Acknowledgments

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MORA VERSUS SYLLABLE: AN ANALYSIS OF NATIVE ENGLISH SPEAKERS' PRODUCTIONS FROM A JAPANESE LANGUAGE GAME

Miwako Hisagi

INTRODUCTION

This paper will examine whether or not native English speakers recognize the reality of the linguistic unit known as a 'mora' found in Japanese (and other languages such as Tigrinya--see Bagemihl, 1988; Ito, 1988 --and some Bantu languages--see Hubbard 1995). This paper discusses data from native English-speaking children attempting to play a Japanese syllable insertion language game for the first time. This Japanese language game was also the focus of an investigation by Skaer (1991) and Haraguchi (1991). In their experiments Japanese speakers' production patterns were consistent with moraic segmentation. Since Japanese is a mora-based language, morae constrain the syllable structure. A mora is defined by Han (1962, in Hoequist 1985) as a unit equal to a short syllable. Ladefoged (1982: 226 in Vance 1987) states that "A mora is a unit of timing. Each mora takes about the same length of time to say" (p.62). In Japanese, all vowels (including those devoiced by phonological rule), geminate consonants, and the syllable-final /n/ are said to be moraic.[1] Since linguists generally define English as a syllable-based language, the theoretical question I ask is this: will these children interpret Japanese as a mora-based or syllable-based language?

Kubozono (1989) states that if standard syllable structure cannot express Japanese word production, the only way to account for speech behavior is to assume the mora as a relevant unit in the speech production of Japanese. If one defines the mora as an intermediate level between syllable and segment, vowel-consonant interaction such as CV-insertion can be described not as segmental, but as moraic productions. Kubozono also pointed out that "in English, there is reportedly a set of general constraints that hold between the peak and the coda, whereas constraints between the onset and the peak are relatively weak (cf. Fudge 1969, 1987). In Japanese, by contrast, co-occurrence restrictions operating between onset and peak are at least as strong as those holding between peak and coda." (p. 269) In other words, in English, there is a special association between the nucleus (peak) and the coda, which are said to form a constituent called the "rhyme." In Japanese, there is no special relationship between the nucleus and the coda. The association between the onset and nucleus is equally weak. The mora has therefore often been recognized as a relevant unit in phonological description. However, unlike a language such as English, the evidence of the Japanese mora suggests that there is no syllable unit 'rhyme' which is often implied to be a universal syllable constituent (see Ito 1988).[2] The present study found clear evidence of language transfer from the native language syllable structure in the

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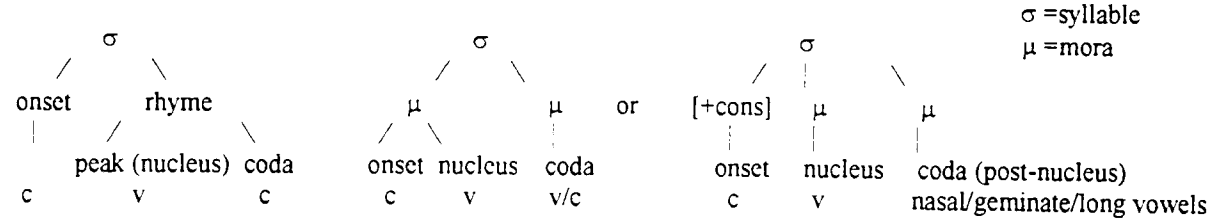
[1] In Japanese, morae are called *onsetsu* or *haku* by Kindaichi (1963 in Vance).

[2] **A.** Standard syllable structure (Ito 1988). **B.** Japanese syllable structure (Kubozono 1989, left and Skaer 1991, right)



production of game words. In terms of the relationship between production and perception results indicate that subjects have the ability to control productions and try to achieve perceptional distinctions in their language processing.

The Japanese language was chosen for this attempt because its phonological structure allows us to compare a child's sensibility at the syllabic level, which often suffices in English, to sub-syllabic units such as certain types of morae in Japanese. The data will suggest some interesting strategies involving the metrical structure of Japanese. I was particularly interested in how special morae (the nasal /n/, geminate consonants, long vowels and diphthongs) were dealt with, i.e., whether the subjects treat them as morae. Not many linguists have dealt with the issue of syllable construction and morae within the exceptional phonology of language games, especially by child L2 learners.

This paper analyzes the data of child native English speakers playing the Japanese syllable insertion game "BABIBUBEBO" to see if they recognize the reality of the mora in Japanese. In experiments with adult native Japanese speakers, subjects treated a nasal /n/ (e.g. /riŋgo/ 'apple' or /mikan/ 'tangerine'); the first member of a geminate, as in /gakki/ 'instrument'; and the second of two long vowels (/ookii/ 'big') or diphthongs (/tokei/ 'clock') as morae (Kubozono 1989 and 1995; Skaer 1987 and 1991; Katada 1990; Poser 1990; Yoshida 1990; Otake and Hatano 1993; Han 1994; Broselow 1996), thus strongly supporting the notion that Japanese is a mora-based language. The question in this study is whether native English speakers recognize the nasal /n/, geminates, and long vowels or diphthongs as weight-bearing units in the prosodic structure of Japanese.[3]

This paper is organized into four major sections. First I will present the issue of whether or not the types of mora-timing units and syllable-timing units in this language game provide evidence for subsyllabic (mora) constituency. Second, I will explain my hypothesis and methodology. Third, I will analyze the speech production based on the data gathered. I will conclude by summarizing the major constructs of the theoretical approach developed here to account for the hierarchical prosodic structure of Japanese, which will show that the children's production conforms to a single theory of universal grammar, and that they generally recognize the Japanese-specific mora parameter.

THE BABIBUBEBO GAME[4]

The object of the language game in question is to insert a consonant-vowel sequence, "bV", after each mora of the cue word, where V is the same as the vowel of the preceding mora. Given the cue word /ki/ (tree), the game form is /kibi/. Likewise, given the cue word /ari/ (ants), the game form is /abaribi/. Moreover, the word /kao/ (face), which consists of a single syllable, is treated as two units, /ka/ and /o/ and the game form is /kabaobo/. The word /kaban/ (bag), which consists of two syllables, is treated as three units, /ka/, /ba/ and /n/ and the game form is /kababababambɯ/. In general, these words, outside of the game format, would be divided differently, depending on the phonetic system one was using, syllable or mora.

[3] The theory-internal prediction from another phonetic view point such as accent and tone would be another way to examine this issue.

[4] Children usually start playing the game around ten years old (reported to me by teachers and my friends), although Haraguchi (1991) mentioned that this game is played by mainly by junior or senior high school students in Japan.

(1)

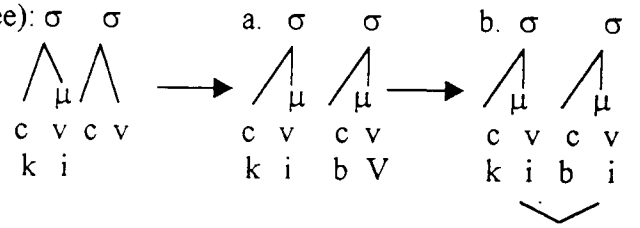
mora-based	vs	syllable-based	
a.ri		a.ri	"ants"
ka.o		kao	"face"
ka.ba.n		ka.ban	"bag"

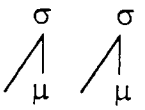
The structure for the game is thus neither a syllable nor a segment, but a mora. A mora may have any of the three following realizations (adopted from Tsujimura 1996: 65):

1. (C)V
2. the first part of a long consonant (or the first part of a geminate)
3. syllable final, or "moraic," nasal /n/

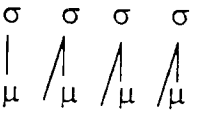
Rules of the game: a. Insert a syllabic skeleton bV after each mora.
b. Spread the preceding vowel to the free syllabic skeleton V.

For example, for the word *ki* (tree):



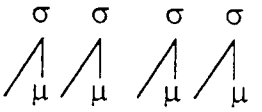


(2) one-mora: ki k i b i "tree"



(3) two-mora: ari a b a r i b i "ants"

σ =syllable
μ =mora

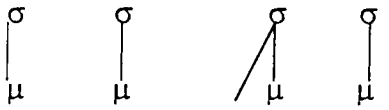


(4) two-mora: kame k a b a m e b e "turtle"

The word /ari/ is a two-mora word consisting of three segmental phonemes, while /kame/ is a two-mora word consisting of four segmental phonemes. From a moraic perspective, one heavy syllable (/a/ in /ari/) and two light syllables (/ka/ and /me/ in /kame/) should be equivalent fillings of a two-mora template, i.e., /a/ as a mora equals /ka/ as a mora. The simple CV-strings present no problems here; more interesting issues arise with examples containing postnuclear morae: a nasal /n/, geminates and long vowels or diphthongs. For long vowels and geminates there are exceptions to the mora-based account. In theory, /bV/ insertion after long vowels and geminates would be explained in a mora-based account. However, long vowels in postnuclear position behave differently (Skaer 1991): the second long vowel is [+cons], it would not be expected to

allow insertion of an affix immediately following; long vowels do not allow 'bV' insertion, which is easily accountable within a framework involving the syllable.

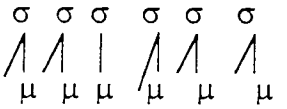
(5) e.g. /ookii/ "big" game word: /obokibi/ (syllable-based)



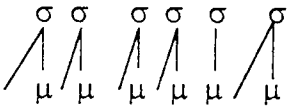
v slot is empty.

Japanese geminates are [+constricted glottal aspiration]. Japanese /p/, /t/, /k/ in the first part of a geminate are slightly aspirated, but not as strongly as their English counterparts (Vance 1987). Skaer (1991: 139) said, "some speakers systematically replace geminates with "tsu" for the orthographic symbol that indicates gemination (っ)." This happened to two of my subjects (S3 and S4).

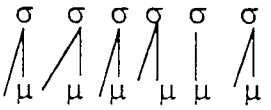
In general, a nasal /n/, geminates, and long vowels or diphthongs are all separate units, and constitute a mora by themselves. These morae could have an empty position. In the case of /n/, the V slot is empty.



(6) nasal /n/ (medial) ri-ɳ-go r i b i m b ɯ g o b o "apple"

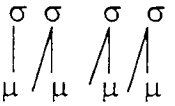


(7) nasal /n/ (final) mi-ka-n m i b i k a b a m b ɯ "tangeline"



(8) diphthong to-ke-i t o b o k e b e i b i "clock"

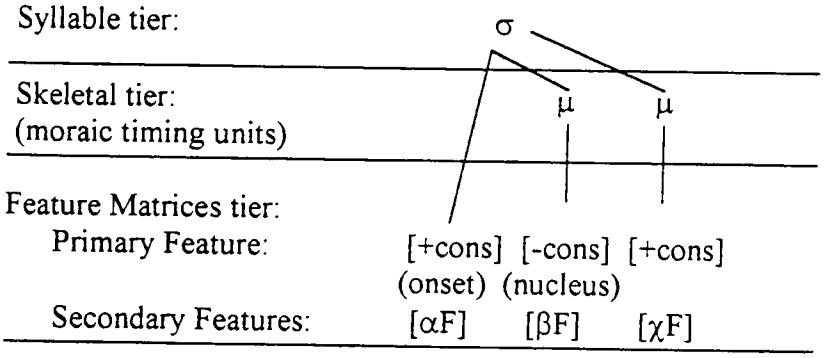
(9) geminate ga-k-ki g a b a k k i b i "instrument"



(10) long vowels o-o-k-i-i o b o k i b i "big"

Our game requires vowel spreading from the nuclear position into the unfilled slot of the inserted affix. Skaer (1991) claimed that since the moraic affix [bV] has no features specified, this violates prosodic licensing.[5] However, because the feature matrix is split into at least two tiers (see (11)), an affix [V] stands for [-cons], allowing for the spread of secondary features to an existing slot, thus avoiding a violation of prosodic licensing.[6] bV insertion with vowel feature spreading requires the recognition of nuclear melodies at the level of feature. As I stated on earier, the association between onset and nucleus is equally weak, making the Japanese syllable structure look like this (Skaer 1991 and 1994):

(11) Japanese Syllable Structure



This explains the situation of long vowels, which do not allow bV insertion because their second members are [+cons] in the nucleus position. In addition, it accounts for the differentiation between the mora and syllable in Japanese by saying that both syllable and morae are used in Japanese even though it is a mora-based language.[7] This Japanese syllable structure also explains the feature assimilation discussed later in this paper.

HYPOTHESIS AND METHODOLOGY

My hypothesis is that the subjects will treat Japanese as a mora-based language when confronted with a game word which lacks a nasal /n/ (especially in medial position), geminates, long vowels or diphthongs. However, because English is syllable-based, they will treat Japanese as syllable-based when dealing with game words which do exhibit these characteristics. Focusing the discussion on the relationship between syllable and mora within a single word, the possible

[5] Ito (1988 in Skaer 1991) said "prosodic licencing requires sequences of segments to conform to language universal and language specific syllabification principles, via epenthesis, spreading, or deletion, particularly in the cases where templates are either unfilled, or are not wholly filled." (p. 40)

[6] Skaer (1987) made a point "Recognition of the syllable tier allows stating the restructuring constraint in a much more elegant manner than a mora-based explanation affords." (p. 62)

[7] Skaer (1994) explains the Japanese metrical unit by mentioning "Constraint Theory": "...in any given string of consonants and vowels, there are theoretically many ways which the consonants and vowels can be grouped together to form larger prosodic units (such as moras or syllables)." (i.e. [cvc][vc] or [cv][cvc]) "However, in Constraint Theory for Japanese, ...constraint builds minimal metrical units...this timing associates the timing tier to the primary feature tier of individual phonemes, via Ito's Universal Core Syllable Condition (UCSC)." (i.e. [cv][cv]c) "...Weight by Position, CV (produced by UCSC) must be attached to the preceding nuclear base-unit and given metrical weight, ..." (p. 65)

production for /riŋgo/ "apple" might include the following: /ribimbɯgobo/, which would demonstrate that the student recognizes the status of the nasal /n/ as a mora in Japanese; /rimbigobo/, which would show that the student is putting /n/ in the coda and is not recognizing it as a mora; and /rimbɯgobo/, which would demonstrate that the student is putting /n/ in a coda, yet appears to be recognizing the syllabic status of /n/ in the choice of /bɯ/ rather than /bi/.

Subjects. The data were gathered from the speech of ten subjects, five boys and five girls, between the ages of 10 and 12. All are Japanese immersion fifth and sixth graders who started learning Japanese in a partial immersion program in the first grade. I chose students of the highest proficiency level based on my observation as a teacher in the class. None knew the purpose of the experiment, and none had had any prior experience with this game.

Methodology. The Babibubebo game was conducted by showing pictures of objects to the subjects. Instructions were given in both English and Japanese prior to the experiment. Subjects were given many examples until they realized the rules of this game. They were told to say the name of each picture first, in order to make sure that their production matched the original word. Then they were told to make a game word by combining the correct character /ba, bi, bɯ, be, bo/ in the following order: simple words as in (2)-(4), nasal /n/ as in (6)-(7), diphthongs as in (8), geminates as in (9), and long vowels as in (10) (see Appendix 1). Any mistakes were corrected during practice on the examples. There appears to be some variability in how BABIBUBEBO is played, i.e. whether or not a /bV/ syllable is inserted. In my experience in Japan, a syllable is inserted after /n/. Haraguchi (1991) also shows insertion of a syllable after /n/. However, Skaer (1991) does not show insertion after /n/. When demonstrating the game, I inserted a syllable after /n/. Haraguchi (1991: 50) mentioned that "This word-game is based on the spelling pronunciation of Japanese words as written in Kana syllabicity." In the actual experiment, however, the subjects saw only a picture, but not the written word (or script) to avoid the orthographical effect, especially for words containing geminate consonants. They were also asked to say the game word at a fast speed to avoid the careful production caused by knowledge of the orthographical character. Skaer (1994) mentioned that "Careful speech treats each mora independently, and demonstrates a direct one-to-one correlation between the words as they are presented graphically in writing, rather than as a product of prosodic (speech) production." (p. 81) Each subject made one recording of 20 words which had no nasal /n/, geminates, long vowels or diphthongs; 36 which had a medial nasal /n/; 28 which ended with a final nasal /n/; 17 diphthongs; 21 geminates; and 20 long vowels. Since geminates in foreign words such as /attakkɯ/ "attack" and /mikkɯsɯ/ "mix" may cause acoustic problems according to Kitahara (1996) [8], I eliminated them from my list. I tried to create a natural environment for the subjects by using the familiar flash card approach and taping them in the classroom. However, after I tested the words, I noticed that the geminates and long vowels are problematic for this experiment. As I stated before, the geminates and long vowels act differently by not following a purely mora-based account, but a syllable-based one. For the purpose of this experiment, I eliminated them from my data.

I analyzed each production carefully to determine whether or not they relied on syllable-constituency. There were some unrelated speech errors (e.g., metathesis, deletion), which were deliberately excluded from the data (see Appendix 2). These speech errors would require another

[8] "...there is a significant relation between the default accentuation (McCawley 1968) and CG (consonant gemination). ...CG is absent in the lexicon but present in the output." (Kitahara 1996 p. 62)

investigation, which is beyond the scope of this paper (for discussion of common speech errors in Japanese, see Kubozono (1989) and for discussion of "slips of tongue", see Jaeger (1991)).

RESULTS

The investigation demonstrates the various ways in which the game system is dependent on the prosodic structure of Japanese. The following paragraphs discuss the production of game words containing the segments of interest, nasal /n/ and diphthongs.

Differentiation of nasal /n/. There are four possible production results for words with moraic /n/. I demonstrate these types with the word *ringo* "apple":

Type A: ri bi m bɯ go bo (well-formed)

Type B: **rim** bɯ go bo (syllable with default vowel "ɯ")

Type C: **rim** **bi** go bo (syllable with spreading from preceding vowel)

Type D: **rim** **bo** go bo (syllable with spreading from following vowel)

Type A is mora-based (a well-formed production). Type B is syllable-based with evidence of some awareness of the moraic status of /n/ in the choice of /b + default vowel ɯ/ rather than /b + preceding vowel/ after a nasal /n/; but it still treats the nasal /n/ as a part of a syllable by producing /rim/ for the example *ringo* "apple" /**ribimbɯ**gobo/. Type C is syllable-based with the insertion of /b+ preceding vowel/ and placement of /n/ in the coda by producing /rim/. Type D is syllable-based, and is a similar phenomenon to Type C except that spreading occurs from the following vowel instead of the preceding vowel. The choice of the default vowel /ɯ/ reflects the spreading of the empty nucleus in the /n/ mora. Kaye calls /ɯ/ the "cold" vowel [9], which he defines as a vowel with no salient features (Kaye 1990, in Yoshida 1990). This follows the universal "Coda Licensing Principle" identified by Kaye (1990 in Yoshida 1990): Post-nuclear rhymal positions must be licensed by a following onset. This principle says that you cannot have two onsets in a row (*OROO). Regarding the example *ringo*, the issue is whether /n/ is in the onset or the rhyme within its mora. According to the Coda Licensing Principle, /n/ must be in the rhyme, licensed by /g/. Otherwise /ŋg/ would be two onsets together, which is illegal. The spreading from the following /o/ can be interpreted as evidence of the licensing relationship between the onset /g/ and /ŋ/ in the coda position.

Medial nasal /n/. The examples of medial nasal /n/ are found in table 1.

[9] The cold vowel is high, back, unrounded vowel [ɯ], since [+round] is the salient feature of U^0. (see Kaye in Yoshida 1990)

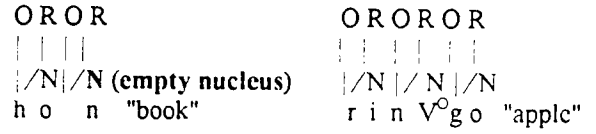


Table 1. Four types of possible productions

	Type A	Type B	Type C [10]	Type D
riŋgo "apple"	ribimbɯgobo	rimbɯgobo	ri(bi)mbigobo	ri(bi)mbogobo
oŋgakɯ "music"	obombɯgabakɯbɯ	ombɯgabakɯbɯ	o(bo)mbogabakɯbɯ	o(bo)mbagabakɯbɯ
senɯki "can	ebembɯnɯbɯkibi	sembɯnɯbɯkibi	se(be)mbenɯbɯkibi	se(be)mbɯnɯbɯkibi

As shown in table 2 below, the subjects followed a mora-based structure in most cases.

Table 2. The number of productions

	Type A	Type B	Type C	Type D	Other	Total
Number of tokens	238	13	24	13	72	360
Percentage	66%	4%	7%	4%	22%	103%[11]

Table 3. The number of non-mora-based productions

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total
Non Mora-based	14	4	18	14	15	12	5	16	12	12	122/360
Percentage	39%	10%	50%	39%	42%	33%	14%	44%	33%	33%	34%

There is evidence of some universal constraints, i.e., the OCP (Obligatory Contour Principle) and nasal place assimilation. The subjects were affected by words starting with either a vowel or a [+voice] consonant such as *ongaku* "music" and *renkon* "lotus root" (*[+voice][+voice] in /**o**bo/ and /**re**be/, See Appendix 1.). Most of the Type C productions involved bilabial consonants preceding the nasal /m/ such as *tonbo* "drgon fly" and *tanpopo* "dandelion" (labial assimilation: fronting). Most of the productions of Type D involved velar consonants preceding the nasal /ŋ/ such as *ongaku* and *sanko* "three (objects)" (velar assimilation: backing). Tsujimura (1996) mentioned that "/n/ is realized as the nasal sound that shares the same place of articulation as the immediately following consonant" (p.30). This explains Type D productions, in which the vowel from the following CV spreads, while Type C labial assimilation came from fronting in which the vowel from the preceding CV spreads. Again in Japanese syllable structure, according to Skaer (1991, 1994), insertion requires the recognition of nuclear melodies, the vowel feature spreading mentioned earlier. That is, vowel spreading in this sense occurs either rightward or leftward depending on the type of feature place assimilation (i.e. fronting or backing), and does not violate prosodic licensing in the secondary feature level of the feature matrics tier (see figure (11)).

Interestingly, there was less coronal assimilation than other forms of place assimilation. The subjects' recognition of the coronal nasal /n/ was somehow very clear. Paradis and Prunet (1991 p. 2) state that "...coronals are the only consonants to be invisible to phonological processes such as deletion in Japanese" (see Grignon 1984: 324). The result, however, is against their claim that "coronal harmonies are much more frequent than other harmonies" (coronal underspecification).

Final nasal /n/. In the test words for final nasal /n/, because there is no syllable following /n/, productions of Type D were impossible. The examples are found in Table 4.

[10] S3 and S4 could say /ribi/ instead of /rin/ for example.

[11] Totals in the data do not always add up to 100 due to numerical rounding.

Table 4. Three types of possible productions

	Type A	Type B	Type C
hon "book"	hobombɯ	hombɯ	hombo
kirin "girraff"	kibiribimbɯ	kibirimbɯ	kibirimbi

As shown in Table 5 below, the subjects treated final nasal /n/ as a mora in 92% cases. No subjects treated /n/ as Type B, but Type C. Following the Coda Licensing Principle, since the final nucleus cannot license the preceding onset to dominate a segment, there is an empty onset position in the structure (see note 9). In this case, although the subjects preferred Type C to Type B, they realized the onset/rhyme pattern by inserting [bV] in this position correctly, not treating /n/ as a part of the onset.

Table 5. The number of productions

	Type A	Type B	Type C	Other	Total
Number of tokens	258	0	13	9	280
Percentage	92%	0%	5%	3%	100%

Table 6. The number of non-mora-based productions

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total
Number of tokens	0	1	5	2	5	0	2	5	1	1	22/280
Percentage	0%	4%	18%	7%	18%	0%	7%	18%	4%	4%	8%

Some speech errors such as /gonibiimbi/ for /gonin/ "five" reflect language-specific constraints, while others, such as final nasal deletion may come from universal constraints. The former case shows that some subjects treated the second vowel of /ii/ as a mora, demonstrating an OCP violation, instead of treating it as a long vowel. Yoshida's (1990) claim for "nuclear fusion" says that "...there exists a process in which two successive nuclear constituents are fused into one by the application of the OCP." (p. 344) The other possibility is that the subject simply treated /in/ as a syllable through a slip of the tongue: goni + in. The latter case shows that they deleted a coronal /n/ by coronal underspecification, supporting Paradis and Prunet's (1991) assertion (see Appendix 2).

Diphthongs. There are four different types of production for diphthongs. I demonstrate these types with the word *sɯika* "watermelon":

Type A: sɯ bɯ **i bi** ka ba (well-formed)

Type B: sɯi bi ka ba (syllable with spreading from the second member of diphthong)

Type C: sɯi bɯ ka ba (syllable with spreading from preceding vowel)

Type D: sɯ bɯ ka ba (syllable/deletion)

Type A is mora-based (a well-formed production). Type B is syllable-based with evidence of mora structure indicated by inserting /b + the second member of diphthong/, while still treating the second member of the diphthong as a part of a syllable by producing /sɯi/ for the example "watermelon" (/sɯibikaba/ instead of the well-formed /**sɯbɯibi**kaba/). Type C is syllable-based,

as indicated by the insertion of /b + the preceding vowel of first CV-string/ and also the production of /sɯi/, thus treating the second segment of the diphthong as a part of the syllable. Type D is syllable-based, as indicated by deletion of the second member of the diphthong, insertion of /b + the preceding vowel/, and production of /sɯi/ before the deletion, treating the second member of the diphthong as a part of syllable. The examples of diphthongs are found in Table 7.

Table 7. The types of possible productions

	Type A	Type B	Type C	Type D
tokei "clock"	tobokebeibi	tobokeibi	tobokeibe	tobokebe
sɯika "watermelon"	sɯbɯibikaba	sɯibikaba	sɯibɯkaba	sɯbɯkaba

Table 8. The number of productions of diphthongs

	Type A	Type B	Type C	Type D	Other	Total
Number of tokens	121	10	1	14	24	170
Percentage	71%	6%	0.6%	8%	14 %	99.6%

Table 9. The number of non-mora-based productions

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total
Number of tokens	6	8	3	3	6	3	3	7	9	1	49 / 170
Percentage	35%	47%	18%	18%	35%	18%	18%	41%	53%	6%	29%

The mora status of diphthong segments is clearer in the data. Type D (8%) follows a universal constraint by deleting the Japanese default vowel [ɯ] of [aɯ] in most cases (e.g. taɯn see Appendix 1): There is vowel assimilation into the preceding vowel (the first member of the diphthong). This language-particular default vowel expresses the radical underspecification theory stated by Archangeli (1988): "Radical Underspecification treats feature specifications as the phonological primitives of a language and it encodes markedness of various systems by the use each makes of Universal Default Rules vs. language-particular default rules." (p. 198) On the contrary, Type B shows that recognition of the second member of diphthongs as a mora is strong, especially in combinations which do not include the default vowel [ɯ] (i.e. [ai], [ei] and [ao]).

DISCUSSION AND CONCLUSION

In this paper, I explored the constituency subjects' productions in a Japanese syllable insertion game, mora versus syllable. The results show evidence of the influence of universal principles such as the OCP and assimilation as well as language-specific parameters (e.g. the mora parameter). The experiment data presented in the preceding section show that the subjects exhibited a remarkable difference in their preferred pattern of segmental game productions. They preferred to use a parameter setting from NL knowledge (syllable-based) when the word was somehow constrained by universal grammar (e.g. OCP *[+voice][+voice], default setting [ɯ]). This language game requires detailed monitoring, mora by mora, by using a parameter setting in the universal principle.

The domain of CV-string is the syllable though the metrical unit is the mora. Thus both the mora and the syllable are relevant units in Japanese phonology. The motivation for the concept of the mora was proven as a consequence of analyzing sequences of nasal /n/ and diphthongs in this paper. Yoshida (1990: 334) pointed out that " ...if a given string cannot be analyzed as forming a single syllable within a theory of a syllable structure then the same theory should be

responsible for explicitly indicating the syllable boundary." I therefore take his claim for the mora parameter in the subjects' perspective of this language game. This also refers to Skaer's claim of "Constraint Theory", which builds minimal metrical units (morae or syllables) in the same theory (see Skaer 1994).

The theoretical questions discussed include: Is it the case that the subjects are initially sensitive to any rhythmic unit? Type B in medial nasal /n/ such as /rimbɯgobo/ showed some sensitivity, while at the same time using the English template treating /rim/ for /ribimbɯgobo/ "apple" as part of a syllable, but not a mora. They accepted Japanese as mora-based in most cases, as shown in the previous section. More specifically, they treated segments such as nasal /n/ and diphthongs as extra-moraic. They used some kind of universal unit of representation, from which they specified the characteristics of the unit of their native language, as the Type C syllable-based nasals. Their native language syllable template determined the way they perceived these units in Japanese at the interlanguage level. If speakers of different language backgrounds control timing differently, language-specific timing rules are needed. These findings are also important from the viewpoint of linguistic theory, such as the fact that certain features of Japanese timing organization for CVCV are governed by "universal rules," as claimed by Chomsky and Halle (1968: 295). Universal models, however, will not account for the entire picture of Japanese timing structure as presented in the previous section.

The structure required for this game is again neither a syllable nor a segment, but a mora. Only the moraic system can consistently explain the way in which the game is processed by native Japanese speakers. The unit should be understood as a mora associated with a nucleus and an onset if there is one. Japanese requires two hierarchical levels of language processing, first the segment and second the word. The subjects clearly identified the need for language-specific implementation rules for speech timing as well as speech production. The following issues were examined in the data: (1) the elasticity of segment productions and (2) the similarity in word productions among words with the same number of morae but with different segmental compositions: /ari/ 'ants' (two mora and one syllable) vs /kame/ 'turtle' (two mora and two syllable).

Under the approach of metrical theory, epenthesis in Japanese is simply the insertion of an empty vowel slot whose features are filled in by the general redundancy rules of this language: a strict CV language. As the rules have the potential to apply in each component of phonology, it is predicted that the epenthetic vowel will be the same regardless of whether insertion takes place in the language game or the NL phonology: it is still a CV-word. The results of this experiment indicate that, acoustically, morae are essential units operating at a certain point in Japanese grammars.

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Appendix 1: Game Words

Simple words		
Non-game word	**Gloss**	**Game Word**
e	picture	ebe
ki	tree	kibi
me	eye	mebe
momo	peach	mobomobo
ari	ants	abaribi
inɯ	dog	ibinɯbɯ
isɯ	chair	ibisɯbɯ
ɯma	horse	ɯbɯmaba
kame	turtle	kabamebe
kɯma	bear	kɯbɯmaba
neko	cat	nebekobo
atama	head	abatabamaba
ahirɯ	duck	abahibirɯbɯ
sakɯra	cherry blossoms	sabakɯbɯraba
tamago	egg	tabamabagobo
hasami	scissors	habasabamibi
nezɯmi	mouse	nebezɯbɯmibi
inošiši	wild boar	ibinobošibišibi
niwatori	chicken	nibiwabatoboribi
monosaši	ruler	mobonobosabašibi
Total 20		

Medial Nasals							
Non-game word	**Gloss**	**Game Word**	**A**	**B**	**C**	**D**	**Other**
riŋgo	apple	ribimbɯgo	7			2	1
tombo	dragon fly	tobombɯbobo	5		4		1
denwa	telephone	debembɯwaba	8				2
kiŋgyo	gold fish	kibimbɯgyobo	5	1			4
empitsɯ	pencil	ebembɯpibitsɯbɯ	5	3			2
sansɯɯ	math	sabambɯsɯbɯɯbɯ	9				1
nihoŋgo	Japanese	nibihobombɯgobo	8				2
ensokɯ	field trip	ebembɯsobokɯbɯ	5		1	1	3
oŋgakɯ	music	obombɯgabakɯbɯ	5			2	3
ninjin	carrot	nibimbɯjibimbɯ	6	3			1
reŋkon	lotus root	rebembɯkobombɯ	5			2	3
sensei	teacher	sebembɯsebeibi	10				
tampopo	dandelion	tabambɯpobopobo	6		2		2
sennɯki	bottle opener	sebembɯnɯbɯkibi	7				3
entotsɯ	chimney	ebembɯtobotsɯbɯ	7				3
šiŋgoɯ	traffic lights	šibimbɯgobobɯbɯ	7			1	2
sempɯɯki	fun	sebembɯpɯbɯɯbɯkibi	5				5
sentakɯki	washing machine	sebembɯtabakɯbɯkibi	7				3
šiŋkansen	Shinkansen	šibimbɯkabambɯsebembɯ	5		2		3

Medial Nasals							
Non-game word	**Gloss**	**Game Word**	**A**	**B**	**C**	**D**	**Other**
onnanoko	girl	obombɯnabanobokobo	5			1	4
konničiwa	hello	kobombɯnibičibiwaba	8				2
saŋko	three (number for things)	sabambɯkobo	2	1	3	2	
yoŋko	four (objects)	yobombɯkobo	6			2	2
sambiki	three (animals)	sabambɯbibikibi	7		3		
yoNhiki	four (animals)	yobombɯhibikibi	5		2		3
sambon	three (long objects)	sabambɯbobombɯ	9				1
yoNhon	four (long objects)	yobombɯhobombɯ	5		2		3
sammai	three (paper)	sabambɯmabaibi	9				1
yommai	four (paper)	yobombɯmabaibi	2	1	3		4
panda	panda	pabambɯdaba	10				
inči	inch	ibimbɯčIbi	4	2	2		2
rampɯ	ramp	rabambɯpɯbɯ	5	2			3
torampɯ	trump	toborabambɯpɯbɯ	9				1
rondon	London	robombɯdobombɯ	8				2
Total 34							

Final Nasals						
Non-game word	**Gloss**	**Game Word**	**A**	**B**	**C**	**Other**
hon	book	hobombɯ	9		1	
kirin	giraffe	kibirmbinbɯ	10			
mikan	tangerine	mibikabambɯ	10			
kaban	bag	kababababambɯ	10			
yakan	kettle	yabakabambɯ	10			
šašin	picture	šabašibimbɯ	10			
sannin	three (people)	sabambɯnibimbɯ	10			
sanbon	three (long objects)	sabambɯbobombɯ	9		1	
yonhon	four (long objects)	yobombɯhobombɯ	8		2	
roppon	six (long objects)	roboppobombɯ	9			1
gonin	five (people)	gobonibimbɯ	7		1	2
sekken	soap	sebekkebembɯ	10			
ninjin	carrot	nibimbɯjibimbɯ	10			
šinkansen	Shinkansen (bullet train)	šibimbɯkabambɯsebembɯ	9		1	
ohirɯgohan	lunch	obohibirɯbɯgobohabambɯ	10			
yasɯmijikan	recess	yabasɯbɯmibijibikabambɯ	10			
otoosan	father	obotobosabambɯ	8		2	
okaasan	mother	obokabasabambɯ	7		2	1
ojiisan	grandfather	obojibisabambɯ	10			

Final Nasals						
Non-game word	**Gloss**	**Game Word**	**A**	**B**	**C**	**Other**
ojisan	uncle	obojibisabambɯ	10			
obaasan	grandmother	obobabasabambɯ	8		1	1
obasan	aunt	obobabasabambɯ	10			
oniisan	brother	obonibisabambɯ	9			1
oneesan	sister	obonebesabambɯ	10			
pan	bread	pabambɯ	10			
raion	lion	rabaibiobombɯ	8			2
raamen	noodle	rabamebembɯ	10			
rondon	London	robombɯdobombɯ	7		2	1
Total 28						

Diphthongs							
Non-game word	**Gloss**	**Game Word**	**A**	**B**	**C**	**D**	**Other**
saikoro	dice	sabaibikoborobo	7	2			1
bowši	ball	bobowbwšibi	8	1			1
bɯdoɯ	grape	bɯbɯdobowbɯ	8				2
tokei	clock	tobokebeibi	10				
šimaɯma	zebra	šibimabaɯbɯmaba	5			2	3
reizoɯko	refrigerator	rebeibizobowbɯkobo	2	3			5
omoi	heavy	obomoboibi	7			2	1
karɯi	light	kabarɯbɯibi	7				3
sɯika	water melon	sɯbɯibikaba	7			2	1
rajio	radio	rabajibiobo	10				
naifɯ	knife	nabaibifɯbɯ	10				
piano	piano	pibiabanobo	10				
taorɯ	towel	tabaoborɯbɯ	7	3			
raion	lion	rabaibiobombɯ	9			1	
taɯn	town	tabaɯbɯmbɯ	6			3	1
gaɯn	gown	gabaɯbɯmbɯ	5			3	2
paɯndo	pound	pabaɯbɯmbɯdobo	3	1	1	1	4
Total 17							

Geminates		
Non-game word	**Gloss**	**Game Word**
rappa	trumpet	rabappaba
ippiki	one (animals)	ibippibikibi
roppiki	six (animals)	roboppibikibi
roppon	six (long objects)	roboppobonbɯ
šippo	tail	šibippobo
hoppeta	cheek	hoboppebetaba
roppyakɯ	six hundreds	roboppyabakɯbɯ
kippɯ	ticket	kibippɯbɯ
teppen	top	tebeppebenbɯ
happa	leaf	habappaba
nippon	Japan	nibippobombɯ
ippai	many	ibippabaibi
kitte	stamp	kibittebe
mittɯ	three (number for things)	mibittɯbɯ
čotto	a little	čobottobo
sekken	soap	sebekkebembɯ
ikko	one (number for things)	ibikkobo
rokko	six (number for things)	robokkobo
gakkoo	school	gabakkobo
gakki	instrument	gabakkibi
bikkɯri	surprise	bibikkɯbɯribi
Total 21		

Long Vowels		
Non-game word	**Gloss**	**Game Word**
ooi	many	oboibi
ookii	big	obokibi
čiisai	small	čibisabaibi
koori	ice	koboribi
tooi	far	toboibi
jɯɯkɯ	nineteen	jɯbɯkɯbɯ
taiiku	gym	tabaibikɯbɯ
iie	no	ibiebe
ɯrešii	happy	ɯbɯrebešibi
kanašii	sad	kabanabašibi
nooto	notebook	nobotobo
boorɯ	ball	boborɯbɯ
koohii	coffee	kobohibi
piinattɯ	peanut	pibinabattɯbɯ
otoosan	father	obotobosabambɯ
okaasan	mother	obokabasabambɯ
ojiisan	grandfather	obojibisabambɯ
obaasan	grandmother	obobabasabambɯ
oniisan	brother	obonibisabambɯ
oneesan	sister	obonebesabambɯ
Total 20		

Although originally part of the stimulus materials, the geminates and long vowels were excluded from the data results as they proved to be especially problematic.

Appendix 2: Speech Errors

Metathesis	**Gloss**	**Game Words**	**Errors**
karɯi	light	kabarɯbɯibi	kabaibirɯbɯ
inči	inch	ibimbɯčibi	ibičibinɯ
riŋgo	apple	ribimbɯgobo	ribigobombɯ
taorɯ	towel	tabaoborɯbɯ	tabarɯbɯobo
Deletion	**Gloss**	**Game Words**	**Errors**
nippon	Japan	nibipobombɯ	nibipobo
raion	lion	labaibiobombɯ	labaibiobo
šiŋgoɯ	traffic lights	šibimbɯgobowbɯ	šibimbɯgobo
ippai	many	ibipabaibi	ibipaba
Others	**Gloss**	**Game Words**	**Errors**
gonin	five (number for people)	gobonibimbɯ	gobonibiimbi
gakkoo	school	gabakobo	gabakobɯmbɯ
rappa	trumpet	rabapaba	rabatsubaɯbapaba
ippai	many	ibipabaibi	ibipaaibi
hoppeta	cheek	hobopebetaba	hobopebetabaaba

THE DERIVATION OF A SONORITY HIERARCHY FROM THE SYLLABLE CONTACT LAW (SCL) AND THE PRODUCTIVITY OF THE SCL IN AMERICAN ENGLISH[1]

Nikoleta Dineen and Daiva Miller

"Why do we say *razzle-dazzle* instead of *dazzle-razzle*?" Steven Pinker asks on p. 170 of his best selling book, ***The Language Instinct*** (1994). "Why *super-duper, helter-skelter, harum-scarum, hocus-pocus, willy-nilly, hully-gully, roly-poly, holy moly, herky-jerky, walkie-talkie, namby-pamby, mumbo-jumbo, loosey-goosey, wing-ding, wham-bam, hobnob, razzamatazz,* and *rub-a-dub-dub*? I thought you'd never ask. Consonants differ in 'obstruency'—
the degree to which they impede the flow of air, ranging from merely making it resonate, to forcing it noisily past an obstruction, to stopping it up altogether. The word beginning with the less obstruent consonant always comes before the word beginning with the more obstruent consonant. Why ask why?"

INTRODUCTION

As we try to answer Pinker's question, we arrive at an alternative approach to a phonological analysis of *razzle-dazzle* and other similar compounds. Pinker suggests that in these compounds, the word with the less obstruent initial consonant is followed by a word with a more obstruent initial consonant. However, there seem to be degrees of obstruency—and of sonority, its opposite as we understand it,—which operate in a place not addressed by Pinker, namely, the syllable contact between adjacent constituents of these compounds. (We will henceforth refer to words such as *razzle-dazzle* as *razzle-dazzle-isms*.[2] In order to maintain consistency with our sources, we will also adopt the antonymous term sonority in place of obstruency.)

Independent of Pinker, we propose that the order of the constituents within the razzle-dazzle-ism depends on the well-formedness of the syllable contact based on the Syllable Contact Law (Hooper 1976) which we will explain after a discussion of sonority in the next section. We will argue that adopting an accurate sonority hierarchy enables one to predict the preferred order of the components of any razzle-dazzle-ism. Conversely, analysis of the preferred order of words in razzle-dazzle-isms is a useful tool in deriving a sonority hierarchy ranking for phonological segments.

To demonstrate our claim, we conducted a study with newly formed razzle-dazzle-isms. The study will be explained in the body of our paper which is divided into four sections. In section one, we will give some theoretical background. We will provide a brief overview of sonority, define the Syllable Contact Law (SCL), and list several versions of the Sonority Sequencing Hierarchy (SSH). Then we will explain our hypothesis and propose a sonority

[1] Thanks to Kerry Manion for welcoming us into her kindergarten class at St. James Elementary School, Falls Church Virginia, and to all the "kids" for telling us what razzle-dazzle-isms they liked best. We are indebted to all our subjects who took time from their busy schedules to be our "guinea pigs." We are grateful also to our friends and colleagues far and near who provided and/or helped us to transcribe and translate foreign language razzle-dazzle-ism examples: Majeed Abu Nimer, Mohanad Al Shaikh, Arash Afshar, Kanae Aoki, MaryJo Archibold, Balazs Barborik, Giedra M. Campbell, Csaba, Luz Echeverri, David Fisher, Carlos Gancedo, Miwako Hisagi, Carl Jacobsen, Jin Mann Joo, Heike Kurtz, SooJung Lee, Teresa Bandrowska Maloney, Leena Maattanen, Asuman Mutlu, Qi Pan, Irena and Vytautas Paulauskas, Yihuan Peng, Louis Remillard, Beate Riemer, Antonina Rodgers, Serge A. Shpilkin, Marija and Jonas Simonis, Terry Stryer, Kaoru Suzuki, Jeanne Trott, Lynn Crawford Trott, Yeon Sun Woo, John Woodgate, Santiago and Elena Valente Zegarra.

[2] Some authors may suggest alternative terms, e.g. Crystal (1987) calls ". . . a type of compund in which both elements are the same or only slightly different, eg. goody-goody, wishy washy, teeny weeny. . . " *reduplication*. We feel that the term *reduplication* is too general and refers to many linguistic phenomena. We prefer to coin a new term, *razzle-dazzle-ism*, which refers to a type of compOund in which the first component is reduplicated several times with a different onset and in which the components alone are meaningless.

hierarchy for American English (AE)[3] . In section two we will describe our subjects and explain our methodology. In section three we will discuss our results. Finally, in section four we will summarize our findings.

THEORETICAL BACKGROUND

The term "sonority" has been explained many ways. Trask's *Dictionary of Phonetics and Phonology* (1996) gives this definition:

> A particular sort of prominence associated with a segment by virtue of the way that segment is articulated. Sonority is an elusive notion. One approach holds that it is the output of periodic acoustic energy associated with the production of a particular segment, and hence of its intrinsic loudness: the greater such output, the greater the sonority of the sound. Others would associate sonority chiefly with the degree of aperture of the vocal tract.(p327).

Ladefoged (1975) defines sonority in his discussion of a sonority principle: The sonority of a segment is " its loudness relative to that of other sounds with the same length, stress and pitch." Christman and Depaolis (1996) write:

... sonority has been characterized as an abstract aspect of language knowledge which, like the phoneme and syllable, has provided descriptive utility as a language construct, but for which a set of invariant physical parameters has not been found.

Crystal (1987) implies in his *Cambridge Encyclopedia of Language*[4] that sonority is tied to acoustical properties. The following table (1), which Crystal attributes to D.B. Frye, suggests the relative decibel values of English segments.

(1)

ɔ: 29	e23	l 20	ʒ 13	ð 10
ɒ 28	i: 22	ʃ 19	z 12	b 8
ɑ: 26	u: 22	ŋ 18	s 12	d 8
ʌ 26	ɪ 22	m 17	t 11	p 7
ɜ: 25	w 21	tʃ 16	g 11	f 7
a 24	r 20	n 15	k 11	θ 0
ʊ 24	j 20	dʒ 13	v 10	

For us, the notion of sonority is tied to the concept of *syllable*. The more sonorous the segment, the more vowel-like it is, and the more likely it is to be a syllable peak. Keeping in mind the varied definitions of sonority, note that its existence is generally accepted and called upon in one way or another to justify a number of "principles" and "laws" relating to the well-formedness of syllables, to syllabification, and to other phonological phenomena. One of these is the Syllable Contact Law (SCL).
Vennemann, (1988) defined the SCL in this way:

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[3] Although we accept the possibility that all human language segments can be ranked by sonority, we lack the means to test on such a grand scale. Hence, our domain: American English.
[4] See p.134 for discussion on amplitude and intensity and p. 164 for syllables.

> A syllable contact A$B is the more preferred, the less the Consonantal Strength of the offset A and the greater the Consonantal Strength of the onset B; more precisely—the greater the characteristic difference CS(B)—CS(A) between the Consonantal Strength of B and that of A.

More simply explained by Hooper (1976) and reported by Clements (1990), the SCL may be stated as in (2), where C = segment and $ = the contact between syllables.

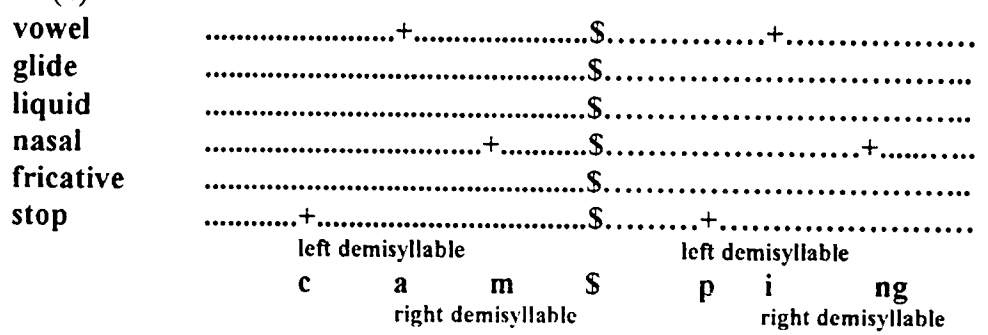
(2) **In any sequence C_a $ C_b there is a preference for C_a to exceed C_b in sonority.**

To illustrate with the word *carpet* ([kaːɹ] $ [pɛt]), [ɹ] is more sonorous than [p]. This falls out from the Dispersion Principle (3) identified and named by Clements (1992).

(3) **The Dispersion Principle:**
a. the preferred initial demisyllable[5] maximizes sonority dispersion
b. the preferred final demisyllable minimizes sonority dispersion.

Illustrating with a monosyllabic word, *bean* [b i n], the initial demisyllable is [bi] the final demisyllable is [in]. The initial demisyllable rises from a stop to a vowel (a maximal dispersion or difference); the final demisyllable falls from a vowel to a nasal (a lesser dispersion). When we apply the Dispersion Principle to the Syllable Contact Law, we see that the rise in the demisyllable (onset and nucleus) on the right should be steeper than the fall of the demisyllable (nucleus and coda) on the left (Weinberger 1998). An illustration of the word *camping* gives us the following chart.

(4)



In order to determine what the optimal syllable contact is, we must agree upon the relative sonority of individual segments. There are numerous theories pertaining to the ranking of segments in the order of their perceived sonority. A term for this order, widely accepted in the literature, is *sonority hierarchy*. Trask (1996) says: " [sonority hierarchy is] a putative ranking

[5] The term demisyllable was first introduced as a phonetic unit in the work of Fujimura et al. (1977). Clements (1992) explains demisyllables as "syllable halves—overlapping portions of a syllable sharing the [syllable] peak."

of segment types in order of their intrinsic sonority. Views differ, but a common ranking is (from least to most sonorous) **oral stops < fricatives < nasals < liquids < glides < vowels.** Some would add further elaborations, such as voiceless plosives< voiced plosives and high vowels< low vowels."

Clements (1990), proposes a simpler hierarchy:

(5) **obstruents<nasals<liquids<glides<vowels.**

He further argues that this was the only ranking likely to hold for Universal Grammar, but allows that individual languages which are more complex might subdivide into narrower categories or invert the rank of certain segments. In describing how he arrived at his preferred hierarchy, Clements notes that as early as 1865, W.D. Whitney suggested a notion of sonority ranking. Clements also recounts that Sievers (1881), Jespersen (1904), Saussure (1916), and Grammont (1933) attempted to use such rankings to explain recurrent patterns of syllable structure. Sievers assigned liquids a sonority ranking above that of nasals based on the fact that syllables such as *mla, mra, alm, arm* were relatively frequent in languages while *lma, rma, aml, amr* were not. Sievers, as cited by Trask (1996) also stated that a consonant's proximity to the "sonant"[6] determined its sonority ranking. Jespersen (in Clements 1990) restated Sievers' claim in a way that is familiar to phonology students today: "In every group of sounds there are as many syllables as there are relative peaks of sonority." Clements[7] tells us that Jespersen (1904) presented the following sonority scale (from least to most sonorous):

(6)
1.(a) voiceless stops, (b) voiceless fricatives
2.voiced stops
3. voiced fricatives
4. (a) voiced nasals, (b) voiced laterals
5. voiced r-sounds
6. voiced high vowels
7. voiced mid vowels
8. voiced low vowels

In spite of such alternative proposals, Clements claims that his simpler hierarchy should hold and proposes the following :

(7) **Sonority Sequencing Principle:**
Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted.

Bell and Hooper (1978) argue that in sonority ranking, one "cannot operate successfully with general categories such as obstruent, nasal, liquid and glide without knowing more of the details of the phonetic realization and phonological properties of the particular segment in the particular language. For instance, all *r*-like sounds cannot be placed at the same point on the scale since there are so many varieties of r . . . "[8]

---

[6] A sonant is any voiced sound capable of acting as a syllabic nucleus: a vowel, liquid, or nasal.
[7] 1990: p. 285, figure1.
[8] p. 12.

sonority is concerned, but rather something which is more sonorous than [n]. To test this we created *Hukk-Nukk*. *Hillung-Nillung* was added to test not only whether [h] is more sonorous than [n], but also to determine how strong the sonority constraint is against the Obligatory Contour Principle (OCP)[13] which is believed to discourage or disfavor the occurrence of consecutive identical segments and even, in many cases, consecutive segments which share certain features, (Trask 1996). Under the OCP the contact [ʊŋ-nɪ] of *Hillung-Nillung* may be treated as a violation because of the two consecutive nasals. If the OCP proves stronger than sonority, subjects should choose the reverse razzle-dazzle-ism, *Nillung-Hillung* with a non-optimal contact, but in conformity with the OCP. Finally, we claim that there is no difference or only marginal difference in sonority within the class of nasals. Therefore, we constructed the razzle-dazzle-ism *Nillus-Millus* and its reversal *Millus- Nillus* which, if our claim is correct, should be chosen randomly by our subjects. In other words, there is an equal probability for choosing either of these two razzle-dazzle-isms.

In Task II, subjects were asked to provide onsets of their own choosing to complete a number of razzle-dazzle-isms with missing onsets (11). We expected that subjects would select onsets in agreement with the SCL.

(11)	heff-__eff	[hɛf-__ef]
	__idge-didge	[__ɪdʒ-dɪdʒ]
	__esh-nesh	[__ɛʃ-nɛʃ]
	__ubb-fubb	[__ʌb-fʌb]
	lom-__om	[lɑm-__ɑm]
	masp-__asp	[mæsp-__æsp]
	__ult-vult	[__ʌlt-vʌlt]
	shevvin-__evvin	[ʃɛvɪn-ɛvɪn]

In each case we tried to create words which sounded plausibly English but which did not immediately suggest real words. We also placed the segments in question next to lax vowels[14] so as not to complicate the perception problem. In order to get a base, non-analytical response from our subjects, we complicated the the task by including not only one-syllabic razzle-dazzle-isms, but also a few two-syllabic examples. Finally, because we included children in our study, we decided that pictures might be helpful in focusing their attention while we conducted the study, so we selected eight pleasant pictures to accompany the razzle-dazzle-isms in Task I (see Appendix C.) The test instrument is included in Appendix B.

Our hypothesis was that subjects would overwhelmingly choose the form which was better-formed when analyzed at the contact between the component words. In other words, if they found fricatives to be more sonorous than stops they would choose e.g. *Fapp-Dapp* ahead of *Dapp-Fapp*, since, according to the SCL, the contact [æp-dæ] is preferred over the contact [æp-fæ] because there is a steeper rise in [dæ] than in [fæ].

[13] For more information on the OCP see Trask (1996.)
[14] Based on Fowler, Treiman, and Gross (1993).

(12)

vowel	.....+.....	$	.....+.....		
glide	.....	$	.....		
liquid	.....	$	.....		
nasal	.....	$	.....		
fricative	.....	$	.....+.....		
stop	.....+.....	$	.....		
	right demisyllable			**left demisyllable**	
	æ	p	$	f	æ

Every pair of razzle-dazzle-isms (and every razzle-dazzle-ism of Task II) was analyzed according to this model.

Data collected from both groups, children and adults, were independently transcribed by two transcribers, the authors of the study. In fact, since the target pronunciations were introduced earlier in our study, we have transcribed only the deviant pronunciations, e.g. *ka[və]-da[və]* for *Kaddub-Daddub*. (See Appendix A.)

RESULTS

All the data are divided into two major sections: adult data and child data. Adult data are further subdivided into *perception data*, *phonetic output data*, *total phonetic output data*, and *production data*. Child data consist of only *phonetic output data* and *total phonetic output data.*

The adult data for Task I, where subjects circled the razzle-dazzle-isms they liked better after hearing a tape with the razzle-dazzle-isms read by a model speaker, are called *perception data.* They are shown in tables 1.1 and 1.2 in Appendix A. There is no such table for children because the children did not circle their own selections; instead, we circled the choices we perceived them to be making based on their phonetic output.

The *phonetic output* of the subjects (some subjects repeated the razzle-dazzle-isms differently from the input offered by the model speaker) is represented in tables 2.1a, 2.2a, 2.1b, and 2.2b in Appendix A. This type of data was recorded for both children and adults.

In Task II on the adult test instrument, subjects were asked to supply a consonant onset that was missing in one of the component words of each razzle-dazzle-ism. This task was designed to give subjects an opportunity to respond actively to a further test of our proposed sonority hierarchy and the productivity of the SCL. This *production data* is presented in table 3 in Appendix A. We did not collect similar data from the children for practical and methodological reasons. Child subjects were not expected to understand the concept of consonant sounds, nor to identify sounds with graphemes.

Total phonetic output—every form that our subjects produced can be found in tables 4a (adults) and 4b (children) of Appendix A.

Children. 1. Fricatives proved to be slightly more sonorous than stops (55%).

2. 63% of the children perceived glides to be more sonorous than vowels. They also found glides more sonorous than liquids. This suggests that glides not only outrank the liquids as expected, but may even outrank some vowels (not expected.)

3. Children found voiceless fricatives more sonorous than voiced fricatives by 94%. This difference suggests that at least for the two particular consonants [f] and [v], the sonority ranking is reversed from our proposed hierarchy. However, when we considered the output of four of our child subjects, we found (based on their output) that they did not differentiate between voiced and voiceless fricatives. This may simply show that they have not yet mastered the voicing contrast.[15] We are not prepared to argue this strongly, but think it might be a productive area for further research.

4. Children treat voiceless stops as more sonorous than voiced stops, at least where [d] and [k] are concerned. Only 28% of children chose *Daddub-Kaddub* over *Kaddub-Daddub*.

5. Children seem to find [h] more sonorous than [n] (57%) in our combined analysis of all the subjects' versions of *Hukk-Nukk* and *Hillung-Nillung*. This suggests that the sonority holds even against the OCP.

6. Finally, children's treatment of [m] and [n] appears to be that [m] (21%) is noticeably less sonorous than [n] (79%).

Based on these results, we have modified our sonority hierarchy as follows:

(13)

vowels
glides
liquids
[h]
nasal [n]
nasal [m]
fricatives
stops

The overall success rate of children, which we identify with the rate for productivity of the SCL, turned out to be 54%.

Adults. 1. Adults treated fricatives as more sonorous than stops 56% of the time, which somewhat strengthens our argument that fricatives and stops should be ranked separately on the sonority scale.

2. Contrary to the children, adults showed very strong preference (76%) for the razzle-dazzle-ism *Anzy-Wanzy* , which supports our view that glides are less sonorous than vowels.

[15] Ingram (1978) treats the need to distinguish between phonetic and phonological development, stating that some children do not acquire certain fricatives phonetically even by age six.

3. Adults were almost as strong as children in their treatment of glides as more sonorous than liquids (71%).This, and their treatment of glides versus vowels, strongly confirms our proposal that vowels are charted at the top of the sonority hierarchy, followed by glides which are followed by liquids.

4. Surprisingly, 77% of the adults treated [v] as less sonorous than [f], which again suggests a need to adjust our proposed sonority hierarchy so, at least, in the case of [v] and [f], the voiceless segment is higher on. the scale.

5. The combined analyses for all the variations of *Kaddub-Daddub* and *Daddub-Kaddub* show that only 39% of adults treated the voiced stop [d] as more sonorous that [k], similar to the fricative situation. Perhaps, more research in differentiating individual segments needs to be done before this issue can be resolved. At present, we simply suggest that voicing contrast not be included in ranking most obstruents on the sonority scale.

6. The results for [h] versus [n] are even stronger with adults (73%) than with children in showing that [h] ranks higher on the sonority scale than [n], although this study does not show exactly how much higher.

7. Finally, adults found significantly less sonority difference between various nasals than children (56% for [m] and 44% for [n]), which suggests that all nasals may share the same degree in sonority (at least in American English).

Based on these results, we have further modified our sonority hierarchy as follows:

(14)

vowels
glides
liquids
[h]
nasals
fricatives
stops

The overall productivity of the SCL for adults based on Task I phonetic output data turned out to be 61%.

Regarding the production table, i.e, Task II, an analysis shows subjects' performance to be in strong (69%) conformity with our sonority hypothesis. Perhaps subjects made selections conforming to the SCL because they had the entire AE inventory of segments from which to choose. For the same reason, fine distinctions, such as we built into Task I of our test instrument (distinctions like voicing, closely ranking segments, etc.) only rarely came into play in Task II. These results convince us, nevertheless, that the SCL is productive in today's speakers of AE.

Table 1.1

PERCEPTION DATA—ADULTS
(only hypothesis-conforming reduplications charted)

word/subject	1 F/14	2 F/45	3 M/46	4 F/44	5 F/83	6 F/57	7 F/56	8 F/52	9 M/52	10 F/52	11 F/45	12 M/41	13 M/34	14 F/35	15 M/30	16 F/41	17 F/28	18 M/34	%
Fapp-Dapp	+	+	+	-	+	+	-	-	+	+	+	-	-	+	+	-	-	-	10/18 56
Anzy-Wanzy	+	-	+	-	-	+	+	-	+	+	+	+	+	+	-	+	+	+	13/18 72
Yeao-Laeo	+	-	+	+	+	+	+	+	+	-	+	+	-	-	-	-	+	-	11/18 61
V'luzz-F'luzz	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	3/18 17
Daddub-Kaddub	+	+	-	+	-	-	-	-	+	+	-	-	+	+	-	-	-	-	7/18 39
Hukk-Nukk	+	+	-	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	15/18 83
Hillung-Nillung	+	-	+	-	-	+	-	-	-	+	+	+	-	-	+	+	+	+	10/18 56
%	6/7 86	3/7 43	4/7 57	4/7 57	3/7 43	5/7 71	3/7 43	3/7 43	5/7 71	4/7 57	5/7 71	5/7 71	3/7 43	4/7 57	2/7 29	3/7 43	4/7 57	3/7 43	55/55

Table 1.2

PERCEPTION DATA—ADULTS
(both reduplications equally well-formed)

word/subject	1 F/14	2 F/45	3 M/46	4 F/44	5 F/8	6 F/57	7 F/56	8 F/52	9 M/52	10 F/52	11 F/45	12 M/41	13 M/34	14 F/35	15 M/30	16 F/41	17 F/28	18 M/34	%
millus-nillus	-	+	+	-	-	+	+	-	-	-	-	+	+	+	+	+	-	+	10/18 56
nillus-millus	+	-	-	+	+	-	-	+	+	+	+	-	-	-	-	-	+	-	8/18 44
%	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	50/50

Legend: "+"—chosen
"-"—not chosen
"n/a"—did not occur

"F"—female
"M"—male
"F/45"—female; 45 years

Table 2.1a

PHONETIC OUTPUT—ADULTS
(only hypothesis-conforming words charted)

word/subject	1 F/18	2 F/45	3 M/46	4 F/44	5 F/83	6 F/57	7 F/56	8 F/52	9 M/52	10 F/52	11 F/45	12 M/41	13 M/34	14 F/31	15 M/30	16 F/41	17 F/28	18 M/34	%
Fapp-Dapp	+	+	+	-	+	+	-	-	+	+	+	-	-	+	+	-	-	-	10/18 56
Anzy-Wanzy	+	-	+	-	-	+	+	-	+	+	+	+	+	+	n/a	+	+	+	13/17 76
Yeao-Leeo	+	-	+	+	+	+	+	+	+	-	+	+	-	-	n/a	+	+	-	12/17 71
V'luzz-F'luzz	-	-	n/a	+	-	n/a	n/a	+	-	-	-	+	-	n/a	-	-	-	n/a	3/13 23
Daddub-Kaddub	+	+	-	+	n/a	n/a	-	n/a	n/a	+	-	-	+	n/a	-	-	-	-	5/13 39
Hukk-Nukk	+	+	-	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	15/18 83
Hillung-Nillung	+	-	+	-	n/a	+	-	-	n/a	+	+	+	-	n/a	+	+	n/a	+	9/14 64
F'lu-[sf]uzz	n/a	n/a	-	n/a	n/a	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	0/4 0
Daddu[m]-Kaddu[m]	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
Hillung-[m]illung	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
Daddub-Kaddub	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
Daddub-Kaddub	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
Daddub-Kaddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1/1 100

Hiltong-Nillung	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
V'luzz-[v]'luzz	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0/1 0
Dadd[ə]-Kadd[ə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1/1 100
Hill[ə]-Nill[ə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0/1 0
Wanzy-[?]anzy	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1/1 100
Yeso-L[j]eso	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0/1 0
Nillung-Hillung	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	0/1 0
%	6/7 86	3/7 43	4/7 57	4/7 57	3/7 43	5/7 71	3/7 43	3/7 43	5/7 71	4/7 57	5/7 71	5/7 71	3/7 43	4/7 57	3/7 43	4/7 57	3/7 43	3/7 43	56/–

Table 2.2a

PHONETIC OUTPUT—ADULTS
(both reduplications equally well-formed)

word/subject	1 F/14	2 F/45	3 M/46	4 F/44	5 F/83	6 F/57	7 F/56	8 F/52	9 M/52	10 F/52	11 F/45	12 M/41	13 M/24	14 F/35	15 M/30	16 F/41	17 F/28	18 M/34	%
Millus-Nillus	-	+	+	-	-	+	+	-	-	-	-	+	+	+	+	+	-	+	10/18 56
Nillus-Millus	+	-	-	+	+	-	-	+	+	+	+	-	-	-	-	-	+	-	8/18 44
%	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	50/50

Legend: "+"—chosen
"-"—not chosen
"n/a"—did not occur

"F"—female
"M"—male
"F/45"—female; 45 years

Table 2.1b

PHONETIC OUTPUT—CHILDREN
(only hypothesis-conforming reduplications charted)

word/subject	1 F/5,6	2 F/5,8	3 M/5,8	4 M/5,9	5 F/5,9	6 F/5,9	7 F/5,10	8 F/5,10	9 M/5,11	10 F/5,11	11 F/6,0	12 F/6,0	13 F/6,1	14 F/6,2	15 F/6,4	16 M/6,5	17 M/6,6	18 F/6,6	19 M/6,7	20 M/6,9	%
Fapp-Dapp	+	+	-	-	-	+	-	-	+	-	+	+	+	+	-	+	+	-	-	+	11/20 55
Anzy-Wanzy	+	-	-	+	n/a	-	-	-	-	-	+	-	+	+	-	+	-	-	+	-	7/19 37
Yeso-Laco	+	+	-	+	+	-	+	-	+	+	-	+	+	+	+	n/a	-	+	+	+	14/19 74
V'luzz-F'luzz	-	-	-	-	-	-	n/a	n/a	+	-	-	-	n/a	-	-	-	-	n/a	-	-	1/16 6
Daddub-Kaddub	+	+	-	-	+	+	-	-	-	-	+	-	-	-	-	n/a	n/a	-	-	-	5/18 28
Hukk-Nukk	-	+	-	-	+	-	-	-	-	-	+	-	-	+	+	-	+	+	+	-	8/20 40
Hillung-Nillung	+	+	+	+	-	+	+	+	+	+	-	n/a	-	+	+	+	+	+	-	-	14/19 74
wanzy-[ʔ]anzy	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1/1 100
da[vo]-[kavo]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
hillu[m]-nillu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1/1 100
kaddu[m]-daddub	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0/1 0
daddu[m]-kaddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	0/1 0
%	5/7 71	5/7 71	1/7 14	3/7 43	4/7 57	3/7 43	2/6 33	1/6 17	4/7 57	2/8 25	4/7 57	3/7 43	3/6 50	5/7 71	3/7 43	3/6 50	3/7 43	3/6 50	3/7 43	2/7 29	46/43

Table 2.2b

PHONETIC OUTPUT—CHILDREN
(both reduplications equally well-formed)

word/subject	1 F/5;6	2 F/5;8	3 M/5;8	4 M/5;9	5 F/5;9	6 F/5;9	7 F/5;10	8 F/5;10	9 M/5;11	10 F/5;11	11 F/6;0	12 F/6;0	13 F/5;11	14 F/6;2	15 F/6;4	16 M/6;5	17 M/6;6	18 F/6;6	19 M/6;7	20 M/6;9	%
Millus-Nillus	-	-	-	+	+	-	-	n/a	+	-	-	+	-	-	-	-	-	-	-	-	4/19 21
Nillus-Millus	+	+	+	-	-	+	+	n/a	-	+	+	..	+	+	+	+	+	+	+	+	15/19 79
[f]'luzz-f'luzz	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	-	n/a	n/a	0/3 0
f'luzz-[f]'luzz	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	+	n/a	n/a	3/3 100
m|lu[θʰ]-n|lu[θʰ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
n|lu[θʰ]-m|lu[θʰ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1/1 100
[f]'lu[ðʰ]-f'lu[ðʰ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0/1 0
f'lu[ðʰ]-[f]'lu[ðʰ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1/1 100
[w]eeo-yeeo	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0/1 0
yeeo-[w]eeo	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1/1 100
%	½ 50	½ 50	½ 50	½ 50	½ 50	½ 50	2/4 50	2/4 50	½ 50	½ 50	½ 50	½ 50	2/4 50	½ 50	½ 50	½ 50	½ 50	2/4 50	½ 50	½ 50	50/50

Legend: "+"—chosen
"-"—not chosen
"n/a"—did not occur
"F"—female
"M"—male
"F/5;6"—female; 5 years 6 months

Table 3

PRODUCTION DATA—ADULTS
(responses to task II)

word/subject	1 F/14	2 F/45	3 M/46	4 F/44	5 F/83	6 F/57	7 F/56	8 F/52	9 M/53	10 F/52	11 F/45	12 M/41	13 M/34	14 F/55	15 M/30	16 F/41	17 F/28	18 M/34	No. occur.
heff-[z]eff	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
heff-[ʤ]eff	n/a	+	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	+	n/a	n/a	n/a	4
heff-[n]eff	n/a	n/a	+	n/a	n/a	+	n/a	+	+	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5
heff-[b]eff	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
heff-[i]eff	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
heff-[w]eff	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	+	2
heff-[l]eff	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	n/a	2
heff-[d]eff	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	2
lom-[tʰ]om	+	+	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	+	n/a	n/a	+	n/a	n/a	n/a	3
lom-[b]om	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	3
lom-[f]om	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	2
lom-[m]om	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	2
lom-[kʰ]om	n/a	n/a	n/a	n/a	n/a	+	n/a	+	n/a	+	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	4
lom-[pʰ]om	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
lom-[d]om	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	1
lom-[l]om	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	1
[bɹ]idge-didge	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
[ɹ]idge-didge	n/a	+	+	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	+	n/a	+	n/a	n/a	5
[m]idge-didge	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	+	4
[b]idge-didge	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[f]idge-didge	n/a	n/a	n/a	n/a	n/a	+	+	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
[h]idge-didge	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	1
[j]idge-didge	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	1
[kʰ]idge-didge	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	1

sp-[tʰ]asp	+	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
masp-[l]asp	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
masp-[ɹ]asp	n/a	n/a	-	n/a	n/a	-	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	4
masp-[gɹ]asp	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
masp-[kʰ]asp	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	+	n/a	n/a	3
masp-[pʰ]asp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
masp-[kl]asp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
masp-[g]asp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	1
masp-[ŋ]asp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	1
masp-[w]asp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	2
[s]esh-nesh	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[m]esh-nesh	n/a	+	+	+	+	+	n/a	n/a	n/a	+	n/a	n/a	+	+	n/a	+	n/a	n/a	9
[ʃ]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[l]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	2
[ɾ]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[kʰ]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	-	n/a	1
[b]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	1
[ŋ]esh-nesh	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	1
[kʰ]ult-vult	-	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	-	n/a	-	-	n/a	n/a	n/a	6
[dʒ]ult-vult	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[ʃ]ult-vult	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[d]ult-vult	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[m]ult-vult	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	+	n/a	3
[v]ult-vult	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[b]ult-vult	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	2
[p]ult-vult	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[g]ult-vult	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[ŋ]ult-vult	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	1
[tʰ]ubb-fubb	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
[l]ubb-fubb	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	+	n/a	+	n/a	4
[d]ubb-fubb	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	-	3
[tʃ]ubb-fubb	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[b]ubb-fubb	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
[kʰ]ubb-fubb	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[ʃ]ubb-fubb	n/a	n/a	n/a	n/a	n/a	n/a	+	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2

[ɹ]ubb-fubb	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	1
[pʰ]ubb-fubb	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	1
[ɬk.ɹ]ubb-fubb	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	1
shevvin-[l]evvin	-	n/a	-	-	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	1
shevvin-[n]evvin	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	1
shevvin-[g]evvin	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2
shevvin-[b]evvin	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
shevvin-[kʰ]evvin	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
shevvin-[d]evvin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	+	+	n/a	n/a	4
shevvin-[m]evvin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
shevvin-[bl]evvin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	+	n/a	n/a	n/a	n/a	n/a	n/a	2
shevvin-[ʃm]evvin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	1
%	3/8 38	5/8 63	4/8 50	6/8 75	7/8 88	6/8 75	7/8 88	6/8 75	4/8 50	6/8 75	5/8 63	5/8 63	6/8 75	6/8 75	6/8 75	7/8 88	5/8 63	4/8 50	65/--

Legend: "+"—hypothesis-conforming choice
"-"—non-hypothesis-conforming choice
"n/a"—did not occur

"F"—female
"M"—male
"F/45"—female; 45 years

Table 4a

TOTAL PHONETIC OUTPUT—ADULTS
(conforming and non-conforming reduplications; the reduplications in bold are hypothesis-conforming)

word/subject	1 F/14	2 F/45	3 M/46	4 F/44	5 F/83	6 F/57	7 F/56	8 F/52	9 M/53	10 F/52	11 F/45	12 M/41	13 M/34	14 F/35	15 M/30	16 F/41	17 F/28	18 M/34	No. conf.
Dapp-Fapp	-	-	-	+	-	-	+	+	-	-	-	+	+	-	-	+	+	+	8
Fapp-Dapp	+	+	+	-	+	+	-	-	+	+	+	-	-	+	+	-	-	-	10
Millus-Nillus	-	+	+	-	-	+	+	-	-	-	-	+	+	+	+	+	-	+	10
Nillus-Millus	+	-	-	+	+	-	-	+	+	+	+	-	-	-	-	-	+	-	8
Anzy-Wanzy	+	-	+	-	_	+	+	-	+	+	+	+	+	+	n/a	+	+	+	13
Wanzy-Anzy	-	+	-	+	+	-	-	+	-	-	-	-	-	-	n/a	-	-	-	4
Laco-Yeao	-	+	-	-	-	-	-	-	-	+	-	-	+	+	n/a	-	-	+	5
Yeao-Laco	+	-	+	+	+	+	+	+	+	-	+	+	-	-	n/a	+	+	-	12
V'luzz-F'luzz	-	-	n/a	+	-	n/a	n/a	+	-	-	-	+	-	n/a	-	-	-	n/a	3
F'luzz-V'luzz	+	+	n/a	-	+	n/a	n/a	-	+	+	+	-	+	n/a	+	+	+	n/a	10
Kaddub-Daddub	-	-	+	-	n/a	n/a	+	n/a	n/a	-	+	+	-	n/a	+	+	+	+	8
Daddub-Kaddub	+	+	-	+	n/a	n/a	-	n/a	n/a	+	-	-	+	n/.a	-	-	-	-	5
Hukk-Nukk	+	+	-	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	15
Nukk-Hukk	-	-	+	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	3
Nillung-Hillung	-	+	-	+	n/a	-	+	+	n/a	-	-	-	+	n/a	-	-	n/a	-	3
Hillung-Nillung	+	-	+	-	n/a	+	-	-	n/a	+	+	+	-	n/a	+	+	n/a	+	9
V'lu-[sf]uzz	n/a	n/a	+	n/a	n/a	+	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	4
F'lu-[zv]uzz	n/a	n/a	-	n/a	n/a	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	0
Kaddu[m]-Daddu[m]	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Daddu[m]-Kaddu[m]	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
[m]illung-Hillung	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Hillung-[m]illung	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
Kaddu[m]-Daddu[m]	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Daddub-Kaddub	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
Kaddub-Da[bd]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1

Daddub-Kaddub	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
Kaddub-Daddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
Daddub-Kaddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Nill[ŋ]-Hill[ŋ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
Hillung-Nillung	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
V'luzz-[v]'luzz	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
F'luzz-V'luzz	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0
Kadd[ə]-Dadd[ə]	n/a	n/a	n.a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1
Dadd[ə]-Kadd[ə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0
Nill[ə]-Hill[ə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1
Hill[ə]-Nill[ə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1
[?]Anzy-Wanzy	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0
Wanzy-[?]anzy	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	0
Laeo-Yeao	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	1
Yeao-L[j]aeo	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	1
Nillung-Hillung	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	0
Hillu[g]-Nillu[g]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	0
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	1

Legend: "+"—chosen
"-" —not chosen
"n/a"—did not occur

"F"—female
"M"—male
"F/45"—female; 45 years

Table 4b

TOTAL PHONETIC OUTPUT—CHILDREN

(ocurrences of conforming and non-conforming reduplications; the reduplications in bold are hypothesis-conforming)

words/subject	1 F/5;6	2 F/5;8	3 M/5;8	4 M/5;9	5 F/5;9	6 F/5;9	7 F/5;10	8 F/5;10	9 M/5;11	10 F/5;11	11 F/6;0	12 F/6;0	13 F/6;1	14 F/6;2	15 F/6;4	16 M/6;5	17 M/6;6	18 F/6;9	19 M/6;9	20 M/6;9	No. ocurr
Dapp-Fapp	-	-	+	+	+	-	+	+	-	+	-	-	-	-	+	-	-	+	+	-	9
Fapp-Dapp	+	+	-	-	-	+	-	-	+	-	+	+	+	+	-	+	+	-	-	+	11
Millus-Nillus	-	-	-	+	+	-	-	n/a	+	-	-	+	-	-	-	-	-	-	-	-	4
Nillus-Millus	+	+	+	-	-	+	+	n/a	-	+	+	-	+	+	+	+	+	+	+	+	15
Anzy-Wanzy	+	-	-	+	n/a	-	-	-	-	-	+	-	+	+	-	+	-	-	+	-	7
Wanzy-Anzy	-	+	+	-	n/a	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	12
Leco-Yeao	-	-	+	-	-	+	-	+	-	-	+	-	-	-	-	n/a	+	-	-	-	5
Yeao-Leco	+	+	-	+	+	-	+	-	+	+	-	+	+	+	+	n/a	-	+	+	+	14
V'luzz-F'luzz	-	-	-	-	-	-	n/a	n/a	+	-	-	-	n/a	-	-	-	-	n/a	-	-	1
F'luzz-V'luzz	+	+	+	+	+	+	n/a	n/a	-	+	+	+	n/a	+	+	+	+	n/a	+	+	13
Kaddub-Daddub	-	-	+	+	-	-	+	+	+	+	-	+	+	+	+	n/a	n/a	+	+	+	13
Daddub-Kaddub	+	+	-	-	+	+	-	-	-	-	+	-	-	-	-	n/a	n/a	-	-	-	5
Hukk-Nukk	-	+	-	-	+	-	-	-	-	-	+	-	-	+	+	-	+	+	+	-	8
Nukk-Hukk	+	-	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	-	-	+	12
Nillung-Hillung	-	-	-	-	+	-	-	-	-	-	+	n/a	+	-	-	-	-	-	+	+	5
Hillung-Nillung	+	+	+	+	-	+	+	+	+	+	-	n/a	-	+	+	+	+	+	-	-	14
[ʔ]anzy-wanzy	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
wanzy-[ʔ]anzy	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[f]'luzz-f'luzz	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	-	n/a	n/a	0
f'luzz-[f]'luzz	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	+	n/a	n/a	3
mi[θ]u[θ]- a[θ]u[θ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
ni[θ]u[θ]- mi[θ]u[θ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[f]'lu[ð]-f'lu[ð]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0

rlu[ðʰ]-[l] 'lu[ðʰ]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
ka[və]-da[və]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
da[və]-[kavə]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
nillu[m]-hillung	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
hillu[m]-nillu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
[w]aeo-yeao	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0
yeao-[w]aeo	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1
kaddu[m]-daddub	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	n/a	0
daddub-kaddub	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	n/a	1
kaddu[m]-daddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a	n/a	1
daddu[m]-kaddu[m]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	n/a	0

Legend: "+"—chosen
"-"—not chosen
"n/a"—did not occur

"F"—female
"M"—male
"F/5;6"—female; 5 years 6 months

Appendix B: TENTATIVE SONORITY AND SCL INSTRUMENT /Adults

Name:
Gender:
Age:
Number of years in D.C. area:
Native language:
Second, third, etc. language:

I.

1.	Dapp-Fapp	Fapp-Dapp
2.	Millus-Nillus	Nillus Millus
3.	Anzy-Wanzy	Wanzy Anzy
4.	Laeo-Yeao	Yeao-Laeo
5.	V'luzz-F'luzz	F'luzz-V'luzz
6.	Kaddub-Daddub	Daddub-Kaddub
7.	Hukk-Nukk	Nukk-Hukk
8.	Nillung-Hillung	Hillung-Nillung

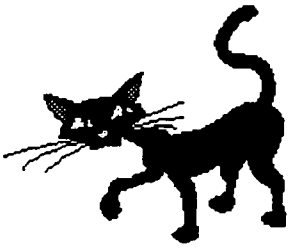
II.

9.	heff-__eff	13.	__esh-nesh
10.	lom-__om	14.	__ult-vult
11.	shevvin-__evvin	15.	__ubb-fubb
12.	masp-__asp	16.	__idge-didge

Appendix C: Pictures

Dapp-Fapp
or
Fapp-Dapp

Millus-Nillus
or
Nillus-Millus



Anzy-Wanzy
or
Wanzy-Anzy

Laeo-Yeao
or
Yeao-Laeo

V'luzz-F'luzz
or
F'luzz-V'luzz

Kaddub-Daddub
or
Daddub-Kaddub

Hukk-Nukk
or
Nukk-Hukk

Nillung-Hillung
or
Hillung-Nillung

Appendix D: Non-English Razzle-dazzle-isms—a sampler[1]

Arabic	[hadi badi]	used in a counting game like "eeny meeny"
Chinese	[kádà]	a swelling in the skin
	[jáɔ kjàɔ]	(of a woman) gentle and graceful
	[tsʊ̃m lûm]	instigate

Since Chinese tones differ for each part of the razzle-dazzle-ism, perhaps they are not valid examples.

Dutch	[kri:s kra:s]	criss cross
	[hotɛl dɛ botɛl]	nuts, mad

Farsi/Persian
In spoken Persian, there is a tendency for speakers to "echo" nouns in order to express non-specificity, lack of importance. The echo occurs with the initial consonant [m].

	[tʃiz miz]	just any thing
	[pɛʰsar mɛʰsar]	any boy
	[batʃɛʰ matʃɛʰ]	any kid
Finnish	[hølynpøly]	nonsense
	[nurin kurin]	topsy turvy
French	[pɛl mɛl]	confusedly, messily
	[tɔhu bohu]	of Hebrew origin; "toroul boroul"in medieval French, "disorder, confusion"
German (Austria)	[hʊtʃ pfʊtʃ]	willy nilly
(nonspecific as to region)	[hɔkʊs pɔkʊs]	magic incantation
	[ruk tsuk]	immediately, suddenly
	[viʃi vaʃi]	description for pejorative evasive answers
Hebrew	[tɔxu wəbɔxu]	"chaos,"referring to the original state of Earth
Hungarian	[dutʃi futʃi]	chubby, e.g. Monika is *duci-fuci*
	[huʃi muʃi]	voluptuous, e.g. Marilyn Monroe was *husi musi*
	[tuṭi muṭi]	an effeminate man
Irish/Gaelic	[ɪʷuwəljʌ bʷəljʌ]	general confusion or mayhem
Japanese	[unome tɑkɑnome]	with a sharp eye for something
	[ɯjɛn kijɛn]	repeated accidental meetings
	[tɪmpʊn kɑmpʊn]	nonsense
	[ʔumiisɛŋ jɑməsɛŋ]	a rascal

[1] Many of the IPA transcriptions are broad because we received a number of razzle-dazzle-isms by mail and were unable to verify them with native speakers in every case.

Korean	[ɑri kɑri]	confusion
	[irakuŋ dʒɑrahuŋ]	a little bit of gossip
	[ɑlɔ tɑlɔ]	having bought clothes
	[ulkit pulkit]	colorful
Latin	[lokɔ fokɔ]	the main point
Lithuanian	[re:kt ɳɛbe:kɫ]	interjection: terrified
	[ʃɑ:lə bɑ:lə]	cold, in the emotional sense, like a wet blanket
	[mɛrgɔs tɛrbɔs]	"girly girls"
	[bɔbə ʈrʲɔbə]	old lady (pejorative)
	[ʃmɑ:ukʃt pəʃmɑ:ukʃt]	interjection: quick as a wink
	[lɑ:pe: snɑ:pe:]	fox, as in "foxy loxy"
	[kɪʃkɪs pɪʃkɪs]	hare or rabbit
	[trʲɔkʃt pokʃt kɛbɛrʲɔkʃt]	quickly—cf. "lickety-split"
	[ʃʲʊmpʊ pʊmpʊ]	a bear's noisy footsteps
Polish	[jɑkɔ tɑkɔ]	so-so
	[hɔtski klɔtski]	a mixture of things
	[fiki miki]	funny acrobatics
	[kɔʃɑl̪ki ɔpɑl̪ki]	tall tales
	[tʌp tsʌp]	grabbing someone quickly
	[wupʊ tsupʊ]	hitting someone
	[ʃmɪŋgʊs dɪŋgʊs]	sprinkling with water—Easter tradition
	[tɛrɛ fɛrɛ kuku]	hard to believe
	[ʃmihi xihi]	bad practical jokes
Russian	[gɔgəl mɔgəl]	a dessert made of raw eggs and sugar
	[ʃuri muri]	colloquial, disdainful,love affair
	[ʃəltai bəltai]	Humpty-Dumpty of the popular nursery rhyme
Slovak	[tsitsɑ mitsɑ]	familiar name for a cat
	[tsitsuʃkɑ mitsuʃkɑ]	diminutive (cat)
	[cuculi muculi]	a smarmy character
	[hɔ:kus pɔ:kus]	magic incantation
	[lɑ:ri fɑ:ri]	when a person doesn't wish to respond
	[tʃɑ:ri mɑ:ri]	similar to hocus pocus
	[hʌki bʌki]	illegible writing
Spanish		
(Peru & Ecuador)	[ɑβrə kɑðɑβrə]	magic incantation
	[ɔki ðɔki]	OK (maybe from English)
(Honduras)	[sumbə mʌɳ:mbə]	carelessness/tomfoolery
	[lɑ xɑnə ɔ lɑ hʷɑnə]	the next one to make the mistake
	[etʃɔ petʃɔ]	What's done is done.

(nonspecific as to region)	[tikis mikis]	fussy, fussing
	[siri miri]	drizzle (from Basque)
Thai	[gatuk g̥atak]	wavy motion
	[kɑo^{w} dʒɑo^{w}]	fresh rice
	[kɔn dʒɔn]	poor people
Turkish	[kɑrə pɑrə]	illegal money, used in drug trade
	[jɑmʊr tʒɑmʊr]	rainy,muddy mess

Yiddish-American

In Yiddish-American communities words are often echoed as a sign of negation.

[bɛrzbɔl ʃmɛrzbɔl]	baseball? who cares?
[dʒinjəs ʃminjəs]	genius? not really!

SONORITY VIOLATIONS IN SLAVIC LANGUAGES: BULGARIAN, RUSSIAN, AND POLISH

Marietta Bradinova & David Welch

INTRODUCTION

In this paper we will look at consonant clusters in three Slavic languages: Bulgarian, Russian, and Polish. More specifically, we will examine the consonant clusters, in the word initial position in these three languages for adherence to the sonority hierarchy. When we find violations, and we believe these languages have many, we will attempt to explain why these apparent violations occur without disputing the sonority hierarchy theory. For example, English consonants adhere quite nicely to the sonority hierarchy in both onsets and codas except for occurrence of the consonant /s/. However, this violation of the consonant /s/ is explained by the theory of extrasyllabicity.

The reason we chose these three languages is because they represent the southern (Bulgarian), eastern (Russian), and western (Polish) Slavic languages. We are curious to see if the consonant violations are similar in occurrence and are dealt with in a similar method. Our claim is that even though the Slavic languages may have many consonant cluster combinations that violate the sonority hierarchy, these languages follow universal principles of grammar and phonology. We will show that most, if not all, of these apparent violations exist in their underlying representation, but are not violations of the sonority hierarchy at the phonetic level.

To assist us in making some of our judgements regarding the pronunciation of the words in these languages, we had native speakers pronounce the words in the respective appendixes. The Bulgarian and Polish native speakers used carrier phrases in their pronunciation of those respective languages. However, the Russian native speaker did not use carrier phrases. All of the native speakers were recorded at normal pronunciation speed, and then recorded a second type using slower, more careful pronunciation.

REVIEW OF PRINCIPLES/RULES

Sonority Scale. Clements (1992) defines the sonority scale as consisting of four natural classes of sounds: obstruents, nasals, liquids, and glides. Unlike others who have proposed a five member scale, Clements chose to combine stops and fricatives into the obstruent group, as shown in (1) below. Therefore, under Clements' classification for sonority, stops and fricatives are treated equally with regard to the sonority hierarchy and consonant clusters.

(1)

least		most
	obstruent < nasal < liquid < glide < vowel	
sonorant		sonorant

Other theorists, Carr (1993), prefer to separate stops and fricatives as shown in (2). According to Carr, stops are the least likely segments to occupy the nucleus because they have the highest degree of blockage of the airstream during pronunciation. This blockage makes stops the least sonorant segments.

(2) 1 2 3 4 5 6
stop < fricative < nasal < liquid < glide < vowel

Carr agrees with Eckman & Iverson (1993) in that voicing also plays a role in the sonority scale. According to these theorists, voiceless stops are less sonorant than voiced stops, and voiceless fricatives less sonorant than voiced fricatives. This is shown in (3) below.

(3)

least				most
	voiceless stops	voiced stops	voiceless fricatives	voiced fricatives
sonorant				sonorant

Sonority Sequence Principle. According to this principle, segments can be ranked along a "sonority scale" in such a way that segments ranking higher in sonority stand closer to the center of the syllable and segments ranking lower in sonority stand closer to the margin. This principle expresses a strong cross-linguistic tendency, and represents one of the highest - order explanatory principles of modern phonological theory.

Clement's provisionai version of the Sonority Sequencing Principle: Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted.

Under this principle, syllables of the type tra, dva, sma, mra are permitted, while syllables like, rta, vda, msa, mla are excluded. Crosslinguistic comparison supports the view that clusters conforming to the Sonority Sequencing Principle are the most commonly occurring, and are often the only cluster types permitted in a given language.

Minimal Distance Constraints. Clements' proposed sonority Dispersion Principle, in particular, characterizes as least complex those syllable types whose onsets show a sharp and steady rise in sonority proceeding from the margin to the peak. Accordingly, obstruent-glide onsets emerge as more complex, or more marked, than obstruent-liquid onsets, because the rise in sonority from obstruent to liquid to vowel makes a steadier progression than does the initially sharp, then nearly flat, increase from obstruent to glide to vowel. On this basis the occurrence in many languages of apparent minimal distance constraints relative to sonority in syllable onsets in fact does derive from markedness considerations. Thus, if a language has onsets with a gradual or irregular rise in sonority (obstruent/glide/vowel) it implies the existence of a sharp and steady rise in sonority (obstruent/liquid/vowel).[1]

Under Clements' notions of core syllabification, then, the markedness of obstruent-glide onsets relative to obstruent-liquid onsets is predicted. A further consequence of this prediction is that no language should have obstruent-glide onsets unless it also has obstruent-liquid onsets.[2]

Minimal Sonority Distance (MSD) Parameter. According to Eckman & Iverson (1993), "Languages that require a greater difference in sonority between adjacent segments will have fewer kinds of consonant clusters in the onset, and languages that allow a smaller minimal difference between adjacent consonants will have more."[3] In example 5 below, Eckman describes the *Markedness Relationship*.

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[1] Eckman, Fred R., and Iverson, Gregory K. 1993. Sonority and Markedness among Onset Clusters in the Interlanguage of ESL Learners. *Second Language Research* 19: pp 248-249.
[2] Ibid, pp 249
[3] Ibid, pp. 235.

(4) Markedness Relationship (Eckman et al 1993)

Marked	relative to	Unmarked
a) Fricatives		Stops
b) Voiced stops		Voiceless stops
c) Voiced fricatives		Voiceless fricatives

(5) Sequential markedness principle:
For any two segments A and B and any given context X_Y, if A is less marked than B, then XAY is less marked than XBY.

Based on the Markedness Relationship and Sequential markedness principle, since voiced [b] is a marked segment relative to voiceless [p], by the principles above, [b] will still be marked relative to [p] when it is in the word-initial position before [r] - hence [br] clusters are more marked than [pr] clusters, and are predicted to cause more IL difficulty than to [pr] clusters. Similarly, initial sequences with the fricative [f] plus a consonant represent structures which, following the hierarchy in (3) and (4) and the principle in (5), are more marked than initial sequences of [p] plus a consonant. Hence, [fr] is predicted to cause more IL difficulty than [pr].[16] The Markedness Relationship also argues against Clement's sonority hierarchy scale which lumps stops and fricatives under the heading of "obstruent", example (1), and offers a valid reason to separate the stops and fricatives as in the scale in example (2).

Maximum Onset Principle. Under this principle, VCV is preferably syllabified V-CV, not VC-V, since V is a simpler final demisyllable than VC, and CV is a simpler initial demisyllable than V. This account extends to VCCV sequences as well. For example the preference for the syllabification V-OLV instead of VO-LV owes to the fact that V is a simpler final demisyllable than VO. Thus V-OLV is a simpler sequence that VO-LV by virtue of the crosslinguistic preference for open syllables. The syllabification V-CCV will be preferred to VC-CV just in case CCV is an admissible core demisyllable type in the language in question.

Extrasyllabicity. According to Clements (1992), consonants that violate the Sonority Principle usually do so on what Clements referred to as the "edges" of syllabification domain, or in other words at the beginning of an onset cluster.[17] The term "extrasyllabic" means the segment beginning the cluster may exist in the underlying (UR) representation as part of the syllable which contains the consonant cluster but is not part of the same syllable in it's phonetic representation (PR). It seems this notion of "extrasyllabicity" cuts across many languages and is used to explain violations of the sonority scale.

SLAVIC LANGUAGES

The Slavic languages currently spoken, according to their genetic relations within Slavonic are: South Slavonic: Bulgarian, Macedonian, Serbo-Croat, Slovene; West Slavonic: Czech, Slovak, Polish, Upper and Lower Serbian (Lusatian); East Slavonic: Russian, Ukrainian, Belorussian (White Russian) (Comrie 1990). In phonological and morphological structure the Slavonic languages are very close to one another, more so than the Romance languages.[18] There are two

[16] Eckman Ibid
[17] Clements, G.N. 1990. The Sonority Cycle and syllable organization. In W. Dressler, H. Luschutzky, O. Pfeiffer, and J. Rennison (eds.) *Phonologica* 1988. Cambridge: Cambridge University Press.
[18] Comrie, Bernard (1990). The Worlds Major Languages. Oxford University Press.

main sets of sound changes that separate Proto-Indo-European from Common Slavonic. One if the tendency for sounds within the syllable to a be arranged in order of increasing sonority (i.e. obstruents, then liquids and semi-vowels, then vowels). The second major set of sound changes is a series of palatalization. By the first palatalization, /g/, /k/, /x/ become, respectively, [ʒ], [tʃ], [ʃ] before original front vowels. By the second platalisation, the same three consonants become, respectively, [ʒ] (a voiced alveopalatal fricative), subsequently de-affricated to /z/ in most languages), /c/ (voiceless dental affricate) and /s/ (but š in West Slavonic) before front vowels[19] newly arisen from monophthongisation.[20]

One major innovation of the early literary period that unites the Slavonic languages in type but divides them in detail is the subsequent development of the jers. In all Slavonic languages, a distinction is made between strong and weak jers, where in general a weak jer is one in word-final position or in a syllable preceding a full vowel, while a strong jer is one in a syllable preceding a weak jer. Weak jers are lost, while strong jers are strengthened to full vowels, but the precise full vowel to which each of the two jers is strengthened varies from language to language. The loss of the jers has a major effect on the phonological structure of words in Slavonic languages, since it leads to consonant clusters that were previously impossible: thus Common Slavonic [gədʌŋəskə] is contracted from four syllables to one in Polish gdańsk[21].

Another phonological development that characterizes much of the Slavonic domain, especially East Slavonic and Polish, is the further development of a systematic opposition between plain and palatalized consonants.

In some Slavic languages the initial consonant clusters consists of:

a) group of consonants, inherited from old Slavic language

b) new groups of consonants, which emerged from the loss of weak reduced vowels and the following phonetic processes.

c) groups of consonants occur in words borrowed after the loss of weak reduced vowels.

d) Groups of consonants with j.

Bulgarian Introduction. Bulgarian Language, official language of Bulgaria spoken by about 8.5 million inhabitants of the country. Together with the closely related Macedonian language, it forms the eastern group of the South Slavic branch of the Slavic languages. Bulgarian uses the Cyrillic alphabet, as do the Russian, Serbian, and Macedonian languages.[22]

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[19] Ibid

[20] According to Trask, R. L., monophthongisation is an obsolete term for "phone" or "segment".

[21] Comrie, Bernard (1990). The Worlds Major Languages. Oxford University Press.

[22] Microsoft Encarta 97 Encyclopedia. 1993-1996. Bulgarian Languages.

Table 1. Chart of the Bulgarian consonants.

	labial	alveodental	alveopalatal	palatal	velar
stops voiceless	p [23]p^j	t t^j		k^j	k
voiced)	b b^j	d d^j		g^j	g
nasals		m m^j	n n^j		
fricatives	f f^j v v^j	s s^j	ʃ ʒ		x
affricates		ts ts^j	tʃ dʒ		
liquids lateral		l l^j			
trill		r r^j			
glides			j		

Note 2: In the Bulgarian consonantal chart, the IPA fricative [ʒ] is written as ɔ.

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Bulgarian words and what we believe are reasons for those violations. This section looks at extrasyllabicity, morphology, epenthesis, deletion, complex clusters, and other. The entire body of consonant cluster violations data considered for this analysis is located in Appendix A. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the root word samples in section (1) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. This theory of extrasyllabicity is used to explain this phenomenon which is seen in many languages throughout the world. Examples (6a) and (6b) are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity for /s/ is applied.

(6)

	UR	PR	Gloss
a.	spádam	spádam	"to fall/go down"
b.	stekə́	stekə́	"to flow down"

In examples (6c) through (6g), we have word initial three consonant clusters. The initial segment of these clusters begin with alveodental and alveopalatal fricatives; a stop, /m/, or /x/ medially; and a liquid. Once the /s/ segment is considered extrasyllabic, there is no longer a violation because the remaining consonants follow the sonority principle.

[23] In Bulgarian, the apostrophe following the following consonants, except bi-labials and liquids, indicates the palatalized sound of that consonant.

	UR	PR	Gloss
c.	spláv	spláf	"alloy"
d.	straná	straná	"country side"
e.	sprixav	sprihaf[24]	"quick tempered"
f.	smrád	smrát	"stench"
g.	ʃtedər	ʃtedər	"generous"

Epenthesis. The following samples are root words which appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is vowel epenthesis occurring to break up the consonant clusters. We found no other examples of epenthesis in our data, thus, for Bulgarian, a rule can be written as in 7c in which epenthesis occurs to break up a voiced labial fricative and a voiced alveodental stop.

(7)

	UR	PR	Gloss
a.	vdlə́bvam	vədlə́bvam	"to make concave"
b.	vdʲávam	vədʲávam	"to thread a needle"

c. $\varnothing \rightarrow /ə/ \;/\; /v/ \rightarrow\rightarrow /d/$

Consonant Deletion. In the Bulgarian language, words beginning with three consonants which violate the sonority hierarchy are sometimes dealt with via consonant deletion. One case in point is demonstrated in (8) below in which the fricative/stop initial consonant which may be explained through extrasyllabicity incurs no alteration of the initial cluster (8a). However, this word has a written variant form (8b) in which the phonological representation results in deletion of the second /t/.[25]

(8)

	UR	PR	Gloss
a.	ʃteslaven	ʃteslaven	"vain" (adj)
b.	tʃteslaven	tʃeslaven	"vain" (adj)

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefixes /v/ and /z/ in the Bulgarian language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation rule with consonants. In situations in which we have morphological prefixes, the prefix is a single consonantal segment, we see violations of the sonority principle. In these situations, it appears that epenthesis and extrasyllabicity can be used to explain the apparent violations. In (9a and 9b), the addition of the prefix /v/ results in a schwa being epenthesized between the prefix and the word initial consonant. This then breaks up the initial CCC consonant cluster [fricative/stop/fricative] to CV CC, or [fricative/vowel] [stop/fricative], and the violation of the sonority principle no longer exists. In addition, the prefix in (9a) assumes the voiceless feature of the following consonant. In (9c and 9d), the prefix /s/ can be considered extrasyllabic just as

[24] The IPA velar fricative /h/ is written as an /x/ in Bulgarian.

[25] Aronson, Howard I. 1968. *Bulgarian Inflectional Morphophonology*. pp. 33-38. According to this author, /tst/ occurs in Slavic languages, p.38.

in section (6) above. In (9c), the prefix is followed by a voiced bilabial stop and assimilates the voiced feature of this consonant resulting in it being pronounced as a /z/.

(9)

	UR	PR	Gloss	Prefix	Stem
a.	vtvərd^{j}ə́	fətverd^{j}ə́	"to harden"	/v/	"tvərd" "hard" (adj)
b.	vglédam	vəglédam	"to stare at"	/v/	"gledam" "to look"

Other. In some words, we find examples, 10a and 10b, of the segment /h/ occurring as the second consonant in a word initial three consonant cluster. The rule in Slavic languages regarding the /h/, is that /c/ and /h/ have voiced allophones [ʒ] and [ɤ] but only before voiced obstruents (except /v/) (Scatton 1975).

(10)

a.	sxvánə	shfánə	"understand"
b.	sxlúpen	shlúpen	"tumble down"

Russian Introduction. Russian Language, official language of Russia. Russian was the lingua franca of the Russian Empire and the Soviet Union; it is still used as a second language in the other former Soviet republics. It is also known as Great Russian and forms, with Belarussian and Ukrainian, the eastern branch of the Slavic languages. Russian includes three groups of dialects: northern, southern, and central, the last named a transitional group combining northern and southern features. The southern and central dialects are distinguished by the so-called *akan'je*, coalescence of certain vowels outside of stress. The standard Russian is based on a central dialect of Moscow. It is one of the five official languages of the United Nations. The Russian language uses the Cyrillic alphabet; it has 33 letters. Spelling is basically, though not completely, phonetic, and the rules of pronunciation are few and simple. A typical feature of Russian vocabulary is large families of words derived from the same root by means of various prefixes and suffixes.

Table 2. Chart of Russian consonants.

	bilabial	labio dental	dental	alveolar	alveo palatal	velar
stops voiced	b b^j		d d^j			g g^j
voiceless	p p^j		t t^j			k k^j
nasals	m		n			
	m^j		n^j			
fricatives						
voiced				z z^j	$ʒ^j$	
voiceless				s s^j	ʃ	X
affricates			ts		tʃ	
lateral			l l^j			
trill				r r^j		
semi vowel					j	

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Russian words and what we believe are reasons for those violations. This section looks at extrasyllabicity, epenthesis and morphology. The entire body of consonant cluster violations data considered for this analysis is located in Appendix B. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the samples in section (6) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. This theory of extrasyllabicity is used to explain this phenomenon which is seen in many languages throughout the world. Examples (11a) and (11b) are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity is applied. We believe example (11c), the voiced counterpart of the /s/ also demonstrates extrasyllabicity word initially in Russian.

(11)		UR	PR	Gloss
	a.	stih	stih	"verse"
	b.	skorost	skɔrast	"velocity"
	c.	zdravi	sdravi	"healthy"

In examples (11d) through (11e), we have word initial three consonant clusters Once the /s/ segment is considered extrasyllabic, there is no longer a violation because the remaining consonants follow the sonority principle.

	UR	PR	Gloss
d.	straʒ	straʒə	"guard"
e.	skripka	skripka	"violin"

Epenthesis. In the examples (12a) through (12c) root words appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is epenthesis occurring to break up the consonant clusters. In 12a and 12b, we have epenthesis before the liquid which serves to form a VC syllable to break up the violation. This seems to occur when the liquid is followed by a [-cont] consonant. In 12c, the epenthesis occurs after the liquid, again forming a syllable to break up the violation, but in this case, the epenthesis forms a CV rather than VC. We believe the epenthesis in these cases occurs to break up two [+cont] consonants. The rules for these two cases appear in 12d and 12e.

(12)

	UR	PR	Gloss
a.	lba	əæba	"forehead"
b.	lgun	əlgun	"liar"
c.	rvanya	rəvanəya	"torn"

d. $\varnothing \rightarrow$ /ə/ / #__liquid C V
[-cont]

e. $\varnothing \rightarrow$ /ə/ / liquid ___ C V
[+cont]

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefixes /v/ and /z/ in the Bulgarian language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation rule with obstruents. In situations in which we have morphological prefixes, the prefix is a single consonantal segment, we see violations of the sonority principle. In these situations, it appears that extrasyllabicity and place assimilation can be used to explain the apparent violations. In (13a and 13b), the prefix /s/ can be considered extrasyllabic just as in section (1) above. The example in (13c) demonstrates a prefix which consists of two segments /vs/. This prefix changes voicing to match the following consonant. In (13d), the prefix is /vz/ and no voice assimilation change is required. While the written form appears to show two segments, we believe they sound like one sound and could be a case of extrasyllabicity. This follows from the fact that the /s/ or /z/ is a coronal and assumes the place of articulation of the preceding labial (Paradis & Prunet 1991). Thus, instead of having two consonants precede the root initial consonant, phonologically there is only one segment.

(13)

UR	PR	Gloss	Prefix	Stem/Gloss
a. spustitsya	spustitsia	"to lower"	/s/ "down"	pustit/"to let go"
b. spustit	spustityɪ	"to release"	/s/ "away"	pustit/"to let go"
c. vskriknut	fskriknut	"to utter a sudden shrick"	/vs/ "intensity"	kriknut/"to shriek"
d. vzboltajut	vzboltajut	"to shake-up"	/vz/ "suddeness"	boltajut/"to shake"
e. vstroinni	fstroinni	"built into"	/v/ "into"	stroit/"to build"
f. vstupit	fstupit	"enter into"	/v/ "into"	stupit/"to step"

Polish Introduction. The Polish Language is a member of the Western group of the Slavic branch of Indo-European languages and thus closely related to Czech, Slovak, and the Serbian ianguage found in Germany. It is the language spoken by most of the inhabitants of Poland and by several million native speakers in the United States; Russia and the other successor states of the Union of Soviet Socialist Republics (USSR); Canada; and elsewhere. Polish dialects include Little Polish and Silesian (spoken in the south) and Mazovian and Great Polish (spoken in the north). Kashubian, or Cassubian, also heard in the north, is often treated as a dialect of Polish, although it evolved as a separate West Slavic language. Contemporary Polish has 7 vowel sounds and 35 consonant sounds, depicted by a modified Latin alphabet. Sounds that are not represented by the alphabet are indicated by diagraphs such as *sz* and *cz* (resembling English *sh* and *ch*) and by diacritics such as *ł* and *ß* (resembling *zh* and a soft *sh*), derived from Czech. Unique to Polish is the *ł* (resembling English *w*). As in the case of Russian, the richness of the consonant system is striking. However, certain Russian oppositions between palatalized dentals (t:t^{j}, d:d^{j}, r:r^{j}) have no counterpart in Polish. On the other hand, Polish has an additional type of opposition, vis. that between tʃ and tc , tʒ and dʑ, ʃ and c , ʒ and ʑ. In the course of its evolution, Polish lost the distinction between long and short vowels, and word accent became fixed on the next-to-last syllable. Polish is the only Slavic language with nasal vowels (*ą* and *ę*), which are derived from Old Slavic nasal vowels. Of the original singular, dual, and plural, the dual has disappeared (as in most Slavic languages).[26]

Table 3. Chart of Polish consonants

	bilabial	labio dental	dental	alveolar	pre palatal	post palatal	velar
stops voiceless	p p^{j}		t d			k^{j}	k g
voiced)	b b^{j}					g^{j}	
nasals	m		n		n^{j}		
	m^{j}						
fricatives							
voiceless		f f^{j}	s	ʃ	s^{j}		X
voiced)		v v^{j}	z	ʒ	z^{j}		
affricates			ts dz	tʃ dʒ	tš dž		
lateral			l				
trill				r			
semi vowel	w				j		

[26] "Polish Languages", Microsoft Encarta 97 Encyclopedia. 1993-1996 Microsoft Corporation. All rights reserved.

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Polish words and what we believe are reasons for those violations. This section looks at extrasyllabicity, morphology, epenthesis, metathesis, complex clusters, and other. The entire body of consonant cluster violations data considered for this analysis is located in Appendix C. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the samples in section (10) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. Examples 14a through 14d are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity is applied.

(14)

	UR	PR	Gloss
a.	zbadać	zbadatʃ	"to examine"
b.	stop	stop	"to stop"
c.	sklep	sklep	"store"
d.	stwór	stʃór	"a creature"

Epenthesis. In the examples (15a) through (15f) these root words appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is epenthesis occurring to break up the consonant clusters. In (15a), the epenthesis occurs before the liquid to break up the CC cluster by creating a VC syllable. In (15b) through (15e), there is epenthesis occurring after the word initial fricative, nasal, and liquid. In these cases, the epenthesis serves to break up a CC cluster by creating a CV syllable, thus modifying the word initial cluster from CCV to CVCV. We believe the epenthesis in (15b) through (15e) serves to break up two [+cont] consonants. Example (15f) does not follow the previous two situations so we are opining that the liquid /r/ in this environment is [-cont]. The rules for the epenthesis are in 15g and 15h.

(15)

	UR	PR	Gloss
a.	lgnąć	əlgnantʃ	"to be attracted to"
b.	szkola	ʃəkola	"school"
c.	msza	mɛZa	"church mass"
d.	rwać	rəvatʃ	"to tear"
e.	chce	χətsɛ	"to want"
f.	rdza	rɛdza	"rust"

g. $\varnothing \rightarrow /\varepsilon/ \; / \#\_\_ \begin{matrix}\text{liquid} \\ [\text{-cont}]\end{matrix} \; C \; V$

h. $\varnothing \rightarrow /\varepsilon/ \; / \; \text{liquid} \_\_\_ \begin{matrix} \\ [\text{+cont}]\end{matrix} \; C \; V$

Metathesis. In listening to the Polish data that was recorded, we believe we found one word in which metathesis occurs in a word with an initial onset of four consonants. In example 16 below, there is one apparent and one potential violation of the sonority hierarchy. First, the consonant cluster initial /s/ appears to be a violation but this is covered by the theory of extrasyllabicity. The potential violation would be the liquid /r/ preceding the consonant /v/ in the phonetic representation. However, you'll notice that in the phonetic representation, the /r/ replaces the second underlying /w/, and one of the /w/s gets deleted.

(16)

UR	PR	Gloss	Prefix/Gloss	Stem/Gloss
skrwawić	skvaritʃ	to be bloody	/s/ "closure"	"to bleed"

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefix /v/ and /z/ in the Polish language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation. In situations in which we have morphological prefixes, and the prefix is a single consonantal segment, we see violations of the sonority principle. In examples such as (17a) through (17c) below, we have the combination fricative [+cont] followed by a stop. This combination could be explained via the theory of extrasyllabicity. If the initial [+cont] segment is considered extrasyllabic, there is no longer a violation of the sonority hierarchy since the stop is followed by a less sonorant consonant. However, in examples (17d) and (17e), the cluster initial fricative is followed by a coronal. We believe this combination can be explained by the fact that the coronal fricative [+cont] is underspecified for place (Paradis & Prunet 1991), although not completely. Therefore the cluster initial fricative combines with the coronal fricative to form a complex syllable which negates the sonority violation at the phonetic representation. Then, both segments together would be considered extrasyllabic. In the case of (17d), the /z/ is epenthesized to keep the /v/ and /b/ from becoming a complex consonant because they share the same place of articulation.

(17)

	UR	PR	Gloss	Prefix	Stem/Gloss
a.	wdrapać	vdr	to climb	/v/ "on top"	drapać "to scratch"
b.	wklejać	fkl	glue something in	/f/ "in"	klejac "to glue"
c.	zblednąć	zbl	to pale	/z/ "inclosure"	blednać "gradual pale"
d.	wzbogacić	vzb	to enrich	/v/ "in"	bogacić "get rich"
e.	wskrobać	fskr	to climb up (animals who use nails)	/f/"on"	skrobać "to scratch"

Complex Consonant. The following words have apparent violations of the sonority principle due to the second segment. However, as in (17d) and (17e) above, these segments are coronals which are underspecified for place and therefore form a complex consonant or the equivalent of an affricate with the preceding stop. This then negates the sonority violation at the phonetic representation.

(18)		UR	PR	Gloss
	a.	bzdura	bzdura	"silliness"
	b.	brwi	brvi	"eyebrow"
	c.	drwal	drval	"lumberjack"
	d.	trwać	trfatS	"to last over time"

CONCLUSION

We believe most of the apparent violations that appear in word initial onset clusters at the underlying representation level in these Slavic languages can be explained in several ways at the phonetic level. Our study indicates that these three languages deal with these violations using similar universal methods observed throughout the world's languages.

The first explanation we used to explain violations of the Sonority Principle in Bulgarian, Russian, and Polish is through the notion of extrasyllabicity. This notion of extrasyllabicity is one way in which the apparent consonant cluster violations in two and three consonant clusters in the onset positions are explained not only in these three Slavic languages, but a way in which it is explained for most languages of the world. In these three languages, we believe that not only the consonant /s/, but also the segments /v/ and /z/ are considered extrasyllabic at the phonological level. In Polish, we believe there are cases in which a second is a coronal that assimilates place with the preceding consonant to form a complex consonant and this complex consonant then becomes extrasyllabic.

In addition to extrasyllabicity, we discovered all three languages using epenthesis as a method to overcome apparent violations of the Sonority Principle. However, some of the environments are different.

We have observed that epenthesis occurs in Polish when the word initial consonant is a liquid. The epenthesis occurs before the word initial liquid to form a VC if the following consonant is [-cont] but the epenthesis occurs after the liquid if the following consonant is [+cont].

Another universal method observed in Polish to avoid a violation of the Sonority Principle is metathesis. This was observed in a four consonant onset cluster in which a liquid /r/ would have followed a voiced fricative labial as the third and fourth consonants in the cluster.

One observation about these languages, is the fact that the minimal distance allowed in the consonant clusters is zero (Eckman & Iverson 1993). According to The Minimal Distance Constraints principle, and given the data we acquired for this study, we believe it can be said that the Slavic languages allow very slight differences in sonority in their consonant clusters.

In conclusion, based upon our findings and data, we believe these three Slavic languages, Bulgarian, Russian, and Polish adhere to the Sonority Principle in most of the consonant clusters found in the word initial onset position.

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Appendix A

BULGARIAN DATA

UR	PR	GLOSS
st ' ágamse	st 'ágamse	to gather up
zgaštam	sgaʃtəm	corner, trap
ftasam	ftasəm	to rise (i.e. dough)
spómn' ə	spómn' ə	to recall
štastie	ʃtastie	happiness
spláv	spláf	alloy
straná	straná	country side
sprixav	sprihaf [1]	quick tempered
stvol	stvol	trunk
skvéren	skəvéren	obscene
skrómen	skrómen	modest
sklád	sklád	warehouse
špric	ʃpritz	squirt
štrakám	ʃtrákəm	snap
zdráv	zdráf	healthy
ždrélo	zdrélo	gorge
spletə́	spletə́	braid
správka	spráfka	verification

[1] The IPA velar fricative (h) is written as an (x) in Bulgarian.

spr′ áx	spr′ áh	stopped[2]
smračáva	smraʦávə[3]	to darken
strésnə	strésnə	scare
str′áskvam	stir′ áskvam	startle
skl′ účə	skl′ účə	conclude
skrijə	skrijə	hide
sdružə	zdruʒə	unite
sglédə	zglédə	to visit the house of a prospective bride
sgrápčə	zgrápʦə	clutch
sgr′ ávam	zgr′ ávam	heat
vpr′ ág	fpr′ ág	team of horse
vtrísə	ftrísə	to have a fever
vklešt′ ə	fkléʃt′ ə	to wedge in
vkl′ účə	fklu′ úʦə	to include
vkrátce	fkrátce	loan word borrowed from russian
sxlúpen	shlúpen	tumble down
sxvánə	shvánə	understand
sxrúskam	shrúskam	crunch
smrád	smrát	stench

[2] This is the past tense form of *spirám* "to stop".

[3] The character c from the Bulgarian consonant chart is the character tʃ **from the IPA chart.**

UR	PR	GLOSS	PREFIX	STEM	STEM GLOSS
vtvərd′ ə	ftvərd′ ə	to harden	(v)	tvərd	hard (adj.)
vpletə́	fpletə́	to weave into	(v)	plet ə́	to knit
vpredə́	fpredə́	to spin into	(v)	predə́	to spin
skovə́	skovə́	to hammer together	(s)	kovə́	to hammer
spádam	spádam	to fall down	(s)down	pádam	to fall
stekə́	stekə́	to flow down	(s) down	tekə́	to flow
sced′ə́	sced′ə	drain	(s)down	ced′ə́	to squeeze
sblíjə́	zblíʒjə	to bring together	(s)	blízo	near (prep)
zbívam	zbivam	to get into a fight	(s)	bi′ə	to fight
zdávam	zdávam	to return	(s)	dávam	to give
včepen′ə	ftsepenya	to go numb	(v)	čepen′ə́	to grow stiff
vkáram	fkárəm	to drive in	(v) in	karəm	to drive
vstrást′ə	fstrást′ə	to become infatuated	(v)	strast	passion (noun)

UR	PR	GLOSS	PREFIX	STEM	STEM GLOSS
vslúšvam	fslúʃvəm	to listen closely	(v)	sluʃəm	to listen
vsmúkam	fsmúkam	to suck in	(v)	smutʃə	to suck
vbivam	vbivəm	wedge in	(v) in	bi′ə	to wedge
vzr′əse	vzryase	to peer into	(v)into	reyase	to wander

vglédam	vglédam	to stare at	(v)	gledəm	to look
vgrad'ə	vgrad'ə́	to build in	(v)	grad'a	to build
vgnezd'ə́	vgenzd'ə́	to nest in	(v)	gnezd'a	to nest
vgorčə́	vgortʃə	to make bitter	(v)	gorčiv	bitter (adj.)
vdlə́bvam	vdlə́bvam	to make concave			
vd'ávam	vd'ávam	to thread a needle			

Appendix B

RUSSIAN DATA

UR	PR	GLOSS
vdoh	vdoh	to inhale
stih	stih	verse
skot	skot	cattle
skorost	skorast	velocity
splav	splav	alloy
sprava	sprava	straight
straž	straʒə	guard
skripka	skripka	violin
vdrugə	vdrugə	suddenly
zdravi	zdravi	healthy

UR	PR	GLOSS
sputnik	sputnik	fellow traveler

lba	əl′ ba	forehead			
lgun	ʔlgun	liar			
rvanya	rvanəya	torn			
vglyadetsya	vgliadestya	peer at			
vspolox	fspoloh	an alarm			
vstupit	fstupit	to enter into	(v)	stupit	to step
vstroinni	fstroinni	built into	(v)	stoit	to build
vtroe	ftroe	three times (adj.) (Note "troe" is a noun that means "three" of something)			
vsplesk	fsplesk	splash (noun)			

UR	PR	STEM	PREFIX	STEM /GLOSS
vpolgoləsa under ones breath	fpolgoləsa	goləsa	(v) into	voice
vtridaroga triple the price	ftridaroga	daroga	(v) into	expensive
vskriknut to utter a sudden shriek	fskriknut	kriknut	(vs) intensity	to shriek
vzboltajut to shake up	vzboltajut	boltajut	(vz) suddeness	to shake
vzdumajutsia to think up suddenly	vzdumajutsia	think up	(vz) suddeness, suddenly	to think about
spustitsya to lower	spustitsia	pustit	(s) down	to let go
spustit to release	spustit	pustit	(s) away	to let go

Appendix C

POLISH DATA

UR	PR	GLOSS
skwar	skʃar	extreme heat
sprzatač	spʃatatʃ	to clean
stwór	stʃór	a creature
stop	stop	to stop
sklep	sklep	store
splot	splot	method of twining

UR	PR	GLOSS	PREFIX	STEM	GLOSS
wdrapač	vdrapatʃ	to climb	(v) on top	drapač	to scratch
wglad	vglad	to look into	(v) into	ogladac	to look at
wglebič	vglenbitʃ	examine deeper	(v) in	wgloboki	deep
wgnieśč	vgɲieʃtʃ	to make inprint	(v) in	gniesc	to knead
wklejać	fkleyatʃ	glue something in	(f)	klejac	to glue
wkladać	fkvadatʃ	put into	(f)	k'lašć	put into
wpleść	fpleʃtʃ	to braid in	(f)	pleść	braid
wtracać	ftrontsatʃ	to interupt something	(f)	tracacać	bump
zblednać	zblednontʃ	to pale	(z) closure	blednać	gradual pale
zbladzić	zblondʒitʃ	to get lost	(z)		
zbroja	zbroya	armor	(z)		

zdjecie	zdentʃie	photograph	(z)	
zdrowy	zdrovi	healthy	(z)	
zglosić	zgvoʃitʃ	to report	(z)	
zgnoić	zgnoitʃ	to criticize	(z)	
zgnic	zgɲitʃ	to rot	(z)	
wprzód	fpʃod	to the front	(f) in pazód	front
wskoczyć	fsko	to jump on something	(f) in skoczyć	to jump
wspak	fspak	exact opposite	(f)	
wstawić	fstavitʃ	put in	(f)	
wzbogacić sie	vzbogaʃitʃ	to enrich	(v) in bogacić	get rich
wzdychać	vzdihatʃ	to sigh	(v) in dychać	breath
wskrobać	fskrobatʃ	to climb up (animals who use nails)	(f) on skaobać	to scratch
wzabronić	vzbronitʃ	to prohibit	(v) in bronić	to defend
wzdluż	vzdvuʒ	along	(v) in (root) dluz	long
wzdrygnąć sie	vzdrignontʃom	to shutter	(v) in involuntary	slight movement
wzglad	vzglad	to consider	(v) in glad	to look at (root) used w/pre/suf
wskrzesić	fskʃesitʃ	to spark	(v) in skrzesić	spark
wstrzelić	fstʃelitʃ	shoot into	(v) in strzelic	to shoot
skrwawić	skvaritʃ	to be bloody	(s) krwawić	to bleed

UR	PR	GLOSS
szkola	ʃəkola	school
szpada	ʃəpada	type of sword
sztorm	ʃətorm	sea storm
zbadać	zəbadatʃ	to examine
lgnąć	əlgnantʃ	to be attracted to...
lgnie	əlgɲie	to be attracted to...
lgać	əlgatʃ	to lie
mgielka	məgielka	little fog
mgnienie	məgɲienie	blink momemnt
mknąć	məknontʃ	move very fast
mknie	məkɲie	to move very fast
msza	məʒa	church mass
lkać	əlkatʃ	to sob
rdza	rədza	rust
rtęć	rədentʃ	mercury
rwać	rəvatʃ	to tear
chce	χətse	to want
cztery	tʃətɛri	four
czkać	tʃəkatʃ	to hickup

dzban	dzəban	vase
dzgać	dzəgatʃ	to stab
szczapa	ʃtʃapa	kindling
scena	stsɛna	movie scene

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

Anthony Nguyen and Carol Brouha

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]	[apəɹejʂ]
`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

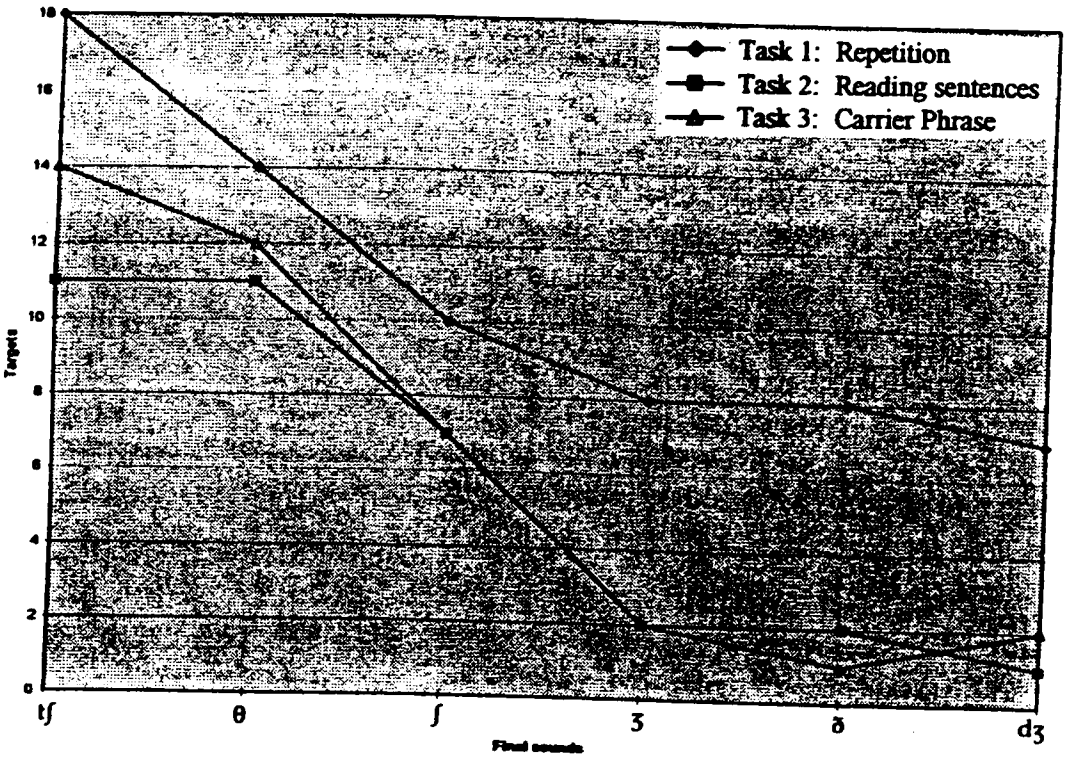

Figure 2. Group II: Performance according to Tasks

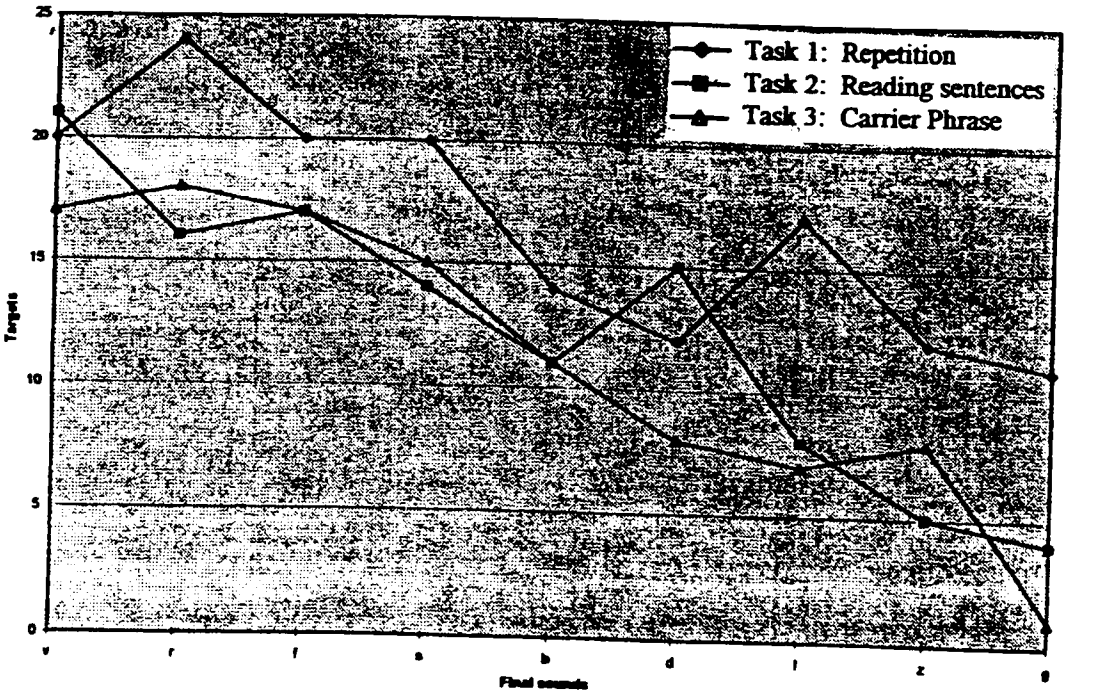

Table 4. Data Summary

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

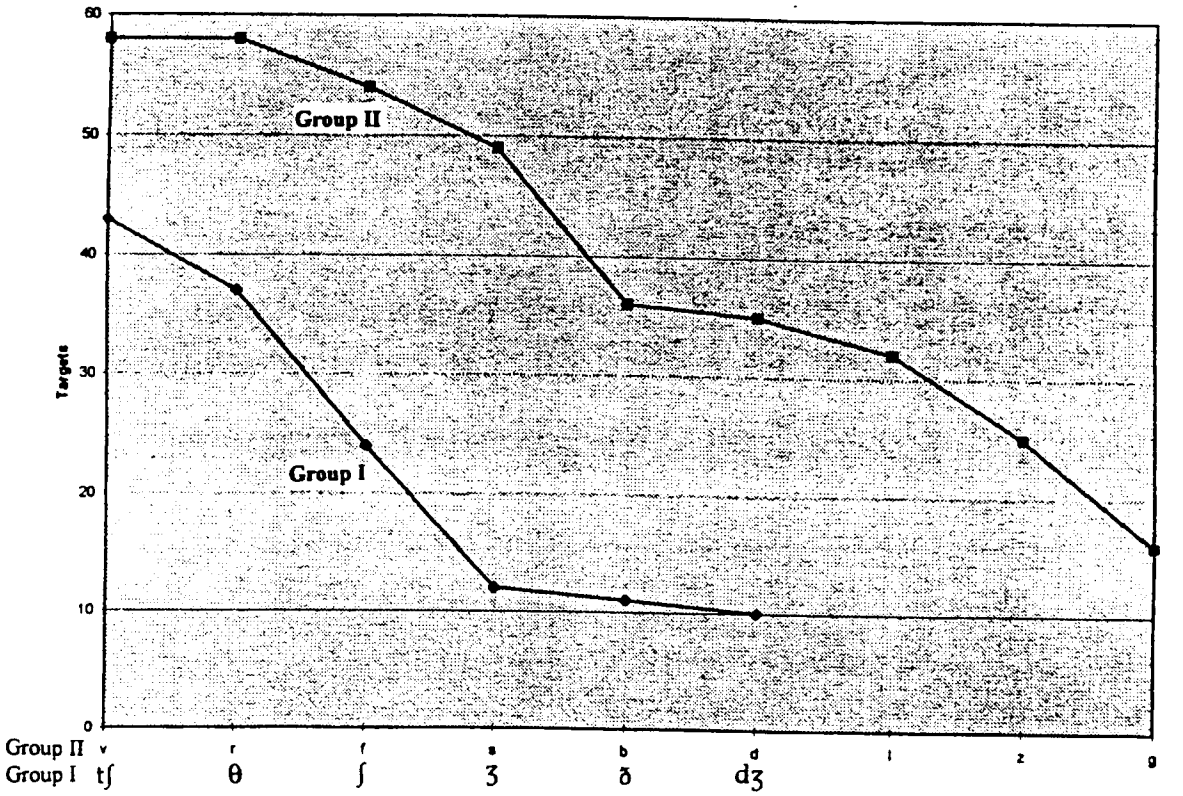

Table 5. Target vs. Error Percentages according to Tasks

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*	[pɪn]	(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

NEGATIVE CONTRACTIONS AND EXTRACTION SITES

Jane Kirsch

It seems that contractions of negatives act differently than other contractions in relation to extraction sites. Gathercole (1981) argued that *twice*, which is assumed to be a contraction of *two times*, cannot occur before *X-er* because there would be two adjacent extraction sites. If *none* is likewise taken to be a contraction of *not one* (Celce-Murcia and Larsen-Freeman 1983) / *not any persons or things* (Stein 1978), then a similar problem with grammaticality would be expected. The following sentences illustrate that this is not the case.

(1) a. There are none smarter than Bill.
b. There is not one smarter than Bill.
c. There are/is not any smarter than Bill.

The 'specialness' of negative contractions and adjacent extraction sites is not limited to quantifier phrases. Tensed auxiliaries in an affirmative sentence can not be contracted when they precede an extraction site. However, this restriction does not apply to a negative contraction.

(2) a. They'll eat later. We will ___ too. *We'll ___ too.
b. They won't eat later. We will not ___ either. We won't ___ either.

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THE JERRY SPRINGER SHOW TAKES ON THE COOPERATIVE PRINCIPLE

Cathleen O'Brien

The recent phenomenon of panel talk shows in our culture would seem to provide for occurrence of the Cooperative Principle (CP) (Grice). The shows use the format of hosting a panel of guests who is asked questions by the host. My observations of *The Jerry Springer Show* however, seem to challenge the Cooperative Principle.

Grice's Cooperative Principle states that the purpose or direction of the conversation "may be fixed from the start (e.g. by an initial proposal of a question for discussion)" (p. 307) which indeed is the case on the show. The show is given a specific title, today's being: *Update: Teens with Older Lovers,* and the questions Jerry asks lead toward why the young girl is interested in the older man and why the older man is sleeping with teenage girls.

In the few episodes of this show that I have viewed, I have found that Jerry's guests do not observe the four maxims of the CP. The following are ways three of the four maxims were not observed in today's show. The maxim of Quantity states, "Do not make your contribution more informative than is required...since it is liable to raise side issues" (p. 308). One of today's guests introduced into the conversation that the older man had children by women other than the teenager he is currently involved with. The maxim of Quality states, "Do not say that for which you lack adequate evidence" (p. 308). This is an excerpt from the show:

> woman: "You're cheating on her now."
> older man: "With who?"
> woman: "I don't know."

The last maxim--which I noticed was not observed throughout this or any of the shows I have viewed--is the maxim of Manner which says simply, "Be orderly" (p. 308). Time and again his guests talk over one another and at least once per show a guest throws something at another guest, picks a fight, or hits another guest. Also, women pulling other women's hair seems to be very popular. All of these detract from any semblance of order in the conversation.

If these maxims were followed, they would "in general yield results in accordance with the Cooperative Principle" (p. 308). But since the Cooperative Principle is not being observed, we cannot assume the presence of a conversational implicature (p. 314) thus a "maximally effective exchange of information" (p. 308) does not occur on *the Jerry Springer Show*. Grice says that following the CP is "reasonable" (p. 309) for us to do and that "it would involve a good deal of effort to make a radical departure from the habit" (p. 309). Could there be a connection between the type of guests Jerry Springer hosts and their effectiveness of communication? If he is interested in guests who seem to be somehow *different,* could it be that their pathologic nature inhibits them from following the CP?

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COMMAND OF THE LANGUAGE

Marisa Schaer

The fact that human attitudes towards language use are intensely judgmental, even on the most objective, or "scientific" levels, seems relevant to our study of theories of language. Language is unique among other disciplines, because it is both the vessel and the content. The acceptability of the form influences the acceptability of the content. On the cutting edge of linguistics, "Squibs and Discussions" in Linguistic Inquiry take their departure from the authors' judgment calls on grammatical usage. I can't think of another science, soft or hard, in which the relationship between a scientist and her/his field is as emotionally charged.