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Transfer of L1 Parameter Settings: Some Empirical Evidence from Polish Metrics

JOHN ARCHIBALD
The University of Calgary

This paper[1] describes an empirical investigation as to the utility of a principles and parameters model of grammar in describing the interlanguage grammars of second language learners. I argue that the framework of parameterized universal grammar is useful in accounting for second language learner knowledge and behaviour. The vast majority of their errors can be accounted for by the transfer of their first language (L1) parameter setting into the second language (L2).

One of the dominant concerns of current linguistic theory is to produce grammars which are feasible; grammars which are learnable. Often the learnability of grammars is determined philosophically (Mathews 1989) or mathematically (Wexler and Culicover 1980). But it is also enlightening to see whether a particular theoretical construct which may meet the mathematical criteria for learnability and be a good model of adult knowledge, can also account for observed phenomena in the acquisition of this construct.

In this paper I describe a study that examines one aspect of the adult grammar of English, metrical phonology, and investigates how people learning English as a second language come to attain this system of knowledge. The study is designed to investigate the acquisition of English stress patterns by adult, non-native speakers of English. Specifically, I look at the behaviour of Polish learners. Polish has different stress-assignment properties that influence the acquisition of English stress. The learners' acquisition

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of stress is examined in light of the metrical parameters proposed by Dresher and Kaye (1990).

Relevance of the Study

This study is relevant to the current research programme in learnability in two ways: (1) it investigates one aspect of the final-state grammar (metrical phonology) and examines learners attempting to acquire that particular system of knowledge, and (2) the study will allow us to collect some empirical evidence relevant to a principles and parameters model of language acquisition. Within current linguistic research, it is generally accepted that theories of language acquisition which posit a mainly inductive learner (i.e., a hypothesis tester) are problematic (cf. Gold 1967; Lightfoot 1982). There have been, however, relatively few empirical studies designed to test the adequacy of the principles and parameters model to account for actual learner behaviour, and fewer still in the area of second language acquisition. To date I think it is fair to say that there has been more work done in the area of second-language syntax (Flynn 1987, 1989a, 1989b; White 1988a, 1988b, 1989a, 1989b, 1990, Liceras 1989) than in second-language phonology (Archibald 1991, 1992a, 1992b; Broselow and Finer 1991; and Singh 1991). Indeed, in the field of second language acquisition it has only been fairly recently that interlanguage phonology has begun to be investigated in depth within sophisticated phonological theories (cf. Tarone 1978, 1984; Broselow 1983; Ioup and Weinberger 1987; James 1988; James and Leather 1987; Leather and James 1990; Mairs 1989). The phonological phenomenon of stress seems to be particularly well-suited to this type of study.

Stress

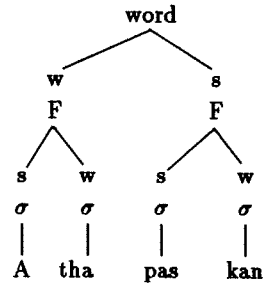
Stress refers to the fact that in a polysyllabic word, there is always one syllable which is more prominent than the others; this syllable is said to be stressed. It makes sense to investigate stress within this framework for two reasons: (1) "accentual systems can be studied in relative independence of other aspects of grammar" (Dresher and Kaye 1990:138); and (2) a well-developed theory of stress within a parametric framework exists — that is metrical theory.

Stress Assignment

Let us now consider some of the necessary aspects of how stress is assigned. Goldsmith (1990) presents a clear summary of the issues involved here. Crucial to stress assignment is the notion of syllable structure. Here I shall be assuming the model of the syllable proposed by Kaye and Lowenstamm (1984).

The syllable rimes are organized into constituent structures. First, the rimes are grouped into *feet* (labelled F), and then the feet are organized into constituents that make up the phonological word. Goldsmith (1990:171) gives the following example:

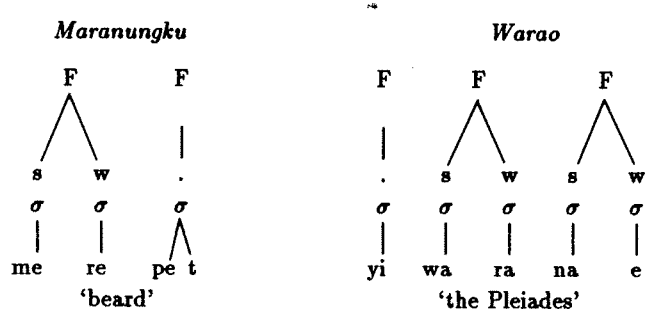
(1)



Languages around the world vary as to whether the feet are strong on the left or the right; whether the feet are always binary; whether the feet are built from the left edge of the word or the right; whether the word tree is strong on the left or the right; and a small number of other parameters.

Foot construction can take place from left to right, or from right to left. However, a particular language will only make use of one of these options. Hayes (1980) gives Maranungku as an example of a language which constructs trees from the left (and feet are strong on the left), and Warao as an example of a language that constructs left-dominant feet from the right (2):

(2)



In many languages, foot construction is sensitive to certain aspects of the makeup of syllables (e.g., vowel quality, vowel length, open or closed syllables, etc.). Hayes (1980) refers to such feet as "quantity-sensitive". So, for example, the principles of stress assignment in Ojibwa could be described as follows (Kaye 1989:143): "Starting from the left edge of a word, construct binary right-dominant feet. Branching nuclei (i.e. long vowels) may not occupy a weak position."

The fact that long vowels must be stressed qualifies Ojibwa as a quantity-sensitive language.There are, in fact, two types of quantity sensitivity that we should distinguish. In order to do so, we need to look at the internal structure of the syllable a little more closely.

Languages vary as to whether they are sensitive to the internal structure of the nucleus or the rime. A language like Hungarian which is sensitive to the structure of the nucleus could, for example, treat branching and non-branching nuclei differently. In such a language long vowels and diphthongs (which both occupy two positions in the nucleus) would be stressed. A language which is sensitive to the structure of the rime like English could treat branching and non-branching rimes differently. So, for example, a syllable which was closed by a consonant (hence a branching rime) would be stressed whereas an open syllable would not be.

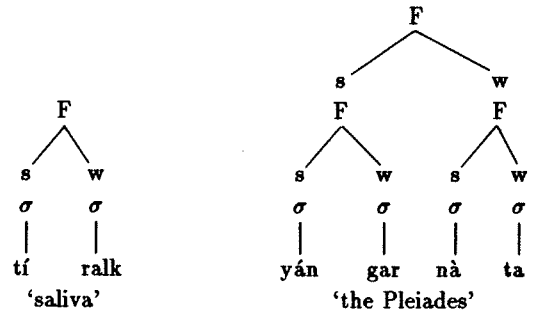
Within Hayes's framework, as well, certain elements such as syllables, suffixes, and segments may be extrametrical. An extrametrical element is invisible to the foot assignment rules. Chomsky and Halle (1968) noted the difference between syllables with branching and non-branching rimes, as illustrated in *jávelin*, and *agénda* where we see that in a large class of nouns, the antepenult is stressed when the penult has a non-branching rime, and the penult is stressed otherwise. Hayes provides an explanation which allows us to generalize as to the stress-assignment rules: for these nouns the word-final rimes are extrametrical. This is the mechanism by which certain English words get main stress as far back as the antepenult when the trees are constructed with binary feet labelled "s w" beginning at the right edge. The stray extrametrical syllable is later adjoined to the neighbouring foot.

Another important terminological distinction is between binary and unbounded feet. Binary feet have, at most, two members, one strong and one weak, while unbounded feet may have any number of members, one strong and any number of weak. If a foot has only one member it is unlabelled. Hayes uses Maranungku to illustrate a language which assigns binary (quantity-insensitive) feet. In Maranungku primary stress falls on the initial syllable and a non-primary stress on every second syllable thereafter (3).

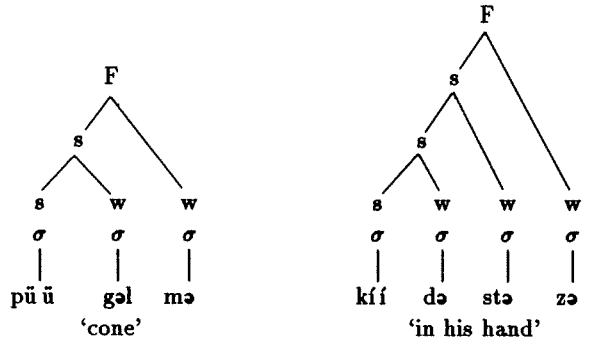
An example of a language that assigns unbounded (quantity-sensitive) feet is Eastern Cheremis. In this language primary stress falls on the last full vowel of the word and, if there is no full vowel, on the first vowel. The examples in (4) do not illustrate the quantity-sensitive nature of Eastern Cheremis, as I merely wish to demonstrate the structure of an unbounded foot.

Whether the unbounded word tree is left-dominant or right-dominant is what determines primary word-stress placement. If the word tree is left dominant as in Hungarian, primary stress will be towards the left edge of the word. If it is right dominant, the primary stress will be toward the right

(3)

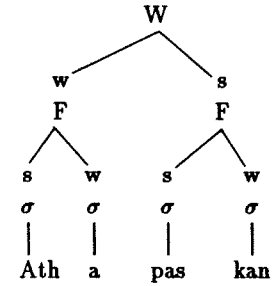


(4)



edge. In English the word tree is right-dominant and primary stress tends to be toward the right edge. Consider the location of primary stress in the word *Athapáskan*. Goldsmith (1990:184) gives the following structure for this word:

(5)



Note that the word tree (W) is strong on the right, while the feet are strong on the left. The primary stress surfaces on the vowel exhaustively dominated by s nodes.

Universal Aspects of Metrical Systems

Halle and Vergnaud (1987:3) outline the following facts that an acceptable theory of stress must be capable of handling:

a) Not all phonemes may bear stress; different languages select specific subsets of phonemes to bear stress.

b) In some languages, every word has one and only one stress.

c) In some languages, every word has at least one stress but may have more than one.

d) The location of stress is often governed by fairly transparent principles:
   (i) In languages with a single stress per word, the location of the stress is determined by the position of the stressable element in the word (final, initial, penultimate and so on) or by its position and its phonetic context (for example, the stress falls on the penultimate vowel if it is long, otherwise on the antepenult).
   (ii) In the case of words with multiple stresses, there appear to be three major principles of distribution:
      1. Stressed and unstressed syllables alternate; for example, stress falls on every other syllable or every third syllable in a word.
      2. Stress falls on phonemes in particular environments — for example, on vowels in heavy syllables, or in lexically marked morphemes.
      3. A combination of the preceding.

It is currently a topic of considerable interest in the second language acquisition literature as to whether adult second language learners violate proposed universals of language. In the words of the discipline whether they have "access to UG". In this paper, I will not be considering whether the data discussed here inform the debate on adult access to UG for two reasons. One is that I am only reporting pooled data which do not reveal individual performance. Only an investigation of case studies of individual learners would reveal enough about a single person's system. The second reason is that while the data presented are consistent with the proposed universals, they do not confirm adult access to UG. In the set of words studied here, any error pattern could be explained by the theoretical mechanism. The subjects could not have done anything that could not have been described by the parameters discussed.

Metrical Parameters

From the perspective of a principles and parameters framework, the learners must determine which type of language they are learning. Universal grammar constrains the hypothesis space by delineating the language type. Table 1 illustrates some of the metrical parameters proposed by Dresher

and Kaye (1990) as being a part of UG.[2] They are designed to determine metrical structure construction and labelling (where P stands for parameter).

Table 1

Some Universal Metrical Parameters

P1:	The word-tree is strong on the [Left/Right].
P2:	Feet are [Binary/Unbounded].
P3:	Feet are built from the [Left/Right].
P4:	Feet are strong on the [Left/Right].
P5:	Feet are quantity-sensitive (QS) [Yes/No].
P6:	Feet are QS to the [Rime/Nucleus].
P8A:	There is an extrametrical syllable [No/Yes].
P8:	It is extrametrical on the [Left/Right].

Again, within this framework, the learner is attempting to answer a few simple questions ("Are the feet binary?" "Are they strong on the left?") rather than create unconstrained hypotheses.

Investigating the Metrics of the Languages in Question

In order to consider how non-native speakers of English come to acquire English stress patterns, first we must consider some of the relevant characteristics of English stress. Chomsky and Halle (1968) revealed the central role of what they called "strong" versus "weak" clusters in stress assignment. They noticed that in a large class of nouns, main stress falls on the antepenult when the penult contains a non-branching rime (weak), and on the penult otherwise. Nouns illustrating this pattern are shown in (6):

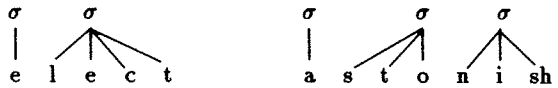
(6) cínema agénda (branching penult)
vénison appéndix (branching penult)

In verbs, the stress falls on the final syllable if it contains a branching rime (consonant cluster or long vowel), and on the penult otherwise. Example (7) shows the patterns we have noticed.

In English, there is a principle of Consonant Extrametricality (Hayes 1980) which states that every word-final consonant in any word is extrametrical. This allows us to maintain the generalization that stress is assigned

[2] I have ignored some of their parameters which are not immediately relevant to the issues discussed in this paper.

(7) eléct (final cluster) astónish
maintáin (final long vowel) édit



to the final syllable of a word if it contains a branching rime (long vowel or diphthong, or consonant in the coda)—otherwise stress is assigned to the penult. This type of extrametricality works well for stress assignment in verbs but is problematic for nouns. In addition to the above rule, English has a principle of Noun Extrametricality which states that the final rime of a noun is ignored in stress assignment. In other words, different grammatical categories assign extrametrical status to different structures. Nouns mark a whole syllable as extrametrical, while other categories mark only a segment. Later in the paper, I will propose one way of parameterizing these facts.

Stress Retraction

Nouns with long vowels in the final syllable behave somewhat differently. Note the stress pattern in words such as: ***húrricàne***, ***báritòne***, ***ántelòpe***, ***cándidàte***, ***mátadòr***. In these words, we see that the main stress is on the antepenultimate syllable (as would be expected with the rules we have discussed so far). What is different about these words, as opposed to nouns like ***cínema*** and ***vénison***, is that there is a subsidiary stress on the final syllable. This class of words can be explained by stipulating that long vowels in the final syllable of nouns are not extrametrical, and have a stress assigned to them as a result of the quantity-sensitivity of English. The fact that we do not observe primary stress (i.e, ***hurricáne***) in this position has been explained by proposing some kind of stress retraction rule for words of this type (Liberman and Prince 1977). Informally stated, the rule would retract the main stress two syllables to the left of the original main stress. While this may appear to be a somewhat ad hoc solution, it can be elegantly formulated in another version of metrical phonology (grid representation). While the issue of whether to use trees or grids to represent metrical structure is fascinating (see Prince 1983 for a discussion), nothing that I will argue hinges on the formal representation used.

English Metrical Parameters

The relevant properties of English stress regarding the items chosen for this study are summarized in Table 2:

Table 2

English Metrical Parameters Settings

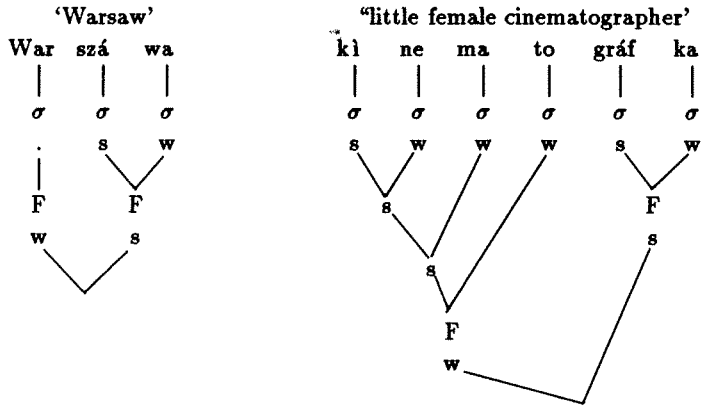
P1:	The word tree is strong on the [Right].
P2:	Feet are [Binary].
P3:	Feet are built from the [Right].
P4:	Feet are strong on the [Left].
P5:	Feet are quantity-sensitive (QS) [Yes].
P6:	Feet are QS to the [Rime].
P8A:	There is an extrametrical syllable [Yes].
P8:	It is extrametrical on the [Right].

These are some of the parameters implemented in the Dresher and Kaye model. While these parameters do not take into account such things as the effect of grammatical category on extrametricality (i.e., that it affects nouns and verbs differently) or the fact that the syllable is not always the domain of extrametricality, the purpose of this study was not to modify Dresher and Kaye's parameters but to conduct an empirical test as to the ability of the general model to account for second language acquisition.

Polish Stress

Polish is a language of essentially fixed stress. In words of more than one syllable, main stress falls on the penult. If at least two syllables precede the penult, then a secondary stress falls on the initial syllable (see example 8).

(8)



Polish has restricted extrametricality; a syllable is marked as extrametrical in formal style on a restricted set of items. In addition, a small number of inflectional endings become extrametrical. One of these is *-a*. Later we will see how this affects subjects' performance.

The parameter settings for Polish are shown in Table 3 (adapted from Hayes and Puppel, 1984):

Table 3

Polish Metrical Parameters Settings

P1:	The word tree is strong on the [Right].
P2:	Feet are [Binary].
P3:	Feet are built from the [Right].
P4:	Feet are strong on the [Left].
P5:	Feet are quantity-sensitive (QS) [No].
P6:	Feet are QS to the [N/A].
P8A:	There is an extrametrical syllable [No].
P8:	It is extrametrical on the [N/A].

The Study

The subjects were assigned two tasks. The first task was a production task that had two sub-parts. In the first sub-part, the subject was asked to read a list of words out loud into a tape recorder. Criteria for selecting the words will be described below. In the second sub-part the subject was asked to read a list of sentences which contained each of the targeted words (see Appendix A). Later, a native English-speaking judge phonetically transcribed the subject's production of the target words including where the subject placed the stress. Inter-rater reliability was ensured by having a second judge (an experienced second-language teacher, trained in phonetics and phonology) score 10% of the production tests. Agreement was obtained between the two judges on 92% of the items. Most of the disagreements were as to whether the subject assigned a primary or secondary stress to a syllable. The scoring procedure was, thus, validated.

The second task was a perception task in which the subjects listened to a native speaker pronounce each of the words twice from a tape. All subjects underwent a training session to ensure that they were able to mark the stress consistently. Once they performed correctly on three items in a row, the second task began. The subjects' task was to mark which syllable they perceived stress to be on. This was repeated for the sentence-focus task. The perception task was conducted second in order that the production task not be affected.

Experimental Items

I limited the main study to (primarily) single stress, monomorphemic nouns and verbs. As we have seen, English stress is sensitive to the grammatical category of the item.

The following classes of words were given to all subjects (in random order). Each class has five words.

Class 1 (Noun — penultimate stress)

All of the Class 1 words are nouns with penultimate stress. All of these items have a tense vowel in the penultimate syllable (underlined) which triggers the quantity-sensitivity of English and attracts the stress. The final syllable always contains a lax vowel. The Class 1 words are:

aróma, Manitóba, aréna, Minnesóta, horízon

Class 2 (Noun — penultimate stress)

All of the words in this class are nouns with penultimate stress. All of these items have a branching rime (underlined) in the penultimate syllable (a closed penult) which triggers the quantity-sensitivity of English and attracts the stress. The final syllable always contains a lax vowel. The Class 2 words are:

agénda, consénsus, appéndix, veránda, synópsis

Class 3 (Noun — antepenultimate stress)

All of the words in this class are nouns with antepenultimate stress. The penults have neither tense vowels nor consonant clusters to attract the stress. The final syllable always contains a lax vowel. The Class 3 words are:

cínema, jávelin, vénison, América, cábinet

Class 4 (Verb — final stress)

All of the words in this class are verbs with final stress. All of the items have tense vowels (underlined) in the final syllable which trigger the quantity-sensitivity of English and attract the stress. The Class 4 words are:

maintáin, appéar, eráse, decíde, achíeve

Class 5 (Verb — final stress)

All of the words in this class are verbs with final stress. All of the items have consonant clusters (underlined) in the final syllable which trigger the quantity-sensitivity of English and attract the stress. The Class 5 words are:

collápse, eléct, obsérve, adápt, convínce

Class 6 (Verb — penultimate stress)

All of the words in this class are verbs with penultimate stress. The final syllables contain neither tense vowels nor consonant clusters to attract the stress. The Class 6 words are:

astónish, édit, cáncel, consíder, intérpret

Class 7 (Noun — secondary stress)

All of the words in this class are nouns which have tense vowels (underlined) in the final syllable and hence have a secondary final stress (with main stress on the antepenult as the penults are neither closed nor contain tense vowels). The Class 7 words are:

húrricane, báritone, ántelope, cándidate, mátador

Each of these words was placed in a declarative sentence of 13 syllables. The target word was always in sentence-final position, and was preceded by a non-stress-bearing lexical item. This was to avoid any possibility of a stress clash, or any sort of rhythm phenomena. By placing the target words after non-stress-bearing elements, this phenomenon was avoided. The experimental sentences are given in Appendix A. I constructed two randomized lists which were administered to all subjects. Order of presentation was not significant.

The Subjects

The subjects of the study were 23 adult Polish speakers. They were students at either a community college in London, Ontario or the Board of Education in London. The Polish subjects ranged in age from 23 to 64, with an average age of 34.3. They were all registered in English as a Second Language programmes, and had studied English for a range of 1 month to 6 years with an average of 1.9 years.

The subjects were also administered the grammar portion of the Michigan Test of English Language Proficiency in order to obtain a measure of their proficiency. The subjects' scores ranged from 0 to 36 (scored out of 40) with the mean of the Polish subjects being 18.348. There was no significant effect of proficiency on the subjects' performance.[3] As their grammar scores went up, their ability to stress and perceive stress correctly did not necessarily improve.

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[3] Word production; proficiency F=.381; p=.768
Sentence production; proficiency F=.093; p=.963
Word perception; proficiency F=.241; p=.8667
Sentence perception; proficiency F=.44; p=.7269

The subjects were also given a multiple-choice vocabulary test of the target words to see whether knowledge of the word's meaning affected their performance. Their scores ranged from 0 to 34 with the mean of the Polish subjects being 19 (scored out of 35). An ANOVA was run to see whether the subjects' score on a vocabulary test had any effect on their performance. No significant effect was observed.[4] Correlations were also run on whether the subjects got the word meaning correct (scored as right or wrong) and which syllable the subject stressed. There were no significant correlations.[5]

I had hoped that the vocabulary test would give me some idea of whether the subjects performed better on lexical items they knew than on lexical items they did not. The lack of any correlation is most likely the result of the type of vocabulary test I administered. The test told me whether the subjects knew the meaning of the word. However, it told me nothing about whether the subject had ever heard the word before which is likely more relevant information.

Developing the Instrument

Let me briefly justify the test instrument I used to gather these data. During pilot testing several different types of tests[6] were administered to 36 native-speaker subjects in order to determine the best wording of the test instrument. The pilot testing revealed two important things. The first was that there was no significant difference between methods of marking stress.[7] The second was that native speakers could perform this task very

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[4] Word-production; vocabulary level: F=.924; p=.4619
Sentence-production; vocabulary level: F=1.632; p=.1894
Word-perception; vocabulary level: F=1.49; p=.2278
Sentence-perception; vocabulary level: F=1.288; p=.2948

[5]

	Correlation Coefficient
Word-production; knowledge of word meaning:	.097
Sentence-production; knowledge of word meaning:	.073
Word-perception; knowledge of word meaning:	.074
Sentence-perception; knowledge of word meaning:	.072

[6] For example:
Please *place a mark* above the ***syllable*** you perceive to be stressed the most.
Please circle the letters you perceive to be stressed the most. Etc.

[7] On the basis of a one-factor ANOVA run on the tests and the scores, it was determined that the method of marking stress did not significantly change the performance of the subjects (F=1.139, p=.3618). The tests were scored as follows. For each item a score of 1 was assigned if the item was marked correctly, and a score of 2 was assigned if the stress was marked incorrectly. For each subject, the items were totalled and a single score was obtained. For example, a hypothetical subject x would have received scores of: 1 1 1 1 1 1 1 1 2 = 11

successfully.[8] I argue that the test instrument is valid.

Once the appropriate wording was decided on, I administered a 20-item test to 55 native speakers of English (an undergraduate class at a university). The same test was administered seven days later to the same class (n = 49). In order that the students not feel that the test could affect their mark in the course, the tests were done anonymously. Therefore, I cannot directly compare a subject's performance on Trial 1 and Trial 2. However, more than 90% of the subjects were the same in both trials thereby justifying a comparison of the means. No significant difference was found between the two trials.[9] I argue that the test instrument is reliable.

The Empirical Study

First of all, let us review the Polish and English metrical parameter settings.

When we look at how Polish speakers pronounce English words (Table 4), then, we should be able to see whether the fixed-stress nature of Polish stress assignment is influencing the subjects' English pronunciation (and perception of English pronunciation). Polish will give us interesting data on the settings of P5 (Polish is not quantity-sensitive), and P8A (Polish has restricted extrametricality).

This would be representative of the fact that the subject assigned stress correctly on the first nine items, but made a mistake on the tenth. The final score would be 11. If the subject got every item correct, then, a score of 10 would be assigned. If the subject got every item incorrect, a score of 20 would be assigned. Subjects' abilities can be assessed by examining these total scores.

[8] An analysis of performance on individual tests revealed native speakers' ability to perform this stress-marking task satisfactorily, as shown in Table 2. A score of 10 would indicate all correct while a score of 20 would indicate all incorrect.

Test		N	Mean	Std. Dev.
Test 1	mark the syllable	6	11	1.673
Test 2	mark the letters	9	10.833	.983
Test 3	circle the syllable	7	10	0
Test 4	circle the letters	7	10.5	.837

[9] (F=2.42; p=.1229). The results of the two trials are shown in Table 4 (where 20=all correct, and 40=all incorrect):

	Mean	Standard Deviation	Standard Error	Mode
Trial 1	22.455	3.584	.483	20
Trial 2	21.51	2.416	.345	20

Clearly this shows that this is a reliable test of the subjects' stress patterns. Having established that it is a valid instrument to investigate native speakers' phonological systems, the instrument can also be used to look at non-native systems.

Table 4

Polish and English Metrical Parameter Settings

		Polish	English
P1:	The word tree is strong on the	[Right]	[Right]
P2:	Feet are	[Binary]	[Binary]
P3:	Feet are built from the	[Right]	[Right]
P4:	Feet are strong on the	[Left]	[Left]
P5:	Feet are quantity-sensitive (QS)	[No]	[Yes]
P6:	Feet are QS to the	[N/A]	[Rime]
P8A:	There is an extrametrical syllable	[No]	[Yes]
P8:	It is extrametrical on the	[N/A]	[Right]

Polish Error Patterns

Appendix D summarizes the number of errors that each Polish subject made on each task, along with their scores on the Michigan test of English language proficiency, the order in which the items were presented, and the score on the vocabulary test.

Let us now turn to look at the performance of the subjects in more detail. Table 5 presents a breakdown of the errors that the subjects made (by class). Here the numbers indicate the number of subjects who made an error[10] on a particular item.

Table 5: Error Totals by Word

	Number of Errors				
	Production		Perception		
	Word	Sent.	Word	Sent.	Total
Class 1					
aroma	6	13	1	3	23
Manitoba	6	2	6	4	18
arena	6	9	0	3	18
Minnesota	7	3	7	4	21
horizon	16	15	2	2	35*

[10] I would like to comment briefly on the procedure of error detection. As I have already said, a second rater evaluated a randomly-selected 10% of the subjects production tapes and achieved a 92% agreement with the first rater. The question must be addressed, though, as to what was considered to be an error. In English, stress and vowel quality are intimately related in that unstressed vowels tend to be reduced to schwas. A *CJL* reviewer raised the question of what would happen if a subject produced a form like *aroma* [ærəmə]. In this hypothetical form the penultimate vowel is a lax [ə] and therefore the initial stress placement is, in some sense, correct. It is just like *cinema*. This situation never really arose in my data in that the Polish subjects tended to retain full vowel quality even in unstressed syllables. Even with this quality, though, the two raters agreed on stress placement.

Table 5 (cont'd)

Class 2					
agenda	0	8	2	3	13
consensus	7	5	1	3	16
appendix	8	5	4	2	19
veranda	6	0	4	2	12
synopsis	9	9	2	0	20
Class 3					
cinema	1	0	1	4	6
javelin	5	2	3	3	13
venison	8	8	4	1	21*
America	0	3	2	3	8
cabinet	9	1	2	3	15
Class 4					
maintain	1	0	18	2	21*
appear	6	6	0	1	13
erase	2	3	1	2	8
decide	3	0	1	0	4
achieve	2	5	1	0	8
Class 5					
collapse	6	5	0	2	13
elect	7	6	3	0	16
observe	2	1	0	0	3*
adapt	5	6	1	1	13
convince	7	6	1	2	16
Class 6					
astonish	4	5	1	6	16
edit	6	5	7	6	24
cancel	3	1	2	1	7*
consider	5	6	3	2	16
interpret	12	5	7	3	27
Class 7					
hurricane	12	4	9	7	32
baritone	11	6	10	5	32
antelope	9	9	8	10	36
candidate	14	8	7	7	36
matador	9	2	7	2	20*

The asterisk refers to an item which behaves exceptionally within a class. These items will be discussed later.

The error rates on the production tasks are significantly different[11] from the error rates on the perception tasks. Note the patterns shown in Table 6:

[11] (p=.0001)

Table 6

Stress Placement

	Mean Number of Errors	Standard Deviation
Word Production Task	6.543	3.776
Word Perception Task	3.2	2.868
Sentence Production Task	5.429	4.097
Sentence Perception Task	2.886	2.272

However, whether the word was presented in isolation or in a sentence did not significantly affect the subjects' performance.[12] The items with an asterisk in Table 5 are noteworthy in that they seem to behave quite differently than the other members of the class in terms of number of errors made on that item (either much higher or much lower). Approximately one item per class appears to behave differently. I will discuss these items under the relevant classes.

Explaining the Polish Errors

For each class of words, I will present a breakdown of the kinds of errors that the subjects made. First I will give a chart which shows the distribution of the error types. I will then discuss the most common error pattern and likely explanation.[13]

Common errors: Classes 1 and 2

Class 1 (tense penult): aroma, Manitoba, arena, Minnesota, horizon

Each of these words is a noun with penultimate stress. Each of the words has a tense vowel in the penult which attracts stress. If the Polish

[12] (p=.0754)

[13] A *CJL* reviewer has raised the interesting point of what effect the orthography of the items had on the subjects' performance. This may have affected both the production and perception tasks in that both involved reading (one silently and one out loud). All I can say is that I can note no specific orthographic cue which correlates with either greater accuracy or more mistakes. Such things as whether a syllable is closed by an orthographically present consonant, or whether a vowel sound is written with one or two orthographic symbols, did not help to explain the subjects' error patterns. In order to talk about what aspects of the writing system might cause confusion, we would need a more fully articulated framework for discussing the similarities and differences of written forms than we have. I know of no sophisticated way of determining whether the written form of *aroma* is more like *cinema* than *agenda*. Attributing errors to this orthographic confusion remains speculative. I will, however, speculate in discussing variation within classes that might be influenced by orthography later.

subjects are transferring their L1 parameter settings they should get these forms correct.

Class 2 (closed penult): agenda, consensus, appendix, veranda, synopsis

Each of these words is also a noun with penultimate stress. Each of the words has a closed penult which attracts stress. If the Polish subjects are transferring their L1 parameter settings they should get these forms correct, too. Due to the quantity-insensitivity of Polish, we would not expect the subjects to treat these classes differently.

Table 7 indicates the breakdown of where the Polish subjects placed stress.[14]

Table 7

Distribution of Stress Placement (Class 1)

(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	64.3	7	26	NA	2.6
spro	62.6	3	33.9	NA	1
wper	86.1	5.2	7	NA	1.7
sper	84.3	3.5	10.4	NA	1.7

Here we note that, as expected, the subjects placed the stress on the penult most often. As usual, the perception scores were higher (more accurate) than the production scores. Table 8 shows the distribution of stress for Class 2:

Table 8

Distribution of Stress Placement (Class 2)

(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	72.2	NA	22.6	NA	5.2
spro	72.2	NA	26.1	NA	1
wper	87	NA	9.6	NA	2.7
sper	89.6	NA	7.8	NA	2.6

Again, we see that the subjects placed the stress on the penult most often, and perception was more accurate than production.

[14] wpro = word production spro = sentence production
wper = word perception sper = sentence perception

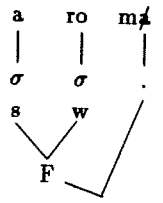
In these two classes, the most common error was to stress the antepenult and, as a result, I shall discuss them together.

Common errors (Classes 1 and 2)

In some respects, it seems surprising that any of the subjects are making mistakes on these words. After all, we would expect penultimate stress if they were treating the words like Polish words. In addition, the input they receive from native English speakers indicates penultimate stress. Why would they get it wrong?

It appears as if extrametricality is influencing the subjects' behaviour in these classes. Polish has restricted extrametricality (Hayes and Puppel 1984). Only a certain subset of inflectional endings become extrametrical. One of these is *-a*. Coincidentally, six of the ten forms in Classes 1 and 2 end in *-a*: *aroma*, *Manitoba*, *arena*, *Minnesota*, *agenda*, and *veranda*. It is not inconceivable that the Polish subjects are marking this vowel as extrametrical (marked with a slash overstrike) and building a structure as shown in (9):

(9)



This would explain the frequency of antepenultimate stress in these words. There was, however, no statistically significant difference in the subjects' treatment of words that ended in *-a* and words that did not. They did tend to make more errors on the *-a* words but the difference was not significant. Table 9 indicates the average number of correct responses for these words:

Table 9

The Effect of Word-Final -a

	W-Pro	S-Pro	W-Per	S-Per
-a words	17.6	16.8	19.5	19.5
non -a words	12.8	13.5	20.5	20.8
t-test results (p=)[a]	.1449	.4263	.6695	.1027

[a]Paired, two-tailed t-tests were run on *-a* and non *-a* words for each task.

Uncommon errors: Classes 1 and 2

What of subjects who stressed either the preantepenult or the final syllables? These uncommon errors are very uncommon. These results could easily be

the result of random variation. Most are made by under five percent of the subjects. In statistical terms, then, having adopted a significance level of $p<.05$, these uncommon errors could be explained as random variation.

Common errors: Classes 3, 4 and 5

Class 3 (N-antepenultimate): cinema, javelin, venison, America, cabinet

Each of these words is a noun with antepenultimate stress. Due to the principle of Noun Extrametricality (which marks the final rime of all English nouns as extrametrical) and the lack of either a tense vowel in the penult or a closed penult, we find this stress pattern. If the Poles are transferring their L1 metrical settings, we would expect them to have difficulty with this class of words (due to their lack of extrametricality). Without extrametricality, the Polish subjects have no mechanism to place stress as far back as the antepenult. We would expect to find errors like *venison*, where they stress the penult.

Class 4 (V—tense final): maintain, appear, erase, decide, achieve

Each of these words is a verb with final stress. Each of the words has a tense vowel in the final syllable (a branching rime) which attracts stress. If the Polish subjects are transferring their L1 parameter settings we would expect them to have difficulty with this class. We would expect them to stress the penult and produce forms like *máintain*.

Class 5 (V—final cluster): collapse, elect, observe, adapt, convince

Each of these words is a verb with a consonant cluster at the end of the word which attracts stress (a branching rime—even after Consonant Extrametricality applies). If the Poles are transferring their L1 parameter settings we would expect them to have difficulty with this class. We would expect them to stress the penult and produce forms like *óbserve*.

Table 10 indicates the patterns of the Polish subjects' performance.

Table 10

Distribution of Stress Placement (Class 3)

(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	80	0	NA	5.2	14.8
spro	84.3	3	NA	12	3
wper	88.7	1.7	NA	7.8	1.7
sper	86.1	2.6	NA	9.6	1.7

Table 10 shows that the subjects did quite well on this class of words. With one exception the most common error, though, was to stress the penult as predicted by L1 transfer. Table 11 shows the distribution of stress placement for Class 4:

Table 11

Distribution of Stress Placement (Class 4)

(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	79.1	NA	NA	20	NA
spro	71.3	NA	NA	28.7	NA
wper	94.8	NA	NA	5.2	NA
sper	93	NA	NA	7	NA

Table 11 chart shows that the subjects, again, did quite well on this class. Their perception scores were higher than on the previous class which can probably be explained by the fact that this class of words contains only two syllable words. I suspect this would make the perception task easier. The production task was still highly influenced by the subjects' stressing of the penult, however. Table 12 indicates the distribution of stress placement for Class 5:

Table 12

Distribution of Stress Placement (Class 5)

(in percentages)

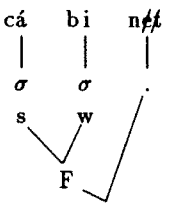
Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	73.9	NA	NA	26.1	NA
spro	78.3	NA	NA	20.1	NA
wper	96.6	NA	NA	3.5	NA
sper	93.9	NA	NA	6.1	NA

Table 12 shows a very similar pattern to Table 11. Perception scores are very high (likely due to the fact that the class is entirely two-syllable words). Production is influenced by the Polish practice of stressing the penult.

In both production and perception of all of these classes, the most common error was to stress the penult. This, as we have seen, is the usual case in Polish stress and is evidence of transfer of the L1 parameter settings. The Polish subjects will be building metrical trees which are strong on the left starting from the right edge of the word. This leads to such productions as *máintain* and *cóllapse* which were common. If the Polish subjects are

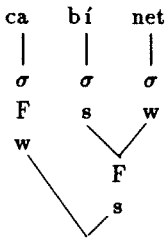
transferring their L1 parameter settings then we would expect the fact that Polish has limited extrametricality to have some effect, and it does. This, in fact, is the mechanism which accounts for the frequency of penultimate stress in the Polish subjects' interlanguages. Consider the native English speaker representation of a word from Class 3 such as *cabinet* (10):

(10)



The Polish subjects would not have this extrametricality, and would, thus, assign main stress to the penult (11):

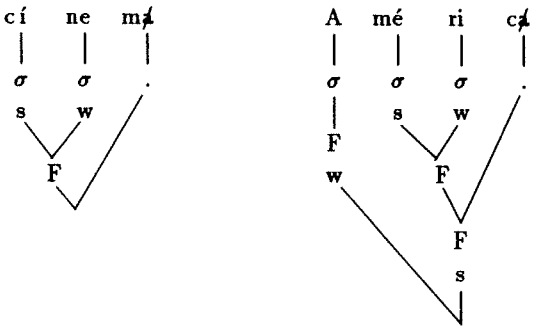
(11)



Once again, we see evidence for the transfer of the L1 parameter settings; in this case P8 and P8A, the extrametricality parameters.

Extrametricality could also help to explain the high success rate on Class 3 words *cinema* and *America*. If the subjects are marking a final *-a* as extrametrical, they would be generating the structures shown in (12), which, again, explains the antepenultimate stresses. There is no evidence of lexical transfer being responsible for this success.

(12)



Uncommon Errors

Once again, with one exception, all of these errors could be the result of random variation (under five percent).

Within-class variation

Venison was the item in Class 3 that caused the most trouble (Class average errors=12.6; *venison*=21). It is most likely that the subjects' lack of exposure to this word made it problematic for them.

Maintain was the word in Class 4 which had the most errors (Class average=8.2; *maintain*=21). Of the 21 errors, 18 occurred in the perception test. This may well have been because it is the only word in the class with two full vowels. All of the other words had one schwa and one full vowel. In this item, then, the perception task was not facilitated by having a reduced vowel present.

Observe was the word in Class 5 that the fewest subjects had difficulty with (Class average=12.2; *observe*=3). I would speculate that this is one case that might have something to do with the orthography. Subjects seemed to do quite well on words that were spelled with a silent -e at the end. For example, *observe*, *decide*, *convince*. Perhaps the learners are using the final *-e* as a cue that the vowel in the final syllable is tense. This also helps to explain the variable performance in Class 7, as we shall see.

Common errors: Class 6

Class 6 (V — penultimate stress): astonish, edit, cancel, consider, interpret

Each of these words is a verb with penultimate stress as there are no branching rimes to attract stress. We would predict, if the Polish subjects are transferring their L1 parameter settings that they would have little trouble with this class. Table 13 illustrates the distribution of stress placement for Class 6:

Table 13

Distribution of Stress Placement (Class 6)

(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	73.9	NA	10.4	NA	15.7
spro	69.6	NA	11.3	NA	9.6
wper	80.1	NA	6.1	NA	13
sper	73	NA	6.1	NA	12.2

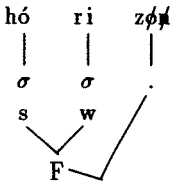
Table 13 shows that the subjects are assigning stress correctly quite well. There are, however, a number of subjects who place the stress in places not predicted by L1 transfer (or L2 input).

In this class, the most common error was to stress the final syllable. The first thing to note is that two of these words are two syllables (*edit* and *cancel*). Therefore, if for whatever reason, the subject is not stressing the penult, the only other choice is to stress the final syllable. But what of the three-syllable words? It is striking to note that on words like *astonish* (Class 6) we get final stress most often, but in words like *horizon* (Class 1) we get initial stress the most. The obvious distinction here is that Class 6 words are verbs while Classes 1 and 2 are nouns. It is reasonable to assume that the Polish subjects are aware of the grammatical category of the lexical items. It also seems reasonable to assume that Polish speakers would be aware that grammatical category could influence stress assignment as a result of their limited extrametricality which is also sensitive to grammatical category and influences stress placement.

Their performance could be the result of a process which could be phrased informally as "if it is a verb, stress the final syllable". This often produces the correct results in English. In two of the three word categories in this study final stress is the correct placement (e.g., *appear*, *observe*, etc.). Some subjects seem to be treating Classes 4, 5 and 6 (all the verbs) in the same fashion. There may, in fact, be a sub-pattern within all the verbs. The subjects seem to do better on verbs that have a final *-e* in the spelling. They do better on *erase* (8 errors), *decide* (4), *achieve* (8), *collapse* (13), *observe* (3), *convince* (16)[15] than they do on verbs that do not end in *-e* such as *maintain* (21), *appear* (13), *elect* (16), *adapt* (13), *astonish* (16), *edit* (24), *cancel* (7), *consider* (16), and *interpret* (27).[16]

English nouns and verbs have different stress patterns. This is explained by the fact that the word-final rime in English nouns is extrametrical, as opposed to the word-final segment in verbs. Many of the errors that the Polish subjects produce can be explained if we assume that they have figured this out. Thus, the errors in Classes 1 and 2 (stressing the antepenultimate) can be explained if we note that the final rime is extrametrical. The learners would appear to be building a structure similar to that shown in (13):

(13)

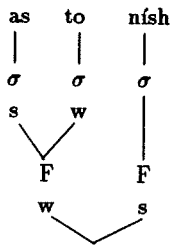


[15] An average of 8.6 errors per item.

[16] An average of 17 errors per item.

For the verbs, however, the subjects stress the final syllable, and then build a binary "s w" foot to the left (14):

(14)



Several of the subjects seem not to be consulting grammatical category with reference to stress assignment and are therefore treating Class 6 and Class 7 words in the same fashion. This is not terribly surprising when we just look at the surface segmental phonology and see sound sequences like *astonish*, *antelope* with exactly the same pattern of consonants and vowels: VCCVCVC, VCCVCVC. We also find totally different stress patterns: VCCV́CVC, V́CCVCVC.

The fact that learners would treat these words in the same fashion is not surprising. The learners who stressed the antepenult are behaving in the same fashion as the learners who are stressing the final syllable; constructing a pattern of alternating stress.

To account for the learners' behaviour within a parametric model, then, we would have to propose some new parameters which looked something like this:

P9: Extrametricality is sensitive to grammatical category [yes/no].[16]
P10: For Nouns the domain of extrametricality is the [rime/segment].
P10A: For Verbs the domain of extrametricality is the [rime/segment].

By enhancing the Dresher and Kaye parameters in this fashion, we could account for the stress patterns found in Classes 4 and 5 as well as for the way in which subjects treated nouns and verbs. Subjects who treated nouns and verbs the same would either have the same setting for P10 and P10A or the wrong setting for P9. Subjects who treated nouns and verbs differently could be accounted for by the logical independence of the parameters.

[16] Here I will just refer to extrametricality though, clearly, this is a simplification. As Dresher (personal communication) points out, grammatical conditioning does not just apply to extrametricality. In addition, many languages have well-defined subvocabularies which work according to different principles. The subvocabularies can be defined in various ways (native vs. non-native; latinate vs. non-latinate; grammatical category; etc.). Again, it is beyond the scope of this paper to consider the learning theory necessary to account for learners reconciling such conflicting input.

Within-class variation

Cancel was the notable word in Class 6 for having many fewer errors than the other items (Class average=18; *cancel*=3). I have no good explanation as to why this form would be so easy for the Polish subjects. I could speculate that this has something to do with a knowledge of English spelling conventions; that to get stress on the [ɛl] syllable we would expect a spelling of *-elle*, as in *gazelle*. However, it seems unreasonable to assume that the subjects of this experiment would have those intuitions.

Common errors: Class 7

Class 7 (N — secondary): hurricane, baritone, antelope, candidate, matador

Each of these words is a noun with initial stress. This is the only class of words which has a secondary stress. These words will likely cause difficulty to the Polish subjects if they are transferring their L1 settings as Polish secondary stress is to the left of the primary stress. For these English words, we find the opposite pattern. Also if the Poles stress the penult, we would expect incorrect forms like *antélope*. Table 14 indicates the stress distribution for Class 7:

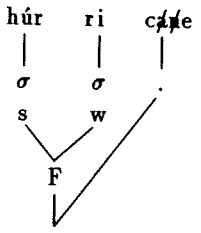
Table 14
Distribution of Stress Placement (Class 7)
(in percentages)

Task	Correct	Incorrect			
		Preante-penult (4)	Ante-penult (3)	Penult (2)	Final (1)
wpro	53	NA	NA	7.8	39.1
spro	71.3	NA	NA	3.5	24.3
wper	64.3	NA	NA	20	15.7
sper	66.1	NA	NA	13	20

From Table 14 we note a general lower level of accuracy; fewer subjects were placing the stress on the correct syllable. Here, the most common error was to stress the final syllable (though on the word-perception test, the penult was stressed more often). The subjects who produced penultimate stress are merely stressing the word as if it were Polish; they are transferring from the L1. But what of the subjects who produced final stress? Many subjects had an initial secondary stress and a final main stress (which was scored as wrong but is not that wrong). This seems to be a transfer of the principles governing Polish secondary stress, as well. In Polish, the secondary stress is to the left of the primary stress, and, in fact, is always on

the first syllable.[17] However, it could also be a relatively low-level matter of phonetic implementation; they had correctly assigned the stress to the right syllables but perhaps their phonetic realization was incorrect. This could be transfer of a Polish implementation strategy. Many of the subjects, though, in many classes produced three syllable words where there was an initial and a final stress — they did not stress the penult. We cannot explain the production of final stress for these words in the same way that we did for Class 6 words (the result of placing final stress in verbs) as these are nouns. Earlier, the claim was made that the Polish subjects' errors were consistent with their having noted that English nouns had extrametrical word-final rimes. If this is the case, we would expect them to treat Class 7 words in the same way (15):

(15)

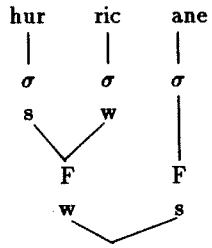


which would be the correct stress placement. But many subjects are not doing this. The question we must ask is why the subjects would treat words like *horizon* (Class 1) differently from words like *hurricane* (Class 7) when both are the same grammatical category and both have, essentially, the same segmental structure (CVCVCVC)? The answer appears to lie in a slight phonetic difference in the segmental structures of the words. Classes 1, 2 and 3 all have lax vowels in the final syllable. Class 7 words all have tense vowels in the final syllable. In addition, four of the five items in Class 7 end in a silent *-e*. Earlier I argued that this orthographic feature might be a salient cue to the subjects that the final syllable contained a tense vowel. In English tense vowels (or at least unreduced vowels) are a fairly reliable cue for the presence of stress. If we consider a word like *banana*, we note the following vowel qualities [bənænə], where the presence of an unreduced vowel is a good indicator of which syllable is stressed (and, conversely, the presence of a reduced vowel ([ə] is a reliable cue for non-stress). I think it likely that the Polish subjects were aware of this correlation in English. Even in the perception tasks for this class, final stress was often marked; perception of an unreduced vowel was taken as a signal that the vowel was stressed. If the subjects decided that the final vowel was stressed, they may

[17] In Hayes and Puppel's (1984:64) words, "form all remaining syllables into an unbounded left-branching structure, with sister nodes labelled s w, and adjoin it to the main stress foot."

well transfer the Polish constraint that the final stress of a word is the main stress. These Polish subjects treated Class 7 words in the same way they treated Class 6 (but for different reasons). Example (16) shows the type of structures they build:

(16)



The subjects have not yet acquired the rule of stress retraction.

Uncommon errors: Class 7

These errors seem less likely to be caused by random variation. The subjects who stressed the penult in this class were transferring their Polish settings to generate penultimate stress.

Within-class variation

Matador was notable in this class for having fewer errors than the other members (Class average=31.2; *matador*=20). I think that this may reflect an orthographic influence, as well. Earlier, I speculated that the subjects were using a final *-e* as a cue for tenseness in the final syllable which would attract stress. This would explain the high number of errors in words like ***hurricane***, ***baritone***, ***antelope***, and ***candidate***. *Matador* is the only word in this class that does not end in an *-e*, and it has fewer errors.

Overall Description of Polish Errors[18]

The composite totals of errors give us the following ranking of word classes in terms of the difficulty they presented to the Polish subjects (17):

(17)

Class 7 N-secondary	Most Difficult
Class 1 N-tense penult	↑
Class 6 V-penultimate	
Class 2 N-closed penult	
Class 4 V-tense final	
Class 3 V-final cluster	↓
Class 5 N-antepenultimate	Least Difficult

[18] Appendix B shows the error rankings of the target words for each of the four tasks.

Summary of Polish Errors

Four factors seem to be underlying the Polish subjects' performance:

(1) the process of transferring a Polish binary strong/weak foot and producing penultimate stress (regardless of the internal structure of the syllable); transfer of [P5].

(2) the process of transferring the L1 extrametricality markings; transfer of [P8A] in many cases.

(3) treating verbs differently than nouns (especially verbs that end in a written *-e*); not the result of transfer.

(4) perceiving unreduced vowels as a cue for primary stress. Related to this is the L1 constraint that the final stress in the word is the primary stress; transfer of [P1].

The inappropriate transfer of the L1 value of the quantity-sensitivity parameter [P5] underlies many of these errors. Only on Class 7 words is there any indication that the Polish subjects are consulting the internal structure of the syllable in their tree construction. On the whole, they show no sign of treating open and closed syllables differently. In addition, it is clear that the subjects have to sort out seemingly conflicting cues as to what the rules of English stress assignment are. Sometimes a three-syllable word has the stress pattern of *aróma* while sometimes it has the stress pattern of *mátador*. The learner is engaged in a process of discovering both which words belong to which classes, and which cues are going to provide the necessary information. This process will probably be influenced by the input the learner receives, and which elements of that input the learner views as most salient.

I think that these results also have something to say to the question of competence versus performance in second language acquisition. Many researchers feel that such tasks as grammaticality judgement tasks allow the researcher to tap into competence without being derailed by performance factors. Performance factors are often called upon to explain variation in the subjects (see also Neufeld 1988 for a treatment of this in the area of phonology). I think, however, in light of these data, we have less support for arguing that receptive skills give us a better picture of the interlanguage system or grammar. In fact, in this study, the reverse is true. We saw less of an L1-transfer effect in the perception tasks. Ideally, both types of data should be considered.

Two Lexicons

Menn's (1983) two-lexicon model may give us a partial explanation of the subjects' differential behaviour on production and perception tasks. The

model allows us to explain learners who are able to perceive distinctions that they are unable to make. The input lexicon stores a recognition form; the output lexicon stores a production form. Thus, if the learner, at a certain stage, is able to perceive which syllable is stressed in target speech but is unable to produce the word correctly, we would say there is a mismatch between the form stored in the input lexicon and the form stored in the output lexicon. For example, a subject may have a lexical entry something like (ignoring segmental characteristics):

(18) Input Representation: **maintáin**

Output Representation: **máintain**

A subject with this lexical entry would be able to perceive stress correctly, but would still be producing the item with incorrect stress. This could explain the fact that the overall performance on the perception tasks was better than the overall performance on the production tasks.

Menn, who deals with child language acquisition, also claims that the input representation normalizes first. In other words, that a particular subject will develop an accurate (adult or nativelike) input representation before the same subject develops an accurate output representation for the same lexical item. In terms of second language acquisition, I think that this would lead us to expect a correlation between proficiency and performance on these tests. We would expect beginning students to have both their input and output representations the same as the L1 representation. We would expect intermediate learners to have changed their input representation to match the L2 form but still have an incorrect output representation. And we would expect advanced learners to have adopted the correct L2 form for both their input and output representations. However, I do not think that we can say that this hypothesis is supported in its entirety by these data. Considering the fact that several of the subjects in this study were absolute beginners and still performed very well on the perception tests, it would be difficult to argue that there is a connection between their level of proficiency (or development) and the form of their input representations. If these absolute beginners have already normalized their input representations, then who has not? Maybe the claim is justified in first language acquisition, but there seems to be a difference for adult second language learning.

Conclusions

I believe that the study was a fruitful one in that the empirical results seem to be largely what the theoretical model would predict. Many studies have taken the general approach of saying something like "We've come up with a certain structural model of a particular linguistic phenomenon. On the

basis of this, we'd predict that people learning this system would behave in a certain way." For example, if Italian speakers can move WH words in ways that English speakers can't, we might expect them to produce English sentences which show their L1 patterns. Largely as a result of working with problematic parameters (pro-drop, COMP/INFL), the empirical studies have not provided clear-cut support for the structural descriptions. In contrast, the empirical study discussed here provides support for the principles and parameters model of description. Much of the learners' behaviour can be accounted for with reference to the metrical parameters proposed. Thus, the parametric model is to be preferred (1) in terms of the higher level reasons such as learnability, and (2) in terms of an actual account of learner knowledge and behaviour. It appears that the learners are transferring their L1 parameter settings into the L2. In this paper, I will not be contributing to the debate as to how markedness factors influence L1 transfer (White 1989b; Liceras 1989; Mazurkewich 1984; Phinney 1987).[19] The principles and parameters model is useful, then, in describing interlanguages as well as monolingual, adult knowledge. It can help us to explain L1 transfer by being explicit about what is transferring. This study shows that stress is not a single thing to be acquired, and that a careful investigation of this phenomenon can help to explain why the learners behave in the way that they do. A rigorous investigation of stress phenomena reveals a great deal of L1 influence. The metrical framework adopted allows us to explain many of the characteristics of the learners' interlanguages.

I feel that the study has ramifications in the fields of (1) theoretical linguistics (having provided some empirical support for a theoretical model), and (2) second language acquisition (showing the utility of adopting the learnability approach to research in this field as we try to account for the acquisition of second language competence).

[19] As Dresher and Kaye (1990) note, the notion of markedness, or default settings with respect to these metrical parameters is complex. Certainly, the kinds of subset relations found in many syntactic parameters are absent. It is, thus, beyond the scope of this paper to compare these results with results from syntactic markedness studies.

Appendix A

Class 1

1. The thing I love about coffee is the *aroma*.
2. In the summer I like to visit *Manitoba*.
3. The town asked for a big loan to build an *arena*.
4. I have never met anyone from *Minnesota*.
5. You can see the sun a bit above the *horizon*.

Class 2

1. We can't talk about that, it's not on the *agenda*.
2. The exam committee couldn't reach a *consensus*.
3. I'm thirty years old and I still have my *appendix*.
4. When it gets hot I like to sit on the *veranda*.
5. He didn't read the book, he just read a *synopsis*.

Class 3

1. On Saturdays I like to go to the *cinema*.
2. When I was in school I learned to throw the *javelin*.
3. It has a strong taste but I really like *venison*.
4. She lives in the United States of *America*.
5. I was trying to fix the doors on the *cabinet*.

Class 4

1. I find that position much too tiring to *maintain*.
2. I don't think she's as old as she might *appear*.
3. You can record over the songs you want to *erase*.
4. The committee will support whatever you *decide*.
5. I was amazed by what you were able to *achieve*.

Class 5

1. I really didn't think that the building would *collapse*.
2. The delegates were still not sure who they should *elect*.
3. You can't take part in the class but you're allowed to *observe*.
4. When I came to Canada, it was hard to *adapt*.
5. Don't talk to me, Bob's the person you have to *convince*.

Class 6

1. Roberta is not very easy to *astonish*.
2. This new manuscript is quite difficult to *edit*.
3. I can't come on Friday, I guess I'll have to *cancel*.
4. They made Tony an offer he's going to *consider*.
5. Some of the results were difficult to *interpret*.

Class 7

1. Edmonton was devastated by a *hurricane*.
2. In the opera company, Bob's the best *baritone*.
3. When we all went to the zoo we saw an *antelope*.
4. They asked me but I don't want to be the *candidate*.
5. My brother always wanted to be a *matador*.

Appendix B

This chart gives a general idea of which words were troublesome for the Polish subjects and which words were not. It is to be read as follows. In the word production task, 16 of the 23 Polish subjects made a mistake on the word *horizon*; 14 of the subjects made a mistake on the word *candidate*; none of the subjects made a mistake on the word *America*. In the sentence production task, 18 of the 23 Polish subjects made a mistake on the word *maintain*, etc.

Word Production	Sentence Production	Word Perception	Sentence Perception
horizon (16)	maintain (18)	baritone (10)	antelope (10)
candidate (14)	horizon (15)	hurricane (9)	hurricane (7)
hurricane (12)	aroma (13)	antelope (8)	candidate (7)
interpret (12)	arena (9)	edit (7)	edit (6)
baritone (11)	antelope (9)	Minnesota (7)	astonish (6)
maintain (10)	synopsis (9)	candidate (7)	baritone (5)
antelope (9)	agenda (8)	interpret (7)	maintain (4)
synopsis (9)	venison (8)	matador (7)	Manitoba (4)
cabinet (9)	candidate (8)	Manitoba (6)	Minnesota (4)
matador (9)	appear (6)	appendix (4)	cinema (4)
appendix (8)	elect (6)	venison (4)	agenda (3)
venison (8)	baritone (6)	veranda (4)	consensus (3)
consensus (7)	adapt (6)	javelin (3)	javelin (3)
elect (7)	consider (6)	elect (3)	arena (3)
Minnesota (7)	convince (6)	consider (3)	America (3)
convince (7)	collapse (5)	agenda (2)	cabinet (3)
aroma (6)	astonish (5)	maintain (2)	interpret (3)
collapse (6)	consensus (5)	cancel (2)	aroma (3)
Manitoba (6)	edit (5)	America (2)	appendix (2)
appear (6)	appendix (5)	horizon (2)	erase (2)
edit (6)	achieve (5)	synopsis (2)	veranda (2)
arena (6)	interpret (5)	cabinet (2)	consider (2)
veranda (6)	hurricane (4)	aroma (1)	horizon (2)
javelin (5)	erase (3)	astonish (1)	convince (2)

(cont'd . . .)

Word Production	Sentence Production	Word Perception	Sentence Perception
adapt (5)	Minnesota (3)	consensus (1)	matador (2)
consider (5)	America (3)	erase (1)	collapse (2)
astonish (4)	Manitoba (2)	decide (1)	venison (1)
cancel (3)	javelin (2)	adapt (1)	cancel (1)
decide (3)	matador (2)	achieve (1)	adapt (1)
erase (2)	observe (1)	convince (1)	appear (1)
observe (2)	cancel (1)	cinema (1)	observe (0)
achieve (2)	cabinet (1)	appear (0)	decide (0)
cinema (1)	cinema (0)	arena (0)	synopsis (0)
America (0)	veranda (0)	observe (0)	achieve (0)
agenda (0)	decide (0)	collapse (0)	elect (0)
Mean: 6.543	5.429	3.2	2.886
Std. Dev.: 3.776	4.097	2.868	2.272

Appendix C

It is likely that some of the uncommon errors (some of which were very uncommon) were the result of performance factors such as distraction, fatigue, an isolated tape click, or some such thing, and could, as a result, be attributed to random variation. However, the fact remains, even the errors which were rare, the errors which were not immediately attributable to L1 transfer, did not violate any universal principle of metrical systems. The following chart shows how the subjects were behaving systematically. The numbers indicate how many of the subjects placed the stress on the final syllable (1), the penult (2), the antepenult (3), or the preantepenult (4). A coding of NA indicates that the target word did not have the appropriate number of syllables (i.e, for the word *cancel* it would be meaningless to say the nobody assigned stress to the preantepenult; there is none. A score of zero was, therefore, not assigned.)

Word Production Task

	Syllable*			
Word	1	2	3	4
Class 1				
aroma	0	17	6	NA
Manitoba	0	17	2	4
arena	0	17	6	NA
Minnesota	0	16	3	4
horizon	3	7	13	NA

*Where:
final = 1; penultimate = 2;
antepenultimate = 3;
preantepenultimate = 4.

	Syllable*			
Word	1	2	3	4
Class 2				
agenda	0	23	0	NA
consensus	1	16	6	NA
appendix	4	15	4	NA
veranda	0	16	7	NA
synopsis	1	13	9	NA
Class 3				
cinema	1	1	21	NA
javelin	5	0	18	NA
venison	3	5	15	NA
America	0	0	23	0
cabinet	8	0	15	NA
Class 4				
maintain	13	10	NA	NA
appear	17	6	NA	NA
erase	21	2	NA	NA
decide	20	2	1	NA
achieve	20	3	NA	NA
Class 5				
collapse	15	8	NA	NA
elect	16	7	NA	NA
observe	21	2	NA	NA
adapt	17	6	NA	NA
convince	16	7	NA	NA
Class 6				
astonish	0	19	4	NA
edit	6	17	NA	NA
cancel	3	20	NA	NA
consider	0	18	5	NA
interpret	9	11	3	NA
Class 7				
hurricane	10	2	11	NA
baritone	10	2	11	NA
antelope	9	0	14	NA
candidate	12	2	9	NA
matador	4	3	16	NA
Totals:	265	310	219	8
Avg/Subj	11.5	13.5	9.5	.3

From this chart we note that many logically possible patterns are not entertained (the number of zeros). If the subjects were wildly testing hypotheses, we would

not expect to see so many zeros. For this task, the Polish subjects had 15 zeros (15 hypotheses which were never entertained). For the 35 words in this task there is a total of 97 syllables, or 97 possible places to put stress. So, for the Poles, 15/97 (15.5%) of the potential stressable slots were never filled. Now, in some respects, counting the zeros is misleading. Between production and perception scores, the number of zeros is about the same, and yet perception scores are much better (the responses are uniformly correct).

Even when there are no zeros, there is almost always a highly preferred error type. This can be seen by looking at the patterns within a word class.

Appendix D

Number of Errors

Subj No.	W-Prod	S-Prod	W-Perc	S-Perc	Michigan Score/40	Order	L1	Vocab. Score/35
3	18	15	8	5	32	2	P	32
10	3	0	0	0	36	2	P	33
100	20	14	11	13	16	2	P	0
103	11	13	0	0	20	2	P	33
104	7	6	0	0	23	2	P	31
105	3	3	0	0	16	2	P	29
106	16	14	9	11	18	2	P	30
108	4	10	5	5	18	2	P	28
109	10	12	0	0	25	2	P	20
113	7	7	2	4	25	2	P	34
200	15	11	6	7	21	1	P	32
201	11	9	9	11	0	1	P	0
202	9	6	2	5	0	1	P	0
203	6	5	3	2	0	1	P	0
204	9	10	9	5	0	1	P	0
205	11	7	6	4	12	2	P	0
206	12	3	1	1	16	1	P	31
207	10	12	9	8	31	1	P	33
208	7	7	7	5	22	1	P	33
209	9	10	2	1	23	1	P	31
210	9	8	10	5	26	1	P	32
211	18	8	3	1	20	1	P	34
20	7	4	9	14	22	2	P	30

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