mustard." – Essen **Pf**erde auch **Pfl**aumen? "Do horses feed on plums, too?" – Wir **schr**eiben heute einen Au**fsatz**. "Today we are going to write an essay." – Tri**nkst** du deinen Kaffee **schwarz**? "Do you prefer to drink your coffee black?"