THE PRODUCTION OF WORD-FINAL CONSONANTS IN ENGLISH BY L1 SPEAKERS OF VIETNAMESE

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INTRODUCTION

The initial observation that led us to investigate word-final consonant production in English by native Vietnamese speakers came from the experience of one of us as an ESL teacher. We noticed that our Vietnamese (VN) students seemed to be frequently substituting with hissing and hushing sounds at the end of many English words. For instance, the following samples came from the high beginning class that sparked the investigation:

Gloss	Native Pronunciation	Student output
`operate'	[apəɹejt]	[apəɹejs]
`ease'	[iz]	[ejktʃ]
`bear'	[bɛɹ]	[biəs]
`clothe'	[kloð]	[kloz]
`rug'	[ɹʌg]	[gʌʃ]

These word-final erroneous segments, sibilants, indeed were in significant numbers. As we initially examined our 1074 tokens to ascertain this rather simple conclusion, more interesting questions evolved concerning the dynamics behind our subjects' (Ss) errors. How were factors such as native language (NL) transfer responsible for the interlanguage (IL) we were examining? Did the universal nature of coronals as underspecified hold for our Ss' production? Because our Ss' epentheses and deletions affected the syllable structure of the IL, we looked at syllable structure in terms of the universal open-syllable (CV) structure. Questions of the relevance of the Dispersion Principle to our Ss' production proved to be fruitful as well. Our data raised questions about developmental factors and the effect of tasks on target language (TL) production. The initial observation turned out to be a door to more interesting questions and conclusions about the systematicity underlying the errors. Looking for patterns, we analyzed the data on three levels: segmental, suprasegmental, and syllable. Trying to adequately explore the phonological system of the native language was the first step in our undertaking. With that knowledge we could understand what part NL would play as transfer into the IL of our Ss. Broselow's (1983) finding that the perceived inability of the Contrastive Analysis Hypothesis to predict the nature and occurrence of errors is often due to inadequate understanding of NL competence underscored in our minds the need to adequately analyze pertinent areas of the NL before we drew any conclusions.

A thorough literature search going back to the 1930's for publications on native language Vietnamese English production of word-final single consonants revealed that nothing on the subject has been published to date. Osburne's (1996) article, "Final Cluster Reduction in English of L2 Speech: A Case Study of a Vietnamese Speaker" did not treat single word-final consonants and examined only one subject. Her conclusion that cluster reductions were influenced by Vietnamese open syllable structure piqued our interest. We could not locate any other discussion on VN syllable structure preference. Sato's (1987) assumption which refutes Tarone's (1980) claim of the universal CV encouraged us not to necessarily accept Osburne's premise that VN is a CV language.

Because VN syllable structure preference is virtually unexplored, we turned the question around for one of our areas of exploration and asked "What will the IL of our subjects reveal about the preferred VN syllable structure?"

We found that while Vietnamese Second Language (L2) production of English final consonants had not been studied, Edge (1991) had studied word-final voiced obstruents in English by L1 speakers of Japanese and Cantonese. Although her goal was to challenge Eckman's (1981) IL rule formation hypothesis and our goal was rather to find systematicity in our 1074 tokens on the three levels mentioned above, her error-categorization grid provided us a useful template which we expanded upon for categorizing word-final speech errors. We expanded it because while her Japanese and Cantonese speakers had little word-final substitution, substitution for our subjects was the primary IL activity. Osburne's and Edge's works are cited here merely to show that in a language-specific sense and in a final-consonant-production sense, lack of previous studies left us on our own to do an original study.

For general theoretical background we first turned to Eckman's Markedness Differential Hypothesis (MDH) which predicts that the areas of greatest difficulty for second language learners will be the areas of the TL which are different from and are more marked than the NL. The more marked an area of the TL is, the more difficult it will be to acquire. We also found Major's (1987) Ontogeny Model for IL phonology enlightening in terms of its predicting power regarding a "positive and partial transfer," a type of transfer that seems to always occur. Finally, the controversy between learning a second language vs. acquiring a second language, as summarized by Tarone (1978), provided us with the useful concept of phonological fossilization, especially for adult learners as in the case of ours Ss.

Eckman (1977), Major (1987), and Weinberger (1987) attest to the widespread devoicing phenomenon in second language learning. Their work led us to predict a similar phenomenon in the Vietnamese-English IL. The MDH provided the explanation. The unreleasing rule as described by Cao (1975) as necessitated by an overloaded timing slot (Nguyen 1967) offered us another way to analyze our Ss production on a segmental level.

The universally special place of coronals (Clements 1985, Paradis and Prunet 1991) which states that coronals are unspecified for place proved an adequate explanation for the predominance of coronal activity in the IL. Clements' (1992) Dispersion Principle offered us a test for IL word-final substitutions. It states that final demisyllables minimize sonority dispersion. We based our syllable-level analysis of substitution on the assumption that if Ss substituted they would choose segments that would not increase sonority distance in the final demisyllable.

Finally, as mentioned above, we used the discrepancy between Tarone's (1980) universal CV and Sato's (1987) disconfirmation of her hypothesis as the background against which to look at IL syllable structure.

Thus, using three different perspectives, segmental, suprasegmental, and syllable, this study begins with a description of the NL, then proceeds to an analysis of native language transfer, substitutions, and syllable structure.

VIETNAMESE

Vietnamese is a monosyllabic language in which each syllable is equivalent to a word, and, as such "there are no phonemic words containing more than one phonemic syllable" (Nguyen 1967: 325). In addition to normal syllable constituents (i.e., vowels and consonants), the language has other distinctive features which are produced simultaneously all together in one syllable: these

are tones and stresses. There are six tones and three types of stresses. While stresses usually do not change the structural composition of the syllable (Thompson 1965: 41), tones are crucial in syllable differentiation. As an example, the difference between the words "**má**" ('mother') and "**mà**" ('but') resides in the two different tones placed on the nucleus: the former having the high-rising tone, whereas the latter having the low-falling tone. The language has 11 vowels and 22 consonants, many of them found in the English system. Since we are only concerned with final consonants in this study, the distinction of the vowel systems between the two languages will not concern us. Table 1 displays the differences between the two consonantal systems, and justifies our focus on two groups of sounds for this study. There are several major VN dialects spoken in different regions of the country, even though the exact numbers and the dialectal boundaries have not been unanimously agreed upon among researchers. For our purpose, we follow Thompson's and Nguyen's (1966) classification, according to which three major dialects are mentioned: "...the large urban centers (especially Hanoi, Hue and Saigon) stand out as supporting rather special dialects, showing the influence of large classes of educated speakers and more extensive contact with other areas." (Thompson: 87-88). Table 2 provides a breakdown of the differences between these dialects concerning the production of the sounds we selected for this study.

Table 1. Vietnamese Consonantal System (as compared to English Consonantal System)

	EXISTING SOUNDS	NON-EXISTING SOUNDS
initially (1)	p t k b d g f s v z(2) m n ŋ l ɹ	θ ʃ(3) tʃ ð ʒ dʒ
finally	p t k m n ŋ	θ ʃ(3) tʃ ð ʒ dʒ

Notes: (1) Only the consonants that are comparable to the English system are given here. There exist other initial consonants in Vietnamese, such as: c, x, ɲ, ɣ, ... but they only occur initially and do not seem to have been used by our Ss in the production of the English tokens presented in this study. For a complete inventory of the VN sounds, see Nguyen (1967) or Thompson (1965).

(2) This sound exists in the Northern Dialect, but not in the others, see Table 2.

(3) This sound exists in the Southern and Central Dialects, but not in the Northern Dialect.

Group I sounds: /θ/, /ð/, /ʃ/, /tʃ/, /ʒ/, /dʒ/

Group II sounds: /b/, /d/, /g/, /f/, /v/, /s/, /z/, /l/, /ɹ/

Table 2. Differences in the three main Vietnamese Dialects

IPA	VN spelling	Northern (Hanoi)	Central (Hue)	Southern (Saigon)
b	b	b	b	b
d	đ	d	d	d
g	g	g	g	g
f	ph	f	f	f
v	v	v	v	v
l	l	l	l	l
s	s/x Example: sai ('wrong') xa ('far')	s/s [saj] [sa:]	ʃ/s [ʃaj] [sa:]	ʃ/s [ʃaj] [sa:]
z	d Example: da ('skin')	z [za:]	y [ya:]	y [ya:]
r	r Example: rang ('fry')	z [zaŋ]	r [raŋ]	r [raŋ]

Note: Only the consonants examined in this paper are given; they correspond to the sounds of Group II. The thick line boxes highlight variations among dialects.

One of the salient characteristics regarding the way VN speakers produce the final stops is worth mentioning, because it will have a significant effect on the production of the English final stops by our subjects. The way native speakers of VN render phonetically the final stops in the NL was described by Cao (1975: 110-111) in the following terms:

> In such a language with invariable syllable structure as Vietnamese, in which a consonant is necessarily either an explosive initial always preceding a vowel, or an implosive final always preceded by a vowel, the closing or opening movement, which are constant and invariant attributes of consonants, naturally are the same, if not greater, importance as their retention, for the acoustic effect of the latter is often less and sometimes not at all significant in comparison with that of explosive and implosive movements. This is especially true with regard to final consonants in Vietnamese, which are all implosive stops without an off-glide phase (phonation stopping in the midst of occlusion), that is to say they all belong to the category of consonants the recognition of which depends mostly on the acoustic cues in the adjacent vowel segment. The retention of a final [p] for example, is only a silence. The noise made by the lips when closing is practically inaudible; the only acoustic cue that makes it possible to distinguish [p] from [k] and [t] , is the particular formant bendings toward the end of the "preceding" vowel, an acoustic effect of the closing movement (underlined ours).

As an example, it is typical for a Vietnamese speaker to say the word "but" as [bʌt˺] without having a fully released stop the way native English speakers do. On the articulatory level, then, after closing the glottis and releasing it, the air is stuck in the lungs (ingressive airstream) instead of going out the vocal tract (egressive airstream). We characterize this NL rule as the Unreleasing Rule (URR). A second important characteristic regarding the final stops in VN is that they all are voiceless, even though they are voiced word-initially, as described by Thompson (1965: 23):

> They (the stops) subdivide naturally into voiceless **p, t, ch (=/c/), k**; and voiced **b, d**, which are also preglottalized and often imploded. The voiced stops occur only initially, while the voiceless stops also occur finally, in which position they are unreleased; **p** occurs only finally (underlined ours).

We characterize this NL feature as the Terminal Devoicing Rule (TDR).

Finally, as mentioned above, we judged that the preferred syllable structure in VN is still an unexplored question, based on the very limited literature available on the subject. As reported by Sato (1987), and based upon works by Nguyen (1967) and Thompson (1965), the following are the allowed syllable types in VN:

V	VC	C(w)V	
CV	CVC	C(w)VC	(where (w) is the optional glide)

Therefore, based on this state of affairs, our study is an interesting test case. We can assume (1) that NL syllable structure will transfer into the IL of our Ss or (2) that Ss have acquired the syllable structure of English. There is some justification for the first choice because our Ss' production, less than 50% target, suggests less than an intermediate stage of language acquisition to us, that is to say, our Ss maybe were still more influenced by the NL than the TL. With this reasoning, we used the following testing procedure. On the one hand, we looked at both deletion and epenthesis errors as contributions to an open-syllable preference, and on the other hand, we considered all other types of errors as contributions to a closed-syllable preference. As an example, if [ɹoz] is realized as either [ɹo:] or [ɹozə], it was considered in both instances as "for" the open syllable preference. Otherwise, it is counted as "for" a closed syllable preference.

METHODOLOGY

To be more focused in our final consonants, we targeted a total of 15 English final consonants, as shown on Table 1, which either do not occur at all in Vietnamese (Group I: /θ/, /ð/, /ʃ/, /tʃ/, /ʒ/, /dʒ/) or only occur word-initially (Group II: /b/, /d/, /g/, /f/, /v/, /s/, /z/, /l/, /ɹ/). Each word-final consonant was presented 3 times in each of 3 tasks to each of 8 subjects (15 consonants x 3 words x 3 tasks x 8 subjects = 1080 tokens). Task 1 consisted of repeating words after a native speaker. Task 2 was reading simple sentences ending in a target word. Task 3 involved using the carrier phrase ("I say. . .") in which the target word was said sentence-finally and word-finally. Each subject was recorded in one setting in the home of one of the transcribers. For the sake of consistency, the same native speaker presented the tasks to each subject. A total of 1074 tokens were recorded and transcribed, because 2 subjects each omitted 3 tokens. After the

recordings, the two transcribers worked separately so that two transcriptions could be used to determine a reliability measure.

SUBJECTS

Data for investigating English final consonant production was elicited from 8 L1 Vietnamese speakers ranging in age from 24 to 45, shown in Table 3-a. The 5 women are students enrolled in Fairfax County, Virginia, High Beginning and Intermediate ESL Classes. The 3 men are employed in Fairfax County. Time in the United States averages 4 years in a range of 1 to 8 years. Five subjects began studying English in Vietnam at age 12, one at age 22, and one at age 25. No subject was taught English in Vietnam by an L1 speaker. Only one subject has a second L2, French. All three Vietnamese dialects, Northern, Central, and Southern, are represented in the sample. Comparative data were also collected from two L1 English speakers serving as a control group (see Table 3-b). The controls' production deviated from the norm significantly in pronunciation of two final consonant sounds and is discussed later under Results.

Table 3-a. Subject Profile

Subject	Age	Sex	Vietnamese Dialect Spoken	Age Starting English	Years in USA
S1	29	F	Southern	25	2
S2	27	F	Southern	12	1
S3	29	F	Southern	12	1
S4	29	F	Southern	12	2
S5	28	M	Southern	22	6
S6	24	F	Southern	22	2
S7	26	M	Central	12	5
S8	45	M	Northern	12	8

Table 3-b. Control Profile

Control	Age	Sex	Birthplace	Native Language
C1	50	M	Maryland	English
C2	41	F	Virginia	English

There was an 86% agreement for the L2 transcriptions and 96% for the control L1 transcriptions. The voicing/devoicing decisions did prove to be troublesome, but, following the method of Edge (1991: 283), transcribers agreed that the length of the preceding vowel would be taken into account. Common one-syllable words with no morphology were chosen. In English all written words ending in the final sounds /ʒ/, /dʒ/, /ð/ end in the grapheme e. In addition, the 3 target words ending with the sound /z/ and the 2 target words ending with the sound /s/ also end in the letter e. This orthographical convention appeared to present a problem to two of our subjects who seemed to actually read the final silent e. Consequently we present two interpretations of epenthesis when

their grapheme-to-sound mistakes could skew the data. Subjects were recorded using a Radio Shack CTR-69 Desktop Cassette and a Radio Shack Realistic Dynamic Omnidirectional Microphone with the following specifications: Impedance: 500 Ohms; Sensitivity: -78 ± 4 Db at 1 KHz; Frequency Response: 100-8000 Hz. We found such sensitive equipment necessary. Because one of us is an ESL teacher we had enough L1 Vietnamese speakers to form an initial dry-run group to test our initial equipment. Our dry run taught us that (1) the unreleasing of final consonants in Vietnamese was hard to detect and we needed to upgrade our microphone and recorder; (2) the pause between presentations of words in Task 1 needed to be prolonged to facilitate transcription; and (3) the subjects needed to be recorded on separate cassettes to prevent accidental recording over existing data and to enable us to easily access data. After recording the final group of eight new subjects, we immediately copied the eight cassettes so that each author could easily have access to them.

HYPOTHESIS

We expect our subjects to have the greatest difficulty with sounds that do not occur in Vietnamese, Group I. Group II will be easier because of NL transfer. Other areas of NL transfer to be expected are primarily devoicing and unreleasing of final consonants. We predict that /s/ will be the most frequent substitution, because it is unspecified for place and because of Ss' probable familiarity with it in basic English morphology as the third person singular ending and as a plural ending. We predict that coronals as a whole will play a significant part in substitutions. Since all of the sibilants are coronals, we therefore predict that the hissing and hushing sounds will show up significantly in the data. We predict that the Dispersion Principle will be active in the demisyllables created by non-target production. That is, the segment that substitutes will not increase the sonority dispersion in final demisyllables. Finally, we predict that the IL of our Ss will raise questions regarding Osburne's assumption that VN supports the hypothesized universal CV-syllable structure, that is, we predict our subjects will substitute final consonants more often than delete or epenthesize.

RESULTS

The overall data is summarized in Table 4 on page 81 for all subjects. The results were categorized under the following headings: target (46.5%), del (=deletion, 8.3%), dev (=devoicing, 12.9%), epen (=epenthesis, 4.8%), sibilation-fricatization (13.2%), unrel (=unreleasing, 16.2%), /-st/ (/st/ cluster, 3.7%), fron (=fronting 1.9%), stop (=stopping, 6.7%), back (=backing, 3.3%), /-n/ (=final /n/, 1.4%), and other (0.7%). The total is 120% because some errors fit into more than one category. The most significant occurrence under "other" turned out to be the 16 nasal substitutions. The controls pronounced /ʒ/ as /s/ 8 out of 12 times, or 66% of the time, and /z/ as /s/ 5 out of 12 times, or 42% of the time. The differences in the tasks present interesting performance profiles of how the Ss responded to each individual task. Task 1, a simple test of the subjects' ability to hear and repeat a word, as might be expected, elicited the most targets, especially when the Ss were producing Group II sounds. The other two tasks appear to be of equal challenge to the Ss. When faced with an unfamiliar sound sentence-finally and word-finally, Ss appear to be more distracted by having to try to pronounce preceding words in a sentence (Task 2) than by just having to say the target word in a carrier phrase (Task 3). However, with the more familiar group of sounds, they did better with the sentence-reading task than with the carrier-phrase task. Figures 1 and 2 show the Ss' performances

according to the tasks for Group I and Group II, respectively. The list of target words as presented in 3 different tasks is provided in the Appendix.

Figure 1. Group I: Performance according to Tasks

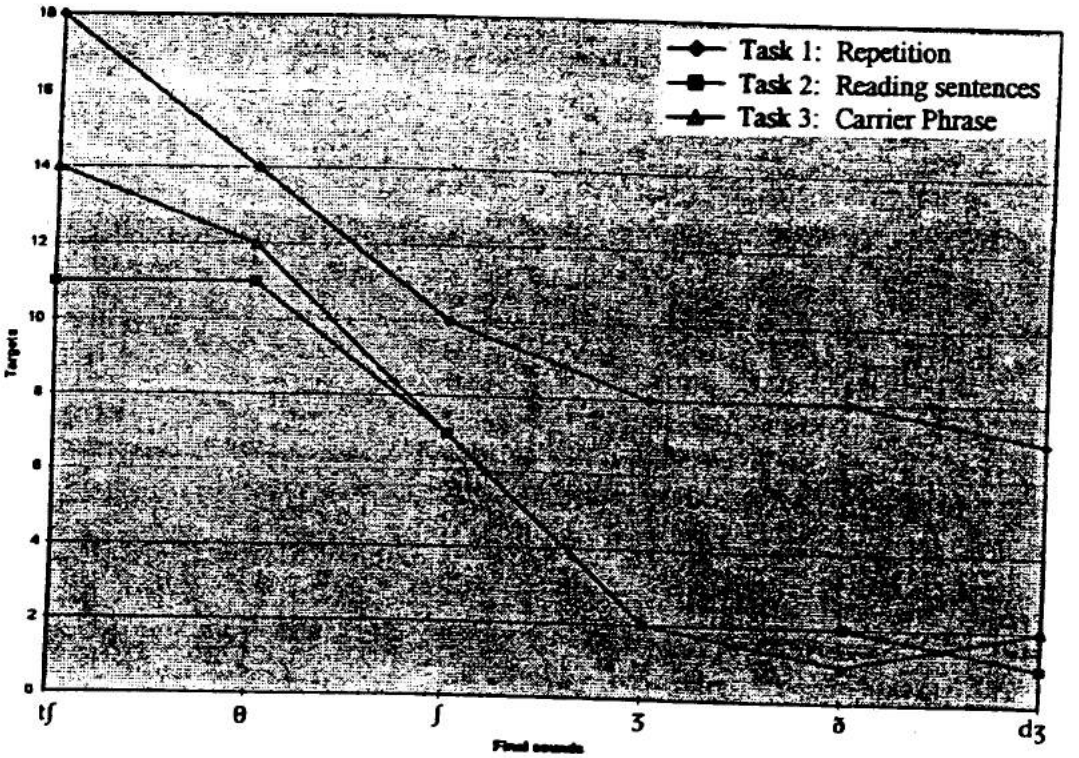

Figure 2. Group II: Performance according to Tasks

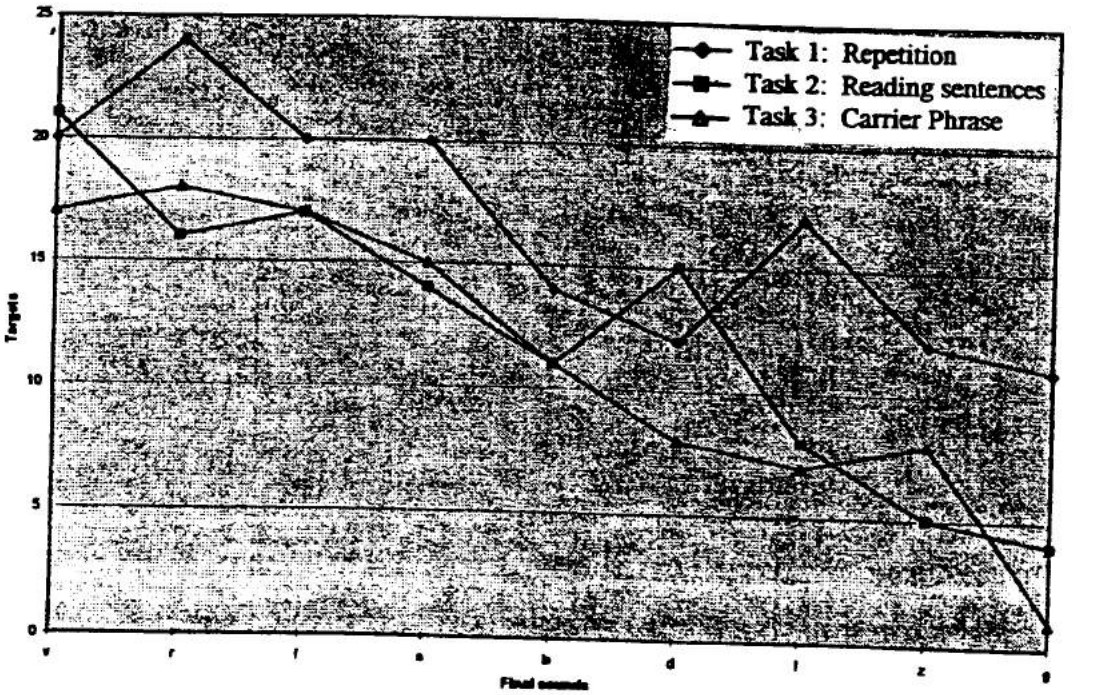

Table 4. Data Summary

Consonant	Target	Del(*)	Dev	Epen	Sibilation/ Fricatization										Unrel	Other					
					f	v	θ	ð	s	z	ʃ	ʒ	tʃ	dʒ		/-st/	Fron	Stop	Back	/-n/	Other
Group I																					
-ʒ	12	7		12	2	1	1		18	5			9	2	1			3	3		
-tʃ	43	2		3					4	1	7				7	5	4	6	2		
-dʒ	10	4	21	7					2	1	6	2			10	5	5	12	9		
- ð	11	4	19	7					6	5								13	13		
-ʃ	24			3					22			1	4	1	15	16		7			
-θ	37	3		1					6				1		17	3	5	14			
Subtotal	137	20	40	33	2	1	1		58	12	13	3	14	3	50	29	14	55	27		
Group II																					
-b	36	2	20	4	5				2						42	2			1		
-d	35	4	22	2					1						36	2			2		2
-g	16	7	21	2					7	1	3	2	2		30	2	7			2	1
-f	54	1		1		1	1		2						14			13	3		
-v	58	4	4	3					1	1											
-s	49	10									1		1		7	4		2	2		
-z	25	11	32	7					1												
-l	32	24				1												1		14	1
-ɹ	58	7							1			1			2	1		2			3
Subtotal	363	70	99	19	5	2	1		15	2	4	3	3		131	11	7	18	8	16	7
Total	500	90	139	52	7	3	2		73	14	17	6	17	3	181	40	21	73	35	16	7

(*) For keys to abbreviations, please refer to page 79, under Results.

DISCUSSION

Language Transfer. It is a well-known assumption that learners of a second language very often carry over the linguistic knowledge of their NL into the grammar of the IL. Phonetically, native speakers of a language tend to adjust the segment sequences of the TL words to conform to the pronunciation requirements of the NL. As a result, the strong version of the Contrastive Analysis Hypothesis (CAH) (Lado 1957) has maintained that all errors in second language learning can be predicted from the differences in structure between the NL and the TL. Specifically, one could predict that the learners would make errors when the NL has a rule that the TL does not, or vice-versa, and when the TL element is marked. The data obtained, as shown in Figure 3, illustrate the areas of difficulty encountered by our Ss regarding the two groups of sounds. The overall targets achieved are clearly higher in Group II than in Group I. In other words, the Ss made more errors in handling the sounds they are unfamiliar with. This is evidenced by the two non-intersecting curves representing each group of sounds. As mentioned earlier, Group II consists of the sounds that occur word-initially in the NL, and thus are somehow familiar to the Ss, who would use a familiar linguistic knowledge in dealing with the same sounds when they occur word-finally in the TL, whereas Group I contains the sounds which are totally new to them. Table 5, obtained from the same sets of data shown in Figure 3, summarizes and compares targets vs. errors according to tasks for the whole corpus of data and displays a clear difference in outcomes: 56.0% targets for Group II vs. 31.8% for Group I.

Figure 3. Overall Performance of Group I vs. Group II

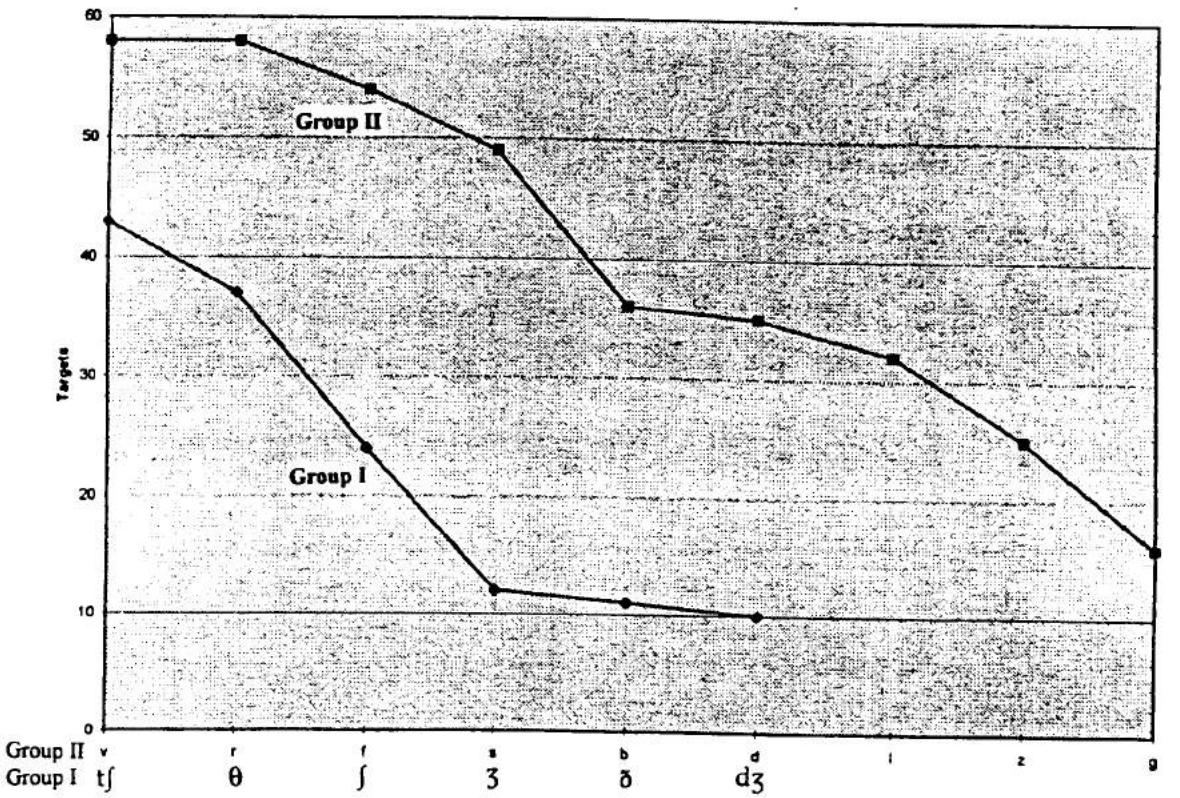

Table 5. Target vs. Error Percentages according to Tasks

Group I	Target %	Non-Target %	Group II	Target %	Non-Target %
Task 1	45.8	54.2	Task 1	69.4	30.6
Task 2	23.9	76.1	Task 2	51.4	48.6
Task 3	26.8	73.2	Task 3	47.2	52.8
Total	**32.2**	**67.8**	**Total**	**56.0**	**44.0**

Data from Figure 3 and Table 5 indicate that our Ss using their NL competence achieved more targets in the words containing the sounds they are more familiar with. This is in line with Major's (1987) hypothesis of a "positive and partial transfer" from the NL to the TL, involving some degree of commonality between the two languages: the learners will be able to learn more easily the material that is common to both languages than the material that does not exist at all in the NL. Major's hypothesis is confirmed by our Ss. Two other major areas of evident transfer from the NL into the IL, terminal devoicing and terminal unreleasing, are discussed next.

Terminal Devoicing. Devoicing has been recognized as a widespread phenomenon in second language learning (Eckmann 1977, Major 1987, Weinberger 1987). Our Ss have shown a noticeable trend in devoicing English final consonants. In Group I sounds, /dʒ/ was devoiced 21 times vs. 10 times for targets, and /ð/ 19 times vs. 11 times for targets, roughly a ratio of 2:1 for each sound. In Group II, voiced sounds appear to have caused the greatest difficulty for the Ss: with the exception of /v/ and /ɹ/, the sounds with the lowest targets are all voiced: /b/, /d/, /l/, /z/, /g/. Overall, terminal devoicing has taken a significant share among all types of errors: 11.9% of all errors in Group I, and 23.5% of all errors in Group II (see Table 6). In addition to the voiceless nature of the NL final stops we mentioned earlier, which has transpired into the TL, we speculate that devoicing in Vietnamese-English IL may be explained by Eckmann's (1977) typological markedness. Indeed, the Markedness Differential Hypothesis (MDH) as hypothesized by Eckmann (1981) proves to be a genuine explanation as to why second language learners opt for the less marked consonants, specifically, the devoiced counterparts of the voiced sounds in the TL. From Group II sounds, /b/, /d/, /g/, /z/ were realized as /p/, /t/, /k/, /s/, respectively, since the latter are less marked than the former, as we had expected. In Group I, however, the Ss did not "devoice" uniformly as we had predicted: /ð/ and / dʒ/ became /θ/ and /tʃ/, respectively, but it is not the case for /ʒ/ which was actually realized as /s/, instead of /ʃ/. How do we account for this anomaly, which involves not only a devoicing process, but also

Table 6. Summary for Terminal Devoicing

Target Segment	Targets achieved	Devoiced to	Number of times	Devoicing compared to Targets (%)
ʒ	12	s	18	150
ð	11	θ	19	172
dʒ	10	tʃ	21	210
v	58	f	4	6
b	36	p	20	55
d	35	t	22	62
z	25	s	32	128
g	16	k	21	131

a change in place of articulation (a fronting process in this case)? Here again, we speculate that (a) these two sounds, both sibilant fricative coronals, /ʃ/ is more marked than /s/ to the Vietnamese subjects on the basis that the former does not exist in the inventory of the NL, at least not for the Northern Dialect. Therefore, opting for an easier sound, the Ss chose to devoice /ʒ/ not to /ʃ/ but to /s/ which is less marked, and (b) the /s/ sound, a coronal par excellence, will play a particularly interesting role in our subjects' interlanguage (see next section on Substitutions).

In summary, our data show evidence of transfer from the NL Terminal Devoicing Rule and also confirm Eckmann's hypothesis on a "directionality of difficulty", i.e., our VN learners will have difficulty in learning and maintaining the superficial voice contrast in English obstruents since the English structure is more marked than the Vietnamese structure with regard to these sounds.

The Unreleasing Rule. Many of the frequent errors made by L2 learners of English involve the production of final obstruents (Edge 1991). For our Ss, this is a clear case of first language transfer, especially when they were facing English final stops. Our Ss, very typically, produced not only the final stops but also other "difficult sounds", especially fricatives and affricates, in the fashion described earlier by Cao (1975) and Thompson (1965), which we have called the Unreleasing Rule (URR). The statistics are strikingly high for this URR performance as shown in Table 7.

As we expected, and as exactly as described by Thompson, the unreleased sounds occurred with the highest frequencies for the stops /b/, /d/, and /g/. Indeed, the counts for URR are even higher than the counts for targets: 42 vs. 36 for /b/, 37 vs. 35 for /d/, and 30 vs. 16 for /g/. For Group I, the URR accounts for 11.7% of the errors, and for Group II, 31.1%. How do we account for the unreleasing of the final sounds in our Ss production?

Table 7. The Unreleasing Rule Performance

	b	d	f	g	l	ʒ	tʃ	dʒ	ð	ɹ	s	ʃ	v	z	θ	Total
S1	5	2	4	2	0	0	2	0	0	0	0	1	0	0	4	20
S2	9	4	4	5	0	0	1	0	0	1	2	4	0	0	5	35
S3	8	7	0	6	0	1	0	2	0	0	3	5	0	0	0	32
S4	5	5	3	6	0	0	2	3	0	0	0	2	0	0	2	28
S5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
S6	4	5	3	3	0	0	2	3	0	1	2	3	0	0	3	29
S7	4	5	0	4	0	0	0	2	0	0	0	0	0	0	3	18
S8	5	6	0	4	0	0	0	0	0	0	0	0	0	0	0	15
Total	42	36	14	30	0	1	7	10	0	2	7	15	0	0	17	**181**

First of all, we speculate that this interference has occurred because of a timing preservation characteristic of the NL. In accordance with the Sonority Principle (Clements 1992) the vowel is the most sonorant element of the syllable (as in all languages), and both edges of the syllable (onset and coda), being less sonorous, only contribute to the meaning of the word, so much so that all other ingredients of the Vietnamese syllable, to include stresses and tones in particular, must share among themselves the only timing slot allowed per syllable/word in such a way that the meaning is carried out naturally. Given the fact that all the constituents of the syllable/word, that is vowel, onset, coda, stress, and tone, must share the timing slot for that syllable/word, the releasing of the final consonants would create yet another sound that must fit into the same timing slot, and would signify to the Vietnamese ear another word. We can therefore predict that, as long as the learners are still in the transfer/developmental stages of their learning curves, this phenomenon will still persist in the IL. Second, since our Ss are all adult learners of English, their phonological systems have reflected high levels of fossilization (Tarone 1978) very common to all adults L2 learners. We need to make a special note here to clarify our point. Although most of our Ss had started learning English at age 12 (S2, S3, S4, S7, and S8), the instruction of English they received in Vietnam was most often taught by VN teachers who obviously are themselves non-native speakers of English, and thus, may not have acquired a native-like pronunciation of final consonants, and who put much more emphasis on grammar, morphology, and syntax than on phonetics or phonology. As a result, the phonological systems of our Ss have been loaded with NL transfer. Now if we consider the ages of our Ss when they came to the USA as the starting point of their real English experience and learning, then the URR results reveal an interesting conclusion. Table 8 below was obtained by reordering the Ss according to their URR performances. Clearly, there is an inverse relationship, although not quite a perfect correspondence, between the URR performance and the length of time the Ss reside in the USA, i.e., the longer a learner stays in the country, the fewer URR errors he/she makes. In other words, the length of time a learner stays in the L2 country will help him/her to "unlearn" the URR from the NL.

A final note regarding our S8 and S5 with respect to their starting ages is worth mentioning. As Table 8 shows, even though S8 has the longest time in the USA, he makes more URR errors than S5: he started the "real English experience and learning" at age 37 while S5 at age 22. Had he come to the United States during his twenties, his URR performance would have placed him in the last row of the table, the perfect place for him and possible evidence for us to conclude

Table 8. URR Performance according to Time in USA

Subject	URR Performance	Years in USA	Age starting in USA
S2	35	1	26
S3	32	1	28
S6	29	2	22
S4	28	2	27
S1	20	2	27
S7	18	5	21
S8	15	8	37
S5	4	6	22

that, for Vietnamese learners of English, the earlier to start, the better to unlearn the URR from the NL. According to our data, this inverse relationship seems to hold true even for the learners that have passed well beyond the Critical Period in second language learning.

SUBSTITUTION

Substitution occurred significantly more often than any other IL device for handling word-final consonants (see Table 4: Data Summary). Compared to the total of epentheses and deletions, the ratio is 271:142. The 271 breaks down into the following categories used as substitutes: fricatization/ affricatization 142, stopping 73, /st/ segment 40, and /n/ 16. Subjects chose to substitute roughly twice as often as they chose to epenthesize or delete.

Substitution is examined below in four ways by (a) verifying the initial observation, "Was there significant incidence of hissing and hushing sounds made by substitutions?" That is, how often did substitution by sibilation occur? (b) examining the /st/ cluster as a sibilant; (c) understanding substitution as a function of the universally special place of coronals; (d) relating the Dispersion Principle to substitution.

Sibilation in substitutions. Sibilation is the use of sibilants in language production and in this paper refers specifically to the substitution of final consonant sounds by sibilants. Edwards (1992: 99) defines the sibilants as the hissing and hussing sounds /s/, /z/, /ʃ/, /tʃ/, /ʒ/, /dʒ/). As Table 9 below shows, the initial question about significant occurrence of the hissing and hushing sounds word-finally in NL Vietnamese English is answered with a resounding yes. As the discussion below will show, "hissers and hushers" are coronals and are therefore very active in substitutions.

Table 9. Summary of the Hisses and Hushes in Substitutions

s	z	ʃ	ʒ	tʃ	dʒ	/st/
73	14	17	6	17	3	40

Total substitutions: 271
Total sibilants used in substitutions: 170
including /st/ : 63%
excluding /st/: 48%
To see which sounds were being substituted for by sibilants, refer to Table 4. Data Summary

The /st/ cluster. The /st/ substitution appears to be an anomaly because the NL has no final clusters, and it is the only cluster produced in our IL data. It occurs across all tasks, but least in the most formal one, repetition. It occurred in Task 1, 10 times; Task 2, 13 times; Task 3, 17 times equalling 40 instances of /st/ substitution, roughly 4% of all errors in the IL. Five out of 8 Ss employed this IL variant, the same Ss who ranked highest in the unreleasing errors (see Table 7 under unreleasing). Why did these Ss substitute a cluster in the IL and why was it /st/? Apparently NL prohibition against final clusters was taking a back seat to something else occurring in the IL when /st/ was being substituted. Our first hypothesis was that it was taking a back seat to autosegmental motivation. Our subjects were adjusting to English timing slots. As mentioned in our section on unreleasing, the timing slots in VN are overloaded with vowel, onset, coda, stress, and tone information (Nguyen 1967). Perhaps, we thought at first, in sorting out what timing slots are for in English, as opposed to their heavy duty in VN, our Ss experienced an NL transfer that predisposed them to cut short the required duration of /-s/. Perhaps they were stopping /-s/ with a homorganic /t/. As Saunders' (1987) data show with NL Japanese learners of English, there is a tendency for second language learners to overshoot or undershoot in milliseconds the duration of /s/.

Perhaps /st/ had been created on these grounds and did not represent the simple substitution of a TL cluster. This interpretation at first appealed to us because it represented an example of Dulay and Burt's (1974) independent and distinct "creative construction" in the IL. However, further analysis (see Table 10 below) showed that /d/ ranked above /s/ for percentages of /st/ substitution. Also, /st/ substituted for 5 other segments as well in the IL, although none of them with as high a percentage

Table 10. Percentages and Number of Substitutions Involving /st/

Sound	Number of times /st/ occurred in total substitutions made	Percentage
d	2 out of 3	66.7
s	4 out of 8	50.0
ʃ	16 out of 46	34.8
dʒ	5 out of 23	21.7
ɹ	1 out of 7	14.3
g	2 out of 17	11.8
θ	3 out of 46	6.5

of their total substitutions as for /s/. The autosegmental motivation hypothesis was weakened, and we finally opted for TL influence in the IL for two reasons: (1) because /s/ and /t/ are both coronals and homorganic, the /st/ cluster was easily acquired and misapplied; (2) TL past-tense /st/ morphology (examples, passed and kissed) as well as TL superlative morphology (examples, richest, hottest), which five of the Ss had recently been taught, might have influenced acquisition of this TL cluster.

Understanding substitution as a function of the universally special place of coronals. As all sibilants and the /st/ cluster are coronals, so are the other high-ranking segments used in substitutions by our Ss: sibilants 170, other fricatives 12, /n/ 16 = 198 instances of coronal substitutions. This is in keeping with the literature supporting the dominant role of coronals in the IL (Clements 1985, and Paradis and Prunet 1991). For example, /s/, unspecified for place, was substituted 73 times, as many times as the stops /b/, /d/, and /g/ combined. Because coronals are dominant not only in the IL but also in English, the fact that our Ss' substitutions were predominantly with coronals in English was easy to predict.

Relating the Dispersion Principle to Substitution. Clements (1992: 68) developed the Dispersion Principle which states that across all languages, there is a preferred initial and a preferred final demisyllable. According to Clements, in our study of word-final consonants we should expect subjects to minimize sonority distances in final demisyllables (nucleus plus coda) when they substituted. Did they? Out of 271 substitutions, Ss substituted with a segment less sonorous than the target 136 times, equalling 50.2% of the substitution tokens. Only 56 times out of 271 substitutions did Ss minimize sonority distance, equaling 20.3% of the 271 substitutions. Table 11 below shows substitution changes according to segment substituted and whether it maximized or minimized sonority dispersion. The comparative sonority of segments is given at the bottom of the chart. We used Greenberg's (1978) sonority hierarchy instead of Clements'

(1992) hierarchy, in order to make the needed distinction between stops and fricatives. We inserted affricates between stops and fricatives, because as a compound segment they are more obstructed than fricatives and less obstructed than stops. In conclusion, our subjects contradicted Clement's Dispersion Principle by more than a 2:1 ratio. Their IL variants tended significantly to maximize dispersion in the final demisyllable.

Table 11. Maximizing vs. Minimizing of Sonority Dispersion in Final Demisyllables

Target Segment	Substituting Segments That Change Sonority Value	Substitution Maximized Dispersion	Substitution Minimized Dispersion
f	b(7) p(7) t(2) l(1)	16	1
b	f(5) s(2) st(2)	0	9
d	st(2) s(1) ɹ(1) ʃ(1)	0	5
g	s(7) ʃ(3) ʒ(2) n(2) z(1) j(1)	0	16
l	n(14) v(1) t(1)	16	0
ʒ	w(2) g(2) t(1) dʒ(3) tʃ(8)	14	2
dʒ	k(4) s(2) z(1) t(3) g(3) ʒ(2) ʃ(6)	10	11
tʃ	s(4) t(4) k(3) z(1) ʃ(6)	7	11
ð	t(11) d(1)	12	0
ɹ	n(2) t(2) s(1) st(1)	6	0
s	st(4) t(1) k(1) p(1) tʃ(1)	8	0
ʃ	st(15) t(7) tʃ(5) dʒ(1)	28	0
v		0	0
z		0	0
θ	t(13) st(3) k(2) w(1) tʃ(1)	19	1
Total		136	56

Note: **Glides > Liquids > Nasals > Fricatives > Affricates >Stops**

SYLLABLE STRUCTURE

Studies by Tarone (1976) support the concept of a universal open syllable structure in second language learning. Sato (1987) discomfirmed Tarone's hypothesis in a study of two Vietnamese learners (ages 10 and 12), indicating that because of L1 transfer, Vietnamese-English IL shows a preference for a closed syllable structure. As mentioned earlier, the preferred syllable structure in Vietnamese is still an unexplored question, even though Sato finally opted, for a "tentative" proposal for a preferred closed syllable structure in Vietnamese. Applying our data to this unsolved puzzle, we offer some evidence that Sato may be right. However, the possibility that our Ss may have already learned the syllable structure of English must also be considered. Table 12 below

shows the outcome: assuming that syllable structure does transfer from the NL to the TL, the balance of 81.2% for the closed syllable vs. 18.8% for the open syllable seems to be robust evidence against the universal open syllable claimed by Tarone, and at the same time, confirms Sato's hypothesis for a preferred closed syllable structure in VN.

Table 12. Preferred Syllable Structure

	For Open syllable	For Closed Syllable	Total
Group I	53	283	336
Group II	89	332	421
Subtotal	142	615	757
Percentages	18.8	81.2	100.0

After examining epenthesis and deletion as contributions to a predominant syllable structure, we contrasted them in light of possible IL constraints against ambiguity. We assumed that the IL of our Ss would show constraints against ambiguity by preserving structure (Weinberger 1987), that is, by having epenthesis predominate over deletion in the IL. We visualized a scale. On one side was the universal constraint against ambiguity; on the other, the fact that deletion is easier than epenthesis, that is, less marked (Weinberger, class lecture, March 98). Before we go further into the discussion, mention again is needed of the idiosyncratic epentheses of two Ss and the consequent adjustment we made. S1 and S6 obviously had grapheme-to-sound confusion in reading words ending in the silent letter e. S1 pronounced the grapheme e as [i, I, ə] when it appeared word-finally 13 out of 14 times. In reading it she created epentheses. Apparently S6 did the same thing 15 out of 23 times. Therefore, when this mistake would affect the data, we give two readings of the data below, one including S1 and S6 and one excluding S1 and S6.

A contrast of averages between epenthesis and deletion (Table 13 below) reveals that subjects favored deletion in Group I when S1 and S6 were discounted and in Group II whether or not S1 and S6 were discounted. The scale came down on the side of deletion, the less marked of the choices contributing to syllable-structure change. By preferring deletion, Ss failed to preserve structure.

Table 13. Frequency of Deletion vs. Epenthesis

	Group I		Group II	
	% of Errors	% of Errors discounting S1 & S6	% of Errors	% of Errors discounting S1 & S6
Deletion	6.9	6.9	24.6	24.6
Epenthesis	11.4	4.9	6.7	4.1
Ratio: Deletion to Epenthesis	0.6:1	1.4:1	3.6:1	6:1

The results seem to indicate that the underlying representations (UR) are in flux regarding the mere existence of consonants word-finally. Given that lack of recognition in our subjects' URs, we would have thought that Group II, in which the segments do occur initially in Vietnamese words, would reveal a much lower percentage of deletion because of NL transfer. We found just the opposite as shown in Table 14 below. How could Ss delete more of the segments they have in their NL than

those they do not have? Although Group II has NL transfer on its side and is composed of only 5 out of 9 coronals as compared to 6 out of 6 coronals in Group I, it is still the group heaviest in deletions. We mention coronals because in keeping with the literature on the special place of coronals (Clements 1985, and Paradis and Prunet 1991), we would have hypothesized that Group II having more stable elements, that is more segments specified for place, would have had fewer deletions because of fewer coronals. Indeed Paradis and Prunet (1991, pp. 20-21) state, "In any position, coronals are more often deleted than non-coronals."

Table 14. Percentages of Deleted Final Consonants

Sound	Percentage	Sound	Percentage
Group I		Group II	
ʒ	9.7	l	33.3
ð	5.6	z	15.3
dʒ	5.6	s	13.9
θ	4.2	ɹ	9.7
tʃ	2.8	g	9.7
ʃ	0	v	5.6
		d	5.6
		b	2.8

The answer must thus lie in the individual nature of the top-ranking deleted segments in Group II. First, liquids /l/ and /ɹ/ are among the last to be mastered developmentally (Edwards, pp. 198, 204) and traditionally present L2 pronunciation difficulties. To illustrate the peculiarity of these sounds with respect to deletion and substitution in the IL, we examined several VN borrowings (see Table 15 below) from English and French words which end with /l/ (Nguyen, 1986, Le and Le, 1980). We discovered two "nativization" rules as described below:

Rule (1): ____l ==> ____n (variant ñ)

Rule (2): ____l ==> ∅

Table 15. Vietnamese Loan Words

English	IPA	Vietnamese		IPA	Rule
ball	[bɔ:l]	ban/banh		[ban/bañ]	(1)
film	[film]	phim		[fim]	(2)
valve	[vælv]	van		[van]	(1)
French	**IPA**	**Vietnamese**	**Gloss**	**IPA**	**Rule**
napalm	[næpalm]	na-pan	*napalm*	[napan]	(1)
filtre	[filtr]	phin	*filter*	[fin]	(1)
pile	[pil]	pin	*battery*	[pin]	(1)

These examples indicate that there must be an underlying mechanism that triggers these rules in the NL, and through our Ss, these rules have transpired from the NL into the IL. This discovery seems interesting, but the scope of this study prevents us from further investigation. For our Ss, as shown in Table 4, out of 72 tokens for the final /l/, we found 32 targets (= 44.5%), 24 deletions (= 33.4% for Rule (2)), and 14 substitutions by /n/ (= 19.5% for Rule (1)).

Next after /l/ in Group II are /z/ and /s/. /s/ is a particularly unstable consonant with regard to place and apparently its voiced counterpart /z/ is as well. These three segments account for 63% of the deletions in Group II and underscore the fact that the individual nature of the segment caused Group II to undergo more deletions than Group I.

One last observation about deletion: On a task-by-task comparison of the whole corpus of data (see Table 16) the highest rate of deletions occurred in Task 2, probably because of the

Table 16. Percentages of Deletion according to Tasks

	Numbers of deletions	Percentages
Task 1: Repetition	25	27.8
Task 2: Reading	38	42.2
Task 3: Carrier Phrase	27	30.0
Total	90	100.0

contextual clues involved in reading sentences as opposed to repetition or the use of carrier phrases. Weinberger's (1987: 414) claim that "linguistic context in an elicitation task affects the ratio of epenthesis to deletion" was upheld. The sentences in Task 2 provided other ways to disambiguate words, therefore this task imposed less constraints on deletion.

SUMMARY

After confirming significant sibilation in the Vietnamese English IL final consonants at 62% of all substitutions made, we investigated the dynamics underlying several categories of final consonant production in terms of target, deletion, devoicing, epenthesis, fricatization and affricatization, unreleasing, creation of the /st/ cluster, stopping, backing, and nasal substitutions. We focused our discussion in three main areas: NL Transfer, Substitution, and Syllable Structure. We found evidence for the following conclusions:

(1) Confirmation of Majors' (1987) hypothesis of a "positive and partial transfer" of NL. Overall targets achieved were clearly higher in Group II (56.0%), which contained NL segments, vs. Group I (31.8%), which contained no NL segments.

(2) Confirmation of Eckman's (1977) Markedness Differential Hypothesis (MDH). Vietnamese learners had difficulty in learning and maintaining the superficial voice contrast in word-final consonants in English since the English structure is more marked than the Vietnamese structure with regard to these sounds.

(3) Instantiation in English productions of Cao's (1975) and Thompson's (1965) descriptions of NL Vietnamese phonetical rendering of stops. We found significant devoicing and unreleasing of final obstruents.

(4) Possible evidence to question Tarone's (1976) claim that the open syllable is a universal in second language learning. We looked at both deletion and epenthesis as contributions to an open-syllable preference and considered all other types of errors as contributions to a closed-syllable preference. While the balance of 81.2% for closed syllable vs. 18.8% for open syllable is perhaps evidence for the Vietnamese-English IL closed-syllable preference, we cannot say that it is sound evidence for NL closed-syllable structure because the closed-syllable preference is possibly the influence of TL syllable structure .

(5) Support for Eckman's (1987) independence of IL rules, in which both positive and negative transfers play a major role, to include terminal devoicing and terminal unreleasing.

(6) Support for the universally special place of coronals in the IL as claimed by Clements (1985), and Paradis and Prunet (1991). Out of 271 substitutions, 198 were coronal, or 73%. /s/, unspecified for place, was substituted 73 times, as many as the three stops /b/, /d/, and /g/ combined.

(7) A challenge to Clement's Dispersion Principle. In substituting, Ss chose segments which maximized final demisyllable dispersion by more than a 2:1 ratio.

CONCLUSION

As Weinberger and Ioup conclude in *Interlanguage Phonology* (1987: 418), second language phonological acquisition "is a dynamic phenomenon, governed by a set of universal developmental processes that interact with transfer processes in many interesting ways," we too, after analyzing our data on three different structural levels, discovered a complex interplay of universals and NL transfer. From the viewpoint of one of us as a native Vietnamese speaker, we join Broselow (1983: 292) in advocating more research on NLs to remedy "inadequacies in our understanding of native speaker competence", because IL errors may be erroneously attributed to transfer when the cause of these errors may lie elsewhere.

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Appendix

Tasks as Presented to Subjects

Task 1: Repetition

Task 2: Reading Sentences

Task 3:Carrier Phrase ("I say. . .")

1. cab
2. did
3. huff
4 big
5. ball
6. rouge
7. match
8. judge
9. bathe
10. both
11. bear
12. house
13. bush
14. beige
15. leave
16. ease
17. tub
18. bad
19. roof
20. sag
21. bill
22. siege
23. prize
24. church
25. badge
26. clothe
27. truth
28. fur
29. bookcase
30. ash
31. have
32. rose
33. crib
34. food
35. off
36. rug
37. full
38. itch
39. edge
40. loathe
41. tooth
42. tar
43. bus
44. fish
45. stove