UNIVERSALS IN INTERLANGUAGE PHONOLOGY: THE CASE OF BRAZILIAN ESL LEARNERS

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1. INTRODUCTION

A major question that has occurred frequently in the second language (L–2) phonology literature has been how to explain phonological errors and learning difficulty. One of the earliest theories put forward, the Contrastive Analysis Hypothesis (Lado 1957), holds that learning difficulty and errors in the target language can be predicted by a systematic comparison between the native and target languages. According to this theory, the areas of the languages that overlap will not pose any difficulty, but the areas that only partially overlap or that do not overlap at all will be a source of difficulty for the L–2 learner. However, the predictive power of the Contrastive Analysis Hypothesis has been seriously questioned because of empirical evidence accrued through research studies. The earliest of these studies was done by Brière (1966), whose research investigating the Contrastive Analysis Hypothesis demonstrated that only part of the error hierarchy found and only some of the errors could be accounted for by native language transfer.

Since then, other factors in addition to transfer, such as age (Ioup and Tansomboon (1987)) sociolinguistic variability (Beebe (1980), L. Dickerson (1975); and Schmidt (1977)), anxiety (Stolen 1987), developmental processes (Muiford and Hecht (1982); Major (1987); and Wode (1976)) and language universals (Eckman (1977, 1981); Tarone (1980); and Anderson (1983)) have each been found to be related in some way to the language learner's interlanguage phonology. Of particular interest in the present study, are language universals because they can make predictions not only about the types of errors that occur but also about the relative difficulty of target language sounds.

2. BACKGROUND

2.1. Language Universals

The term "language universals" is used here generically to include universals of both language and language learning. Included in the discussion below are: (1) universals of content; (2) universalist theories of first language (L–1) acquisition; and (3) universalist theories of L–2 acquisition.

The term "universals of content" (Wolfram and Johnson (1982)) refers to forms which are widespread across the phonemic inventories of languages of the world. An example can be found in vowel systems. Crothers (1978) has shown that all languages have at least three vowels: /i/, /a/, and /u/ in their phonemic inventories, and the most common type of vowel system is one that contrasts five vowels. Further, individual vowels can be predicted on the basis of the universal forms. For example, a language with four or more vowels has /ɛ/ or /i/ in its vowel system, and languages with more than five vowels generally have /ɔ/ in their systems. In other words, some of the sounds in languages exist in hierarchical or implicational relationship with other sounds. Thus, in the vowel example cited above, /ɛ/ can be said to imply the existence of /a/, /i/, and /u/. The same kind of implicational relationship also exists for consonants. For example, voiceless obstruents tend to be more widespread across languages than their voiced counterparts, and any language that has voiced obstruents will always have the corresponding voiceless obstruents (Sloat, Taylor and Hoard (1978)).

The term "universalist theories of language acquisition" as it is used here, refers to theories which posit specific acquisition sequences or phonological processes in L–1 acquisition. Jakobson (1941) formulated predictions about L–1 acquisition sequences based on a universal hierarchy of structural laws determining the frequency of occurrence and distribution of sounds in particular languages. His theory predicts, for example, that voiceless consonants are acquired before their voiced counterparts, and that stops are acquired before nasals, followed by fricatives and then liquids.

Stampe's (1969) theory of natural phonology, on the other hand, is concerned with phonological processes rather than developmental sequences of sound segments. His model of phonology assumes that the phonological system of a language is governed by a system of universal processes which act as automatic responses to articulatory pressures, leading to a modification of sounds which results in easier articulation (e.g., reduction of consonant clusters in English). He theorized that language acquisition involves a gradual suppression of these natural processes as the learner acquires the phonological rules of a language, which are different from processes in that they lack universality and are often not well motivated phonetically (e.g., the velar softening rule in English).

However, within the field of L–1 acquisition, disagreement exists as to the extent to which such theories of language development can accurately predict actual learning sequences and developmental processes. Macken and Ferguson have noted that the widespread individual differences among children acquiring the same language have led to a

"shift away from a deterministic linguistic model toward a flexible model that accomodates variation in development by acknowledging the role of the child, the diversity of input, and the variety of possible solutions" (1981:115).

They hold that each child's exploration and regularization of the linguistic input s/he receives can result in different acquisition sequences and phonological processes. Nonetheless, in spite of individual variation, certain trends have been observed in L–1 development that are widespread across many children.

Language universals have also been explored, although to a more limited extent, in L–2 acquisition. Eckman (1977) was one of the first researchers to apply the notion of universals to L–2 acquisition; however, his theory incorporates elements of native language transfer as well as typological universals. He argues that the predictability of the Contrastive Analysis Hypothesis is greatly improved when language universals are also taken into account. The theory states that those areas of the target language which differ from the native language and are more marked (less natural) will be difficult and that the relative difficulty will correspond to the relative degree of markedness of the structures investigated. The areas of the target language that are distinct from the native language but are unmarked will not be difficult.

Anderson (1983) tested Eckman's theory in an L–2 study on the difficulty of English syllables for two groups of language learners: native speakers of Egyptian Arabic and Chinese. Because Egyptian Arabic syllable structure is closer to that of English than that of Chinese, it was predicted that the Arabic group would perform significantly better than the Chinese group on English syllables similar in structure to syllables in Egyptian Arabic. While this was confirmed, it was also found that the markedness differential hypothesis correctly predicted the relative difficulty of most of the cluster types investigated for each group. Thus, although the absolute scores were generally higher on most types of clusters for the Arabic group, the same hierarchy of errors was found for both groups, and the hierarchy was correctly predicted by the notion of "markedness" (Eckman 1977). Initial clusters, which were considered natural or unmarked, were easier than final clusters, which were considered more marked because of their more limited occurrence across the languages of the world. In addition, shorter clusters, which were considered unmarked or natural, were easier to learn than longer clusters.

However, while language universals and markedness may play a role in L–2 acquisition, it is also important to consider the extent to which variability occurs in the acquisition process. Just as variability was found among children acquring L–1 phonology (see Macken & Ferguson 1981) it must also be dealt with in L–2 acquisition.

2.2. Variability in L–2 Acquisition

Koutsoudas and Koutsoudas (1983) have noted that in L–2 acquisition studies, each subject may be different from the others and his/her L–2 performance may be heavily influenced by individual characteristics such as the dialect spoken in the native language, length of instruction received in the target language, length of residence in the country where L–2 is spoken, motivation to learn the L–2, and so

forth. In other words, one can expect that the problems encountered during L–2 acquisition might vary from person to person.

In addition to individual differences, another factor that L–2 researchers need to consider is the problem of sociolinguistic variability. That is, the fact that different social situations will trigger different speech styles. When delivering a lecture, for example, one might use a different speech style than if one were talking to a friend. Consequently, phonological forms have been found to vary according to the formality of the social situation (Labov 1966). Supporting sociolinguistic variability in L–2 acquisition, Nemser (1971), L. Dickerson (1975), and W. Dickerson (1977) have shown that the more formal the task, the more formal the style used by the learner and consequently, the fewer the number of errors.

In conjunction with task variability, one also needs to consider the problem of the testing situation. Researchers (Wolfram and Johnson (1982)) have shown that the subjects' performance also tends to vary according to the way they are tested. For example, interviews with the use of a tape recorder very often produce a careful speech style, no matter how formal or informal the task is.

To summarize the review of literature presented above, universalist theories such as those put forth by Jakobson (1941) and Stampe (1969) have not been completely supported by empirical research on children. It has also been found that variation exists among children resulting in different patterns of development. Similarly, in L–2 acquisition, while some evidence has been put forward supporting the influence of language universals on L–2 development, individual differences, and the effect of sociolinguistic variables on L–2 performance have also been found to play a role in acquisition.

Before presenting the predictions of difficulty for the present study, it is first necessary to compare and contrast the phonological systems of American English (hereafter AE) and Brazilian Portuguese (hereafter BP) since this study investigates the difficulty of certain AE sounds for native speakers of BP.

3. CONTRASTIVE ANALYSIS BETWEEN BRAZILIAN PORTUGUESE AND AMERICAN ENGLISH

The contrastive analysis of AE and BP phonology discussed below is based on Azevedo's (1981) analysis.

3.1. The vowel system

The AE vowel system has more vowel phonemes than BP does since the high vowels, /I/ and /U/; the mid–vowel, /ʌ/; and the low vowel, /æ/ do not occur in BP.

However, when considering the phonetic representation of both vowel systems, it becomes apparent that the AE /I/ and /U/ occur in BP as allophones of /i/ and /u/ respectively in unstressed position, as in "mistura" ([mɪstúra]) and "pular" ([pUlář). By the same token, AE /ʌ/ is very close to the BP [ə], which is an allophone of /a/, found before a nasal consonant (i.e., "chamo" – ['səmu]) and in final unstressed position (i.e., "folha" –['fol̃ə]). The tense vowels /i/ and /u/ are approximately equivalent in BP and AE, except that in AE they are slightly longer and somewhat glided.

The only entirely new AE vowel for the BP speaker is the low front vowel, /æ/, since it is not equivalent on the phonemic level to any BP vowel and does not occur at all on the phonetic level.

3.2. The consonant System

When comparing the consonants of BP and AE, one observes that AE /č/, /ǰ/, /θ/, /ð/, /ŋ/, and /h/ do not exist in BP as phenomes. However, an examination of the phonetic representation of the consonants of both languages reveals that the only AE consonants that cannot be found in BP on the phonetic level are /θ/, /ð/, /ŋ/, and /ɾ/. The affricate sounds [č] and [ǰ], which are phonomes in AE, are allophones of /t/ and /d/ respectively in BP and [h] is an allophone of /ř/, in BP.

On the other hand, although the "r" is realized differently on the phonetic level in BP and AE, the fact remains that both languages have "r" phonemes. BP has both a trilled–r phoneme as well as a flap–r, both of which have several phonetic realizations. English, in contrast, has one "r" phoneme, a retroflex "r" which has voiceless and voiced phonetic variants.

When considering the differences and similarities between the consonant and the vowel systems of BP and AE, the sounds fall into different categories according to the type of comparison or contrast. One category includes sounds such as the bilabial nasal "m", which exist in both languages on the phonemic and phonetic levels, the BP and AE sounds having almost exactly the same phonetic realization. On the other hand, there is another category of sounds containing sounds such as "I", which while identical on the phonetic level, belong to different phonemes in each language. In contrast, there is yet another class of sounds containing sounds such as the "r", while equivalent in some sense phonemically, are realized differently phonetically in each language. Finally, there are sounds in each language that do not correspond to any sound in the other language, either on the phonemic or phonetic level. There are four such sounds in AE – the "θ", "ð". "ŋ", and "æ", which are completely absent in BP.

It is this last category of sounds that is of particular interest in the present study because the sounds are completely new to the BP speaker. Because none of the sounds corresponds in any way, either phonetically or phonemically, to sounds in BP, no differences in difficulty among the four sounds can be predicted on the basis of the Contrastive Analysis Hypothesis. This allows predictions of difficulty to be made based on other factors, such as language universals, allowing the results to be interpreted unambiguously.

3.3. Predictions of difficulty

The major purpose of this study is to determine whether language universals can predict the order of difficulty of AE sounds that do not occur in BP, either phonetically or phonemically. As noted above, the sounds that meet this requirement are

/θ/, /ð/, /ŋ/, and /æ/. In addition, another AE vowel, the mid–central vowel, /ʌ/, will be included. The BP vowel [ə] is almost identical to the AE [ʌ] occurring as an allophone of the vowel /a/ in unstressed syllables and before nasal consonants. It will serve as a point of comparison for the four new sounds investigated. The study will investigate the relative difficulty of these sounds for native speakers of BP learning AE as a second language. The study will also investigate the types of errors that occur and will attempt to categorize them according to their source. The predictions of relative difficulty will be based on universal implicational relationship that have been found across languages on the world and from universals of L–1 acquisition, in particular, those proposed by Jakobson (1941). Eckman's MDH is not used here to make predictions, since the sounds investigated are all new or zero–category sounds, except for the [ʌ] which is a BP sound included as a point of comparison.

Implicational universals and universals of language acquisition make several predictions of difficulty for the sounds under investigation. As noted above in section 2.1., Jakobson's theory predicts that L–1 sounds are acquired based on a universal hierarchy of structural laws that determine the frequency of occurrence and distribution of sounds in particular languages. Specifically, his theory predicts that nasals are ordered before fricatives in his acquisition hierarchy. What this predicts for the present study is that the nasal /ŋ/ will be easier than the fricatives /θ/ and /ð/.

In addition, as noted earlier, it has been reported (Sloat, Taylor and Hoard (1978)) that voiced obstruents are not as widespread across languages of the world as their voiceless counterparts, and that whenever a voiced obstruent has been found in a language, the corresponding voiceless form has also been found, but the converse is not true. What this predicts for the present study is that the voiceless fricative, /θ/, should be easier than its voiced counterpart, /ð/.

Predictions of difficulty based on language universals can also be made as to whether a consonant will be easier to pronounce as a single consonant or in consonant clusters and whether a consonant is easier to pronounce in word–initial or word–final position. As noted above, Greenberg (1978) has shown that across languages of the world any consonant occuring in a cluster will also occur as a single consonant, but the converse does not hold. A consonant may occur alone while not occurring in clusters. What this predicts for the present study is that consonants will be easier to pronounce as single consonants than in consonant clusters. Greenberg (1978) also showed that initial clusters are more widespread, approximately four times more common than initial clusters across the languages of the world. It is also well known that the CV syllable is more natural than the CVC syllable. What these facts predict for the present study is that consonants in initial position should be easier to pronounce than consonants in final position.

In addition to these predictions of difficulty based on language universals, another prediction can be made concerning natural phonological processes and errors. Stampe (1969) has argued that final obstruent devoicing is a natural process that occurs during L–1 acquisition. It is one of the processes that is later suppressed as the child learns the phonological "rules" of the language. On the other hand, voicing of final voiceless consonants is not considered a natural process. What this predicts for the present study is that devoicing errors for the voiced fricative /ð/ in word–final position will occur significantly more often than voicing errors for /θ/ in the same position.

In addition, to investigate the role of native language transfer, as a point of contrast for the predictions of difficulty based on language universals, the vowel /ʌ/, has been included in the study. As noted earlier, BP has a similar sound, the [ə], which occurs as an allophone of the low central vowel /a/. It is predicted that because this sound is not new, it will be easier than the other sounds investigated.

Variability is another aspect of L–2 performance that this study investigates. The data will be examined to determine the extent to which (1) individuals deviate from any dominant group patterns found; (2) task (formal vs. informal) affects variability; and (3) individuals may vary in performance at two different times on the same task. The only prediction to be made is that accuracy will be greater on formal tasks than on informal ones. This prediction is consistent with research findings from earlier studies (Nemser (1971); Johansson (1973); L. Dickerson (1975); W. Dickerson (1977)).

In summary, the following predictions of relative difficulty and errors are made:

1. The mid central vowel /ʌ/ is predicted to be pronounced more accurately than all other sounds investigated because it is not a new sound.
2. The velar nasal /ŋ/ is predicted to be pronounced with greater accuracy than the fricatives /θ/ and /ð/.
3. The voiceless interdental fricative, /θ/, is predicted to be pronounced with greater accuracy than its voiced counterpart, /ð/.
4. A consonant occurring alone will be pronounced with greater accuracy than when occurring in a consonant cluster.
5. A consonant in word–initial position will be pronounced with greater accuracy than in word–final position.
6. Accuracy in pronunciation will be greater on formal tasks than on informal ones.

4. METHODOLOGY

4.1. Subjects

The subjects for the study were eight Brazilian students pursuing either their Master's or Ph. D. degrees at Iowa State University. They were four females and four males ranging in age from 22 to 44. All the subjects had studied English in Brazil prior to coming to the U.S. with the amount of instruction ranging from four months to 13 years. The length of time spent in the United States varied from three months to three years and the TOEFL scores ranged from 500 to 613. The dialects represented by the sampling population were Carioca, Paulista, Mineiro, Gaucho, and Paranaense (see Table 1 for a summary of the subjects' profile).

All the subjects volunteered to participate in the study after having been contacted by the investigator and having been instructed on the purpose of the project.

TABLE 1. PROFILE OF THE SUBJECTS

Subject	Sex	Degree Being Sought	Age	Length of Permanence in the U.S.	Amount of Instruction Prior to Coming to theU.S.	Dialect	TOEFL
A	F	M.A.	37	3 months	6 years	Carioca	600
B	M	Ph.D.	39	34 months	4 months (1)	Gaucho	560
C	M	Ph.D.	38	3 months	3 years	Mineiro	500
D	F	Ph.D.	36	36 months	— (2)	Carioca	590
E	M	Ph.D.	34	24 months	4 months (1)	Paulista	530
F	F	Ph.D.	44	24 months	7 years	Paranaense	580
G	M	M.A.	22	3 months	13 years	Mineiro	613
H	F	Ph.D.	30	12 months	5 years	Paulista	520

(1). Subjects attended an Intensive English Program

(2). Subject had lived in the U.S. for two years before returning for a Ph.D. program.

4.2. Procedures

The data were obtained through a test (see Appendix A) which was developed for the purpose of investigating the English phonemes /θ/, /ð/, /ŋ/, /æ/, and /ʌ/. The criteria against which the sounds were compared was native American English pronounciation, as spoken by an educated speaker.

The test contained three parts: Part I, in which the subjects were to read a word–list twice (Trials I and II); Part II, in which the subjects were to read a passage; and Part III, in which the subjects were asked to paraphrase the passage read in Part II. The test included these three tasks so that data about the subjects's articulatory skills could be captured on a range of tasks differing in the degree to which they should elicit "careful" versus "casual speech".

The first part of the test contained a word–list with the phonemes /θ/, /ð/ and /ŋ/, in word–initial, word–medial, word–final position both in isolation and in consonant clusters. The vowels /æ/ and /ʌ/ were both tested in essentially the same environments – in words which constituted either minimal or near–minimal pairs.

The words used in the test were of high frequency. Thorndike and Lorge's *Teacher's Word Book of 30,000 Words* (1952) was used as a resource, and words that occurred at least once per 1,000,000 words of running text were selected for the test. This category of frequency represents the most commonly occurring words. No help with meaning was given to the subjects, since it was felt the words should have been familiar to them.

Students read the word–list twice (Trials I and II), so that their performance on both trials could be compared. It is important to note that on Trial II, the words were presented in a different order than on Trial I.

The second part of the test contained a passage which included words with the target sounds in the same positions tested for in the word–list. The subjects read the passage first silently and then aloud. The third part of the test required the subjects to paraphrase the same passage in their own words.

In Part I of the test, the five target sounds appeared a total of 96 times; in Part II, they appeared a total of 95 times; and in Part III, the number of occurrences of each target sound varied from subject to subject.

The tests were given individually during a single meeting in a sound–proof room in the presence of only the investigator. All the instructions were given in Portuguese to ensure that the subjects clearly understood what they were expected to do.

The speech samples were recorded an a Sharp AV–2000 audio tape recorder for all three parts of the test, and the tapes were then transcribed phonetically in moderately narrow transcription by a native speaker of AE with training in phonetics.

4.3. Data Analysis

A score of one was given to a sound pronounced correctly. A score of zero was given for all substitution errors, and all errors for the same sound received the same score (e.g., [t] and [s] for θ were both counted as zero). Group mean scores were computed for each of the segments and consonant clusters investigated.

5. RESULTS

An analysis of variance was performed using the Statistical Analysis System (SAS) so that differences among the target sounds, the subjects, and the parts of the test could be accounted for. An analysis of variance was also performed for each of the consonants investigated to test whether performance differed depending on the position or environment tested. The differences found will be discussed separately below in the following order: (1) hierarchy of difficulty of individual sounds in all positions and environments tested; (2) single consonants versus consonant clusters; (3) consonants in initial versus final position; (4) a classification of errors; (5) subject variability; (6) task variability; and (7) trial variability.

The results reported are total scores combining the three parts of the test. However, when comparing positions and environments (single consonants vs. consonant clusters), only the scores from Part I of the test were included. Also, in comparing trial variability, only Part I of the test was used, and in comparing task performance, the three parts of the test are reported separately.

5.1. Hierarchy of difficulty

Results from the analysis of variance (see Table 2) indicated that the greatest source of variability was among the sounds investigated ($p = .0001$).

Table 2. ANOVA source table for score variability on eight subjects by three parts by five sounds

SOURCE	DF	SS	MS	F-VALUE	P-VALUE
Subject	7	8370.893	1195.842	2.43	0.0245
Part	2	499.684	249.842	0.51	0.6036
Sound	4	95084.091	23771.022	48.29	0.0001

A Tukey Honestly Significant Difference (HSD) test was then computed in order to determine which sounds differed from each other (see Table 3).

The predicted order is presented again formulaically below for ease of comparison:

1. /ʌ/ > /θ/, /ð/, /ŋ/, and /æ/
2. /ŋ/ > /θ/ and /ð/
3. /θ/ > /ð/

Results from Tukey's test indicated that the five sounds could be divided into three significantly different groups: (1) the easiest sounds /ʌ/ and /ŋ/; (2) the sound intermediate in difficulty, /θ/, and (3) the most difficult sounds, /ð/ and /æ/.

Table 3. Tukey's studentized range (HSD) test for the five sounds investigated*

Tukey Grouping	Mean	N	Sound
A	91.406	24	/ʌ/
A	79.903	24	/ŋ/
B	45.538	24	/θ/
C	23.836	24	/ð/
C	23.727	24	/æ/

*Sounds preceded by the same letter are not significantly different from each other

It can be seen that, except for the /ʌ/ and /ŋ/ sounds which were equal to each other in difficulty, the predicted order was confirmed.

5.2. *Single Consonants vs. Consonant Clusters*

All three consonants in this study were tested both as single consonants and in consonant clusters. An analysis of variance was computed to test whether there was a difference in performance when pronouncing /θ/, /ð/, and /ŋ/ separately or in consonant clusters. It was predicted that consonants would be easier alone than in clusters.

The results have shown that except for the voiceless interdental, /θ/ ($p > .05$), there was a difference according to whether the consonants were pronounced separately or in clusters. The voiced interdental, /ð/, was indeed easier when pronounced as a single consonant ($p < .05$), which agrees with the predictions made. However, contrary to what had been expected, the velar nasal, /ŋ/, was dramatically easier for the subjects when pronounced in consonant clusters ($p < .05$). Table 4 below summarizes the subjects performance when pronouncing /θ/, /ð/, and /ŋ/ as single consonants and in consonant clusters.

Table 4. Comparison of the subject's scores on the consonants /θ/, /ð/, and /ŋ/ as single consonants and as consonant clusters*

	Percentage of correct answers		
Sound	Single Consonant	Consonant Cluster	P level
/θ/	60.4%	52.1%	$p > .05$
/ð/	34.4%	15.6%	$p < .05$
/ŋ/	17.2%	96.9%	$p < .05$

*Due to the fact that the appearance of the target sounds was not consistent throughout the test, only the scores from Part I will be considered in Table 4

5.3. *Initial vs. Final Position*

For this study, /θ/ was tested in initial, medial and final positions, both as a single consonant and in consonant clusters. /ð/ was tested in the same positions as its voiceless counterpart, with the exception that it was not tested in consonant clusters in initial position since there are no initial clusters with /ð/ in AE. Therefore, /ð/ was tested twice in medial position (medial I and II in Table 5) but with the target sound appearing in a different order within that position. For example, the consonant /ð/, in words like "smoothness" was the first element in the cluster, but in words like "farther" it followed a consonant. Since the velar nasal does not occur in initial position in AE, it was only tested in medial and final positions, both as a single consonant and in consonant clusters.

It had been hypothesized that /θ/. /ð/, and /ŋ/ would be more difficult in final position since this is the least natural/more marked among the positions, and since consonant clusters as well as many single consonants do not occur in final position in BP. However, the results confirmed this prediction only for the voiced interdental, /ð/ ($p < .05$). For the voiceless interdental, /θ/, no significant difference was found among the different positions tested ($p > .05$). For the velar nasal, /ŋ/, final position was easier than medial ($p < .05$), which disconfirmed the expectations (see Table 5).

Table 5. Percentage of correct sounds for /θ/, /ð/, and /ŋ/ as single consonants and as consonant clusters, according to position

Sound	Single Consonant	% Correct Answers	Consonant Cluster	% Correct Answers
/θ/ position	1. initial	66%	1. initial	41%
	2. medial	59%	2. medial	62%
	3. final	56%	3. final	53%
/ð/ position	1. initial	44%	1. medial I (1)	6%
	2. medial	56%	2. medial II(2)	38%
	3. final	3%	3. final	3%
/ŋ/ position	1. medial	16%	1. medial	94%
	2. final	19%	2. final	100%

(1) Syllable final (e.g. smoothness)
(2) Syllable initial (e.g. farther)

5.4. Classification of errors

Error patterns for each target sound investigated will be discussed separately below. Tables 6 and 7 in Appendix B contain a list of all the substitution, deletion and epenthesis errors made by the subjects while attempting to pronounce AE target sounds.

5.4.1. The voiceless interdental: /θ/. For the voiceless interdental, the use of [t] was the most common error in all the positions tested either as a single consonant or in a consonant cluster. Other errors that occured were the use of the voiced stop [d̪] and fricatives such as [s], [z], and [f]. The fricative errors were relatively infrequent, occuring approximately 25% of the time. Errors in voicing were rare, most of the substitutions being voiceless sounds.

5.4.2. The voiced interdental: /ð/. For the voiced interdental, the two most common substitution errors were [d̪] and [θ], depending on the position or type of cluster being tested. For example, for a single consonant in initial and medial position, and in consonant clusters in medial II position, [d̪] was the most common error, whereas, for a single consonant in final position and in consonant clusters in medial I and final position, [θ] was the most common error.

Similar to their performance on the /θ/ sound, the subjects used stops (i.e., [d̪], [t̪]) and fricatives (i.e., [s], [z]) in their substitution of /ð/. Of all the substitutions, 80% were due to the use of a stop and 20% were due to the use of a fricative. The final position was the one that received the largest number of substitutions, both as a single consonant and as a cluster. The overwhelming majority of the sounds substituted for /ð/ in final position involved errors in voicing, most of the substitutions being voiceless sounds.

5.4.3. The velar nasal: /ŋ/. When /ŋ/ was pronounced as a single consonant, the most common error was due to the insertion of [g] in medial position (e.g., the pronunciation of "singer" as [sɪŋgə]), and the insertion of [g] and [k] in final position (e. g., the pronounciation of "young" as [yəŋg] or [yəŋk]. However, when tested in a consonant cluster, the opposite seemed to be true: most of the errors were due to the omission of the following consonant (either [g] or [k], such as the pronunciation of "finger" as [fɪŋə]. However, as noted earlier, there were far more errors in /ŋ/ as a single consonant than when it occurred in a cluster.

5.4.4. The low front vowel: /æ/. The substitution of [ɛ] for [æ] was by far the most common error encountered with the low front vowel. Two common patterns were found among the subjects: (1) the use of a specific sound such as [ɛ] for /æ/ (e..g., [ɛn] for "Ann"); and (2) the use of a sound which was pronounced between two sounds, for example, [mɛ˞] for "man".

5.4.5. The mid central vowel: /ʌ/. The most common error committed by the subjects was the substitution of [U] for /ʌ/. The subjects also occasionally used [U̝], a vowel intermediate between [U] and [ʌ].

5.5. Subject variability

Results from Table 2 above indicated that some of the variability of the scores was due to subject variability (p = .0245). That is, the overall difference in the scores was due not only to the intrinsic difficulty of the sounds tested, but also to the differences among the subjects themselves.

Table 8 shows the overall performance of the subjects on all three parts of the test. Results from this table show that subject G was the one who performed the best on the test (73% of correct answers) while subject E was the one with the weakest performance (27% of correct answers).

Table 8. Overall performance on Parts I, II, and III of the test

Subject	% Correct Answers
G	73%
D	52%
F	50%
A	49%
B	45%
H	42%
C	40%
E	27%

When looking at individual orders of difficulty (see Table 9) one observes that, with the exception of subjects B and G, all the other subjects followed the same order of difficulty that had been predicted. That is: (1) /ŋ/ > /θ/ and /ð/, and (2) /θ/ > /ð/. In addition, the results showed that /ʌ/ was consistently easier than /æ/ for all the subjects. This indicates that variability tended to occur in the absolute scores and not in the scores relative to each other.

Table 9. % of correct sounds for /θ/, /ð/, /ŋ/, /ʌ/, and /æ/ among the subjects tested

	Order of Difficulty				
Subjects	Consonants			Vowels	
A	/ŋ/ (81%)	/θ/ (59%)	/ð/ (21%)	/ʌ/ (93%)	/æ/ (20%)
*B	/ŋ/ (83%)	/ð/ (11%)	/θ/ (5%)	/ʌ/ (96%)	/æ/ (67%)
C	/ŋ/ (80%)	/θ/ (65%)	/ð/ (4%)	/ʌ/ (82%)	/æ/ (7%)
D	/ŋ/ (80%)	/θ/ (80%)	/ð/ (26%)	/ʌ/ (93%)	/æ/ (9%)
E	/ŋ/ (78%)	/θ/ (8%)	/ð/ (5%)	/ʌ/ (69%)	/æ/ (19%)
F	/ŋ/ (83%)	/θ/ (49%)	/ð/ (23%)	/ʌ/ (100%)	/æ/ (35%)
*G	/ŋ/ (100%)	/ð/ (76%)	/θ/ (70%)	/ʌ/ (88%)	/æ/ (17%)
H	/ŋ/ (75%)	/θ/ (40%)	/ð/ (24%)	/ʌ/ (100%)	/æ/ (20%)

*Subjects did not follow the order of difficulty predicted

5.6. Task variability

This part of the study investigated the subjects' performance on three different tasks, which ranged from formal, such as reading a word–list, to more informal, such as paraphrasing. The subjects were expected to make more errors on Part III of the test than Part II, and more errors on Part II than Part I, because Part I had the most formal task and Part III the least formal one. That is, the degree on formality was expected to be in negative correlation with the number of errors made.

Results from Table 2 above indicated that no significant difference was found among the three parts of the test (p = .6030). This in part contradicted findings from previous studies (Nemser (1971); Dickerson (1977) and others) where the sociolinguistic situation, that is, the degree of formality, had been found to have an effect on the subjects's performance.

5.7. Trial variability

One of the objectives of this study was to check for the subject's consistency in Trials I and II of the test. A "Wilcoxon Signed Test" (Blalock 1972) was performed, and the subjects' scores from both trials were compared (see Table 10).

Table 10. Subjects' scores on Part I, Trials I and II *

Subject	Trial I	Trial II
A	60.4%	53.1%
B	39.6%	35.4%
C	42.7%	41.7%
D	63.5%	62.5%
E	27.1%	22.9%
F	52.1%	52.1%
G	64.6%	63.5%
H	37..5%	31.3%

* These percentages are based on 96 test items.

Despite the fact that the same word–list was read twice, results showed that seven out of eight subjects performed better on the first trial (p = .0078). This might be an indication that the subjects were paying more attention when they were going through the word–list the first time and therefore fewer errors were made.

6. DISCUSSION

It had been hypothesized that the following hierarchy of difficulty would be found: (1) /ʌ/ > /θ/, /ð/, /ŋ/, and /æ/; (2) /ŋ /> /θ/ and /ð/; (3) /θ/ > /ð/. /ʌ/ was expected to be the easiest sound because it occurs in BP as an allophone of /a/.

According to the Language Universals predictions, the velar nasal was expected to be easier than both fricatives, /θ/ and /ð/, because nasal sounds are more natural than fricatives, and according to Jakobson (1941), they come first in the universal

acquisition order; /θ/ was expected to be easier than /ð/ because voiceless sounds are more natural than voiced ones.

Results from this study confirmed most of the predictions made, indicating support for the Language Universals Hypothesis. The only prediction not confirmed concerned the relation of /ʌ/ to the other sounds. Though easier than /θ/, /ð/, and /æ/, it was not significantly different in dificulty from /ŋ/. Nevertheless it is important to note that the results did not disconfirm the predicted order. They merely did not support it.

Concerning consonant clusters, it had been hypothesized that /θ/, /ð/ and /ŋ/ would be significantly more difficult in clusters than as single consonants since consonant clusters are less natural than single consonants. Results from this study indicated that this prediction was true only for the voiced interdental, /ð/. No significant difference was found between /θ/ as a single consonant and in clusters. However, it should be noted that the accuracy was 8% higher on the single consonant than on the consonant clusters (see Table 4) although this difference was not statistically significant. On the other hand, the prediction that the /ŋ/ would be easier as a single consonant than in clusters was disconfirmed, the /ŋ/ being easier in clusters than alone. The reversal in the predicated order of difficulty for the /ŋ/ might be explained in light of the kinds of errors that occured. Most of the errors involved the epenthetic addition of [g] or [k] after [ŋ]. This may have resulted from the influence of the spelling system. Since [–ŋg–]/[–ŋk–] and [–ŋ–] are realized graphically as <ng> or <nk>, the tendency to insert [g] or [k] may have been strong.

In addition, this study predicted that initial position would be easier than final position, but the results supported this prediction only in part. Data indicated that the voiced interdental, /ð/, was indeed more difficult in final position, although no difference in position was found for the voiceless interdental, /θ/.

The fact that /θ/ was not as difficult as /ð/ in final position might be explained in light of another fact from natural phonology – voiceless sounds are more natural in final position than voiced ones, and voiced sounds are frequently devoiced in word final position. Thus, while many of the final /ð/ errors were devoicing errors, the converse was not true. There were few voicing errors for /θ/. Actually, in some sense, Contrastive Analysis would have predicted otherwise because [z], a voiced sound in BP, is an allophone of /s/. in final position under certain conditions.

Nevertheless, in spite of the role that natural phonology played, the error analysis across the eight subjects indicated that most of the errors made could have been predicted by Contrastive Analysis since they were due to the use of a sound that existed in the subjects' native language. For example, when trying to pronounce the English interdentals, /θ/ and /ð/, the subjects mainly used /t̪/ and /d̪/ as substitutes. However, the results also showed that processes other than L–1 interference also influenced the subjects' performance, for example, the replacement of final [ð] by [θ] as noted above. This, according to Ingram (1979), is a very common process in child phonology.

Findings from this study coincide with some of Johansson's (1973) findings in the sense that subjects used not only sounds which occurred in L–1 and L–2 but also sounds witch existed in neither language. An example of this can be found in the use of [ɛ^{r}] for [æ]. This might be an indication that the subjects were trying to

modify sounds that existed in their native system in the direction of the target sound and as a result, they produced a sound intermediate between the native and the target sounds. These intermediate sounds could not be predicted by Contrastive Analysis.

Results from this study revealed that /ʌ/ was easier than /θ/, /ð/, and /æ/, with most of the errors being due to the use of either [U] or [u]. This might also be an indication that the subjects were heavily influenced by the spelling system since most of the words containing /ʌ/ are spelled with "u" such as "bus", "cup", "bun", and so forth.

For task variability, it had been predicted that the more formal the task, the fewer the errors that would be made. However, results from this study did not confirm such a prediction since no significant difference in performance was found among the three parts of the test. A possible explanation for such a result might be found in the testing situation used in this investigation. As noted earlier, interviews in the presence of an investigator and with the use of a tape recorder will generally produce a careful speech style regardless of the informality of the tasks (Wolfram and Johnson 1982). In other words, the fact that the investigator was present during the whole interview and a tape recorder was used, might have influenced the subjects' performance in the sense that they were more careful with their speech production, regardless of the task. Also, the subjects were paraphrasing something they had just read. A paraphrasing task based on something read rather than spoken may result in a more careful style.

In this study, no predictions were made for subject variability but it is important to note that this potentially important source of variability may be one of the most difficult to control for, since there are many factors that can contribute to individual differences.

Although the number of subjects is too small to draw definitive conclusions, the data suggest that certain factors may be related to performance. One might wonder if age, for example, had anything to do with performance. Subject G, who was the youngest among the subjects, was also the one who had the best performance. Or it could have been the length of time they studied English prior to coming to the U.S. Data from this study seems to indicate that this may also be an important source of variability, since the subject's profile reveals that the best performer had studied English for 13 years while the worst performer had studied English for only four months.

Intuitively one might think that the longer the subjects remain in the country where L–2 is spoken, the better their L–2 proficiency will be. However, data from this study does not indicate so. The subject who had been living in the U.S. for five years had 52% of her answers correct, as opposed to 73% of correct answers for the one who had been living in the U.S. for only three months. In sum, further research controlling for factors such as age, length of residence in the U.S., amount and type of instruction (whether it focused on grammar, listening, pronunciation, speaking or writing) received is still necessary, since no definite answer can be reached with so few subjects.

To summarize the above discussion, it has been found that the hierarchy of difficulty predicted in this study was confirmed for the most part. The only exception,

concerned the relation of the mid–central vowel, /ʌ/, to the velar nasal, /ŋ/, since no significant difference was found among them. Consonant clusters were more difficult than single consonants only for /ð/ since no significant difference was found for /θ/, and /ŋ/ was easier in clusters than as a single consonant. Concerning position, it had been hypothesized that initial position would be easier than final position and results have shown that while /ð/ was indeed easier in initial position, no significant difference in this area was found for /θ/. In this study, one could find errors that could be explained by Contrastive Analysis (i.e., interference errors) as well as errors that could not be explained by Contrastive Analysis but that could be explained by natural phonology and developmental processes. In addition, results have shown that there were errors that could be explained by neither of the above theories, but instead by the influence of the spelling system. Examples would include the epenthesis errors with the velar nasal (as explained earlier in the Discussion) and the use of [U] and [u] as a substitute for /ʌ/. Concerning task variability, no significant difference was found among the three parts of the test, a fact which might be explained by the testing situation used in this study. Despite the fact that no prediction was made on subject variability, data suggest that individual characteristics might have played a role in the subject' L–2 performance.

7. LIMITATIONS, CONCLUSIONS, AND SUGGESTIONS FOR FURTHER RESEARCH

7.1. Limitations

There are some very important limitations that need to be considered here in the sense that they were felt to have influenced the results of this study. For example, the assertions made here are not to be generalized since eight subjects is too small a sample group for use in drawing conclusions. The present study is mainly a descriptive study. In addition, the following considerations need to be kept in mind:

1) All the subjects volunteered to participate in this investigation, which might have contributed to a biased sampling. Researchers have found that "volunteers may differ from nonvolunteers on important variables such as motivation, interest, and so forth, which can influence the results" (Moore 1983:127)

2) Subjects differed in aspects important to the study such as dialect spoken, time of residence in the U.S., and length of instruction prior to coming to the U.S. Only through a study with a larger sample can light be thrown on the possible effects these factors have on performance.

7.2. Conclusions

In spite of the limitations mentioned above, the results of the study confirmed many of the predictions for the group of subjects investigated. A hierarchy of difficulty among the sounds investigated was expected to be found and results from this study confirmed such expectations. Therefore, one might conclude that language universals is a better predictor of difficulty among new sounds than Contrastive Analysis is, which predicts that new sounds are all equal in difficulty.

Since predictions for word position (initial, medial, and final) and phonetic environment (clusters vs. single consonants) were only partially confirmed, further investigation involving a wider variety of obstruents in initial, medial, and final positions, as well as in clusters and as single consonants, is still necessary.

Although language universals was found to be important in predicting relative difficulty of sounds, L–1 interference nevertheless accounted for many of the subjects' errors. However, it is also important to observe that not all the errors were due do L–1 interference. Phenomena such as "devoicing", which is a common developmental processes during L–1 acquisition was also found among the data. This might be an indication that there is a certain universality in the language acquisition process. That is, some of the same natural processes that occur in L–1 acquisition, might also be used later on during L–2 acquisition.

The fact that no task variability was found in this study, contradicted findings from previous studies (Nemser (1971); W. Dickerson (1977) and others) where the kind of task had an effect on performance. Such a difference might be explained in light of the testing situation used in this study. Researchers (Wolfram and Johnson 1982) have already found that outside investigators with tape recorders do tend to affect the subjects' performance, causing them to use a more careful or formal style.

7.3. Suggestions for Further Research

Since not many studies have investigated the pronunciation problems of BP speakers, there is room for more research in this area. Further investigation involving a larger sample, selected in a different manner, and controlling for personal facts, such as length of residence in the U.S. and amount of instruction received prior to coming to the U.S., is necessary to determine whether the order of difficulty and errors found in this study would remain constant across different testing conditions and language learners.

This study has failed to show a difference in the kind of task performed, which contradicts results from previous studies. This may have been due to the presence of the investigator or to the use of a tape recorder.This is an area that needs to be further investigated.

Another suggestion for researchers interested in this area of study is the investigation of the degree to which spelling influences the pronunciation of target sounds. In this study there was an indication that such was the case with the mid–central vowel, /ʌ/.

In conclusion, in spite of the above limitations, this study has shown that both language universals and native language transfer can explain certain facts about L–2 phonology. Language universals is a better predictor of relative difficulty than Contrastive Analysis. However, Contrastive Analysis seems to be a better predictor of the types of errors that occur than Language Universals or natural phonology.

It is hoped that the present study will be followed by more research on the effects of Language Universals, L–1 transfer, misunderstanding of the L–2 spelling system, and sociolinguistic variability on the acquisition of L–2 phonology. It is apparent at this stage in L–2 research that interlanguage phonology is a complex phenomenon requiring therefore a multifaceted research approach.

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APPENDIX A

Part I, trial 1: Read the following list of words

THINK	STUCK	RHYTHMIC	LATHES
BATHE	LEATHER	FAITHLESS	THREE
THRASH	BANK	YOUNG	HAND
ANN	SMOOTHES	FARTHER	DUMB
HUT	NORTH	BUN	WRONG
TRUTHFUL	PAT	CAN	THOUGH
FINGER	NUT	ATHENS	FOURTH
THERE	HUM	FARTHER	LUCK
TACK	BAN	THINK	BACK
SMOOTHLY	THICK	STUN	EARTH
BIRTH	HANGER	BOTH	LONGING
NUN	SMOOTHNESS	AMONG	BUT
MAT	PINK	THREAD	LOATHSOME
OTHER	THROAT	BRINGER	BREATHE
THOUGHT	PATH	RUT	CLOTH
RINGER	SMOOTH	FAT	TAN
METHOD	PAN	BREATHES	NORTHERN
GUN	LUNCH	ANGER	TOOTHPICK
MAN	DUCK	BATHES	NEITHER
AUTHOR	AT	RUN	GUT
SINGER	NOTHING	CAT	HAT
FURTHER	THE	TEETH	FAITHFUL
THANK	HANG	BLANKET	FARTHEST
FAN	THANK	CLOTHE	THAT

Part I, trial 2: Read the same words in reverse order

FAN	TANK	CLOTHE	THAT
THANK	HANG	BLANKET	FARTHEST
FURTHER	THE	TEETH	FAITHFUL
SINGER	NOTHING	CAT	HAT

AUTHOR	AT	RUN	GUT
MAN	DUCK	BATHES	NEITHER
GUN	LUNCH	ANGER	TOOTHPICK
METHOD	PAN	BREATHES	NORTHERN
RINGER	SMOOTH	FAT	TAN
THOUGHT	PATH	RUT	CLOTH
OTHER	THROAT	BRINGER	BREATHE
MAT	PINK	THREAD	LOATHSOME
NUN	SMOOTHNESS	AMONG	BUT
BIRTH	HANGER	BOTH	LONGING
SMOOTHLY	THICK	STUN	EARTH
TACK	BAN	THINK	BACK
THERE	HUM	FARTHER	LUCK
FINGER	NUT	ATHENS	FOURTH
TRUTHFUL	PAT	CAN	THOUGH
HUT	NORTH	BUN	WRONG
ANN	SMOOTHES	FARTHER	DUMB
THRASH	BANK	YOUNG	HAND
BATHE	LEATHER	FAITHLESS	THREE
THINK	STUCK	RHYTHMIC	LATHES

Part II: Read the passage[1] silently and then read it aloud
Part III: Paraphrase the passage with your own words

A cop was directing traffic on North Fifth Avenue one day and everything was going along rather nicely. Suddenly people started running, screaming, and climbing up trees; cars and taxis started to honk their horns, and drive into each other and up on to the sidewalks. Pretty soon the cop saw what was causing the problem. Walking down the street was a man with an enormous alligator on a leash.[2]

The cop breathes deeply, goes near the man and points his finger at the alligator. "Take that alligator to the Central Park Zoo" he yells, "Thanks for the suggestion", says the man, and he walks off towards the zoo.

The next day, the same cop is directing traffic on the same corner on North Fifth Avenue. Everything is rather calm until suddenly people start to run and scream and climb up the trees, and cars and buses are crashing into each other. "What could it be this time," thinks the cop.

Along comes the same man, with the same alligator on a leash, walking down the street.

"Hey, Mister, I thought I told you to take that alligator to the Central Park Zoo!" But this time bursting with anger.

"I did," said the man. "And he liked it so much that today we are going to the Museum of Natural History!"

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[1] Passage from the book *What's so funny?*, by Elizabeth Claire.
[2] Leash: a rope or chain to hold a pet such as a dog or a cat.

APPENDIX B

Table 6. Substitution, epenthesis, and deletion errors commited by BP speakers when attempting to pronounce /θ/, /ð/, and /ŋ/ in all three parts of the test.

Target Sound	Position	Type of Error	Score	Total Number of Errors
θ	Initial /θ-]	[t̪-]	27	35
		[s-]	6	
		[d̪-]	1	
		[ð-]	1	
	Medial /-θ-/	[-t-]	30	41
		[-s-]	9	
		[-d-]	1	
		[-ð-]	1	
	Final /-θ/	[-t̪]	39	60
		[-s]	8	
		[-f]	5	
		[-t]	2	
		[-d̪]	2	
		[-ð]	2	
		[-z]	1	
		[-Ø]	1	
	Initial cluster /θc-/	[-t̪c-]	35	37
		[sc-]	2	
	Medial cluster /-θc-/	[-t̪c-]	17	25
		[sc-]	8	
	Final cluster /-cθ/	[-ct̪]	33	58
		[-cs]	18	
		[-cØ]	3	
		[-cf]	2	
		[-ct]	1	
		[-cd̪]	1	
/ð/	Initial /ð-/	[d̪-]	390	395
		[t̪-]	3	
		[θ-]	2	
	Medial /-ð-/	[-d̪-]	54	54

Table 6 – continued

Target Sound	Position	Type of Error	Score	Total Number of Errors
θ	Initial /θ-]	[t-]	27	35
		[-t̪]	13	
		[-s]	7	
		[-d̪]	4	
		[-z]	2	
	Medial I cluster /-ðc-/	[-θc-]	32	61
		[-t̪c-]	14	
		[-d̪c-]	7	
		[-sc-]	7	
		[-zc-]	1	
	Medial II cluster /-cð-/	[-cd̪-]	33	41
		[-cθ-]	6	
		[-ct̪-]	2	
	Final Cluster /-ðc-/	[-θc]	21	63
		[-t̪c]	16	
		[-sc]	10	
		[-zc]	8	
		[-fc]	4	
		[-vc]	2	
		[-d̪c]	2	
/ŋ/	Medial /-ŋ-/	[-ŋc-]	53	53
	Final /-ŋ/	[-ŋc]	55	72
		[-n]	17	
	Medial Cluster /-ŋc-/	[-ŋØ-]	6	9
		[-Øc-]	2	
		[-nc-]	1	
	Final Cluster /-ŋc/	[-ŋØ]	2	4
		[-nc]	2	

Table 7. Substitution errors commited by BP speakers when attempting to pronounce /æ/ and /ʌ/ across all three parts of the test.

Target Sound	Type of Error	Score	Total Number of Errors
/æ/	[ɛ]	376	396
	[ɛ˞]	14	
	[ʌ]	3	
	[ɔ]	2	
	[ɛ˞]	1	
/ʌ/	[U]	10	38
	[U˕]	7	
	[ɛ˖]	7	
	[a˕]	3	
	[u]	3	
	[u˕]	2	
	[æ]	2	
	[æ˕]	2	
	[ɔ]	1	
	[O˗]	1	