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ABSTRACT

Articles in this special issue include the following: "Allophonic Splits in L2 Phonology: The Questions of Learnability" (Fred R. Eckman, Abdullah Elreyes, Gregory K. Iverson); "Native Language Influence in Learners' Assessment of English Focus" (M. L. Garcia Lecumberri); "Obstruent Voicing in English and Polish. A Pedagogical Perspective" (Wiktor Gonet); "The Acquisition of English Syllable Timing by Native Spanish Speaker Learners of English: An Empirical Study" (Francisco Gutierrez-Diez); "A Comparison between English and Spanish Subjects' Typicality Ratings in Phoneme Categories: A First Report" (J. A. Mompean-Gonzalez); "Profiling the Phonological Processes Shaping the Fossilized IL of Adult Learners of English as a Foreign Language. Some Theoretical Implications" (Rafael Monroy Casa); "L2 Evidence for the Structure of the L1 Lexicon" (Charles Reiss); "Finnish-English Phonetics and Phonology" (Kari Sajavaara, Hannele Dufva); "An Applied Interlanguage Experiment into Phonological Misperceptions of Adult Learners" (Paul Tench); and Review Article, "Learning the Phonology of a Language: An Optimality Theory Approach" (Juan Antonio Cutillas-Espinosa). (Individual papers contain references.) (SM)

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Perspectives on Interlanguage Phonetics and Phonology

Issue Editors:

Rafael Monroy & Francisco Gutiérrez

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Table of Contents

IJES, Volume 1, Number 1, 2001

Foreword vii

RAFAEL MONROY & FRANCISCO GUTIÉRREZ
«Introduction: Perspectives on Interlanguage Phonetics and Phonology» ix

ARTICLES:

ROBERT S. CARLISLE
«Syllable Structure Universals and Second Language Acquisition» 1

FRED R. ECKMAN, ABDULLAH ELREYES & GREGORY K. IVERSON
«Allophonic Splits in L2 Phonology: The Question of Learnability» 21

Mª LUISA GARCÍA LECUMBERRI
«Native Language Influence in Learners' Assessment of English Focus» 53

WIKTOR GONET
«Obstruent Voicing in English and Polish. A Pedagogical Perspective» 73

FRANCISCO GUTIÉRREZ
«The Acquisition of English Syllable Timing by
Native Spanish Speakers Learners of English. An Empirical Study» 93

J.A. MOMPEÁN-GONZÁLEZ
«A Comparison between English and Spanish Subjects' Typicality Ratings
in Phoneme Categories: A First Report» 115

RAFAEL MONROY
«Profiling the Phonological Processes Shaping the Frozen IL of
Adult Learners of English as a Foreign Language. Some Theoretical Implications» 157

CHARLES REISS
«L2 Evidence for the Structure of the L1 Lexicon» 219

KARI SAJAVAARA & HANNELE DUFVA
«Finnish-English Phonetics and Phonology» 241

PAUL TENCH
«An Applied Interlanguage Experiment into Phonological Misperceptions of Adult Learners» 259

REVIEW ARTICLE:

J.A. CUTILLAS-ESPINOSA
«Learning the Phonology of a Language: An Optimality Theory Approach» .... ~~279~~ 277

ABOUT THE AUTHORS 301

INSTRUCTIONS TO AUTHORS 305

Foreword

The *International Journal of English Studies* (IJES), a refereed journal published by the University of Murcia (Spain), has been established to channel our research interests in a much wider way than *Cuadernos de Filología Inglesa*, the journal it replaces. Edited by members of the Department of English Studies and with an internationally acknowleged Editorial Advisory Board, the journal will be published twice-yearly in the form of English-language monographs covering areas of Language and Linguistics, Language Learning and Teaching, and Literature and Cultural Studies.

Several improvements have been introduced in this new journal. The most noticeable one is no doubt the change of policy as far as the language is concerned. Unlike *Cuadernos*, written mostly in Spanish with a Spanish audience in mind, the new journal is presented entirely in English, as the title clearly reflects, and aims unambiguously at an international readership. The new developments in the disciplines that constitute our concerns clearly demanded a new forum where our ideas could be expressed and challenged by an international, critically-minded audience.

A second innovation of IJES refers to its overall policy. While the journal tries to act as an integrative forum for the expression of opinions in the multi-disciplinary fields of linguistics, language learning and teaching and literary as well as cultural studies, it does not make any explicit statement regarding ideology. In fact, one important aspect of this journal is its refusal to align itself with a single theoretical position. Rather, it favours diversity and welcomes submissions that can make substantive contributions from any of the above-mentioned areas, irrespective of methodological and epistemological differences. This does not mean that a particular monograph may not reflect a specific position, something which will depend on the editor(s) of the volume in question.

Another improvement of the new journal refers to content. In the past, each volume reflected research in literary and linguistic fields in a very broad way. Contributions were so thematically diverse that usefulness was seriously impaired and it often proved impractical to search for something of personal interest. This pitfall was all the more evident as there is no shortage of specialised journals that address well-defined areas within linguistics, literary and cultural studies in a far more unified way. Despite the generic nature of its title, the *International Journal of English Studies*, tries to overcome this deficiency by introducing a new policy that envisages monographs on specific topics within such areas. To this purpose we shall invite contributions from different authorities in order to bring to light the latest developments in the fields —any scholar from any institution is welcome to propose and edit a special issue of the journal, provided that it is co-edited with a member of our Department.

IJES starts with a monograph devoted to *Perspectives on Interlanguage Phonetics and Phonology* (1.1) and another to *Writing in the L2 Classroom: Issues in Research and Pedagogy* (1.2). These will be followed by other stimulating topical issues such as *New Trends in Computer Assisted Language Learning/Teaching*, *Irish Studies Today*, or *Discourse Analysis Today*.

As General Editor, I am very grateful to David Walton, Dagmar Scheu, Elisa Ramón, Pascual Cantos and Javier Valenzuela, the Editorial Assistants of CFI, who were personally involved with the planning and development of IJES through countless meetings and discussions of ideas. I would like to thank the Issue Editors for their coordination and editing process in general, which always took place under my irritating and often stressing pressure. In this sense, I am also very grateful to the members of the Editorial Advisory Board who were specifically involved with this number for their advice and assistance. I would also like to acknowledge the very insightful and useful suggestions and comments offered by the Readers, which served as a very important source for the naming of IJES contributors and for planning. Finally, I would like to acknowledge the support and assistance of the Servicio de Publicaciones of the University of Murcia ('Murcia University Press'), as well as the Departamento de Filología Inglesa at the same Institution, which have provided me with the basic facilities and the costing associated with the launch of IJES, and particularly with the production of this volume, edited by Rafael Monroy and Francisco Gutiérrez.

JUAN MANUEL HERNÁNDEZ CAMPOY
General Editor, IJES

Introduction:
Perspectives on Interlanguage Phonetics and Phonology

This opening volume of IJES is special in more than one sense. To begin with, it focuses on linguistics –or to be more precise, applied linguistics. This is by no means a statement of a preferred area for the journal, it simply reflects the research interests of many members of this Department who have been involved in the application of linguistics for a number of years now. It is not a mere accident that our university hosted the First National Conference of Applied Linguistics and that our Department was heavily involved in it. What is more unexpected is the fact that this first volume should be devoted to second language phonology. Indeed, during the second half of the 20th century there has been a growing interest in the phonological component of second/foreign language learners and phonological theory is undergoing unprecedented theoretical changes, but interlanguage phonology has never been the most prominent field of research within applied linguistics. As Major pointed out in 1998, second-language phonology lags in quantitative terms behind research on syntax, discourse or pragmatics.

One reason for this state of affairs is the growing gap existing between task oriented classroom practices whose concern is the attainment of tangible results in foreign language acquisition, which openly clashes with the abstractness of most contemporary phonological theories. These, far from focusing on specific pronunciation problems encountered by the (adult) learner, try to provide insights into the exact nature of L2/FL acquisition processes, particularly those of a developmental nature. The link between language acquisition and universal constraints is currently being researched within different theoretical phonological frameworks mainly concerned with the effects universal constraints may have on IL phonology. Thus the learner's output is supposedly affected by constraints imposed by a universal set of natural processes (Natural Phonology), by implicational hierarchies and markedness (MDH), by post-lexical rules (Lexical Phonology), by a universal hierarchy of features geometrically represented (Feature Geometry), by a set of constraints (some violable) shared by all speakers (Optimality Theory), by features that enter into a number of complex associations with other segments both in terms of levels and directionality (Autosegmental Phonology), etc. They certainly inspire new developments in second language phonology while data from second/foreign language learners provide feedback and have a direct bearing on the justification of these theories in an attempt to provide solutions to many problems still unresolved. It is in this context that this volume makes its appearance.

By bringing together a number of papers specially written for this occasion, we hope to contribute to the ongoing debate on foreign language learning and to consolidate further research carried out on interlanguage phonology. Thus, **Carlisle** starts his article with a list of studies that draw on the classic distinction between marked/unmarked syllable. He assumes the CV syllable as an absolute substantive universal, which serves as a reference for the explanation of the increasing structural complexity of other syllables. Syllable structure is described by reference to Clement's (1990) Sonority Sequencing Principle whereby the syllabic nucleus is a peak of maximum sonority from which adjacent segments to the right and left of such peak progressively decrease in sonority. General preference for type CV syllable is reflected on and supported by data from historical linguistics and language learning. The more complex a syllable, the more marked it is. Other signs of markedness are deviations from Clement's SSP, such as sonority plateau (*fact*) and sonority reversals (*spin*). The author comments on several studies by other authors and by himself on the learning of foreign language syllables. The results are analysed in the light of two concurrent hypotheses: transfer of L1 syllable structures and/or preference for CV structure. Such results strongly support the L1 hypothesis. Nonetheless Carlisle shows that language transfer is compatible with the influence of syllable structure universals in explaining the learner's interlanguage as regards syllable acquisition. As to syllable margins, results support the hypothesis that learners modify more marked onsets and codas more frequently than their less marked counterparts. This correlates with the fact that learners acquire shorter onsets and codas before longer ones. Learners also modify complex margins which do not adhere to the SSP (such as sonority plateau and reversals) more readily than those that do.

Eckman, Elreyes and **Iverson** try to show that phonological theory can both inform and constrain the path of phonological learning. To test the applicability of two ordered rules of lexical phonology —the structure preservation rule and the lexical derived environment constraint— the authors claim that the process of phonemically splitting in the target language two sounds which are allophones of one phoneme in the learner's mother tongue is governed by such rules. The splitting sounds chosen for the study are Spanish [d, δ] and Korean [s, R]. A cross-sectional study conducted with 15 Spanish subjects and 15 Korean subjects, all learners of English, shows that interlanguage errors of 'non-phonemic split' adhere to a sort of implicational patterning: lack of phonemic contrast in derived words implies the same error in non-derived words but the reverse does not necessarily hold true. A longitudinal study conducted with 5 native Spanish speakers, half of whom are trained in the production of the target contrast in only derived words, shows that subjects mastering that type of contrast after the instructional period are also able to produce that contrast in non-derived contexts, while those trained to master the contrast in only non-derived words may or may not show their application in derived ones. Thus we get a two-way support for the authors' hypothesis that interlanguage phonological rules conform to the principles of phonological theory.

García Lecumberri studies, against the background of well known tonicity contrasts between Spanish and English, the possible influence of Spanish on native speakers of that language during their assesment of marked tonicity in English. The target of study is twofold: (a) discrimination by Spanish learners of English of information focus as signalled by placement of nuclear tones in sentence initial and medial positions. The results show both that focus in initial position is more readily attested than in mid position (in Spanish, initial focus is more frequent and unumbiguous than in mid position), and that out of two tasks employed for the discrimination test —multiple choice and open questions— the second is far more demanding than the former as a means of correctly identifying sentence focus. And (b) the second target of her study is the acceptability by native Spanish speakers of the naturalness of focus assignment in English. The results of the acceptability test show that the lower identificaiton rates obtained by Spanish NL subjects as compared to English native speakers is influenced, at least in part, by their native language. The acceptability scores obtained by the learners are higher in the case of initial focus than in medial focus, which is consistent with the focus identification results pointed out in (a) above and, again, in keeping with the fact that in Spanish focus in medial position is less natural than focus in initial position.

Consonant voicing, until quite recently defined in a static 'segmental' way, is best understood according to the perspective of intricate timing between the formation of the closure, and the vocal fold vibration. As the time scale used by the brain's "voicing programs" operates in centiseconds, the control of most nuances of phonation is below the threshold of feedback control. Such are the small timing details responsible for the impression of 'partial voicing'. Foreign language phonation control belongs to most persistent points in native language interference. The problem is especially aggravated if in the learner's native language (e.g. Polish) the number of degrees of voicing is smaller than the number of voicing categories in the language studied. Pronunciation problems can have two sources: phonology and phonetics, and both are convincingly discussed in **Gonet**'s paper which also shows positive and negative aspects of the interference of the Polish voicing system onto the learner's attempt to master the pronunciation of English. Especially difficult to learn is the control of 'partial voicing', where a 20-30 ms. shift in the initiation of voicing may produce a different sound. The author argues that the use of visual feedback can help foreign learners in acquiring the nuances of English pronunciation.

The article by **Gutiérrez** reports on contrastive syllable timing (English-Spanish) and the acquisition of English syllable timing by Spanish native speakers. The results of the contrastive study are used to explain the influence of the native language in the acquisition of a FL. Thus some timing errors in the learners' interlanguage are accounted for by NL influence or transfer and some others are developmental errors. Among the former, the learners show a durational ratio of tonic/non-tonic syllable which is intermediate between the ratios obtained for English and Spanish by their respective native speakers, thus showing interference at work. As a sample of developmental error, the author points out the learners' slower tempo that obtains when they make both tonic and non-tonic syllables proportionally longer than the syllables of native English speakers. Regarding the comparison of timing in both languages, an interesting result is the equal duration of non-tonic syllables, which runs counter to a widespread belief among teachers of English to native Spanish speakers, who contend that English non-tonic syllables are shorter than Spanish ones.

Jose Antonio Mompean's article is an experimental study on the perception of within-category allophonic differences in phonemes by both native speakers of English and Spanish learners of English as a second language. More specifically, the study tries to show how representative (or typical) different examples of a given phoneme category like /i/ are perceived by subjects in both groups. This is done using a 7-point rating scale. The study also tries to determine the possible determinants of the typicality ratings obtained. The results of the study show that the degree of representativeness of each allophonic realisation of /i/ (as determined by the following consonant) varies in both groups. In the English group, the most representative examples of /i/ are those that are both oral and non-diphthongized irrespective of the length of the vowel whereas in the Spanish group the quantity of the vowel is directly proportional to its rated representativeness. This seems to demonstrate that previous explicit instructional learning (e.g. learning that the vowel under investigation is the "long i") can affect within-category perceptual typicality judgments.

Monroy's paper describes the frozen IL of 65 adult learners of English in a natural setting with the purpose of profiling the phonological processes that underlie their output. He is also concerned with their impact level on the learners' oral behaviour and the role played by transfer and developmental processes in such behaviour. The analysis of the data yields ten fundamental processes shaping the learners' IL which are reflections of the three macro-processes of addition, subtraction and substitution. While not claiming any specific ranking order, he found that consonant substitution processes permeated the speech of all informants whereas synaeresis was the least favoured process. The ten processes are discussed in turn considering their degree of phonological dependence on L1 phonotactic patterns. It is reported that prothesis, epenthesis, synaeresis and consonant insertion violate the universal CV canonical syllable. Substitutions processes serve our author to argue against Major's Similarity/ Dissimilarity Hypothesis on the grounds that such a distinction is based on each individual's perception which ultimately governs production. Major's Ontogeny Model is criticised under vowel substitution considering that interference suffices to explain the IL behaviour of the informants without the resort to developmental processes. Consonant substitution is discussed both in connection with Major's contention that transfer errors decrease while developmental errors increase and then finally decrease, and Eckman's MDH and Structural Conformity Hypothesis which predict that unmarked terms are learned earlier and more easily than marked ones. Such claims are questioned by Monroy's data which favour fricativization over plosiveness. Discrepancies also arise in connection with Eckman's phonological directionality as reflected in voicing/devoicing. Cluster simplification, on the other hand, provides partial support to Eckman's predictions but there is not a ready explanation for cases where liquids are followed by /s/ or voiceless plosives. Finally, obstruent deletion seems to follow L1 patterns too, although nasal and sibilant behaviour requires a more detailed explanation.

Reiss discusses how data from L2 acquisition can provide answers to the problematic question of the specific nature of L1 lexicon. He starts distinguishing three main issues: the acquisition of an L1 by a child given a language faculty (what he calls the HUMAN PROBLEM); the problem of deciding among different computational models which yield the same grammatical output (the ARTIFICIAL INTELLIGENCE PROBLEM) and the question of figuring out the mental grammar of a speaker from insufficient data (THE LINGUIST'S PROBLEM). He criticises the concept of Richness of the Base advocated by Optimality Theory because it seems to betray a disinterest for the actual nature of the lexicon. Reiss discusses of two main approaches to homophony: *radical vagueness* (two or more homophones always correspond to a single, vaguely specified lexical entry) and *radical ambiguity* (each homophone corresponds to a different lexical entry; all possible grammatical categories are underlyingly present in all languages). Reiss favours a compromise position, defending the need of assigning different lexical entries to some surface-similar strings using five different arguments. Finally, he shows cases where only L2 data can help decide whether two homophones correspond to different lexical entries: if this is the case, L2 learners should not have problems acquiring morphological L2 contrasts that are underlyingly present in their L1, but not on its surface; if these problems exist, this will imply that there is no L1 underlying specification for that particular category.

Sajavaara and **Dufva** discuss several issues pertaining to the fields of phonology; more specifically, the role of phonological descriptions in language teaching/learning, phonological learning and English-Finish contrastive studies. They question the role of phonetic/phonological descriptions of an L2 during the teaching/learning of that language by foreign learners. Phonological oppositions, features and rules can be played down by language redundancy and by the fact that they are static entities or structures lacking the dynamic element of processes, such as those involved in language learning. Regarding phonological learning, the authors state that native teachers and non-native teachers evaluate errors differently and point out that the exclusive teaching of a single usually stereotyped accent poses problems for the correct perception of other accents and registers by the learner. Contrastive analysis, adequate though it may be when it meets its theoretical objectives, does not necessarily contribute to the explanation of practical teaching/learning problems. One of the reasons for that is that it is usually restricted to grammars (including phonology) leaving out other levels such as pragmatics and the ways different levels interact during the process of communication. Reference is made to the non-linear nature of speech production and perception and to the "dual code hypothesis", according to which sequences of words are detected prior to the hearing of phonological elements. Interference is greatest at the phonological level owing to the little optionality found in the area of phonology. In the last part of the article the authors report on the findings of a research project on phonological contrasts between English and Finnish.

Finally, **Paul Tench** starts his article by reporting on two experiments by Ahn, one on production, another on perception of English vowels by Korean learners, as a background to the account he gives of his own experiment on the (mis)perception of English vowels, consonants and clusters by a wider sample of Korean learners of that language. The author thus stresses the importance of phonological perception, side by side with production, if we are to fully understand and describe the learner's phonological interlanguage. He relies on the contrastive analysis hypothesis together with classroom observation. He also adheres to three strategies, pointed out in Ahn's study, which learners use to make up for their phonological mismatchings: re-interpretation within the learner's interlanguage lexicon, the invention of unknown words, and judgement-refusal (i.e. refusing to give evidence of the phonological segment(s) heard).

The author refers to the need to develop production and perception materials to be used for group and individual work in keeping with the results of his and other similar experiments where he shows which target contents are problematic for the learner. In the light of common assumptions about the role of non-phonological linguistic levels in making up for the listener's failure to effectively use the phonological component during the speech decoding process, Tench's digression on methodological procedures to isolate the learner's (mis)perception of the phonological component is of interest to researchers.

RAFAEL MONROY AND FRANCISCO GUTIÉRREZ
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Syllable Structure Universals and Second Language Acquisition

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ABSTRACT

The purpose of this paper is to review research in L2 acquisition that has examined the influence of syllable structure universals on the structuring of interlanguage phonology, research that essentially began in the early 1980's. Not all of the researchers conducting these studies claimed to be examining the influence of syllable structure universals; instead, a number of them expressly stated that they were examining the influence of typological universals, most of which were documented in Greenberg's (1965) seminal research. However, many of Greenberg's implicational statements are completely in accordance with current theoretical descriptions of the syllable; consequently, the L2 research based on the those implicational statements offer evidence for the influence of syllable structure universals on the structuring of interlanguage phonology.

The paper begins with a brief description of syllable structure universals, brief because only those syllable structure universals that have inspired corresponding research in L2 acquisition are presented. The presentation also assumes that the syllable has three constituents: the onset, the nucleus, and the coda. Such a division is in accordance with much of the research on the syllable, and dividing the syllable into these three constituents facilitates both the description of the universals and the review the L2 research.

KEYWORDS: syllable, onset, language universals.

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I. SYLLABLE STRUCTURE UNIVERSALS

I.1. The CV Syllable as an Absolute Universal

All descriptive and theoretical studies of the syllable recognize that the CV syllable is an absolute universal in the languages of the world (Battistella, 1990; Blevins, 1995; Cairns & Feinstein, 1982; Clements, 1990; Greenberg, 1965; Kaye & Lowenstamm, 1981; Hulst & Ritter, 1999; Vennemann, 1988. Vennemann (1988) explicitly expresses this universal in sections of his Head Law and Coda Law. Part A of his Head Law (where head is synonymous with onset) states that "a syllable head is the more preferred: (a) the closer the number of speech sounds is to one" (p. 13). In turn, Part A of the Coda Law states that "a syllable coda is the more preferred: (a) the smaller the number of speech sounds in the coda" (p. 21). Thus, a single C is the optimal onset and a zero C is the optimal coda, meaning that the CV syllable is the core syllable in all languages.

Research in historical linguistics has demonstrated that syllable structure changes abide by syllable preference laws, and that "if a change worsens syllable structure, it is not a syllable structure change,...but a change on some other parameter which merely happens also to affect syllable structure" (Vennemann, 1988, p. 2). This means that diachronic examples should exist of CV syllables evolving from less preferred forms, such as V, CCV, and CVC syllable types.

As expected, examples of all these changes have occurred. Vennemann notes a number of historical cases in which headless syllables (V syllables) acquired a single consonant as an onset, thus producing a CV syllable. The following examples are from Italian (Vennemann 1988, p.14):

(1)	*Ge.nu.a*	→	*Ge.no.va*	
	Man.tu.a	→	*Man.to.va*	
	Pa.du.a	→	*Pa.do.va*	
	vi.du.a	→	*ve.do.va*	'widow'
	ru.i.na	→	*ro.vi.na*	'ruin'

As demonstrated in the examples above, contiguous vowels beginning with a high back vowel developed a glide (step not shown) that eventually strengthened into the consonant /v/, which then acted as a one-member onset.

In addition to creating CV syllables from V syllables, languages also reduce CCV syllables to CV syllables as Vennemann (1988) has demonstrated from German language data (p. 15). Early Old High German (OHG) had some complex onsets consisting of /h/ followed by a consonantal sonorant. In late OHG the initial /h/ had disappeared resulting in one-member onsets:

(2)	**Early OHG**		**Late OHG**	
	hnigan	→	*nigan*	'to bow'
	hlut	→	*lut*	'loud'
	hruofan	→	*ruofan*	'to call'
	hwiz	→	*wiz*	'white'

Further examples of CCV syllables being reduced to CV syllables come from Pali (Vennemann, 1988, p.15):

(3)	ambra	→	amba	'mango'
	srotas	→	sota	'stream'
	svapna	→	soppa	'sleep'
	syandana	→	sandana	'wagon'

These examples from Pali demonstrate that the two-member onset /br/ was reduced to the one-member onset /b/ and that /sr/, /sv/, and /sy/ were each reduced to the one-member onset /s/.

Finally, CVC syllables have been reduced to CV syllables by the loss of the one-member coda as the following examples from Italian demonstrate (Vennemann 1988, p.14):

(4)	*patrem*	→	*padre* 'father'
	cantat	→	*canta* '(he) sings'
	fac	→	*fa* 'make!'
	dic	→	*di* 'say'

I.2. The Length of Margins

The markedness of margins (both onsets and codas) increases with length, a fact captured by the observation that the presence of onsets or codas of length n in all languages implies the presence of at least one subsequence *n - 1* in the corresponding positions (Greenberg, 1965; Kaye & Lowenstamm, 1981). This generalization holds true with the exception as noted by Greenberg that the presence of CV does not necessarily imply the presence of V (a syllable with a zero onset).

Evidence for a preference for shorter onsets and codas exists from both historical linguistics and from phonological processes from many languages, which reduce complex codas and onsets by vowel epenthesis or deletion; in contrast, very few examples exist in the world's languages of processes that produce complex onsets or codas (Blevins, 1995).

Historically, examples exist of languages losing at least some of their complex onsets as demonstrated in (2) and (3) for Pali and Old High German; other languages that have reduced the number of their complex onsets include English and Greek (Hock, 1986). A large number of languages have also lost some of their complex codas, such as Sanskrit and Greek (Hock, 1986).

I.3. Sonority Sequencing

All cross-linguistic descriptions of the syllable note that the segments composing syllables are patterned in a certain manner based upon sonority. The preferred syllable type in all languages is one in which the nucleus is the most sonorant constituent and consequently, comprised of a vowel; in turn, the segments comprising the onsets and codas rise continuously in sonority from the most peripheral member; this pattern is known as the Sonority Sequencing Principle (Clements, 1990), and a model of it occurs in (5).

One-member onsets and codas by definition must adhere to the Sonority Sequencing Principle because they must be comprised of segments that are less sonorant than the nucleus. However, one-member onsets and codas differ dramatically from each other in which segments are preferred. If an onset consists of one segment, a strong universal tendency exists for the segment to be weak in sonority, thus obstruents are preferred over sonorants in that position. The reverses is true for codas: One-member codas are preferred that are high in sonority.

(5)

			Nucleus			
			vowels			
		glides		glides		
Onset		liquids		liquids		*Coda*
		nasals		nasals		
	fricatives				fricatives	
	stops				stops	

Universally preferred complex onsets are constructed by selecting a segment lower on the sonority scale and following it with one higher on the scale; for example complex onsets consisting of a stop followed by a liquid or a fricative followed by a glide adhere to the Sonority Sequencing Principle. In turn, complex codas are formed by selecting a segment higher on the scale and following it with one lower on the scale, so a nasal may be followed by a stop or a liquid may be followed by a fricative. Syllables adhering to the Sonority Sequencing Principle occur in all languages, and many languages have only syllables that adhere to it.

Though the Sonority Sequencing Principle expresses a very strong universal tendency, complex margins may violate it in two manners. First, two segments in a margin may have the same sonority; these are known as sonority plateaus (Clements, 1990) and are found in a few languages including English, as in the words *sphere* and *fact*. Second, the more peripheral segment in the onset or coda may have higher sonority than a segment closer to the nucleus; such aberrant sonority profiles are known as reversals and occur in some languages including English as exemplified by *spin, sky, ax*, and *hops*. Sonority reversals are more serious departures from the Sonority Sequencing Principle than are sonority plateaus and are consequently less frequent and more marked.

One last point needs to be made about the Sonority Sequencing Principle and complex margins. Two complex onsets or codas can abide by sonority sequencing, yet one may still be preferred over the other cross-linguistically. This observation has been made in a number of studies perhaps the most well-known being that of Greenberg (1965), who documented implicational relationships between pairs of consonant clusters. One such implication is that if a language has a two-member onset consisting of an obstruent followed by a nasal, then is will also have one consisting of an obstruent followed by a liquid, meaning that the former is more marked than the latter. An implicational relationship for codas is that if a language has a two-member coda consisting of two nasals, then it will also have one consisting of a nasal followed by an obstruent[1]. These two implicational statement seem to be part of a larger generalization: All else being held constant, complex margins are preferred that have a sharper rise in sonority from the most peripheral member[2]. Vennemann (1988) cites a number of historical cases for this preference; in Greek, for example, nasal + liquid onsets evolved into plosive + liquid onsets.

II. L2 RESEARCH

II.1. Preference for the CV Syllable

As discussed above, the CV syllable is an absolute substantive universal; all languages have CV syllables, and some have only CV syllables. Any syllable types that are more complex than the CV syllable are therefore marked, the degree of markedness directly dependent on the degree of complexity. Given that CV syllables are unmarked, some researchers in L2 acquisition hypothesized that the CV syllable would be produced in interlanguage independent of native language transfer. The evidence for this hypothesis has been some positive, but weak for a number of reasons that will be presented below.

In the first study, Tarone (1980) transcribed the English narratives of two speakers each of Korean, Cantonese, and Portuguese and found that the participants modified 137 syllables (about 20% of the syllables that they produced) either through epenthesis, deletion, or the insertion of a glottal stop. Although most of the modifications could be attributed to native language transfer, 30 (about 22% of the modified syllables) could not and were therefore interpreted as evidence for a preference for the CV syllable.

Following the same procedures used by Tarone, Hodne (1985) examined the English syllable structure of two native speakers of Polish. Polish was chosen because it has syllable structures at least as complex as those found in English; in fact, Polish and English share at least 26 complex onsets and 26 complex codas. Hodne collected 666 syllables in an interview task and a narrative. The corpus of data contained 66 syllable structure errors; of those 21 could not be attributed to transfer, and of those a mere 11 (about 16%) resulted in CV syllables.

Sato (1984) examined the spontaneous and informal English conversations of two Vietnamese youths. Data were gathered at three different points over a 10-month period. Sato selected Vietnamese because over 81% of the phonemic syllables in the language are closed. Given that Tarone (1980) had found that transfer was more prevalent in accounting for the syllable structure of the interlanguage than was any possible preference for the simple open syllable, speakers of Vietnamese offered an interesting case because a transfer hypothesis would predict that the participants would favor closed rather than simple open syllables in the interlanguage. Sato examined the production of two-member codas by the participants and found that of the 489 two-member codas produced over the 10 months, 363 were reduced (one member of the coda was deleted) and 61 were completely deleted. In other words, approximately 12% of the target syllables with two-member codas were reduced to CV syllables.

Benson (1988) taped two adult native speakers of Vietnamese in informal conversation with the investigator. Benson investigated both monosyllabic words consisting of an open syllable and a closed syllable ending in [p, t, k, m, n] or [ŋ] as Vietnamese has closed syllables ending in those segments. Three types of errors were examined: the insertion of a consonantal segment after a word-final V, the occurrence of an epenthetic vowel after a word-final C, and the deletion of a word-final C. Of the 537 target closed syllables, 92 were modified towards CV syllables through deletion, but only 11 of those resulting CV syllables could not be attributed to transfer.

Riney (1990) examined the syllable production of 40 native speakers of Vietnamese who were distributed equally among four age groups: 10-12, 15-18, 20-25, and 35-55. Riney restricted his examination to stressed monosyllabic words ending in the word-final one-member codas /t/, /k/, and /v/; environment was controlled so that only items followed by a vowel or a pause were examined. Riney examined two types of errors: epenthesis after a one-member coda or deletion of the coda, both modifications resulting in a CV syllable. The four groups differed on the frequency with which they modified the target onsets. The youngest group simplified the least frequently (15.8%) and used the strategy of deletion nearly twice as much as epenthesis. The next three groups each modified approximately one third of the target items (34.8, 30, and 38.7%, respectively), but they differed on the strategies that they used; with age epenthesis increases and deletion decreases[3]. This study indicates that even speakers of languages having word-final CVC syllables will variably modify some of them to CV syllables in the L2[4].

Two generalizations can be made from these studies, the first being that transfer is the primary process involved in modifying the syllable structure of the interlanguage; clearly, most modifications of syllable structure found in the studies just described could be attributed to transfer rather than to any preference for the CV syllable. Researchers have commented on how susceptible interlanguage phonology is to transfer from the L1. For example, Ioup (1984), in a comparison of phonological and syntactic modifications in interlanguage, remarked that transfer appears to be more influential in structuring interlanguage phonology than in structuring interlanguage syntax. In fact, she states "that transfer is the major influence on interlanguage phonology" (p. 13).

Two studies that clearly demonstrate the influence of transfer on the structuring of interlanguage phonology have been conducted by Broselow. In the first study, Broselow (1983) investigated syllabification errors in the English of native speakers of Arabic who spoke two distinct dialects: Iraqi and Egyptian. Both dialects have syllable structure conditions that disallow consonant clusters in word-initial position. Yet speakers of each dialect modify English words with initial consonant clusters in a different manner. Egyptian speakers will pronounce *flow* as [filo] whereas Iraqi speakers will pronounce it as [iflo]. Both pronunciations can be attributed to rules of epenthesis in the native language that bring underlying syllable structures into conformity with surface structure restrictions on syllable structure. In a word such as *flow*, the first consonant is extrasyllabic (unassociated with a nucleus) and a vowel must be inserted to which the consonant is resyllabified according to convention before it reaches surface structure (Clements & Keyser, 1983). The Egyptian rule of anaptyxis inserts a vowel to the right of the extrasyllabic consonant to which it resyllabifies forming a CV syllable. In contrast, the Iraqi rule of prothesis inserts a vowel to the left of the extrasyllabic consonant to which it resyllabifies forming a VC syllable. If the preference for the CV syllable had been powerful, Iraqi speakers might have been expected to pronounce words such as *flow* as [filo] at least some of the time because such a strategy would have created a CV syllable independent of L1 transfer; however, such pronunciation was not evident for Iraqi speakers. In the second study, Broselow (1984) studied the Arabic of native English speakers and found that they resyllabified Arabic to conform to English syllable structure conditions.

More evidence for the strength of L1 transfer over a preference for the CV syllable also comes from studies on the English of native Spanish speakers. In a number of independent studies, Carlisle (1988, 1991a, 1991b, 1997, 1998, in press) examined the production of /sC(C)-/ onsets in English. Spanish has a large number of words that begin with the sequence /esC/ such as *escuela, estampa*, and *espia*. For each word, the /e/ is predictable and consequently inserted by phonological rule. Because the epenthesis of /e/ takes place in the derivation of the words, the underlying representations begin with the sequence /sk/, /st/, and /sp/, which are prohibited onsets according to the syllable structure conditions of Spanish (Harris, 1983). Consequently, in the underlying representations /s/ is an extrasyllabic consonant, and Spanish speakers respond to this consonant by inserting a vowel before it. The resyllabification convention then applies forming a syllable of the extrasyllabic consonant and the prothetic vowel, the result being that the relevant derived words in Spanish begin with a VC syllable. This same rule of prothesis is transferred into Spanish/English interlanguage phonology. Spanish speakers will variably pronounce words such as *snow, slow*, and *steep* as as [esno], [eslo], and [estip], a pronunciation that results in the words beginning with a VC syllable. In none of the studies did the participants ever produce forms such as [seno], [selo], or [setip] as might be expected if the participants really had a preference for the CV syllable independent of language transfer. Other studies have examined native Spanish speakers acquiring languages that have complex onsets beginning with /s/ or /ʃ/ such as Swedish (Abrahamsson, 1999; Hyltenstam & Lindberg, 1983), German (Tropf, 1987), and Italian (Schmid, 1997); all these studies found that when the target onsets were modified at all, they were modified by prothesis nearly exclusively.

The second comment about the research is that though it has provided positive evidence for a preference for CV syllable independent of language transfer, the results have been rather weak. Some researchers apparently assumed that target syllables would have to be reduced to CV syllables in order to show the influence of language universals on L2 acquisition. Consequently, some of the research used target syllables that had complex codas, but complex codas are rarely reduced to CV syllables (as seen in the discussion of Sato's research), instead they are usually reduced by one consonant only, thus a CVCC syllable will be reduced to a CVC syllable. Though the CV syllable is the unmarked syllable type, syllable structures fall along a continuum of markedness. Thus, CVCC syllables are more marked than CVC syllables, which in turn are more marked than CV syllables. This begin true, it would not be necessary for an L2 learner to produce CV syllables to demonstrate that language universals were an influence in the interlanguage. If L2 learners produce less marked structures, rather than the unmarked, independent of language transfer, then linguistic universals can reasonably be claimed to be an influence. For example, if L2 learners whose native language has only CV syllables produce a CVC syllable instead of a CVCC target syllable, they have not only produced a syllable not found in their native language, but one that is also less marked. This point is brought out clearly in the following section.

II.2. The Length of Margins

As mentioned previously all descriptive and theoretical studies of the syllable have found that the markedness of both onsets and codas increases with length (Cairns & Feinstein, 1982; Greenberg, 1965; Kaye & Lowenstamm, 1981; Vennemann, 1988), a fact captured by the observation that the presence of an onset or coda of length n implies the presence of $n - 1$ (Greenberg, 1965; Kaye & Lowenstamm, 1981). Researchers in L2 phonology have hypothesized that L2 learners would modify more marked margins more frequently than less marked ones. Results from a good number of studies have uniformly supported this general hypothesis.

Weinberger (1987) examined word-final codas produced by four adult speakers of Mandarin and found that the frequency of modification increased linearly with the length of the coda; 5.5% of one-member codas were modified, 29.8% of two-member codas, and 42% of three-member codas. In other words, as markedness increased, so did the frequency of the syllable simplification strategies.

In a study on the modification of both onsets and codas, Anderson (1987) examined the casual conversation of 29 speakers of colloquial Egyptian Arabic, and 10 speakers each of Amoy and Mandarin Chinese and found that all groups of participants made significantly more modifications (either by deletion or epenthesis) of margins as their length increased. Arabic speakers did not modify one-member onsets at all, but they did modify over 7% of two-member onsets. The Chinese speakers produced similar results, modifying 1% of the one-member onsets, but over 10% of the two-member onsets.[5] For each group, an increase in the length of the onset produced a statistically significant increase in the frequency of modification. Results for the codas were similar. The native Arab speakers modified only about 2% of one-member codas, 17.4% of two-member codas, and over 30% of three member codas. The Chinese participants modified about 20% of the one-member codas, 50% of the two-member codas, and about 74% of the three-member codas. As was true for onsets, increases in length of codas produced statistically significant increases in the frequency of modification.

In another study, Eckman (1991) examined the reduction of complex codas and onsets by 11 native speakers of three different language: Japanese, Cantonese, and Korean, none of which allow complex codas or onsets. Unlike Anderson and Weinberger, Eckman did not compare the frequency with which two-member and three-member onsets and codas occurred relative to each other Instead, he used a criterion measure of 80% correct production to determine the presence or absence of a particular structure. For example, if a participant produced onsets of the form /spr-/ correctly 80% of the time, the structure was regarded as present in the interlanguage phonology. And if either or both of the two subsequences (/sp/ and /pr/) reached the criterion level, then they were also present and the hypothesis that the less marked margins would reach the criterion level before the more marked ones was confirmed. The hypothesis could have been falsified if the three-member margins was present and both of the two-member subsequences were absent according to the 80% criterion. Eckman examined three three-member onsets and eight three-member codas across 11 participants and four tasks and found three falsifications; that is, in three cases, a three-member cluster was present at the criterion level, but both two-member subsequences were absent. However, these three falsifications were by two participants and did not occur in all tasks. Even with the falsifications, this study provides very strong evidence that less marked onsets and codas are acquired before more marked onsets and codas.

In a recent study Hancin-Bhatt (2000) examined the production of five classes of one-member codas —voiceless stops, voiced stops, fricatives, liquids, and nasals— and three two-member codas —liquid + stop, liquid + fricative, and liquid + nasal— by 11 native Thai speakers. She found the participants correctly produced 84.4% of the one-member onsets and only 63% of the two-member onsets. Because the investigator was working within the framework of optimality theory, she did not analyze the data statistically.

Carlisle (1997, 1998, in press) in a five year longitudinal study on the acquisition of /.sC(C)/ onsets by native Spanish speaking adults examined the question of whether more marked onsets are modified more frequently than less marked onsets. At all three times of data gathering, the researcher examined the production of the two-member onsets, /sp/ and /sk/, and the three-member onsets, /spr/ and /skr/. The data gathering instrument, which consisted of 176 topically unrelated sentences, was constrained in two important manners. First, only onsets that violated the Sonority Sequencing Principle were examined because previous research had determined that onsets that violate it are modified significantly more frequently than those that do not (Carlisle, 1991b; Tropf, 1987). Second, the phonological environment before the onsets was controlled as previous research has determined that native Spanish speakers use prothesis significantly more frequently after consonants than after vowels before /.sC(C)/ onsets (Carlisle, 1991a, 1991b, 1992). Results from Time I revealed that the 11 participants simplified 38% of the two-member onsets and 48% of the three-member onsets, a statistically significant difference ($p < .01$).

The research question for Time II and III was different than that used at Time I. For Time II and III, the general hypothesis was that the less marked onsets would be acquired before more marked onsets. Acquisition was determined through the use of a criterion level of 80% correct production, the same criterion that had been used in previous research (Andersen, 1978; Cancino, Rosansky, & Schumann, 1975; Eckman, 1991; Eckman & Iverson, 1993). That is, if L2 learners produced a certain structure correctly 80% of the time, then that structure was considered acquired. Since the two-member onsets, /sp-/ and /sk-/, are less marked than are the three-member onsets, /spr-/ and /skr-/, they should have reached the criterion level before the more marked onsets. The hypothesis would not have been supported if either of the more marked onsets reached the criterion level before the less marked onsets. Ten participants were still available at Time II and thus 20 tests of the general hypothesis were possible. Two cases supported the hypothesis in that the less marked onset reached the criterion level before the corresponding more marked onset. The other 18 tests were consistent with the hypothesis in that either both onsets reached the criterion level, or neither did. Most importantly, no tests failed to support the hypothesis. Only four participants remained at Time III, permitting 8 tests; all results were consistent with the hypothesis.

In a longitudinal case study, Abrahamsson (1999) tracked the production of /.sC(C)/ onsets in Swedish by a native Spanish speaker. Abrahamsson's participant was a beginning learner of Swedish who was taped nine times over a ten month period. During that time he modified .77 of the three-member onsets that he produced and .59 of the two-member onsets, a statistically significant difference ($p < 01$).

All of the studies reviewed in this section have produced uniform results: Longer onsets and codas are modified significantly more frequently than shorter onsets and codas. Consequently, L2 learners acquire shorter onsets and codas before the longer ones.

II.3. Sonority Sequencing

II.3.a. The Sonority of Codas

As discussed previously, a universal tendency exists for one-member codas to be comprised of sonorant consonants. Some research exists demonstrating that L2 learners will delete less sonorant one-member codas more frequently than they will more sonorant one-member codas.

Tropf (1987) examined the deletion of one-member codas and found that the lesser the sonority of the segment comprising the coda, the higher the frequency of deletion Thus, plosives were more frequently deleted than fricatives, fricatives more frequently than nasals, and nasals more frequently than liquids. This finding supports the universal tendency that more sonorant codas are preferred over less sonorant codas.

II.3.b. Preferred Complex Margins

A number of studies have found complex margins that are more preferred universally are modified less frequently than those that are less preferred. As discussed in the section on sonority sequencing, onsets consisting of an obstruent + liquid are less marked than those consisting of an obstruent + nasal because the presence of an obstruent + nasal onset implies the presence of an obstruent + liquid onset. To test the possible influence of this implicational universal in L2 acquisition, Carlisle (1988) examined the frequency of epenthesis before the onsets /sl/, /sm/, and /sn/, the hypothesis being that epenthesis would occur less frequently before the obstruent + liquid onset than the obstruent + nasal onsets because the former is less marked than the latter.

For this study, 14 native Spanish speakers read a list of 435 topically unrelated and randomly ordered sentences, 145 sentences each for /sl/, /sm/, and /sn/. Environment was strictly controlled because, as discussed previously, studies had revealed that epenthesis occurred significantly more frequently after consonants than after vowels before word-initial /sC/ onsets in Spanish/English interlanguage phonology (Carlisle, 1991a).

The mean proportions of epenthesis before the three onsets were .29 for /sl/, .38 for /sm/, and .33 for /sn/; an ANOVA produced a significant difference among the three means. Pairwise comparisons revealed that the mean frequency of epenthesis before /sl/ was significantly less than those before /sm/ and /sn/ as hypothesized. In addition, /sm-/ was also more frequently modified than was /sn-/, although the two onsets are not in any known markedness relationship. However, the segments in the latter onset are homorganic and may be easier to articulate, as indicated by Greenberg (1965) who found that for codas a sequence of a nasal and a homorganic obstruent is less marked than a nasal followed by a heterorganic obstruent; and although no similar universal relationship has been expressed for onsets, the same relationship may hold in a richer theory of markedness. Another possible explanation may be found in Clements's Sequential Markedness Principle (1990, 313) stated below:

(6) For any two segments A and B and any given context X Y, if A is simpler than B, then XAY is simpler than XBY.

Given that anterior coronals are less marked than are labials, then the sequence /sn/ is less marked than /sm/ and should therefore be modified less frequently.

Results from a recent case study of a native Spanish speaker learning Swedish seem to contradict the findings in Carlisle's reseearch just discussed. Abrahamsson (1999) found that his participant actually modified /sl-/ onsets more frequently than he did /sn-/ onsets though the result was not statistically significant. However, as Abrahamsson notes, the corpus of data contained only 44 cases of /sl-/ and 67 cases of /s/ followed by a nasal. In addition, although Abrahamsson took environment into account and found that prothesis occurred significantly more frequently after word-final consonants than after word-final vowels as had been found in previous research (Carlisle, 1991a, 1992, 1997), he did not perform a sub-analysis of the environments before just the two onsets in question. Consequently, if a greater percentage of word-final consonants appeared before /sl-/ and before /sN-/, where N equals nasal, then a greater frequency of epenthesis would be expected before /sl-/ than before /sN-/, a result attributable to environment rather than to the markedness relationship between the target onsets.

II.3.c. Sonority Plateaus and Reversals

Several studies have provided evidence that margins abiding by the Sonority Sequencing Principle are modified less frequently than those that do not, plateaus and reversals. The first study with onsets was conducted by Tropf (1987) who examined German onsets produced by 11 native Spanish speaking adults. The data came from about one hour of taped conversations with each of the participants. Though the results are difficult to interpret because Tropf did not take environment into account, perform statistical analyses, or separate the findings for two-member and three-member onsets, his results suggest that onsets abiding by the Sonority Sequencing Principle are modified less frequently than those that do not.

In a later study that attempted to avoid the problems evident in the Tropf study, Carlisle (1991b) examined the production of /sl-/ and /st-/ onsets by 11 native Spanish-speaking adults; the two onsets differ in that /sl-/ conforms to expected sonority sequencing, and /st-/ is a sonority reversal. Since the latter is more marked than the former, it should be modified more frequently. Each participant read a reading instrument consisting of 290 sentences, each sentence containing one occurrence of a word-initial /sl/ or /st/; environment was strictly controlled before the target onsets. The frequency of epenthesis was .36 before /st/ and .25 before /sl/, a significant difference at $p<.0004$. Thus, the frequency of modification of the onset that violated the Sonority Sequencing Principle was significantly greater than the frequency of modification of the onset that did not violate it.

Findings reported by Major (1996) seem to contradict those just discussed. Major found that native speakers of Portuguese learning English modified /sl/ onsets more frequently than /st/, /sp/, and /sk/ onsets. However, he also presents an argument that the seemingly aberrant findings may be attributed to positive transfer. Another possible exception comes form the work of Abrahamsson (1999) previously discussed. Ambrahamsson found that the participant in his case study modified .75 of 44 /.sl-/ onsets and .59 of 291 /.s + STOP-/ onsets. Again, however, these may be attributable to the small number of /.sl-/ onsets in the study and a to a possible confounding effect of environment.

A few studies have provided evidence that codas abiding by the Sonority Sequencing Principle are preferred over sonority plateaus and reversals. Tropf (1987) examined three codas that ended in a fricative —lateral + fricative, nasal + fricative, and plosive + fricative. The first two abide by the Sonority Sequencing Principle, and the last is a sonority reversal. Though Tropf did not perform a statistical analysis, the summary data in his tables clearly indicate that the 11 Spanish-speaking participants modified the plosive + fricative coda much more frequently than the two codas that abide by the Sonority Sequencing Principle. In addition, the participants modified the nasal + fricative coda more frequently than the liquid + fricative coda, which is in accordance with the universal tendency for those complex codas to be preferred that have a sharper rise in sonority from the most peripheral member. Tropf also examined four two-member codas having a plosive as the most peripheral member. Three of the onsets abided by the Sonority Sequencing Principle, and one was a sonority plateau. Again, the codas that abided by the Sonority Sequencing Principle were modified much less frequently than the one that did not.

Eckman (1987) examined the production of two-member and three-member codas by six participants, two speakers each of Korean, Japanese, and Cantonese and found that both two-member and three-member codas were reduced as expected. Although Eckman did not provide the frequencies with which two-member codas were reduced in relation to three-member codas, his study provides a revealing insight about the preference for codas that abide by the Sonority Sequencing Constraint. Eckman found that when his participants reduced three-member codas they tended to delete a segment that would result in one of the subsequences that abide by the Sonority Sequencing Principle. For example, a word such as *clasped* has a coda of the form [spt], which could be reduced to [sp], [pt], or [st]. In actual production, however, the participants normally produced the first and third variant; the second variant, a sonority plateau, rarely occurred. Though exceptions to the above generalization did appear, they may have been influenced more by morphology than phonology. In the rare cases in which a three-member coda, such as [pts] in *opts*, was reduced to the more marked subsequence consisting of a stop-stop, rather than to the less marked subsequence, the deleted fricative was always an allomorph of an inflectional morpheme, one that marked plurality or the third person singular of the present tense. In fact, if a three-member cluster consisted of two stops and a fricative, the fricative was deleted only if it were an allomorph of an inflectional morpheme; the fricative in such codas as [kst] as in *waxed* was never deleted. A number of studies have demonstrated that inflectional morphemes are frequently dropped by non-native English speakers (Moore & Marzano, 1979;

Politzer & Ramirez, 1973). This behavior is apparently so strong that it will be done even if the result is a more marked structure on the phonological level.

In a second study, Eckman (1991) measured the acquisition of two stop-stop codas (/-pt/ and /-kt/) and four fricative-stop codas (-ft/, /-sp/, /-st/ and /-sk/) against a criterion measure of 80% correct production, hypothesizing that the less marked codas would reach the criterion level before the more marked coda. By using four different tasks to gather data from 11 native speakers of Japanese, Korean, and Cantonese, Eckman found only two falsifications out of 44 tests of the hypothesis. In other words, in two cases at least one of the more marked codas reached the criterion level before any of the less marked codas did. The other 95% of the tests either supported the hypothesis or were consistent with it, providing evidence that less marked structures are more easily acquired than are more marked structures.

CONCLUSION

This study reviewed research in L2 acquisition demonstrating that syllable universals have a strong influence on the frequency with which L2 learners modify syllables and on the order that they will acquire certain syllable types. Though research methodologies and analyses have differed from study to study, the results support the following claims:

i) Learners will produce CV syllables independent of language transfer.

ii) Learners will modify longer margins more frequently than shorter margins with the result that the shorter margins are acquired before the longer margins.

iii) Learners will delete one-member codas at a frequency inversely related to their sonority —the greater the sonority the lower the frequency of deletion.

iv) Learners will modify complex margins adhering to the Sonority Sequencing Principle less frequently than those that do not.

v) Among complex margins that abide by the Sonority Sequencing Principle, some are more preferred than others; learners will modify the less preferred margins more frequently than the more preferred margins.

The research reviewed in this article found very few exceptions to the expected outcomes, and those may be attributable to a small amount of data, transfer from the L1, or to the influences of morphological processes or markedness principles unrelated to syllable structure universals.

NOTES

[1] Nearly all implicational statements for complex margins are written for those consisting of two-members; implicational statements for longer margins are really non-existent.

[2] Whereas nearly all theoretical discussions of the syllable support this claim for complex onsets, the claim is more disputable for complex codas. For example, Clements (1990, p. 304-305) states that nasal-obstruent codas are preferred over liquid-obstruent codas, which goes against the current claim, but he also states that glide-obstruent codas are preferred over liquid-obstruent codas, which supports the current claim.

[3] These studies generated a great deal of discussion on the preferred strategies L2 learners use to produce CV syllables, epenthesis or deletion. It became apparent that factors such as L1 background and age were highly relevant. (For a review see Carlisle, 1994).

[4] Several other studies that did not specifically study the preference for the CV syllable type may, nevertheless, offer insights into the modification of word-final syllables. Eckman investigated the strategies that native Japanese speakers (1981b, 1984) and native Mandarin speakers (1981a) used to modify word-final voiced obstruents. He found that the participants either produced the word-final obstruent without modification or else used schwa paragoge. The use of schwa paragoge may be attributable to the preference for the CV syllable. However, Eckman (1981a) noted that schwa paragoge also preserves more of the underlying structure and may be preferable for communicative reasons, rather than for phonological ones.

[5] No comparison was made between two-member and three-member onsets because not enough data was available.

REFERENCES

Abrahamsson, N. (1999). Vowel epenthesis of /sC(C)/ onsets in Spanish/Swedish interphonology: A longitudinal study. *Language Learning*, 49, 473-508.

Andersen, R. (1978). An implicational model for second language research. *Language Learning*, 28, 221-281.

Anderson, J. (1987). The markedness differential hypothesis and syllable structure difficulty. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 279-291). Cambridge, MA: Newbury House.

Battistella, E. (1990). *Markedness: The evaluative superstructure of language*. Albany: The State University of New York Press.

Benson, B. (1988). Universal preference for the open syllable as an independent process in interlanguage phonology. *Language Learning*, 38, 221-242.

Blevins, J. (1995). The syllable in phonological theory. In J. Goldsmith (Ed.), *The Handbook of Phonological Theory* (pp. 206-244). Cambridge, MS: Blackwell.

Broselow, E. (1983). Non-obvious transfer: On predicting epenthesis errors. In S. Gass & L. Selinker (Eds.), *Language transfer in language learning* (pp. 269-280). Rowley, MA; Newbury House.

Broselow, E. (1984). An investigation of transfer in second language phonology. *International Review of Applied Linguistics*, 22, 253-269.

Cairns, C., & Feinstein, M. (1982). Markedness and the theory of syllable structure. *Linguistic Inquiry*, 13, 193-225.

Cancino, H., Rosansky, E., & Schumann, J. (1975). The acquisition of the English auxiliary by native Spanish speakers. *TESOL Quarterly*, 4, 421-430.

Carlisle, R. (1988). The effect of markedness on epenthesis in Spanish/English interlanguage phonology. *Issues and Developments in English and Applied Linguistics*, 3, 15-23.

Carlisle, R. (1991a). The influence of environment on vowel epenthesis in Spanish/English interphonology. *Applied Linguistics*, 12, 76-95.

Carlisle, R. (1991b). The influence of syllable structure universals on the variability of interlanguage phonology. In A. D. Volpe (Ed.), *The seventeenth LACUS forum 1990* (pp. 135-145). Lake Bluff, IL: Linguistic Association of Canada and the United States.

Carlisle, R. (1992). Environment and markedness as interacting constraints on vowel epenthesis. In J. Leather, & A. James (Eds.), *New sounds 92* (pp. 64-75). Amsterdam: University of Amsterdam Press.

Carlisle, R. (1994). Markedness and environment as internal constraints on the variability of interlanguage phonology. In M. Yavas (Ed.), *First and Second Language Phonology* (pp. 223-249). San Diego: Singular Publishing Company.

Carlisle, R. (1997). The modification of onsets in a markedness relationship: Testing the interlanguage structural conformity hypothesis. *Language Learning*, 47, 327-361.

Carlisle, R. (1998). The acquisition of onsets in a markedness relationship: A longitudinal study. *Studies in Second Language Acquisition*, 20, 245-260.

Carlisle, R. (in press). The acquisition of two and three member onsets: Time III of a longitudinal study.

In J. Leather, & A. James (Eds.), *New Sounds 2000.* Amsterdam: University of Amsterdam Press.

Clements, G. (1990). The role of the sonority cycle in core syllabification. In J. Kingston & M. Beckman (Eds.), *Papers in laboratory phonology I: Between the grammar and physics of speech* (pp. 283-333). Cambridge: Cambridge University Press.

Clements, G., & Keyser, S. (1983). *CV phonology: A generative theory of the syllable.* Cambridge MA: The MIT Press.

Eckman, F. (1981a). On the naturalness of interlanguage phonological rules. *Language Learning*, 31, 195-216.

Eckman, F. (1981b). On predicting phonological difficulty in second language acquisition. *Studies in Second Language Acquisition*, 4, 18-30.

Eckman, F. (1987). The reduction of word-final consonant clusters in interlanguage. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 143-162). Providence, RI: Foris Publications.

Eckman, F. (1991). The structural conformity hypothesis and the acquisition of consonant clusters in the interlanguage of ESL learners. *Studies in Second Language Acquisition*, 13, 23-41.

Eckman, F., & Iverson, G. (1993). Sonority and markedness among onset clusters in the interlanguage of ESL learners. *Second Language Research*, 9, 234-252.

Greenberg, J. (1965). Some generalizations concerning initial and final consonant clusters. *Linguistics*, 18, 5-34.

Hancin-Bhatt, B. (2000). Optimality in a second language phonology: codas in Thai ESL. *Second Language Research*, 16, 201-232.

Harris, J. (1983). *Syllable structure and stress in Spanish: A non-linear analysis.* Cambridge, MA: The MIT Press.

Hock, H. H. (1986). *Principles of historical linguistics.* Berlin: Mouton de Gruyter.

Hodne, B. (1985). Yet another look at interlanguage phonology: The modification of English syllable structure by native speakers of Polish. *Language Learning*, 35, 404-422.

Hulst, H.van der, & Ritter, N. A. (1999). Theories of the syllable. In H. van der Hulst & N. A Ritter (Eds.), *The syllable: Views and facts* (pp. 13-52). Berlin: Mouton de Gruyter.

Hyltenstam, K, & Lindberg, I. (1983). Invandrares svenska. En kritisk genomgång av materialet i projektet Svenska för invandrare (Josefson, 1979) särskilt med avseende på det insamlade materialets användningsmöjligheter [Immigrants' Swedish. A critical examination of the material in the project Swedish for Immigrants (Josefson, 1979), with special reference to the usefulness of the collected material]. *SSM Report 9, Studium av ett invandrarsvenskt språkmaterial [A study of immigrant Swedish language material]* (pp.5-51). Stockholm University, Department of Linguistics.

Ioup, G. (1984). Is there a structural foreign accent? A comparison of syntactic and phonological errors in second language acquisition. *Language Learning*, 34, 1-17.

Kaye, J., & Lowenstamm, J. (1981). Syllable structure and markedness theory. In *Theory of markedness in generative grammar* (pp. 287-315). Pisa, Italy: Scuola Normale Superiore.

Major, R. (1996). Markedness in second language acquisition of consonant clusters. In Dennis R. Preston and Robert Bayley (Eds.), *Variation and second language acquisition* (pp. 75-96). Amsterdam: Benjamins.

Moore, F. B., & Marzano, R. J. (1979). Common errors of Spanish speakers learning English. *Research in the Teaching of English*, 13, 161-167 .

Politzer, R. L., & Ramirez, A. G. (1973). An error analysis of the spoken English of Mexican American pupils in a bilingual school and a monolingual school. *Language Learning*, 23, 39-62.

Riney, T. (1990). Age and open syllable preference in interlanguage phonology. In H. Burmeister & P. Rounds (Eds.), *Variability in second language acquisition: Proceedings of the tenth meeting of the second language research forum: Vol. II* (pp. 655-666). Eugene, OR: Dept. of Linguistics, University of Oregon.

Sato, C. (1984). Phonological processes in second language acquisition: Another look at interlanguage syllable structure. *Language Learning*, 34, 43-57.

Schmid, S. (1997). Phonological processes in Spanish-Italian interlanguages. In J. Leather & Allan James (Eds.), *New Sounds 97* (pp. 286-293). Klagenfurt, Austria: University of Klagenfurt.

Tarone, E. (1980). Some influences on the syllable structure of interlanguage phonology. *International Review of Applied Linguistics*, 18, 139-152.

Tropf, H. (1987). Sonority as a variability factor in second language phonology. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 173-191). Providence, RI: Foris Publications.

Vennemann, T. (1988). *Preference laws for syllable structure and the explanation of sound change*. New

York: Mouton dc Gruyter.

Weinberger, S. (1987). The influence of linguistic context on syllable simplification. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 401-417). Rowley, MA: Newbury House.

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Allophonic Splits in L2 Phonology: The Question of Learnability

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ABSTRACT

The research reported in this paper is intended as a contribution to the understanding of several well-known problems relating to the learning of phonemic contrasts in second language (L2) phonology. The paper describes a series of ongoing studies examining what Lado (1957) hypothesized to represent maximum difficulty in second language pronunciation, namely, a phonemic split. This is the process involved when an L2 learner must split native language (NL) allophones into separate target language (TL) phonemes. Two core principles of phonological theory are described and evaluated for their relevance in explaining the series of well-defined, implicationally-related stages involved in a phonemic split. Finally, the paper reports the results of an empirical study designed to test the explanatory adequacy of these principles, and concludes with a discussion of the implications of these studies for second language phonology in general.

KEYWORDS: Second-language phonology; interlanguage phonology; pronunciation difficulty; phonemic split; stages of second-language acquisition; learnability; structure preservation; derived environment constraint.

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INTRODUCTION

Over the last few years there has been a resurgence within second language acquisition (SLA) theory and instruction in the amount of attention that has been devoted to the teaching of pronunciation, though by common concession this aspect of language learning is still poorly understood, and often poorly taught (Celce-Murcia et al. 1996; Morley 1987, 1991, 1994). The research reported in this paper is intended as a contribution to the understanding of several well-known problems relating to the learning of phonemic contrasts in second language (L2) pronunciation. In particular this paper focuses on some of the effects that the competing influences of similarity and difference between native and target language sound systems have on the learning of (L2) phonology (Wode 1983a, Flege 1980, 1987; Major & Kim 1999). The purpose of the present paper is to report on a series of ongoing studies examining the role of phonological theory in the explanation of L2 pronunciation; in particular, the paper seeks to evaluate two core principles in phonological theory for their relevance in explaining what Lado (1957) hypothesized to represent maximum difficulty in second language pronunciation, namely, the splitting of native language (NL) allophones into separate target language phonemes.

The paper is structured as follows. Reprising discussion in Eckman and Iverson (1997, 1999), we first describe two linguistic constructs that we believe are crucial in learning the pronunciation of a target language, and review the issues that are involved in splitting native language allophones into separate target language phonemes. We then outline the phonological principles which are relevant to our investigation and follow this by reporting the results from a study designed to test these principles. We frame the discussion in terms of conventional "rules" rather than optimality theoretic "constraints", primarily for clarity of exposition, but we believe that the general principles at play (which emerged from work in the theory of lexical phonology) will hold for any version of phonology in which issues such as these are addressed.

I. PRONUNCIATION DIFFICULTY

We start with the assumption that, in order to acquire a target language (TL), the L2 learner must acquire a lexicon (a set of words and their affixes) along with a set of rules (or equivalent constraints) for combining the lexical items into larger utterances, and then pronouncing them. Potential impediments to this learning arise from two areas: 1) from certain inherent difficulty in learning the various TL lexical items and rules, and 2) from areas of the NL that may interfere with this acquisition.

Given this, and focusing on the area of pronunciation, we can identify at least two aspects of the NL and TL where differences may cause difficulty: differences in inventory, in which the TL contains sound segments that do not exist in the NL, and positional differences, such that the

TL may have a contrast between two sounds that are allophones of the same phoneme in the NL. Phoneme inventory differences have long been recognized as a source of learning difficulty, at least as far back as Lado (1957), and as recently as Flege (1987) and Major & Kim (1999), but a special status has been accorded to positional differences in which the allophones of an NL phoneme represent separate phonemes in the TL (Lado 1957, Hammerly 1982). The task of the learner in such cases is to split the NL allophones into separate TL phonemes.

Two examples of an allophonic split, both relevant to the arguments in this paper, are: (1) a native speaker of Spanish learning the English distinction between /d/ and /ð/, and (2) a native speaker of Korean acquiring the English contrast between /s/ and /š/. In Spanish, [d] and [ð] are allophones of the phoneme /d/, because [ð] occurs after continuant segments and [d] occurs elsewhere; in Korean, [s] and [š] are allophones of syllable-initial /s/, because [š] occurs only before the vowel [i], [s] elsewhere. In English, of course, all of these sounds are separate phonemes, and thus a Spanish speaker learning English must learn to factor the allophones [d] and [ð] into separate phonemes, and a Korean-speaking ESL learner must acquire the contrast between /s/ and /š/. In what follows, we will argue that the splitting of NL allophones into TL phonemes potentially involves two stages which are explained by established phonological principles.

II. THE PHONOLOGICAL CONTEXT

In this section, we summarize the motivation for two general principles which have emerged out of the theory of lexical phonology (Kiparsky 1973), Structure Preservation and the Lexical Derived Environment Constraint.

(1) STRUCTURE PRESERVATION
Representations within the lexicon may be composed only of elements drawn from the phonemic inventory.

(2) LEXICAL DERIVED ENVIRONMENT CONSTRAINT
Lexical rules apply only in derived environments; postlexical rules apply across-the-board.

These principles presuppose that phonological rules are divided into two groups: those that apply within the lexicon of the language as words are being formed, i.e., the lexical rules, and those that come into play after words have been entered into sentences, the postlexical rules. Lexical rules exhibit two special properties that are of concern to us: (1) they apply only to "derived" forms (i.e., to words whose relevant portions have been modified by previous rule, or which are built up out of separate meaningful elements); (2) they are constrained to produce only segments which are found in the phonemic inventory, or, more generally, to produce just those kinds of structures which exist in the lexicon. Postlexical rules, on the other hand, do not require the form to which they apply to be derived, or composite, and are not constrained to be structure preserving, hence they may produce segments which are not part of the phonemic inventory.

A frequently cited example of a typical lexical rule in English is Trisyllabic Laxing, so named because it has the effect of making a stressed or accented vowel short if it is in the third syllable from the end of the word. This rule accounts for alternations in vowels such as those in the word pairs listed in (3).

(3)	sane	[sén]	sanity	[sǽnəɾi]
	divine	[dəváɪn]	divinity	[dəvínəɾi]
	serene	[sərín]	serenity	[sərɛ́nəɾi]

The stressed vowel in each of the unsuffixed words in (3) is tense, but that same vowel is pronounced as lax when the word it is in consists of a stem followed by the two-vowel suffix -*ity*. The words in (4a, b), on the other hand, illustrate that this rule applies only in so-called derived environments (i.e., when an affix has been appended, not when the word itself consists of just the stem), and the word in (4c) exemplifies that only particular suffixes (e.g., -*ity* but not -*able*) will trigger Trisyllabic Laxing.

(4)	a.	stevedore	[stívədɔr]	*[stívɛ́dɔr]
	b.	nightengale	[náɪtəngel]	*[nítɛngel]
	c.	notable	[nóɾəbəl]	*[nɔ́ɾəbəl]

An example of a postlexical rule in (American) English is Flapping, which accounts for the pronunciation alternations in (5).

(5)	a. bet	[bet]	betting	[bɛɾɪŋ]
	b. ride	[raɪd]	riding	[raɪɾɪŋ]

Flapping must be a postlexical rule because it is not structure preserving in that it produces the sound [4], which is not part of the phonemic inventory of English. Unlike lexical rules such as Trisyllabic Shortening, moreover, Flapping may apply between words (e.g., to the first [t] in *Hit it!*) as well as within single lexical entries (e.g., the noun *matter* may be pronounced the same as the comparative adjective *madder*, both with medial flaps). The distinction is thus one between lexical rules that apply strictly within words as they are being created, preserving structure in the sense of (1), and postlexical rules that may apply within as well as between words after they have been created, without regard for any limitations on the inventory of speech sounds.

The other core principle, the Lexical Derived Environment Constraint as stated in (2), overlaps substantially with Structure Preservation inasmuch as lexical rules are structure preserving, and by (2) are restricted to apply only to configurations that are derived through processes of affixation or word formation, or the application of another rule, i.e., they may not affect basic lexical entries. If such rules were to apply to unmodified lexical items without affixes, there would be no trace left in terms of crucial alternations which support the recovery of underlying representations. As Kiparsky illustrated with respect to Finnish, for example, the structure-preserving rule in that language converting /t/ to [s] before /i/ crucially applies only in derived contexts, as in (6a), where processes of word formation have brought the (stem) /t/ and the (suffix) /i/ into juxtaposition.

(6)	Finnish assibilation				
	(a)	/halut+i/	→	[halusi]	'want-ed'
	(b)	/koti/	→	[koti]	'home'
	(c)	*[kosi]			
	(d)	/halut+a/	→	[haluta]	'to want'

If the /t/ plus /i/ sequence is already on hand in the basic lexical listing, on the other hand, the rule does not apply, as shown in (6b). Of course, if the rule were to apply here, producing (6c), there would be no basis for "recovery" of the underlying /t/: Finnish speakers would never be able to figure out that the word for 'house' is [koti] if it were always pronounced as *[kosi]. The /t/ in /halut/ 'want', conversely, does undergo the change to [s] when a (suffix) /i/ follows, because this /t/ remains in other instances of the form that do not undergo the rule, as exemplified in (6d). Similarly, if the lexical Trisyllabic Laxing rule in English were to apply in nonderived contexts, i.e., within single-meaning structures like *nightengale*, there would be no basis for recovery of the fact that the first vowel in this word is /ay/, not /ɪ/, since the form would always be pronounced with the incorrect lax vowel.

Thus, Structure Preservation requires that lexical rules produce segments which are phonemes of the language, and the Lexical Derived Environment Constraint holds that (structure preserving) lexical rules may apply only to configurations that are crucially derived, as through a process of affixation. The relationship between these two notions has been argued to be even tighter than this, however. Based on the analysis of primary language data relating to rules with lexical as well as postlexical functions, Iverson (1993) makes the more general case that not only are lexical rules constrained to apply just in derived environments, as in conventional lexical phonology, but so are the applications of all structure preserving rules, whether functioning lexically or postlexically. The effect of this narrower limitation, which we adopt here as the operative version of the Derived Environment Constraint (cf. also Kiparsky 1973), is that neutralizing rule applications in any part of the grammar may not affect basic lexical items:

(7) DERIVED ENVIRONMENT CONSTRAINT
Structure preserving rule applications are restricted to derived environments.

Both Structure Preservation and the Derived Environment Constraint have implications for learnability. The Derived Environment Constraint is fundamentally a condition on the recoverability, or learnability, of words and their parts. Applying neutralizing rules to nonderived forms would make the lexical form of the word essentially unlearnable, because there would be no alternations from which the learner could acquire the phonemic representation. Likewise, Structure Preservation, which associates chiefly with lexical rules and is not applicable in the postlexical component, correlates generally with the distinction between phonemic and allophonic distribution. Since postlexical rules are typically (though not exclusively) allophonic, and since lexical rules almost always result in the loss of contrast between sounds in specific environments, the long-standing distinction between distributional statements defined on phonemes and those defined on allophones is accommodated rather directly, reflecting the presumed primary cognitive status of the traditional phoneme. That is, a language's inventory of phonemes is part of what must be actually learned in learning the language, along with other essentially arbitrary information encoded in the lexicon, including the particular meanings of lexical entries and their individual syntactic properties. Postlexical material, by contrast, is cognitively less prominent, presumably precisely because it lies outside the arena where meaningful contributions to word formation take place. i.e., the lexicon.

These two principles have interesting implications for the development of L2 learners' sound patterns.

III. SECOND LANGUAGE ACQUISITION

Hypothesizing that Structure Preservation and the Derived Environment Constraint also govern interlanguage grammars, we predict the existence of progressive stages of learning associated with the influence of an NL allophonic rule on the acquisition of the TL pronunciation. To illustrate, we reconsider the two examples of an allophonic split mentioned above (and discussed in Eckman & Iverson 1997, 1999), namely, that in Spanish [d] and [ð] are allophones of the phoneme /d/, and in Korean, [s] and [š] are allophones of /s/.

In a language-contact situation in which the NL grammar incorporates a postlexical (allophonic) rule relating segments already contained in the phonemic inventory of the TL, the transfer of the NL rule to the IL would not result in any change in the rule's applicational status for a learner who has not yet acquired the TL contrast. That is, the rule still is not structure preserving, and so will continue to apply postlexically in the IL, with the learner consequently erring across-the-board on TL words containing the contrast in question. In the Spanish example, the prediction is that the learner, at stage 1, would err consistently on English words with intervocalic /d/, producing forms such as [læðər] 'ladder' and [rɛðər] 'redder' rather than [lædər] and [rɛdər].[1] A first-stage Korean learner of English would be predicted to err consistently on TL words containing a /si/ sequence, pronouncing *receive* as [rišiv] and the words *messy* and *meshy* both as [mɛši].

Once the learner begins to acquire the TL contrast, however, the status of the NL (postlexical) rule becomes structure preserving in the IL grammar, and thus subject to the Derived Environment Constraint. This means that the rule now may no longer apply in all contexts, but rather is restricted to derived environments, i. e., across a morpheme boundary. In our Spanish-English example, the learner would continue to make errors contrasting /d/ and /ð/, but would make them only in derived contexts, now pronouncing *ladder* with [d] ([lædər], non-derived context), but still producing *redder* with [ð] ([rɛðər], derived context). At some later point, if the learner continues to progress, we might expect this rule to be eliminated from the IL altogether.

This scenario reduces to the claim that an NL postlexical rule which produces as output a TL phoneme will, if incorporated into the IL grammar, observe the principles of Structure Preservation and the Derived Environment Constraint. We state this claim explicitly as the hypothesis in (8).

(8) Interlanguage phonological rules conform to the principles of phonological theory.

According to (8), the predicted stages of acquisition, using a Korean learner as an example, are these:

(9) The three predicted possible stages for a learner:

Stage I, NO CONTRAST: not to make the relevant target language contrast, applying the native language rule in both derived and nonderived contexts (e.g., a Korean ESL learner says the pairs *sea–she* and *messing– meshing* homophonously, as [ši] and [mɛšɪŋ]);

Stage II, PARTIAL CONTRAST: to make the relevant contrast in some words, applying the native rule only in derived contexts (a Korean ESL learner says *sea–she* correctly but errs by producing *messing– meshing* homophonously);
Stage III, CONTRAST: to make the relevant contrast in all words, applying the native rule in neither derived nor nonderived contexts (a Korean ESL learner says the pairs *sea–she* and *messing– meshing* correctly);

Excluded: to make the relevant contrast in some words, applying the native rule only in nonderived contexts (a Korean ESL learner says the pairs *sea–she* homophonously, but says *messing– meshing* correctly).

In our view, then, universal principles of grammar place learnability constraints on the kinds of IL grammars that can be acquired. If we are correct about this, it would be possible for a Spanish learner of English to first acquire the contrast between [d] and [ð] in only non-derived environments (words consisting of only a single morpheme), but it would never be possible for a learner to acquire this contrast only in derived environments. In other words, our hypothesis reduces ultimately to a learnablility claim: IL grammars in which [d] and [ð] are contrasted only in derived environments will never be learned.

To test these predictions empirically, we conducted both a cross-sectional and instructional study.

IV. THE STUDIES

The purpose of the cross-sectional study was to test for the existence of the three predicted stages outlined in (9), and the absence of the excluded stage. Accordingly, for the hypothesis to be supported by the data from the cross-sectional study, we should attest only three kinds of learners: those who make the relevant contrast (between [d] and [ð] for Spanish speakers, and between [s] and [š] for Korean speakers) in both derived and nonderived contexts; those who make the relevant contrast in nonderived environments, but who may not make the contrast in derived environments; and finally, those who have not yet acquired the relevant contrast in either context. We should not find, according to the hypothesis, a learner who has the contrast in derived environments but lacks it in basic words.

The purpose of the instructional study was to test the two pedagogical implications of the hypothesis. It is predicted that a learner who is taught to make a phonemic split between NL allophones only in a derived environment will generalize this learning to the nonderived environment, but a learner who is trained to make the contrast in a nonderived context will not necessarily extend it to derived environments. To support these claims, it must be the case that a learner who initially lacks the contrast in both derived and basic environments and who is trained to make the contrast in only derived environments either will learn the contrast also in nonderived words, or will learn it in both derived and nonderived words. Such a learner, however, will not learn the relevant contrast only in derived words. But a learner who is trained on the contrast in only nonderived contexts may acquire that contrast without generalizing it to derived contexts.

IV.1. The cross-sectional study

IV.1.a. Subjects

We elicited pronunciations of English words from sixteen ESL learners, nine native speakers of Spanish, and seven native speakers of Korean. Learners with these two NL backgrounds were chosen because, as outlined above, their NL includes an allophonic distribution of segments which are contrastive in English. All of the subjects were in the process of learning English as a second language. These learners ranged in age from 17 to 31, each had been in the United States for less than six months, and each was from one of the two lower modules in the University of Wisconsin–Milwaukee ESL Intensive Program. All of the subjects were paid for their participation.

IV.1.b. Methodology

The first step was to establish a baseline on each of the subjects to determine whether their IL exhibited the relevant contrast: /d/ vs. /ð/ for Spanish-speaking subjects, /s/ vs. /š/ for Korean speakers. In order to accomplish this, the subjects met individually with one of the authors and/or one of the research assistants appointed to the project. The subjects' pronunciations of words containing the sounds in question were elicited using pictures accompanied by definitions. Pictures were used to avoid the subjects basing their pronunciation on the spelling of the words. The subjects were given directions and examples for an exercise in which they were presented with a loose-leaf notebook containing drawings depicting a word on one page, and a definition of the word on the facing page. The subjects were instructed to pronounce the word that was depicted.

The exercise was designed to elicit English words exhibiting the relevant contrast in both a derived and nonderived environment. Words exhibiting the contrast in a nonderived environment were basic, monomorphemic lexical items. The words exhibiting the contrast in a derived environment contained a suffix, either the progressive "ing" or the adjectival "y" suffix. The exercise was constructed so that the pictures contained a cue indicating which of the two suffixes was to be added to the word being pictured. For example, if the subject was shown a picture of some grass on one page, and a definition of grass on the facing page, the subject was to produce the word *grass*. If the picture and definition presented to the subject also contained the cue "adjective" on the page below the picture and the definition, then the subject was to produce the adjectival form of *grass*, namely, *grassy*. Thus, the subjects produced two kinds of baseline words, those containing the sounds in question in a nonderived context, i.e., without a suffix added, and those with the sound in a derived context, i.e., with the addition of a suffix. Some examples of the pictures and definitions used in this elicitation are contained in Appendix A.

To ensure that the subjects understood the exercise, they were given written directions along with a set of practice words. All of the subjects were able to complete the practice words satisfactorily and move on to the baseline words. During the elicitation of the baseline, subjects were prompted on the words they did not recognize from the pictures and definitions. All of the subjects were able to produce all of the baseline words elicited by the pictures and definitions by the end of the first session. The lists of words used for each NL group along with the directions used for this exercise are given in Appendix B[2].

Baselines were established on all of the subjects over two to five sessions held as close together as the subjects' schedules permitted, in most cases within one or two weeks. All of the sessions were tape recorded. Two transcriptions were done for each session: one was made during the session itself, whereby the interviewer transcribed only the segments relevant to the contrast in question (i.e., the [d] and [ð] for the Spanish speakers and the [s] and [š] for the Korean subjects) on a score sheet; the other was transcribed at a later date by one of the research assistants. Two reliability checks were then done on the transcriptions. The live transcription of the segments in question was checked against the transcription of those segments based on the tape. Where the two transcriptions differed, which occurred in only 0.88% of the cases, those segments were not scored as part of the data.[3] Additionally, randomly selected, five-minute portions of the tapes were later re-transcribed by a research assistant who had not performed the original transcription. A reliability figure was computed by making a point-to-point comparison between the two transcriptions and then dividing the number of agreements (2,520) between the transcriptions by the number of agreements and disagreements (2,778). This yielded a figure of .91, which was deemed adequate[4].

IV.1.c. Scoring

We now turn to a description of how the subjects' productions were scored. Because the focus of the study was to determine whether the subjects could make a contrast between two segments which occurred in the NL, albeit as allophones, the question was not whether the subjects could produce the segments in question, but whether they could produce them in the appropriate environment[5]. Accordingly, subjects were scored on their ability to produce the relevant segments in TL positions where the segment did not occur in the NL. For example, [š] in Korean occurs only before the vowel [i], whereas [s] never occurs before [i], but does occur before all other vowels. Consequently, we were interested for scoring purposes in a subject's ability to produce [s] before [i] in TL words, and, conversely, their ability to produce [š] before vowels other than [i]. A subject's score, therefore, is the percentage of relevant segments produced in the appropriate TL contexts, where that context is different from where that segment occurs in the NL. For example, Korean subjects were given credit for exhibiting the /s/–/š/ contrast in nonderived contexts only if the subjects reached criterion (see below) producing [s] in words where [s] occurred before [i], and also reached criterion producing [š] in words where this sound occurred before some vowel other than [i]. We did not score, in other words, Korean subjects' productions of [s] before vowels other than [i], or their pronunciation of [š] before [i], because this is where these segments occur in the NL. In short, we scored only those productions of the relevant sounds that were in a non-NL position; had we scored segments in the environments where they occurred in the subject's NL, the scores would have been artificially inflated.

One other point needs to be made about scoring. Only the features that were relevant to the particular contrasts in question were scored. In some cases, this meant that the subject was given credit for a "correct" production, even though the segment the subject produced may not have been entirely target-like. For example, virtually all of our Spanish subjects devoiced final obstruents to some extent, causing them to render words such as *head* variably, at times as [hɛt] and on other occasions as [hɛd]. Because voicing was not the focus of this study, the subject was given credit in these cases for producing a /d/, despite the fact that a voiceless alveolar stop was produced. Likewise, if the subject spirantized the final stop and produced variably [hɛð] as well as [hɛθ], the subject was scored as producing a word-final /ð/, despite the fact that it was realized as its voiceless counterpart. To do otherwise would have artificially inflated the error rates on this contrast as well.

The data were then analyzed to determine whether the subjects exhibited the relevant contrasts in both the derived and nonderived contexts. The criterial threshold used to determine the presence of a contrast was successful production of the contrast in at least 80% of the attempts in two consecutive sessions[6]. This criterion was chosen because we observed that any subject whose performance exceeded 80% for two straight sessions did not subsequently fall below the 80% threshold. Thus it seemed that 80% performance represented a systematicity from which the subject did not later retreat.

Those subjects who lacked the relevant contrast in both derived and nonderived environments were entered into the instructional study. Those that evidenced the contrast in at least some positions were not eligible for the instructional study, and were therefore designated for the cross-sectional study, the results of which we now outline.

IV.1.d. Results of the cross-sectional study

As it turned out, there were no Stage I Korean subjects; therefore, the cross-sectional results include those from all seven of the Korean subjects, plus two Spanish-speaking subjects who were Stage II learners.

The protocol stipulated that only subjects who lacked the contrast in both the nonderived and derived environments were to be entered into the instructional study. Accordingly, any subject who had the contrast in question in at least one of the environments, became part of the cross-sectional study, the purpose of which was to attest only the predicted stages in (9)[7].

Figures 1 through 7 show that all of the Koreans exhibited the contrast between /s/ and /š/ in at least the nonderived context. More specifically, the facts represented in Figures 1 through 3 show that subjects K1, K2 and K3 were Stage III learners who evinced the contrast in both derived and nonderived environments. The results in Figures 4 through 7 depict Korean learners who, during the initial baseline measures, showed the contrast only in the nonderived contexts, but shortly thereafter evidenced the contrast also in the derived environment.

Figure 1. Baseline Probes for Subject K1

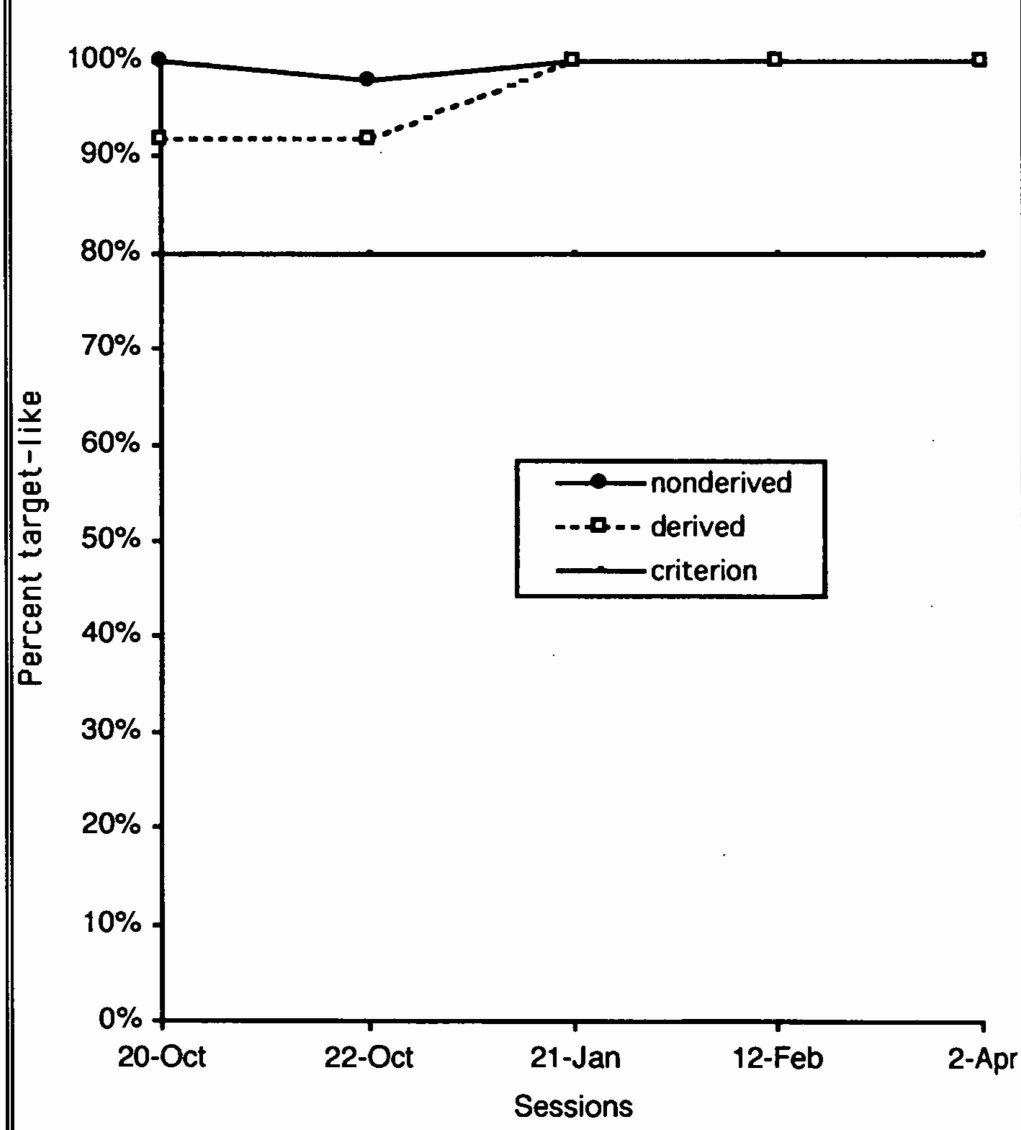


Figure 2

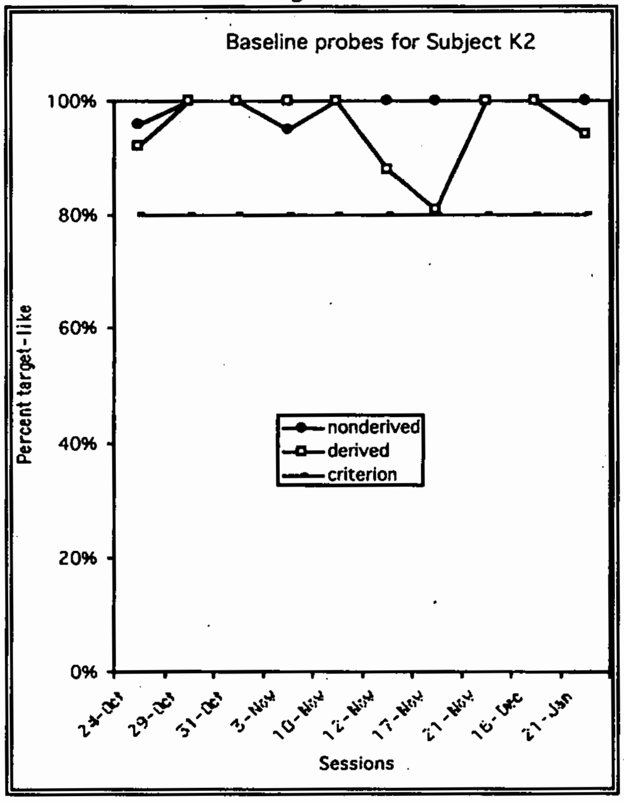


Figure 3

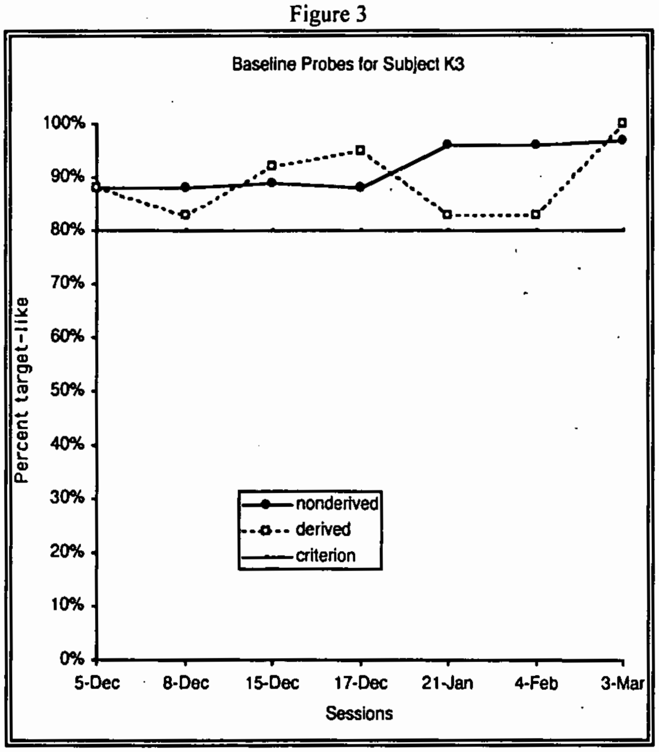


Figure 4. Baseline probes for Subject K4

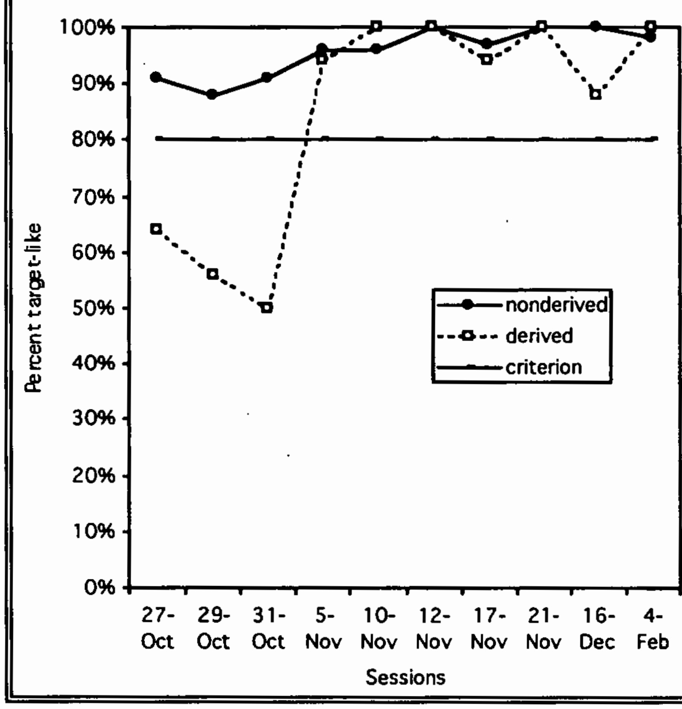


Figure 5. Baseline probes for Subject K5

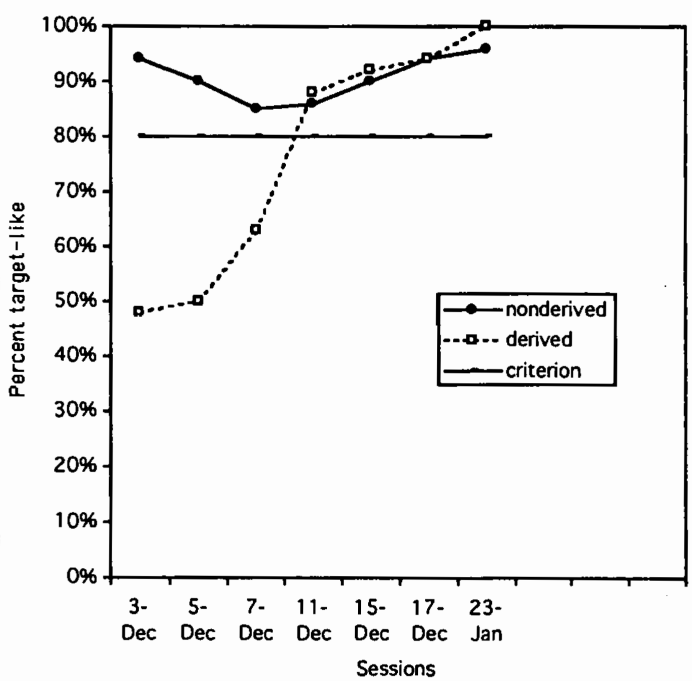
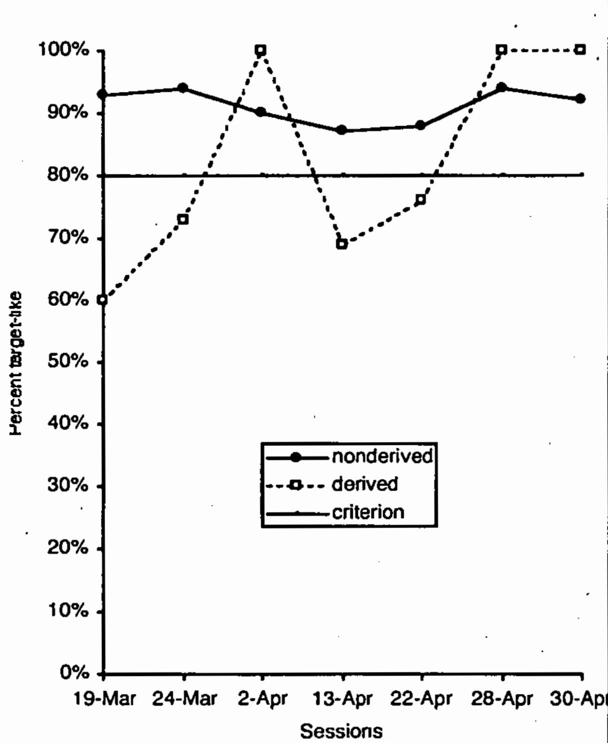
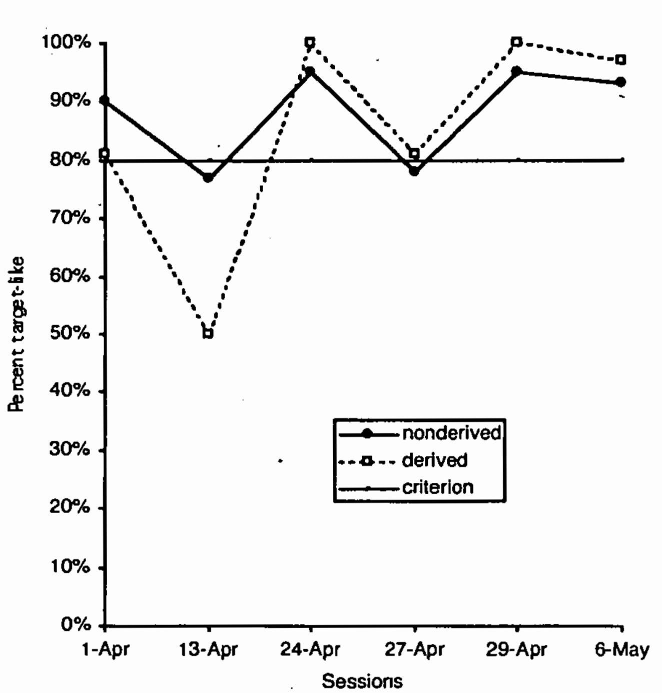


Figure 6. Baseline Probes for Subject K6



Figrure 7. Baseline Probes for Subject K7



There were two Spanish-speaking subjects who also were entered into the cross-sectional study. Figures 8 and 9 represent the baseline results for subjects S1 and S2, both Stage III learners who exhibited the /d/-/ð/ contrast in both derived and nonderived environments.

Figure 8. Baseline Probes for Subject S1

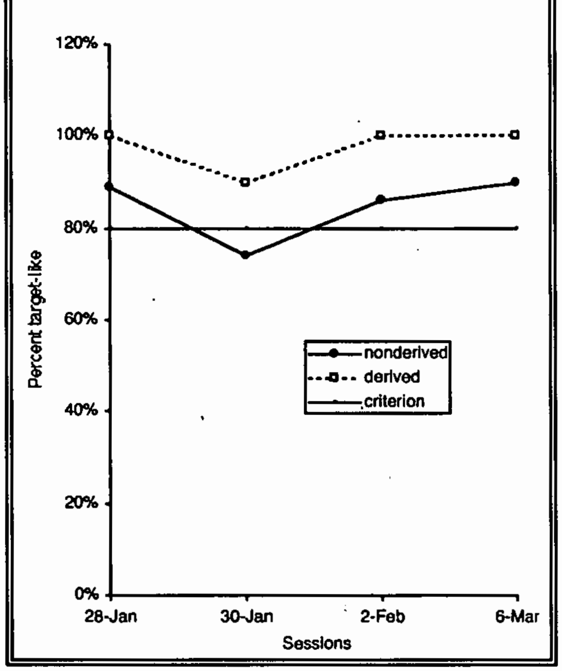
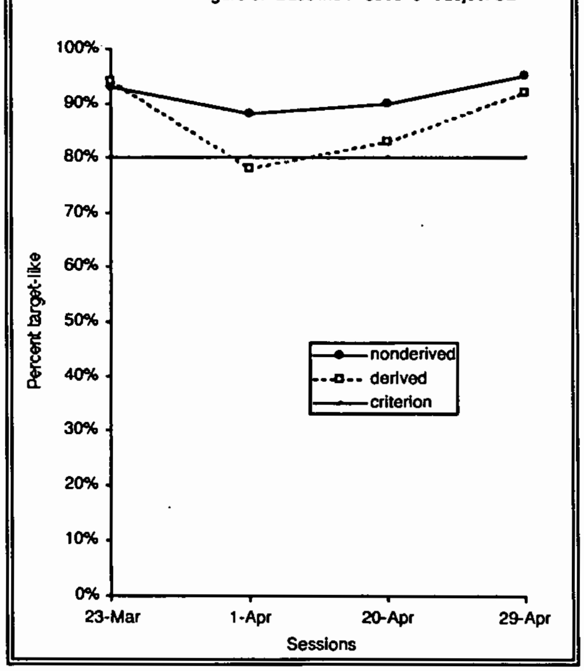


Figure 9. Baseline Probes for Subject S2



In sum, all of the results from the cross-sectional study depict IL grammars that are at either Stage II, having the relevant contrast in only nonderived environments, or Stage III, evincing the contrast in both derived and nonderived contexts. None of the IL grammars we analyzed had the contrast only in derived environments. Therefore, all of the results from the cross-sectional study are in conformity with the hypothesis. We now turn to the instructional study.

IV.2. The instructional study

IV.2.a. Subjects

All of the subjects who lacked the relevant contrast in both derived and nonderived contexts, based on the baseline probes, were entered into the instructional study. As there were no Stage I Korean subjects, all seven of the subjects in the instructional study were Spanish speakers.

IV.2.b. Methodology

The subjects who were entered into the instructional study were trained on the relevant contrasts using a single-subject design (also called a within-subject design, McReynolds and Kearns (1983)). Because there has been little or no discussion of such designs in the SLA literature, it would be worthwhile for us to describe this methodology in more detail. Much of what follows is based on the discussion in McReynolds and Kearns (1983).

In any experimental situation, the goal is to show it was the treatment applied in the course of the experiment that caused the observed change in the subjects' behavior. Because the subjects are exposed to a variety of input and stimuli outside the experiment room during the course of the study, however, it is important for the experimenter to control for these extraneous variables, and the design of the experiment must be structured accordingly. The vast majority of experiments in the L2 literature are group designs, and although these can take several forms, the standard design is to identify a large set of subjects from which two groups are formed: an experimental group and a control group. Both groups are measured on the dependent variable (in our case, the relevant L2 contrast) at the beginning of the experiment and again at the end. In the interim, the independent variable (in our case, training on the relevant contrast in either a derived or a nonderived context) is administered to the experimental group, but not to the control group. Data from the subjects in each group are pooled and a mean is computed. The mean of the experimental group is compared with the mean of the control group, and if a difference is found, it is submitted to a statistical test to see if the difference is significant, or reliable. Extraneous variables in group designs are controlled for by randomly drawing both the experimental group and the control group from the same population, and exposing the control group to the pre-treatment and post-treatment measures, but not to the treatment itself. The control group's performance is an indication that factors outside the experimental conditions do not have an effect on the subjects' responses. In other words, the less change the control exhibits between the pre- and post-treatment measures, the more control has been exercised during the experiment. The assumption is that the same external factors are operating on both the control group and the experimental group. If the control group's behavior does not change during this time and the experimental group's behavior does, the conclusion is that this change must be due to the treatment and not to the external variables.

In single-subject designs, by contrast, there is no control group; instead, the control is within the subject. Each subject goes through both a non-treatment and a treatment period. In other words, each subject in a single-subject design goes through all phases of the experiment, whereas in a group design the control group never receives the treatment (the experimental group goes through a treatment period but never through a time where there is no treatment). The assumption underlying single-subject designs is that although external stimuli could affect the subjects' responses, these factors are present during the non-treatment phase of the experiment as well. Thus, if the subjects' performance on the dependent variable changes during the period of treatment, the conclusion is that this change was caused by the treatment.

For our purposes, however, the clear advantage of a single-subject design as described by McReynolds and Kearns (1983) is that it enables the particular question we are posing to be addressed in the first place, and directly so: Will a learner who acquires a TL contrast in derived environments necessarily generalize it to nonderived environments, as implied by the hypothesis in (8)? As Eckman (1994) has argued in detail, questions bearing on whether IL grammars will adhere to universal principles must be addressed by studying individual IL grammars, not by using group designs in which the data are pooled. It would not even be possible, in our view, to investigate this question using a group design because the answer revolves around whether there are *any* IL grammars that violate the hypothesized relationship between derived and nonderived environments, not whether the mean performance of a group of subjects supports the hypothesis.

In a single-subject design, then, one subject can serve to falsify the hypothesis. In a group design, this is not the case, as there may be—and usually are—subjects whose performance runs counter to the hypothesis. Yet because the data from all subjects in the group are pooled, there may be enough subjects whose behavior is in conformity with the hypothesis to counterbalance that of a few whose performance contradicts the hypothesis. In our study, on the other hand, data from a single, recalcitrant subject are sufficient to falsify our claim. Thus, the hypothesis we are testing is claimed to hold for all learners, not just for the mean of a group.

This point, we believe, needs to be emphasized for another reason, also pointed out by McReynolds & Kearns (1983). A single-subject design allows for the recording of individualized data, whereas individual patterns may well be masked in group studies. For example, as will be seen in the results reported below, there are several ways in which a subject's performance can be in compliance with the hypothesis. Subjects, regardless of whether they were trained on the contrast in derived environments only or nonderived environments only, would support the hypothesis if they (a) acquired the contrast only in the nonderived environment; (b) learned the contrast in both derived and nonderived contexts; or (c) did not acquire the contrast in either environment. Pooling such data from a group study, on the other hand, may well obscure the fact that the data support the hypothesis, especially if the data reflect all three of these situations.

And finally, a single-subject design gives us the freedom to conduct studies with relatively small numbers of subjects. If we were to conduct a group design, we would be forced to find large numbers of subjects who lacked the relevant contrast before we would be able to apply the treatment. We would, in other words, have to wait until we could recruit numerous appropriate subjects before we could conduct the study. In a university-level ESL program, of course, this is not practical, because it is unlikely that there would be a sufficient number of students in the program at that time who would also be at that level of proficiency.

We return now to the description of the methodology of the instructional study. As our first step we established a baseline on each subject to determine which of them evinced the relevant contrast according to the criteria discussed above. Generally speaking, in single-subject designs, the baseline consists of the scores on the first several sessions. For this study, however, we did not score the first session for the purposes of establishing the baseline, because, in the initial session, many of our subjects did not always recognize which words were being depicted by the pictures and the definitions. In these cases, the subjects were given prompts until they learned which word went with which picture. The initial sessions, therefore, elicited many pronunciations of the baseline words that were based on imitations. But because all of the subjects had learned which baseline word went with which picture by the second session, and no longer had to be prompted, we established our baselines beginning from the second session in which the baseline words were elicited.

For the instructional study, the baseline established the starting point for each subject with respect to the relevant contrast. As indicated, only those subjects who did not reach criterion on the relevant contrast on the baseline words were entered into the instructional study. Subjects were randomly assigned to one of two training conditions: either the subject was trained using nonce words exhibiting the contrast only in nonderived environments, or the subject was trained on nonce words showing the contrast only in derived environments. Nonce words were used for training to ensure that all subjects were equal with respect to their knowledge of the training words; that is, none of the subjects knew any of the training words at the outset. The subjects were given directions at the beginning of training that the exercise required them to produce words on the basis of a picture and a definition, as was the case with the baseline words. However, in the instructional study, the directions informed the subjects that the words used in the exercise were not real words of English, but had been made up for the purposes of this exercise.

There were twelve training words in all —six minimal pairs— each of which was associated with a fabricated definition and a picture. An example of a picture used for the instructional study is shown in Appendix A, and the list of the training words is given in

Appendix B. Since the training words were not real words, the subjects were prompted during the initial sessions on which word went with which picture. The subjects were told in the directions that they were to try to learn the words and their associated pictures as quickly as possible. To prevent the subjects from becoming bored with the exercise, they were told that after they had learned the words on the basis of the pictures and definitions given together, they would be asked to name the words on the basis of just the pictures alone, or just the definitions alone. During each training session, the subjects went through eight to ten trials of the words[8]. All of the subjects had learned which training words went with which picture and definition by the end of the second training session. The subjects were taught to make the relevant contrast through the investigators' describing and modeling the correct pronunciation, and then correcting the subjects' productions[9]. All of the subjects' pronunciations were recorded during the sessions and later transcribed by research assistants who were experimentally blind as to the intent of the study.

The specific type of single-subject design used for the instructional study was a staggered, multiple baseline design in which three subjects were entered into one training condition, and four subjects were entered into the other (McReynolds and Kearns, 1983). Each successive subject in a given condition was administered one additional baseline measure. More specifically, subjects S3, S4, and S5 received instruction on the /d/–/ð/ contrast in only derived environments, while subjects S6, S7, S8 and S9 were instructed on the contrast in only nonderived environments. Subjects S4 and S5 are considered direct replications of S3's treatment. Therefore, S3's baseline was established over two sessions, while the baselines for S4 and S5 were established over three and four sessions, respectively. The procedure was identical with the other treatment group: S6's baseline was established over two sessions, with an additional baseline measure added to the baseline of each additional, replicating subject, meaning that S9's baseline consisted of five measures.

From time to time during the training, the baseline words were elicited from the subjects. It was hypothesized that the subjects would generalize the contrast learned on the basis of the training words (i.e., the nonce words) to the baseline words (i.e., the real words). In fact, it is the subjects' performance on the baseline words that provides the test of the hypothesis: it was predicted that subjects who were trained only on nonce words exhibiting the contrast in derived environments would generalize this contrast to the baseline words and evince the contrast in both nonderived and derived environments; it was further hypothesized that subjects trained only on nonce words exhibiting the contrast in nonderived environments would not necessarily generalize this contrast to derived environments in the baseline words.

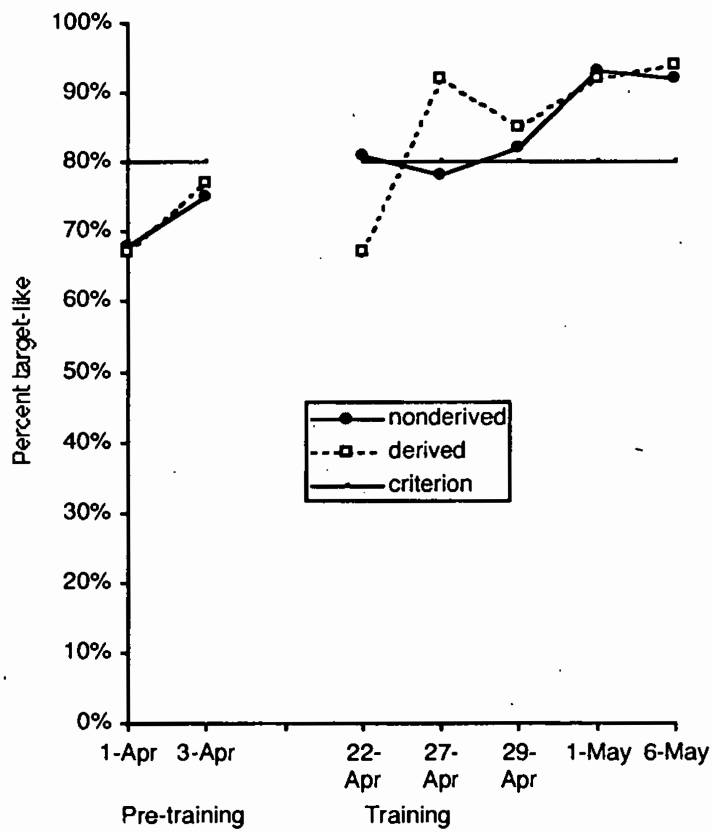
IV.2.c. Results of the instructional study

Figures 10 through 16 represent the results from the Spanish-speaking subjects entered into the instructional study. As can been seen from the graphs, none of the subjects had the contrast between /d/ and /ð/ during the baseline, or pre-training sessions.

S3, S4 and S5 were trained on words showing the contrast only in derived environments, while S6 through S9 were trained using words containing the contrast only in basic environments. Figure 10 shows that S3 acquired the contrast in both basic and derived environments at about the same time. Figures 11 and 12 present results which are particularly interesting. S4, although trained on words with the contrast only in derived contexts, generalized this training first to baseline words with the contrast in nonderived positions, and then subsequently to derived environments, while S5, who was also trained in the derived context condition, implemented this contrast in nonderived environments, but not in derived contexts.

Stated differently, S3 responded to the treatment by quickly becoming a Stage III learner. S4 first passed through Stage II, where she had the contrast only in basic contexts, before becoming a Stage III learner. S4 became a Stage II learner, and did not generalize the contrast to derived environments in the baseline words despite having been instructed only on derived-environment training words. All three of these outcomes are permissible under the hypothesis.

Figure 10. Baseline Probes for Subject S3



Subjects S6 through S9, whose results are depicted in Figures 13 through 16, respectively, were trained in the non-derived condition. As shown in Figure 13, S6 generalized the contrast from basic to derived contexts, an outcome which, while not expected, is nevertheless allowed by the hypothesis. The results from S7 are particularly interesting. She acquired the contrast in the non-derived environment on the baseline words by the 5th (February 25th) baseline session, but did not acquire the contrast in derived environments until the 10th baseline elicitation (May 8th). Thus, S7 clearly evidences an acquisition sequence in which she acquired the contrast first in lexically basic environments and then, more than two months later, also in morphologically composite environments. Subject S8 acquired the contrast in the basic environments in which she was trained, but did not generalize the contrast to derived environments. And S9 acquired the contrast in both environments at the same time, as was the case with S6.

Figure 11. Baseline probes for Subject S4

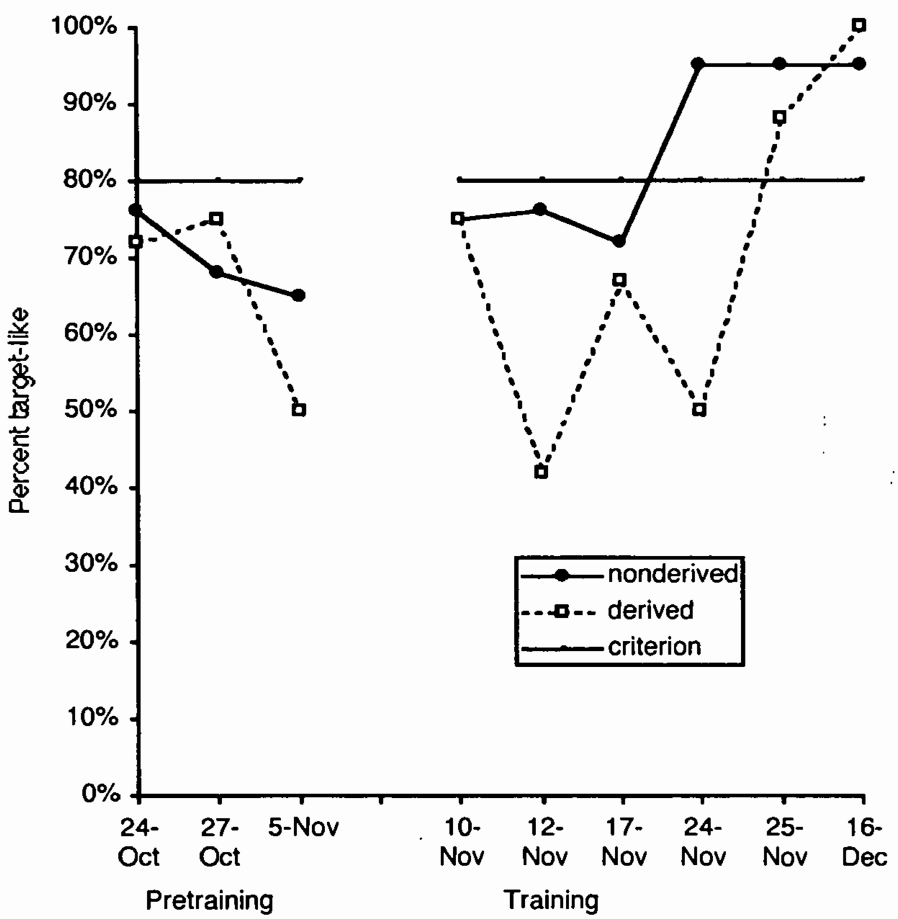


Figure 12. Baseline Probes for Subject S5

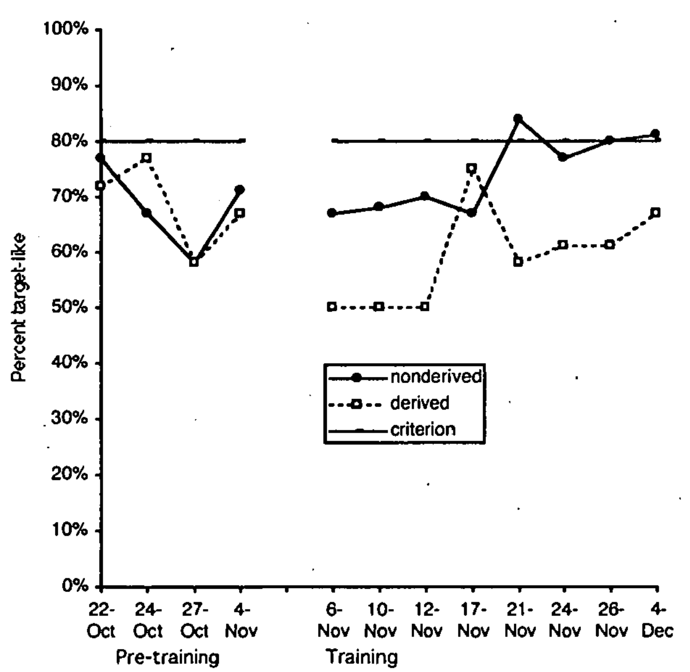
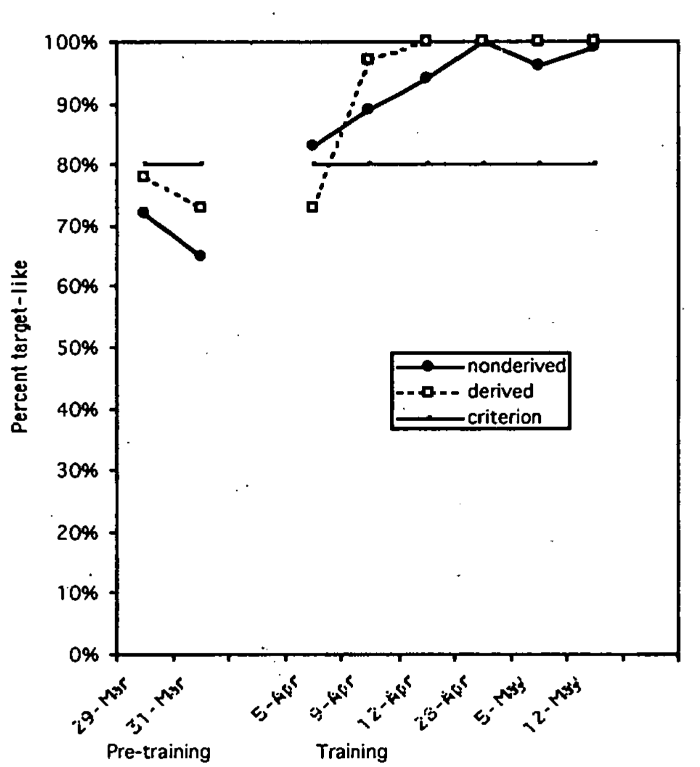


Figure 13. Baseline probes for Subject S6



Our training of Stage I subjects, then, produced learners who were either Stage II or Stage III, while not producing any learners whose IL grammar is excluded by the hypothesis in (8). All of these outcomes confirm our claims, with the results from S4, S5, S7 and S8 being supportive in particularly interesting ways.

To summarize this section, results from our training study suggest that splitting NL allophones into separate TL phonemes entails significantly more than learning to pronounce new sounds. The acquisition of a TL contrast where none exists in the NL is, as our results support, governed by phonological principles which constrain the acquisition to proceed through only some of the logically possible stages of learning

Figure 14. Baseline Probes for Subject S7

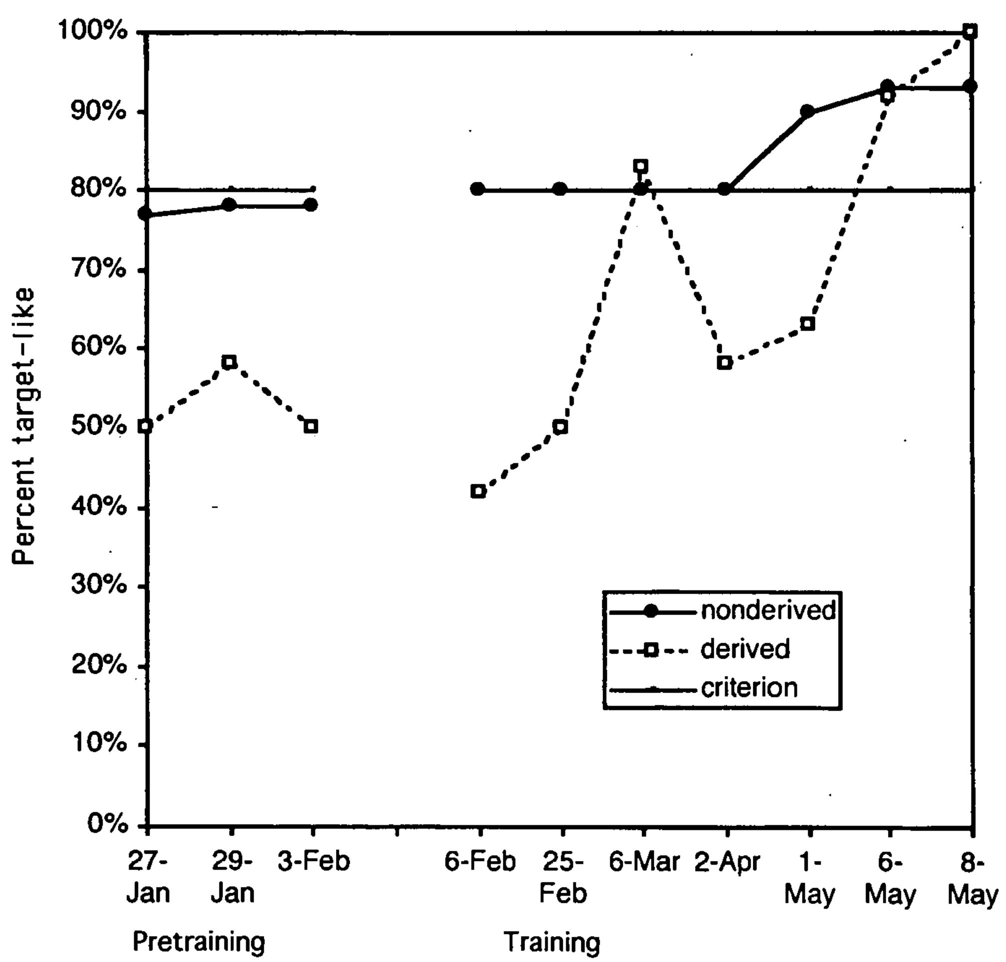


Figure 15. Baseline probes for Subject S8

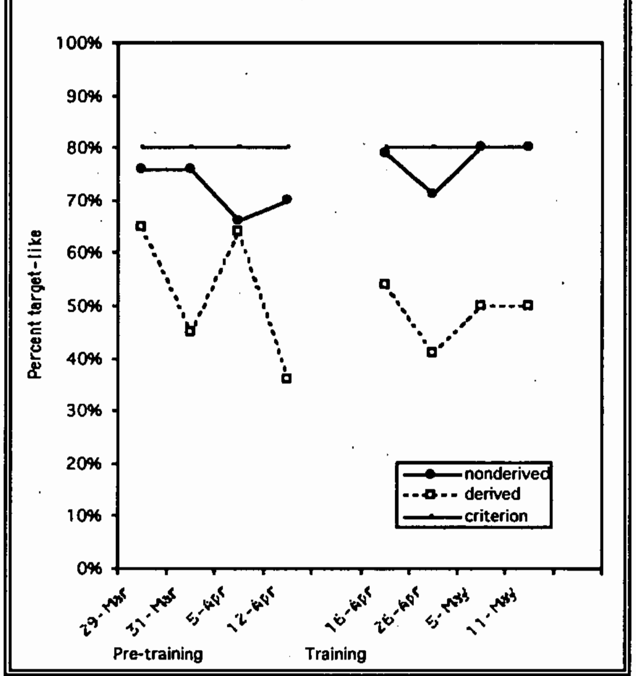
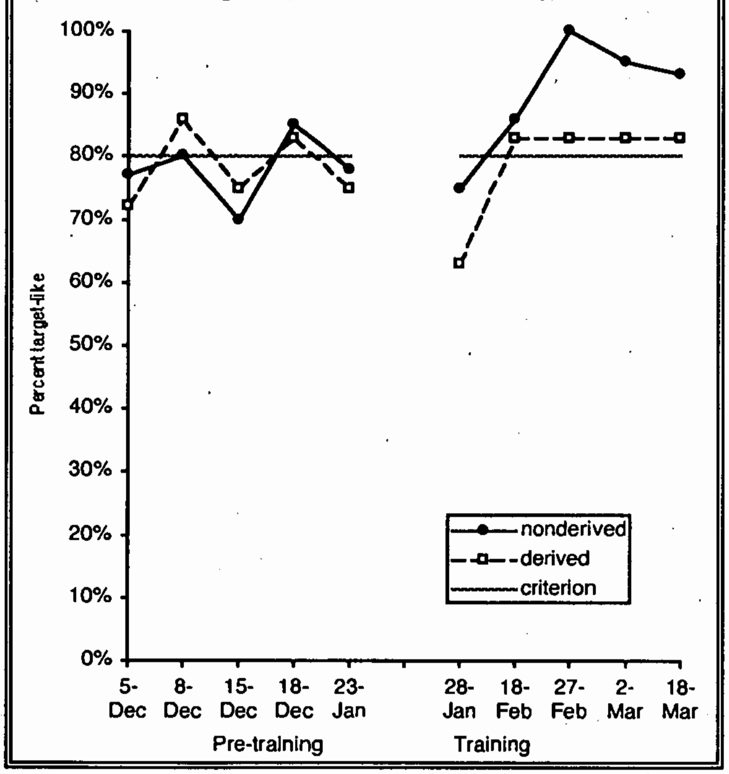


Figure 16. Baseline Probes for Subject S9



V. DISCUSSION

We focus here on three points: (1) the fundamentally abstract nature of IL phonology, (2) the fact that we encountered no Stage I Korean subjects, and (3) the implications of our findings for pronunciation pedagogy.

Results from the experimental study reported here support the claim that certain facts about the pattern of IL phonological development and interference can be accounted for through interaction of the principles of Structure Preservation and the Derived Environment Constraint. We have argued that these principles, which can be explicitly linked to conditions of learnability, provide an explanation for why one type of phonological learning—splitting NL allophones into TL phonemes—takes place as it does.

The learning of L2 pronunciation thus amounts to more than the simple mimicking of TL sounds. Rather, in the cases that we have considered, it is clear that acquisition of TL pronunciation involves incorporating contrasts as part of a general system that is constrained by universal principles of phonology. In our view, here as elsewhere (e.g., Eckman & Iverson 1996), second language phonology is a fundamentally abstract enterprise, parallel (though obviously not always identical) to the organization of sound structure which is characteristic of natively learned languages. We have tried to show in this paper that the perhaps most basic of abstractions in phonology, the familiar notion of contrast, is incorporated into interlanguages in a progressive way that conforms to principles that have been uncovered in the analysis of primary languages.

The fact that we encountered no Korean-speaking learners who lacked the contrast between /s/ and /š/ in both environments perhaps needs some comment, and two possible explanations come to mind. First, there is a possibly confounding variable among Korean learners of English in that their NL contrasts two strident alveolar fricatives: one of these phonemes is a glottally tense /s'/ (e.g., [s'al] 'uncooked rice'), produced with increased vocal fold constriction, the other is a lax /s/ (e.g., [sal] 'skin'), produced with the breathy quality of a substantially more open glottis (Iverson 1983). Of these two phonemes, at least in the standard Seoul dialect, only lax /s/ palatalizes before /i/; thus, we have [ši] 'city', but [s'i] 'seed', i.e., we do not get *[š'i] for 'city' (Ahn, 1998). It is therefore possible that the Korean subjects were implementing the TL contrast between /s/ and /š/ before high front vowels by substituting the NL glottally tense /s'/ for English /s/ and the NL plain /s/, which palatalizes before [i], for English /š/. Indeed, many of the Korean subjects' productions of TL [s] did seem to be equivalent to NL [s']. Thus, it is possible that Korean ESL learners who have had sufficient English exposure to matriculate in an ESL program at an American university will probably already be aware of the TL contrast between /s/ and /š/, and they may well realize that this contrast can be successfully implemented using NL phones. The second explanatory factor, as implied in the work with Chinese and Japanese learners by Brown (1998), is that it can also be the case that the Korean subjects are rather easily able to implement a plain vs. palatalized contrast in fricatives because Korean already contrasts plain anterior versus palatalized coronal segments, e.g., /t/ vs. /č/. Still, nothing in this observation would account for the stages of acquisition which are hypothesized in (9) and attested in our studies.

The final issue we address concerns the implications of our findings for second language pedagogy, and here we have two points to make. The first reflects back to the claim we made above, namely, that learning L2 pronunciation involves far more than simply mimicking TL sounds. IL phonology, in other words, is abstract in that it invokes higher-order principles of phonological theory while incorporating phonemic contrasts into a system. And as L2 pronunciation takes place in stages, instruction and assessment of pronunciation must take these stages into account.

To be more specific, let us ask what might be indicated by systematic learner errors relating to an allophonic split made in monomorphemic lexical items versus errors made in words that are morphologically composite. According to the framework we have proposed, systematic errors made on the contrast in basic, monomorphemic lexical items indicate that the learner is at Stage I. If mistakes are made here, according to our findings, the learner will err in morphologically composite items as well. Errors made only in derived contexts, on the other hand, indicate progress in learning the contrast. In our framework, this indicates a Stage II learner, the point at which the contrast has been learned only partially (in terms of the contexts in which it has been acquired). Conversely, the absence of errors in monomorphemic forms does not mean that the contrast is completely mastered, as the leaner may still err in derived contexts. Our point, simply stated, is that not all errors involved in splitting NL allophones are "equal"—some errors (derived contexts) are "better" than others (monomorphemic contexts) in that they indicate progress in acquisition.

And finally, these points can be applied to pronunciation instruction as well. We note that recent methodological principles in pronunciation pedagogy (Celce-Murcia, et al. 1996) stress that pronunciation teaching cannot focus only on words, but must also take larger domains such as the sentence and discourse into account. The results from our studies support these claims, for the added reason that the distinction between derived and nonderived contexts, in the sense expressed by the Derived Environment Constraint, is crucial to a learner's fully acquiring the TL contrast between noncontrasting NL sounds.

VI. CONCLUSION

In this paper we have reported and attempted to explain the stages and patterns involved in the acquisition of a split between NL allophones. We have argued, on the basis of both cross-sectional and instructional data, that the principles of phonological theory, which can be linked to learnability, govern the way in which this acquisition takes place. We have tried to show, in particular, that TL contrasts between NL allophones are incorporated into interlanguages progressively, not at once, and that the progression follows a path which is laid out by the interaction of two very general phonological considerations: the Derived Environment Constraint and Structure Preservation.

NOTES

1. Although we use the term "err consistently", we do not want to imply that there is no variation here, as variation in the Ils of L2 learners has been well documented and is clearly present in our own data.

2. We chose the baseline words, as much as possible, according to how easy they were to picture and how likely it would be that the subjects were familiar with the words. For the Spanish speakers, we chose words that had the targeted contrast in onset position before a vowel, in coda position following a vowel, and in the middle of a word between vowels. For the Korean subjects, we invoked the same considerations, but in addition we chose words instantiating the contrast before the high front vowels [i] and [ɪ], as well as before other vowels. In the lists, any word with the suffix *-y* or *–ing* is a derived context.

3. The percentage of agreement varied from subject to subject, and from group to group, though the percentage of disagreement between the live transcription (which included only the consonants in question) and the tape transcription never exceeded 0.97%. The higher disagreement percentages occurred, in general, with the Spanish-speaking subjects more than with the Korean-speaking subjects, as it was more difficult to distinguish [d] and [ð] on the tape than it was to differentiate [s] and [š].

4. The reliability figure based on the re-transcription of randomly-selected portions of the tape is lower than that computed between the live transcription and the tape transcription because the former was based on a point-to-point comparison between transcriptions of the entire word, whereas the latter was based on a comparison of the just the consonants in question. The research assistants transcribed the subject's pronunciation of the whole word, on both the original transcription and the re-transcription, so that the assistants could remain experimentally blind as to what the focus of the study was.

5. One of the anonymous reviewers questioned why we did not conduct spectrographic analyses of the subjects' utterances, citing that this could have pointed out cases of "covert contrast" or "near merger" in which subjects may be making a contrast, but in a way that does not phonetically match how the contrast is implemented in the TL (Flege 1980). While we agree that it is reasonable to ask whether there are instances of our subjects' making a covert contrast between the segments in question, we also believe that, within an L2 context, it is interesting to investigate whether the subjects are producing the appropriate phonetic categories as perceived by native speakers of the TL. Given this as the goal of our study, it is rather beside the point whether the subject is making a covert contrast or near merger.

6. An anonymous reviewer pointed out that the 80% criterion is often used without discussion in the SLA literature, and further suggested that instead of using such a threshold, we should report the scores in terms of percentages and statistical levels of significance. We believe, however, that establishing a meaningful criterial threshold is the most insightful way to report the data, and further, that employing levels of statistical significance does not obviate the need for the criterial threshold. First, we consider that performance at the 80% level on two successive sessions is meaningful because, as we stated in the text, this represents a level of systematicity below which the subjects did not fall at a later date. And second, simply reporting percentages and levels of significance, as the reviewer suggested, does not address the questions we

are posing. To test our hypothesis, we must be able to say whether or not a given learner has the contrast in question. The basis for this decision, it seems to us, is whether the subject evidences enough systematicity with respect to that contrast for one to confidently conclude that the contrast is present. Suppose that a given subject performs at the 40% level in the nonderived context and at the 20% level in the derived context, and suppose, further, that it can be shown statistically that those two levels are significantly different. This result still does not provide an answer to the question as to whether the subject *has* the contrasts in the specified contexts, because one still has to decide whether 40% and 20% are systematic enough to warrant the conclusion that the contrast is present. Consequently, the use of statistical levels of significance does not remove the need for a criterial threshold.

7. The subjects who were entered into the cross-sectional study were, while the instructional study was being conducted, held in an extended baseline phase, during which time the investigators continued to meet with the subjects and to elicit the baseline words. This is why there are as many as ten baseline measures on some of the cross-sectional subjects.

8. The number of tokens of both the baseline words and the training words varied for each subject, which is why we report the scores in terms of percentages. In the initial sessions of the baseline words, the subjects went through four or five trials of the words; in the later baseline sessions, as the pictures and definitions became much more familiar, the subjects went through only two or three trials. In any given baseline session, however, the subject performed at least two trials of the baseline words. The number of tokens of the training words also varied from subject to subject and from session to session. In the earlier training sessions, subjects went through the words more slowly, producing on average five or six trials of each word. In the later sessions, subjects often produced up to ten trials of each word. In the later sessions, to prevent the subjects from becoming bored with the exercise, the training words were also elicited on the basis of only the pictures or only the definitions.

9. The training given to the subjects dealt only with the consonants in question ([d] and [ð] for the Spanish speakers, [s] and [š] for the Koreans), and thus did not focus on the pronunciation of vowels or on the production of other consonants. Moreover, there was nothing innovative or "exciting" about the training: the pronunciations were modeled, at times as single words and at other times as part of a minimal pair, and the subjects were then given feedback on their productions. In short, the focus of the study was not to investigate the effects of learning a contrast based on different teaching methods, but rather to identify the grammatical implications of learning a contrast in a given environment.

REFERENCES

Ahn, S-C. (1998). *An Introduction to Korean Phonology.* Seoul: Hanshin Publishing Co.

Brown, C. (1998). The Role of the L1 Grammar in the L2 Acquisition of Segmental Structure. *Second Language Research*, 14, 136-193.

Celce-Murcia, M., D. M. Brinton & J. M. Goodwin. (1996). *Teaching Pronunciation: A Reference for Teachers of English to Speakers of Other Languages.* Cambridge: Cambridge University Press.

Dinnsen, D. A. & Barlow, J. A. (1998). On the Characterization of a Chain Shift in Normal and Delayed Phonological Acquisition. *Journal of Child Language*, 25, 61-94.

Eckman, F. (1994). Local and Long Distance Anaphora in Second Language Acquisition. In E. Tarone et al. (Eds.), *Research Methodology in Second Language Acquisition*, (pp. 207 – 225). Mahwah, NJ: Lawrence Erlbaum Associates.

Eckman, F. R. & G. K. Iverson. (1996). Onset and Coda Preferences in Korean-English Interlanguage. In Jae-Kee Shim, et al. (Eds.), *Essays in Honor of Ki-Moon Lee*, (pp. 916-938). Seoul: Shin-gu Publishing Co.

Eckman, F. R. & G. K. Iverson. (1997). Structure Preservation in Interlanguage Phonology. In S. J. Hannahs and M. Young-Scholten (Eds.), *Focus on Phonological Acquisition*, (pp. 183-207). Amsterdam & Philadelphia: John Benjamins Publishing Co.

Eckman, F. R. & G. K. Iverson. (1999). Learnability in Second Language Pronunciation: Splitting Native-Language Allophones into Target-Language Phonemes. In *Representation and Process: Proceedings from The Third Pacific Second Language Research Forum*. Tokyo: Aoyama Gakuin University.

Flege, J. (1980). Phonetic approximation in second language acquisition. *Language Learning*, 30, 117–134.

Flege, J. (1987). The production of "new" and "similar" phones in a foreign language: Evidence for the effect of equivalence classification. *Journal of Phonetics*, 15, 47-65.

Hammerly, H. (1982). Contrastive Phonology and Error Analysis. *International Review of Applied Linguistics* 20, 17-32.

Iverson, G. K. (1983). Korean /s/. *Journal of Phonetics,* 11, 191-200.

Iverson, G. K. (1993). (Post)lexical Rule Application. In E. M. Kaisse & S. Hargus (Eds.), *Studies in Lexical Phonology*. (pp. 255-275). New York: Academic Press.

Kenstowicz, M. (1994). *Phonology in Generative Grammar*. Cambridge, MA: Blackwell Publishers.

Kiparsky, P. (1973). Abstractness, Opacity, and Global Rules. In O. Fujimura (Ed.), *Three Dimensions of Linguistic Theory*. (pp. 57-86). Tokyo: TEC.

Kiparsky, P. (1982). Lexical Phonology and Morphology. In I. S. Yang (Ed.), *Linguistics in the Morning Calm*. (pp. 3-91). Seoul: Hanshin.

Kiparsky, P. (1985). Some Consequences of Lexical Phonology. *Phonology Yearbook,* 2, 85-138.

Lado, R. 1957. *Linguistics Across Cultures: Applied Linguistics for Language Teachers*. Ann Arbor: University of Michigan Press.

Major, R. & E. Kim. (1999). The Similarity Differential Rate Hypothesis. In J. Leather (Ed.), *Phonological Issues in Language Learning: A supplement to Language Learning* 49, Supplement 1, (pp. 151-183). Ann Arbor, MI: Basil Blackwell Publishers.

McReynolds, L. V. & K. P. Kearns. (1983). *Single-Subject Experimental Designs in Communicative Disorders*. Austin: Pro-Ed.

Morley, J. (Ed.) (1987). *Current Perspectives on Pronunciation.* Washington, D.C: Teachers of English to Speakers of Other Languages.

Morley, J. (1991). The Pronunciation Component in Teaching English to Speakers of Other Languages. *TESOL Quarterly,* 25, 481-520.

Morley, J. (1994). A Multidimensional Curriculum Design for Speech-Pronunciation Instruction. In Joan Morley (Ed.), *Pronunciation Pedagogy and Theory.* (pp. 66-91). Alexandria, VA: Teachers of English to Speakers of Other Languages, Inc.

Vennemann, Theo, gen. Nierfeld. (1972). Rule Inversion. *Lingua,* 29, 209-42.

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Native Language Influence in Learners' Assessment of English Focus

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ABSTRACT

Accentual focus is a frequent linguistic device in English which may also be used in Spanish but less widely and less frequently. Given this disparity, it was expected that native language influence would manifest itself in FL learners' focus assessments as compared to native English speakers. Other factors were also expected to account of listener perceptions, such as task type and linguistic competence. Two focus domains were used to test hypotheses: utterance initial and utterance medial focus. Focus identification was tested using two tasks which differed in their cognitive demands: multiple choice and open questions. Acceptability was estimated by asking listeners to rate utterances on a five point scale. English NL listeners displayed better focus identification rates as compared to FL learners. This result may be understood both as an effect of native competence advantage and also as a reflection of native language influence. Both listener groups found utterance initial focus easier to identify and considered it to be more acceptable than medial focus. Both groups showed worse results in the open test, which is interpreted as a consequence of this task being more demanding on listeners' explicit knowledge. These trends were much more pronounced amongst FL learners. It is suggested that the potential ambiguity of English medial focus is partly responsible for the bias against it. Additionally, Spanish listeners results show the their NL influence in this bias as well as in the good results for initial focus and acceptability estimations.

KEYWORDS: accent, focus, native language influence, foreign learners.

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I. INTRODUCTION

The present study is intended to contribute to the knowledge of intonation acquisition, which has received less attention than segmental acquisition within second language research, by examining foreign language perception of accentual focus. The term focus is used in a broad sense, referring to that which the speaker draws attention to (Maidment 1990). This study will concentrate on intonation as a device to highlight new information; more specifically on pitch accents as focus signallers.

Accentual prominences are often employed to signal focus domains, particularly in languages such as English, which have fixed word order (Cruttenden 1997). This accentual function has been the object of a considerable body of research for English so that its characteristics are quite satisfactorily described (Gussenhoven 1984, Bolinger 1989, Taglicht 1982, Tench 1996 to mention but a few). One of these characteristics is that English accentual focus may sometimes be ambiguous as to its scope (Halliday 1976). For instance, accent placement on the last lexical item[1] of an intonation unit may signal "all-new" information (Cruttenden 1997), that is to say, all the material in the intonation unit is presented as new information, but it may also be interpreted as narrow focus on the accented item itself or on its immediate constituent. There are other syntactic and morphological mechanisms by which information may be highlighted such as elision, use of pro-forms, cleft and pseudo-cleft sentences, etc.

Traditionally, Spanish was thought to signal information focus by these other mechanisms since it is a language with free word order whereas the nucleus or main accent of the sentence was considered to be unmovable (for example, Navarro Tomás 1948). Sosa (1991, 1999) on the other hand, though agreeing with this view of the nucleus ("tonema" in traditional Spanish intonational studies), presents some additional intonational focusing devices for the varieties of Hispano-American Spanish he analyzes. According to Sosa, focus may be achieved by introducing an intonation group break (i.e., "tonality" in Halliday's terms) following a rise, as in the following example (Sosa 1991:134), or by means of a rise without group breaks (H*+H)

Se	le	van	**ta**	ron	a	me	dia	**no**	che
			I					I	
			H* H%					L+H* L%	

These two possibilities would amount to different degrees of focusing strength. In both cases, the focused element would be that where the rise is implemented. In the above example, the verb "levantaron".

In our opinion there is sufficient evidence to believe that accentual focus realized with falling prominences (i.e., quite similar to the realization in English) is also a possibility in

Spanish (Ortiz Lira 1994, García Lecumberri 1995, García Lecumberri et al. 1997)[2]. Whether this focal pitch accent is considered to be the nucleus of the group depends on (i) the definition of nucleus and (ii) the analysis of post-focal material[3].

Accordingly, we cannot consider accentual focus to be an unknown mechanism for Spanish language learners, although it may be less frequently used and in fewer structures than it is in English. For instance, it was found (García Lecumberri 1995) that sentence initial focus in Spanish is easily produced and identified by native speakers whereas sentence medial focus is far less common[4].

It is well known that the NL can have considerable influence on the acquisition of a FL or L2. However, after a period when pure transfer was seen as the only or the most relevant factor, in recent years its relative weight in second language acquisition has been strongly contended. Nevertheless, pronunciation is often seen as a case apart: most authors believe that phonetic/phonological mistakes are frequently due to first language (L1) influences, even more so than errors at other levels (Altemberg & Vago 1983; Bohn 1995; Cenoz & García 1999; Eckman 1981; Ellis 1994; Flege 1992; Flege & Bohn 1989; García & Cenoz 1997; Ioup 1984; Major 1994; Scholes 1986; Wode 1980). In this sense, sound system differences between the NL and the target language pose various degrees of difficulty to learners which may be manifested as errors. This is not to say that language differences lead to errors, but that they may do so. Since the NL may cause the use of other strategies instead of or besides straightforward sound transfer, such as borrowing or avoidance (Ellis 1994) I prefer the term *influence* rather than *transfer* as Kellerman & Sharwood-Smith (1986) propose.

Given that English and Spanish differ in the frequency and acceptability of accentual focus as has been mentioned, it was our aim in the study described here to examine the presence and/or extent of NL influence on learners' perception and assessment of English focus. More specifically, we wanted to investigate whether native language (NL) responses for Spanish were replicated by Spanish speakers when confronted with English accentual focus, that is to say, whether their NL bias in favour of sentence initial focus over sentence medial focus would be carried over to their assessment of English focus and how this FL discrimination would compare to that by native English speakers[5].

Additionally, since accentual focus is more common a mechanism in English than it is in Spanish, we were interested in finding out if NL influence would also be manifest in acceptability judgments. For this, English accentual focus acceptability ratings by Foreign Language (FL) learners would be compared to those by native English speakers.

There are undoubtedly many other factors which can account for learners' pronunciation errors, such as those related to an individual's characteristics, for instance aural/oral abilities (Cummins 1983, Leather & James 1991), age of acquisition/learning (Singleton 1995), motivation (Guiora & Schonberger 1990), learning strategies (Lengyel 1995), level of FL attained (Bongaerst et al. 1995), as well as developmental errors (Major 1987, 1999) and degree of NL maintenance/use (Major 1990). However, some of these factors fall outside the scope of the present study since, as shall be seen below, our FL listeners were a homogeneous group as to FL level and age, and we had limited access to data about their individual personal abilities/skills.

In sum, the questions that this research meant to address were:

i) Do Spanish FL learners of English show the *influence* of their native identification patterns in discriminating English accentual focus?
ii) Is *native competence* evident as a favouring factor for the discrimination of English accentual focus?
iii) Does a task's degree of difficulty have different consequences for native speakers vs. FL learners' perceptions?
iv) Does the acceptability of a NL structure influence the perceived acceptability of a similar structure in a FL?
v) Are there evidences of any other factors at work in FL learners' results?

II. MATERIALS

Two different perception tests were designed with the aim of extracting listeners' assessments of accentual focus in English. These tests were given to all listeners (English native and FL listeners): Test 1 was an information structure test. Test 2 was a acceptability test (see sections 3 and 4 below).

II.1. Stimuli

The input consisted of the utterances of an R.P.[6] English speaker (for more details see García Lecumberri 1995). The number of utterances set for listeners to evaluate consisted of twelve target sentences (see appendix) with eighteen distractors interspersed. Six of the target sentences had been realized by the speaker with utterance initial accentual focus (on the sentence subject) and six with utterance medial accentual focus (on the verb). All sentences were simple declaratives to avoid syntactic focus markings. Focused constituents only contained one potential accent to prevent ambiguities of scope within a constituent.

Listeners were presented with 30 sentences within which the two types that were the object of study, utterance initial or medial focus, were randomly distributed. They were allowed to listen to utterances more than once.

II.2. Listeners

Forty subjects took part in the tests: twenty native speakers o English and twenty native speakers of Spanish. There were twenty native English listeners who were all speakers of a fairly standard variety of southern British English. None of them were linguists and they had no phonetic training. None of them were fluent in any language other than English. They had at least a secondary school education or its equivalent.

Spanish listeners were selected from the group of second year English Philology at the UPV/EHU. They were asked to complete a questionnaire giving details about themselves (birth place and date, where they lived, languages spoken and what level, stays abroad, English exam results etc.). The answers given to these questions were used to select a homogeneous group of twenty speakers: They were all native Spanish speakers with a fairly similar level of English (between intermediate and upper intermediate). Most of them had never lived in an English speaking country or had only spent a few weeks there and did not show significantly different results in their English exams from other students[7] and were therefore included in the sample. All listeners had studied English Phonetics but tests were done before they studied English intonation so that their performance in the test would reflect acquisition of intonation from exposure rather than from systematic training.

III. FOCUS IDENTIFICATION TESTS

There were two types of focus identification test. One of them was a multiple choice test, the other was an open test. They will be described in turn.

III.1. Materials

Out of the forty listeners, twenty took the multiple choice test: ten English native speakers and ten Spanish FL English learners selected at random within their linguistic group.

Listeners were told that an exchange between two people -one asking questions and the other one answering them- had been edited so that they would only hear the answers. They had to find the question which corresponded to each of the answers from amongst the four possibilities that were offered. They were encouraged to pay attention to the "way" sentences were said and not only to their lexical meaning.

The test presented four potential choices for each utterance, of which only one was right. Choices were wh-questions, each refered to a different constituent and focus scope for each utterance: subject, verb, complement, predicate, subject plus verb or an all-new question. For target sentences with sentence initial focus, the right multiple choice question would refer to the subject of the sentence. For target sentences with sentence medial focus the right choice would refer to the verb of the sentence. The structure of the test can be best appreciated in the following example of an utterance realized with sentence medial focus (option 'c' is the right one):

Stimulus: His friend BORrowed the money

Options:

a-Who borrowed the money?
b-What did his friend borrow?
c-What did his friend do about the money?
d-What happened with the money?

Twenty other listeners (ten English speakers and ten Spanish FL English learners) were asked to do an open test. Instead of being given four choices, listeners were asked to make up a plausible question for each stimulus. For this, a written version of all sentences was presented with a gap provided for the listeners to write their question underneath each utterance.

It was thought that the two tests would make unequal demands on the participants linguistic knowledge: the multiple choice test would be more apt to provoke intuitive answers whereas the open test required a more detailed analysis of the stimulus utterance and therefore required for a more explicit manifestation of participants' knowledge.

III.2. Analysis and Results

The number of right and wrong judgements was calculated. Questions provided in the open test were considered to be right as long as they referred to the focus signalled in each case. If an answer involved elements outside the focus domain, it was classified as wrong even if focused material was also included.

Percentages of right and wrong listeners' identifications were calculated. Comparative statistics between the two listener groups were done applying paired two tailed t-tests.[8]

Tables 1 and 2 show intra-group perception comparisons for the two types of focus in the two different types of test. Tables 3, 4 and 5 show comparison between the two listener groups.

Table 1*: English listeners' English focus perceptions in different conditions. *(NLE= Native Language English)

Condition	NLE Initial	NLE Medial	M.C. NLE Initial	Open NLE Initial	M.C. NLE Medial	Open NLE Medial
Number of responses	120	120	60	60	60	60
Number of correct responses	114	93	60	54	49	44
Percentage of correct responses	95.00%	77.50%	100.00%	90.00%	81.67%	73.33%
t	4.16		2.56		1.22	
probability	0.0001		0.013		0.23	

Table 2: **Spanish listeners' English focus perceptions in different conditions.** *(FLE= Foreign Language English)*						
Condition	**FLE Initial**	**FLE Medial**	**M.C. FLE Initial**	**Open FLE Initial**	**M.C. FLE Medial**	**Open FLE Medial**
Number of responses	120	120	60	60	60	60
Number of correct responses	84	43	47	37	34	9
Percentage of correct responses	70.00%	35.83%	78.33%	61.67%	56.67%	15.00%
t	6.23		1.93		5.46	
probability	0.0001		0.058		0.0001	

Table 3: **English versus Spanish listeners' perceptions for English initial and medial focus.** *(NLE= Native Language English; FLE= Foreign Language English)*				
Condition	**NLE Initial**	**FLE Initial**	**NLE Medial**	**FLE Medial**
Number of responses	120	120	120	120
Number of correct responses	114	84	93	43
Percentage of correct responses	95.00%	70.00%	77.50%	35.83%
t	5.41		7.76	
probability	0.0001		0.0001	

Table 4: **English versus Spanish listeners' perceptions for English initial and medial focus in multiple choice tests.** *(NLE= Native Language English; FLE= Foreign Language English)*				
Condition	**M.C. NLE Initial**	**M.C. FLE Initial**	**M.C. NLE Medial**	**M.C. FLE Medial**
Number of responses	60	60	60	60
Number of correct responses	60	47	49	34
Percentage of correct responses	100.00%	78.33%	81.67%	56.67%
t	4.04		3.08	
probability	0.0002		0.003	

Table 5: **English versus Spanish listeners' perceptions for English initial and medial focus in open tests.** *(NLE= Native Language English; FLE= Foreign Language English)*				
Condition	**Open NLE Initial**	**Open FLE Initial**	**Open NLE Medial**	**Open FLE Medial**
Number of responses	60	60	60	60
Number of correct responses	54	37	44	9
Percentage of correct responses	90.00%	61.67%	73.33%	15.00%
t	3.75		9.09	
probability	0.0004		0.0001	

According to the data in the above tables, we can see that the difference between English and Spanish listeners is statistically significant for all of the variables and conditions: overall initial focus perception, overall medial focus perception, initial and medial focus perceptions in the multiple choice test and in the open test. The smallest difference between the two groups of listeners corresponds to medial focus in the multiple choice test. On the other hand, the biggest difference that can be observed between the two groups of listeners is that for medial focus perceptions in the open test. As for intra-group identification rates, the results show that utterance initial focus is perceived significantly more accurately than utterance medial focus for both English and Spanish listeners. The two listener groups also display better perception rates in the multiple choice test for both focus types. In the case of Spanish speakers, the difference between the two tests is always statistically significant whereas for English speakers differences are less pronounced and only statistically significant in the case of utterance initial focus.

III.3. Discussion

The results obtained in this study show that for the two listeners groups, medial focus is more difficult to discern than focus in initial position.

At first glance the fact that English native speakers display any difficulty may be puzzling, since accentual focus is a very frequent linguistic device which they must be very familiar with. However, English focus displays some features which may give rise to a certain amount of potential ambiguity in its interpretation. A focal accent may be ambiguous in its leftward scope when it is placed in the unmarked position, that is, on the last lexical word of the intonation group (Halliday 1976). For Cruttenden (1997) deaccenting of the final lexical item with consequent leftward displacement of the accent to a previous word may also render focal interpretations ambiguous as to their leftward scope. Thus, for instance, a sentence such as (4a) with focus on "admires" may be an answer to either (4b) or (4c):

(4a) Diane adMIres his music
(4b) What does Diane think of his music?
(4c) What do his friends think of his music?

On the other hand, an initial focal accent is not ambiguous since there are no constituents to its left.

The group of English listeners did not experience problems identifying utterance initial focus, as the results from our tests indicate: they obtained 100% right identifications in the multiple choice task and 90% in the open test. We believe this latter lower result is due to the higher intrinsic difficulty of the open task as compared to the multiple choice one (see below).

The group of English FL learners, as has been pointed out, displayed significantly worse identification rates than the English NL listener group for all conditions. Their identification of utterance initial focus is considerably better than that of utterance medial focus, as was also the case with NL listeners, but the difference between the two focus types is more pronounced in the FL group. Learners show quite good global identifications rates (70%) for utterance initial focus, which, again as in the NL group, are better in the multiple choice test.

We can offer two possible explanations for the superior behaviour of utterance initial focus. On the one hand, as has already been pointed out, the domain of English utterance initial focus is not ambiguous, so that there is less potential for confusions. On the other hand, as was mentioned in the introduction, previous studies (García Lecumberri 1995, et al 1997) show that in Spanish, utterance initial focus is much more frequent than utterance medial focus and more easily perceptible. Therefore, positive influence of the learners NL together with the lack of ambiguity of the Target Language (TL) structure (utterance initial focus) account for the good results obtained by learners in our identification tasks.

As far as utterance medial focus is concerned, it is worth noting the very low correct identification rate (15%) obtained by FL listeners for medial focus in the open test. In this case too, the two former explanations offered for the superior behaviour of utterance initial focus amongst FL learners still hold: medial focus is more problematic for Spanish learners of English because of (i) its intrinsic ambiguity potential in the TL and (ii) because in the learners NL medial focus is also more rare and difficult to perceive. It may be mentioned that Spanish medial focus also presents a considerable amount of ambiguity -as in English- but in Spanish ambiguity rests in the rightward scope of the focal accent (García Lecumberri & Cabrera 1999, Estebas 2000). Additionally, the intrinsic difficulty of the open test constitutes a third possible factor in the results obtained.

Let us now examine in some more detail the question of task difficulty. It has been pointed out that the type of task used as research instrument may be a source of considerable variability (Ellis 1994, Major 1999). Our results show that for both English NL and FL listeners, the open test was more demanding. In the case of English NL listeners, this higher degree of difficulty constituted no great obstacle given their native competence. On the other hand, students' English knowledge was much more severely tested in the open test since it was a task that involved explicit knowledge much more intensely than the multiple choice test (Bialystock 1990, 1991). As was pointed out above, FL participants in this study had not been instructed on English prosody in general, nor in particular on accentual focusing. The multiple choice test offered ready solutions, so that it made small demands on the learner's explicit knowledge of this structure, but the open test was a more cognitively demanding task, in which the written production of adequate context was required. This made subjects analyze the structure more closely and thus created more difficulties for FL listeners by making stronger explicit knowledge necessary for a structure which the learners had not learnt through explicit instruction. Native English listeners were able to access their native competence in order to answer the task demands. Learners of English had to draw on the knowledge of a pattern that they have acquired only implicitly and partially.

IV. FOCUS ACCEPTABILITY TEST

This test was designed to investigate (i) how acceptable English NL and FL listeners considered accentual focus in English, (ii) whether their estimations corresponded to their perceptibility of said structures and (iii) whether FL listeners would show influence from their NL (Spanish) in their acceptability judgements since, as was seen in a previous study (García Lecumberri 1995), Spanish medial focus is considered by native speakers to be significantly less natural than utterance initial focus[9]. The same forty listeners took part in this test.

IV.1. Materials

It was felt that the acceptability of an utterance's intonation could only be properly estimated if seen in context. Therefore a written transcript of the stimuli utterances was provided which included their respective trigger questions so that listeners were fully aware that the utterances they were assessing had a missing context. The same recorded utterances used for the other tests were played again as stimuli for the present one.

Listeners were asked to rate the acceptability of utterances on a scale of 0 to 4[10]. Listeners were strongly encouraged to judge the appropriateness *of the way* each sentence was uttered taking into account the question that had triggered it, without regarding lexical or syntactic considerations.

IV.2. Analysis and Results

Scores given by listeners were tabulated. Mean scores and standard deviations were obtained for each listener group and condition. Comparison between listener groups was done applying paired two tailed *t*-tests. Results are displayed in tables 6 and 7.

***Table 6*: English vs. Spanish listeners' acceptability estimations for initial and medial focus.**
(NLE= Native Language English; FLE= Foreign Language English)

Condition	NLE All	FLE All	NLE Initial	FLE Initial	NLE Medial	FLE Medial
Number of responses	240	240	120	120	120	120
Mean response	3.61	3.34	3.63	3.50	3.58	3.18
Standard Deviation	0.71	0.92	0.72	0.87	0.69	0.94
t	3.46		1.24		3.66	
probability	0.0006		0.22		0.0004	

Table 7: **English and Spanish listeners' intra-group acceptability comparisons for initial vs. medial focus.** ***(NLE= Native Language English; FLE= Foreign Language English)***				
Condition	**NLE Initial**	**NLE Medial**	**FLE Initial**	**FLE Medial**
Number of responses	120	120	120	120
Mean response	3.63	3.58	3.50	3.18
Standard Deviation	0.72	0.69	0.87	0.94
t	0.80		2.73	
probability	0.43		0.007	

As can be seen in table 6, the overall acceptability ratings given by the two listener groups differ significantly. However, this difference rests mainly on ratings for medial focus for which Spanish listeners' estimations are significantly lower than English listeners'. On the other hand, there is no significant difference for initial focus ratings although English listeners still rate it as more acceptable. Table 7 shows that English NL listeners are more homogeneous in their ratings for the two types of focus without significant differences, whereas FL listeners display significantly lower ratings for utterance medial focus than for initial focus.

IV.4. Discussion

As was mentioned above, the two focus domains investigated in this paper are possible in Spanish, therefore it was to be expected that both English NL and FL listeners would assign considerably high acceptability ratings. However, since Spanish often resorts to word order for focusing purposes and thus accentual focus is less frequent than in English, we expected accentual focus to be considered less acceptable by FL listeners.

As can be seen in table 6 above, these expectations were confirmed: there is a significant difference between acceptability ratings given by English NL vs. FL speakers for focused sentences as a whole, since English listeners consider accentual focus more acceptable than Spanish listeners do. This might seem an obvious result in that English listeners were rating not only their own language, but a speaker with an accent not too dissimilar to their own. However, it could also be argued that FL listeners could have been expected to be less discriminating in a foreign language and therefore, more likely to consider any native-sounding speech acceptable.

However if we look at the differentiated scores for utterance initial focus and for medial focus we can see that FL speakers are not being undiscriminating. Spanish listeners consider English initial focus more acceptable than medial focus, which corresponds to the bias towards English utterance initial focus in both perception tests above and also to the bias in their native language, as was found in previous studies on Spanish focus (García Lecumberri 1995). Accordingly, Spanish NL acceptability patterns are reflected in our listeners' assessment of English focus.

English NL listeners also rate utterance initial focus slightly more acceptable. This bias is correlated to their focus discrimination one, since as we saw, they were also more likely to identify utterance initial focus correctly. As was mentioned this preference may be due to the absence of domain ambiguity for utterance initial focus in English.

Even though lower rated, medial focus was still considered by both native and non native speakers to be within the categories "quite possible" and "totally possible". The difference between the two groups of listeners reaches significance levels in the lower ratings Spanish listeners assign medial focus which, as has been mentioned, may be a reflection of their NL. Nevertheless, Spanish listeners rated utterance medial focus very high if we take into account their focus discrimination results for this structure, particularly in the open test (see 3.3. above). Therefore it is likely that their level of tolerance is quite high to English sounding speech, without this amounting to making them undiscriminating.

V. CONCLUSIONS

English FL learners were consistently less accurate identifying English focus than English NL listeners, which confirmed our expectations: native competence gave and advantage to English NL listeners.

Native competence proved to be particularly advantageous when listeners had to contend with more demanding tasks. Open identification tests were found to be much more challenging than multiple choice tests, and as was expected, both listener groups showed variability in their focus discrimination results as a function of task intrinsic difficulty. But more interestingly, it was seen that differences between the two listener groups reached the largest proportions in the more demanding open test. It is suggested that the open task exerts more demands on explicit knowledge, which neither of the two listener groups are presumed to possess for the structures investigated here since there had been no training nor familiarization with the structures under study. Consequently, listeners had to resort to their implicit knowledge of accentual focus, which is naturally greater in the case of native speakers than in language learners, thus the greater effect of task variability in the FL listener group.

Previous research has shown that accentual focus in Spanish is less frequent and rated less acceptable than it is in English. Therefore the lower identification rates displayed by FL learners as compared to NL listeners in the present study may be seen to be at least partly due to the influence of their own NL. Nevertheless, NL influence in the present study can also be seen to have had positive effects on FL listener's perceptions: the high levels of utterance initial focus identification and the high acceptability scores may be partly due to the fact that accentual focus is not alien to Spanish listeners.

When comparing the perception results obtained for the two types of focus studied separately, we found that both listener groups showed better discrimination and higher acceptability estimations for focus in utterance initial position than for medial focus. This bias in the case of English NL speakers may be due to the fact that focus in medial position may be ambiguous as to its scope whereas focus in initial position does not show this type of ambiguity.

The Spanish listeners' bias towards focus in utterance initial position was much more marked particularly as far as discrimination was concerned. One of the reasons why FL listeners manifested this great bias may be the same one proposed for English listeners' results, i.e., the different ambiguity potential of the two structures. Additionally, accentual focus in medial position is a mechanism used in Spanish too but less frequently than in initial position and than it is in English. Therefore, as was mentioned, English utterance initial focus is likely to be the object of greater positive influence from the learners' NL than medial focus.

Focus identification and focus acceptability results followed similar trends in each of the listener groups and for each focus domain. Therefore, there was consistency between listeners' discrimination and acceptability assessments. However FL learners showed proportionally more tolerance than perceptual accuracy in their results.

English NL listeners rated both types of focus as more acceptable than FL listeners did. Still, FL listeners consider English focus quite acceptable and, in the case of initial focus, they do not differ significantly in their ratings from the NL group. It is open to debate whether FL listeners considered these accentual focus structures quite acceptable because of their knowledge of English or whether their acceptability ratings refered to and/or were caused by the fact that the native English-sounding voice of the stimuli prejudiced them in increasing their tolerance level. Nevertheless, the fact that initial focus obtained higher ratings shows a discriminating assessment which may be explained in terms of NL influence as well as in the above mentioned knowledge of the two English focus domains.

Our results confirm the importance of NL influence on the acquisition of the phonetic/phonological component of a FL. In particular, this study shows that NL influence is also manifest at the suprasegmental level. On the other hand, findings lead us to believe that other factors such as task cognitive demands, inherent linguistic characteristics of the target structure, knowledge of these and a heightened levels of tolerance towards TL speech are also responsible for the perceptions and assessment of FL learners. There are other factors, including personal characteristics and differing TL levels which probably have influence on FL as well as NL listener perceptions of accentual focus but further research is necessary to ascertain the weight of these and other variables.

Acknowledgement

I would like to thank the listeners who took part in these tests. They very generously made room for my tests in their spare time despite their tight work schedules. I am also grateful to Roy Major for his comments and suggestions on an earlier version of this paper.

NOTES:

1. Except for some constructions such as intransitive sentences of the type "the kettle is boiling" in which neutral sentence accentuation falls on the subject or final adverbials and vocatives which are deaccented despite being the last lexical items (Cruttenden 1990).

2. Equally, there are other languages with non-fixed word order which also admit accentual focusing (for example Italian, French, Portuguese and Catalan, see Estebas 2000 for a discussion).

3. In our opinion, Spanish post-focal material is often deaccented and therefore a classic view of nucleus as the last accent in the group would classify such an early focal accent as nuclear (see García Lecumberri 1995). However, in quite similar Catalan contours, Estebas (2000) proposes an analysis of post-focal material as a reduced underlying accent which may or not surface.

4. Sentence initial focus obtained 91.60% correct identifications and a mean naturalness rating of 3.43 (on a scale of 0 to 4) whereas sentence medial focus got 50.19% correct identifications and its mean naturalness rating was 3.24 (see op. cit. p. 71 and 82). The difference between initial and medial focus was statistically significant both as far as percentage of correct perception and naturalness rates were concerned. As far as production is concerned, in scripted tests, sentence initial focus had 85.75% correct productions versus 57.97% for medial focus, the difference being statistically significant too (op. cit. p. 207).

5. This particular point was also analyzed using partly the same data used in García Lecumberri (2000). However, in the present paper the statistical analyses are different as is the discussion presented.

6. R.P. stands for "Received Pronunciation" and it refers to the accent spoken by upper social classes in Britain. It is supposed to be devoid of regional characteristics and therefore often taken as the standard British accent, although it shares many features with south (non western) accents. Other well known terms used for this variety are "BBC English" and "Queen's English" (Trask 1996).

7. Two of them had a "B" in their English exam but so had nine other listeners. If second year half-term results are taken into account, none of these three students got one of the three "A" results recorded.

8. The data for English native perceptions were used in García Lecumberri (1995) but statistic results are different since other tests were applied.

9. It was seen that both English and Spanish listeners considered intonational focus quite natural in their respective NLs. However, English speakers always showed significantly higher naturalness scores. Additionally, the ratings given for utterance initial focus were always higher than those for utterance medial focus, but the difference was only significant amongst the Spanish group (García Lecumberri 1995).

10. A description of each of the scores was also provided as follows: zero = "impossible in English", 1 = "hardly possible", 2 = "possible", 3 = "quite possible" and 4 = "totally possible".

APPENDIX : Target utterances and trigger questions

Initial Focus Sentences

1. Isabel paid the waiter / Who paid the waiter?
2. Andy came for a meal / Who came for a meal?
3. I ordered those dishes / Who ordered those dishes?
4. My neighbour gave a reward / Who gave a reward?
5. Miranda studies languages / Who studies languages?
6. The boy plays the violin / Who plays the violin?

Medial Focus Sentences

7. Gary manages their restaurant / What does Gary do in their restaurant?
8. His friend borrowed the money / What did his friend do about the money?
9. My brother loves animals / How does your brother feel about animals?
10. Diane admires his music / What does Diane think of his music?
11. The war divided the region / What did the war do to the region?
12. David removed his belongings / What did David do with his belongings?

REFERENCES

Altemberg, E. P. & Vago, R. M. (1983). Theoretical implications of an error analysis of second language phonology production. *Language Learning*, 33: 427-447.

Bialystock, E. (1990). *Communication Strategies: A Psychological Analysis of Second-Language Use*, Oxford: Blackwell.

Bialystock, E. (1991). Achieving proficiency in a second language: a processing description: In R. Philipson, E. Kellerman, L. Selinker, M Sharwood-Smith & M. Swain (Eds.), *Foreign/Second Language Pedagogy Research*, Clevedon: Multilingual Matters.

Bohn, O. S. (1995). What determines the perceptual difficulty encountered in the acquisition of non-native contrasts. *XIII International Conference on Phonetics Sciences*, Stockholm, 4: 84-91.

Bolinger, D. L. (1989). *Intonation and its Uses*, Stanford: Stanford University Press.

Bongaerts, T., Planken, B. & Schils, E., (1995). Can late learners attain a native accent in a foreign language? A test of the Critical Period Hypothesis. In D. Singleton, & Z. Lengyel, (Eds.), *The Age Factor in Second Language Acquisition*, Clevendon: Multilingual Matters, 30-50.

Cenoz, J. & García Lecumberri, M. L. (1999). effect of training on the discrimination of English vowels. *International Review of Applied Linguistics*, 37, 4: 261-275.

Cruttenden, A. (1986, 1997). *Intonation*, Cambridge: Cambridge University Press.

Cruttenden, A. (1990). Nucleus placement and three classes of exception. In S. Ramsaran (Ed.)*Studies in the Pronunciation of English: A commemorative volume in honour of A.C. Gimson*, London: Routledge, 9-18.

Cummins, J. (1983) Language proficiency and academic achievement. In J. Cummins & M. Swain (Eds.) (1986) *Bilingualism in Education*. London: Longman, 138-162.

Eckman, F. R. (1981). On predicting phonological difficulty in second language acquisition. *Studies in Second Language Acquisition* 4: 18-30.

Ellis, R. (1994). *The Study of Second Language Acquisition.* Oxford: Oxford University Press.

Estebas, E. (2000). *The Use and Realization of Accentual Focus in Central Catalan with a Comparison to English*, PhD. dissertation, University College London, UK.

Flege, J. E. & Bohn, O. S. (1989). An instrumental study of vowel reduction and stress placement in Spanish-accented English. *Studies in Second Language Acquisition* 11: 35-62.

Flege, J. E. (1992). Speech learning in a second language. In C. Ferguson, L. Menn & C. Stool-Gammon (Eds.), *Phonological Development: Models. Research and Applications*, York: York Press, 565-604.

García Lecumberri, M. L. & Cabrera, M. (1999). Dominio del foco acentual en español frente al inglés. *Proceedings of the Sixth International Symposium on Social Communication*, Santiago de Cuba, 1: 185-190.

García Lecumberri, M. L. & Cenoz, J. (1997). Identification by L2 learners of English vowels in different phonetic contexts. In J. Leather & A. James (Eds.), *New Sounds 97*: Klagenfurt: University of Klagenfurt 196-205.

García Lecumberri, M. L. (1995). *Intonational Signalling of Information Structure in English and Spanish*, Bilbao: UPV/EHU.

García Lecumberri, M. L. (2000). Identificación del foco entonativo inglés por estudiantes frente a hablantes nativos. *Estudios de Lingüística Aplicada* 32: 19-28.

García Lecumberri, M. L., Cabrera, M., Maidment, J. (1997). Accentual realisation of focus in Spanish and English. *ESCA International Workshop on Intonation:* 141-144.

Guiora, A. & Schonberger, R. (1990) Native pronunciation of bilinguals. In J. Leather & A. James (Eds.), *New Sounds 90.* Amsterdam: University of Amsterdam, 26-36.

Gussenhoven, C. (1984). *On the Grammar and Semantics of Sentence Accents*, Dordrecht: Foris Publications.

Halliday, M.A.K. (1976). Theme and information in the English clause. In G. Kress (Ed.) *Halliday: System and Function in Language*, Oxford: Oxford University Press, 174-188.

Ioup, G. (1984). Is there a structural foreign accent? A comparison of syntactic and phonological errors in second language acquisition, *Language Learning*, 34: 1-17.

Kellerman, E. & Sharwood Smith, M. (Eds.) (1986). *Cross Linguistic Influence in Second Language Acquisition*, Oxford: Pergamon.

Leather, J. & James. A. (1991). The acquisition of second language speech. *Studies in Second Language Acquisition* 13: 305-41.

Lengyel, Z., (1995). Some critical remarks on the phonological component. In D. Singleton, & Z. Lengyel, (Eds.), *The Age Factor in Second Language Acquisition*, Clevendon: Multilingual Matters, 124-134.

Maidment, J. A. (1990). Focus and Tone in English Intonation. In S. Ramsaran (Ed.) *Studies in the Pronunciation of English: A commemorative volume in honour of A.C. Gimson*, London: Routledge, 19-26.

Major, R. C. (1987). A model for interlanguage phonology. In G. loup & S. Weinberger (Eds.) *Interlanguage Phonology?: The acquisition of a second language sound system*, New York: Newbury House, 101-124.

Major, R. C. (1990). L2 Acquisition, L1 Loss and the Critical Period Hypothesis. In J. Leather & A. James (Eds.), *New Sounds 90*. Amsterdam: University of Amsterdam, 14-25.

Major, R. C. (1994). Current trends in interlanguage phonology. In M. Yavas (Ed.) *First and Second Language Phonology*, San Diego: Singular Publishing Group.

Major, R. C. (1999). Chronological and stylistic aspects of second language acquisition of consonant clusters. In J. Leather (Ed.), *Phonological Issues in Language Learning*, Oxford: Blackwell, 123-150.

Navarro Tomás, T. (1948). *Manual de Entonación Española*, Madrid: Guadarrama.

Ortiz Lira, H. (1994). *A Contrastive Analysis of English and Spanish Sentence Accentuation*, PhD. dissertation, University of Manchester, U. K.

Scholes, R. J. (1986). Phonemic interference as a perceptual phenomenon. *Language and Speech* 11: 86-103.

Singleton, D. (1995). A critical look at the Critical Period Hypothesis in second language acquisition research. In D. Singleton, & Z. Lengyel, (Eds.), *The Age Factor in Second Language Acquisition*, Clevendon: Multilingual Matters, 1-29.

Sosa, J. M. (1991). *Fonética y Fonología de la Entonación del Español Hispanoamericano*, PhD. dissertation, University of Massachusetts.

Sosa, J. M. (1999). *La Entonación del Español*, Madrid: Cátedra.

Taglicht, J. (1982). Intonation and the assessment of information. *Journal of Linguistics*, 18: 213-230.

Tench, P. (1996). *The Intonation Systems of English*, London: Cassell.

Trask, R. L. (1996). *A Dictionary of Phonetics and Phonology*, London: Routledge.

Wode, H. (1980). Phonology in L2 Acquisition. In S. W. Felix (Ed.), *Second Language Development*, Tübingen: Gunter Narr.

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Obstruent Voicing in English and Polish. A Pedagogical Perspective

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ABSTRACT

'Voicing' in English voiced obstruents has been defined in terms of 'full' vs. 'partial'. When teaching English pronunciation to native speakers of Polish, where voiced sounds can be only fully voiced, it is diffcult to make the students aware of the phonation strategy to be used to obtain 'partially voiced' sounds, especially in plosives. The accessability of digital speech analysis computer software has made it possible to visualize the acoustic properties of speech sounds which can facilitate the teaching of English pronunciation to Poles, providing a visual feedback in class and at home. This is necessary for obtaining the correct phonation control that functions with utmost precision measured in centiseconds.

Yet speech visualisation for the purpose of teaching English phonetics in Poland is employed only at the author's institution, and the remaining hundreds of schools and universities do not take advantage of the possibilities modern technology offers. The 'pedagogical perspective' of the paper aims at exerting an encouraging impact both on teachers of phonetics and on students of English. The article also provides a description of Polish voicing rules and a detailed comparison of voicing in English and Polish obstruents based on the concept of Voice Onset Time.

KEYWORDS: acoustic phonetics, spectrographic analysis, obstruent voicing, VOT phonetic interference, teaching English pronunciation, speech timing, phonology.

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I. INTRODUCTION

Appropriate rendering of voicing belongs to relatively persistent pronunciation difficulties encountered by Poles when they learn English or German, where voicing control is governed by totally different implementation rules than those that are used in Polish (Gonet 1981:309, 315-317). Especially difficult to conceive and implement is the type of voicing often referred to as "partial", applied equally to English fricatives, plosives and affricates. When students rely on this term, they imagine "partial (de)voicing" as a segmental feature that characterizes sounds throughout their articulation[1]. Such an approach makes the acquisition of foreign voicing strategies very difficult if not totally impossible.

In modern perspective, however, voicing is associated with the timing of the vocal fold vibration relative to consonant constriction —narrowing for fricatives, and complete closure for stops (i.e. plosives and affricates). Possible phonation types used in English and Polish are such in which vocal fold vibration can (a) start simultaneously with the formation of the constriction and persist during its whole duration (Polish and English voiced obstruents between voiced sounds), (b) it can be delayed relative to the formation of the constriction (Polish word initial voiced obstruents), (c) it can cease prior to the release of the constriction (English word final "partially" voiced obstruents), (d) it can be simultaneous with the release of the constriction (English word initial partially voiced stops), (e) it can be little delayed relative to the release of the constriction (English and Polish voiceless stops), and (f) it can be further delayed relative to the release of the constriction (English aspirated voiceless plosives), schematically:

Occlusion	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx........	xxxxxxxx............	xxxxxxxxx...............
phonation	xxxxxxx	...xxxxx	xxxxx....	xxxxx	xxxxx	xxxxx
	(a)	(b)	(c)	(d)	(e)	(f)

***Figure 1*: Schematic presentation of the timing relations of voicing to occlusion**

Cases (b) and (d) through (f) are commonly referred to as Voice Onset Time, that is, the time interval that elapses between the release of closure and the initiation of vocal fold vibration[2]: negative for (b), also called prevoicing; simultaneous, or '0', for (d), short positive for (e) and long positive for (f); case (c) is known as 'voicing into closure' (VIC). In literature, these terms are used in reference to stops (plosives and affricates); here we shall extend their application to fricatives, treating the term 'closure' as equivalent to 'constriction' (after all, closure is the extreme degree of constriction).

Correct rendering of these intricate timing relations is very hard to achieve, as it does not involve any specific shifts in the gross configuration of articulators, but rather synchronization of the two components shown in the diagram that requires accuracy of less than 30 ms. Our experience has shown that it is possible to facilitate this process of acquisition of foreign language articulation by the use of visual representation of articulation obtained through computer based devices that present on the computer screen spectrograms and oscillograms in which acoustic correlates of individual articulation gestures can be found. The author's preliminary experiments carried out with Polish adult students of English (cf. Gonet et al 2001) have produced encouraging results which will add to the scarce literature on this subject (e.g. Chun 1988 on the use of visualisation in the teaching of intonation).

II. IMAGING: OVERVIEW

Presence of phonation is easily seen both in the spectrogram, in the form of a voicebar situated at the bottom of the spectrogram, and in the oscillographic waveform, as regular quasiperiodic vibrations (Figure 2):

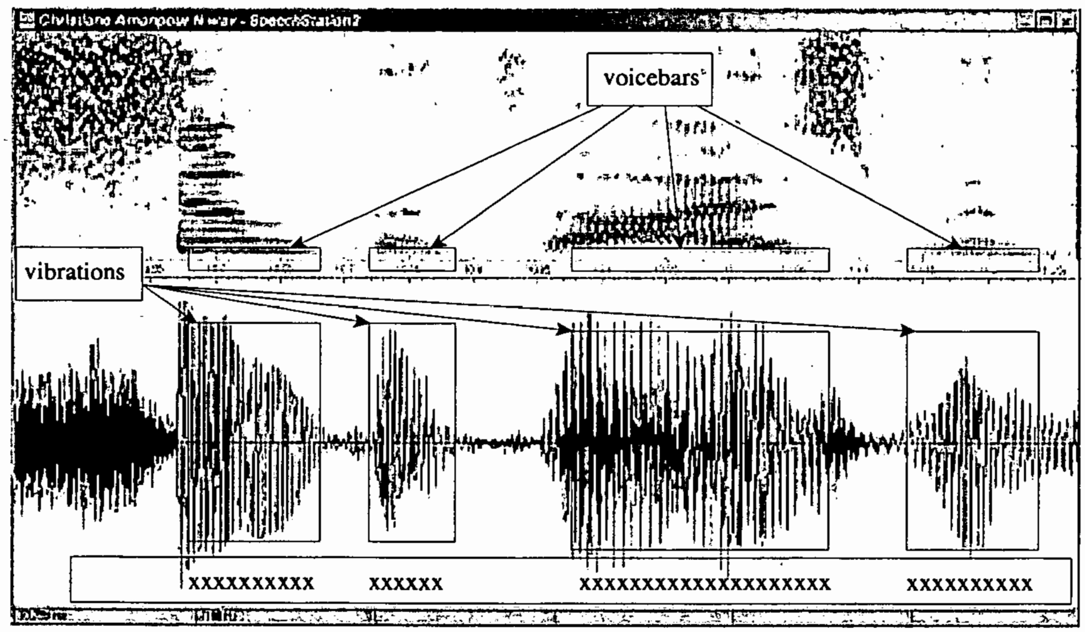

Figure 2: **Phonation marked 'xxx', as seen in a waveform and a spectrogram; clues indicated by rectangles. Utterance 'sympathize with'**

Because the analysis of acoustic images of phonation in fricatives presents a less complicated picture, it will be dealt with first; a discussion of stops will follow.

III. FRICATIVES

Polish word initial fricatives and affricates are either voiced or voiceless. Nowocień (2000:39) shows that in Polish about 20% of the duration of the phonation interval precedes the formation of the constriction of fricatives, and 70%, in affricates.

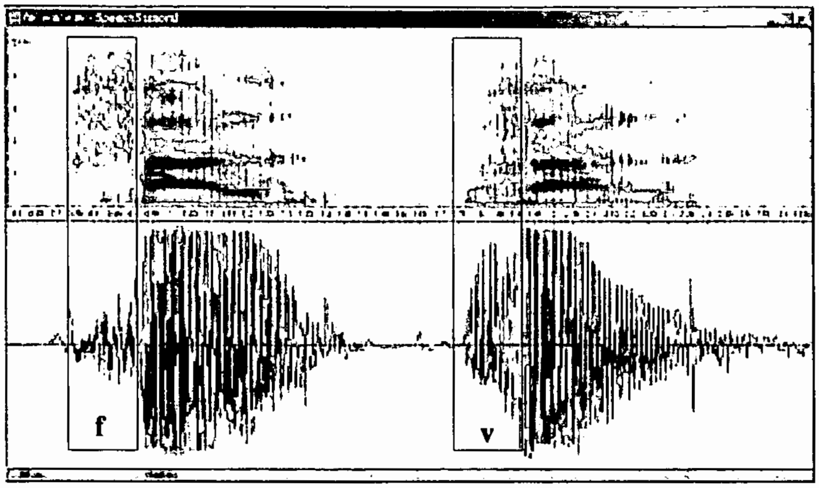

Figure 3: **Polish [fal] ('waves', gen. pl.), [wal] ('hit' voc.). Polish is transcribed using the SAMPA ASCII phonetic transcription; cf. http://www.phon.ucl.ac.uk/home/sampa/polish.htm**

In English, word initial fricatives are 'partially (de)voiced' which, in terms of our typology, represents Case (b) in Fig. 1, i.e. the 'negative VOT' (prevoicing) or, in our terminology, 'voicing from closure'. In Nowocień (2000:40), about 40% of the fricative constriction was voiceless, and 60%, voiced, while in English affricates, voiceless and voiced intervals were of equal duration. Consider the following example coming from the author's database:

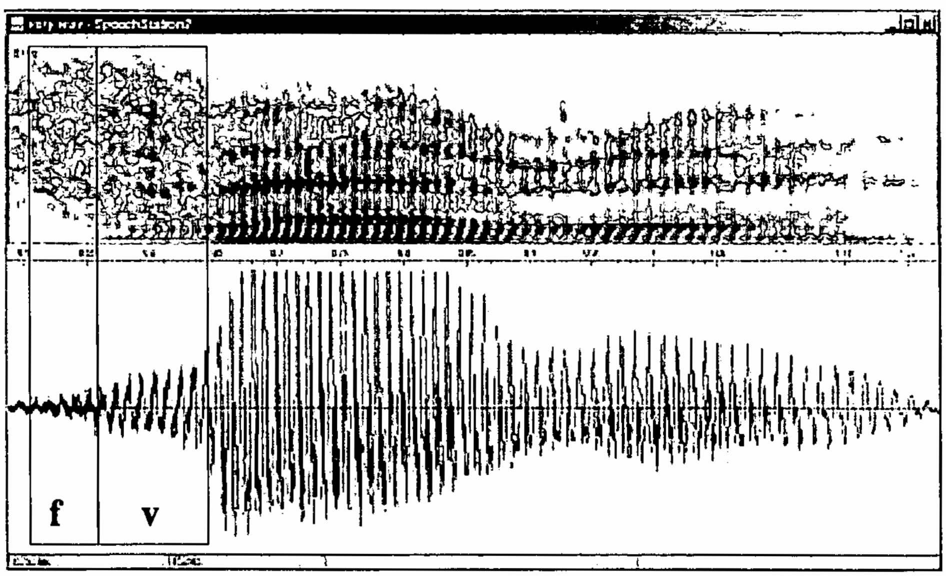

Figure 4: **English 'very'; VOT= - 90 ms (duration of [v] = 160 ms, 44% voiceless [f], 56% voiced [v]**

In word final position Polish admits only voiceless fricatives, irrespective of the morphophonological status of the consonant:

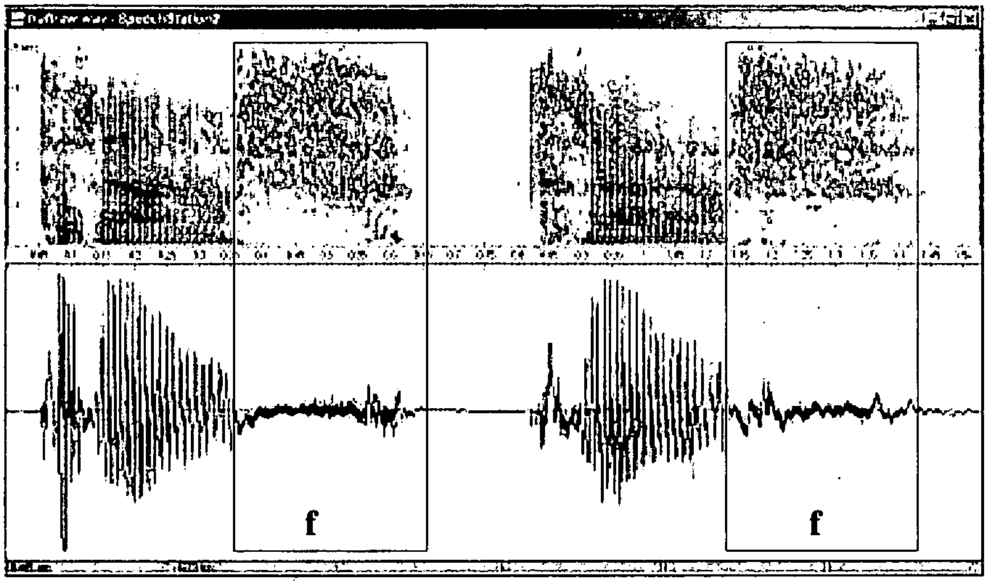

***Figure 5*: Polish 'traf' [traf] ('chance') vs. 'traw' [traf] ('grass', gen. pl.)**

In English, in an analogical environment, articulation requires the use of Case (c) from Fig. 1, i.e. 'voicing into closure'; this, however, results in the formation of a transition segment, in which noise is superimposed on the quasi-periodic vibration[3]; cf. Figures 6 and 7:

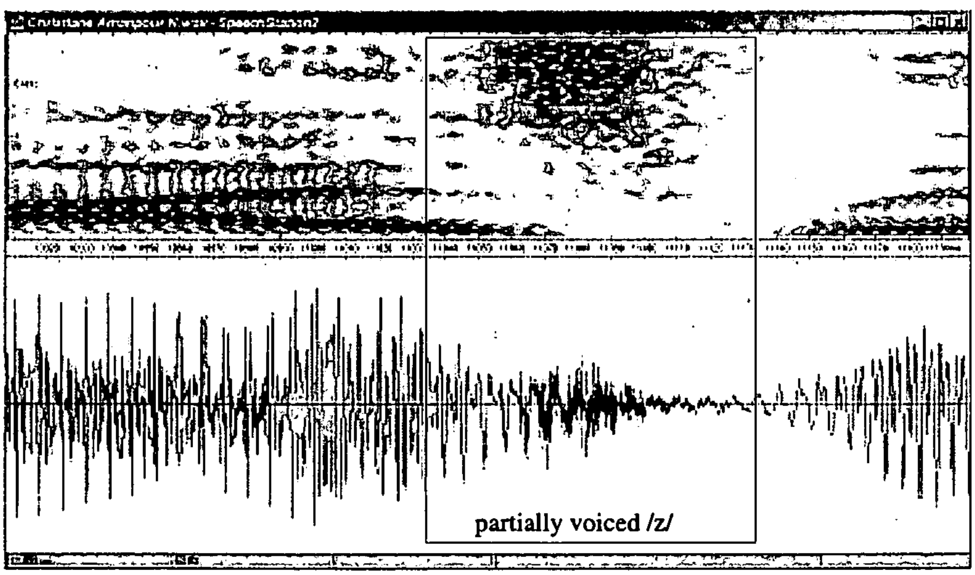

***Figure 6*: English [aiz wi] – part of 'sympathize with'; cf. also Fig. 7**

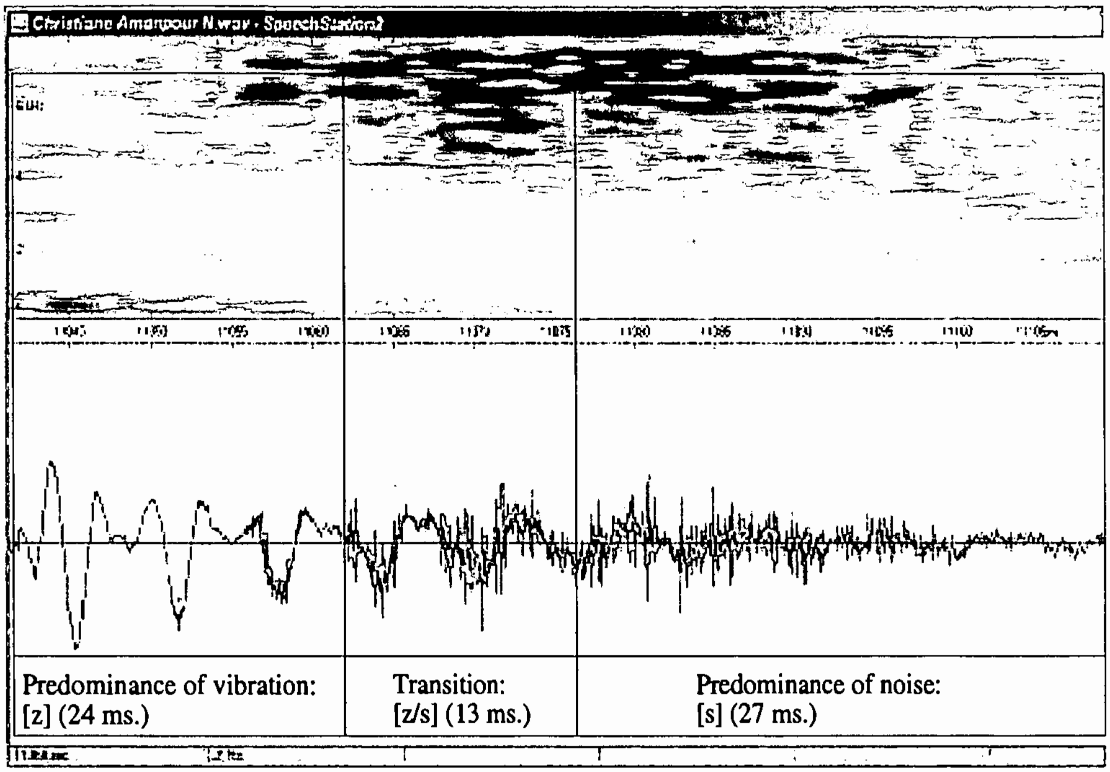

***Figure 7*: Magnification of partially devoiced [z]: voiced part 38%, transition 20%, and voiceless 42% of duration of [z]**

On the basis of data presented elsewhere (Gonet, in preparation), it was found out that the amount of voicing in word final fricatives significantly depends on their place of articulation: the longest voiced part of the fricative (80% of its duration) appears in the interdental fricative; shorter (60% of the duration) voicing is associated with the labio-dental fricative, and the shortest (50%), with the alveolar /s/. This regularity can be explained by referring to perceptual strength of these sounds: the less conspicuous the fricative is, the more care is taken by the speakers to distinguish the lenes from the fortes by prolonging the duration of the voiced interval. Thus, the mellow interdental fricative is usually voiced during almost all of its duration, the more conspicuous [v] is pronounced with a shorter voicing interval, while the most strident [z] is very often voiced in not more than 50% of its duration. This less careful rendering of voicing can also be the result of the interplay of morphology when the voicing value can be predicted in inflectional endings on the basis of the voicing of the segment it precedes.

In English, word medially, partially devoiced fricatives occur adjacent to voiceless sounds (Figure 8):

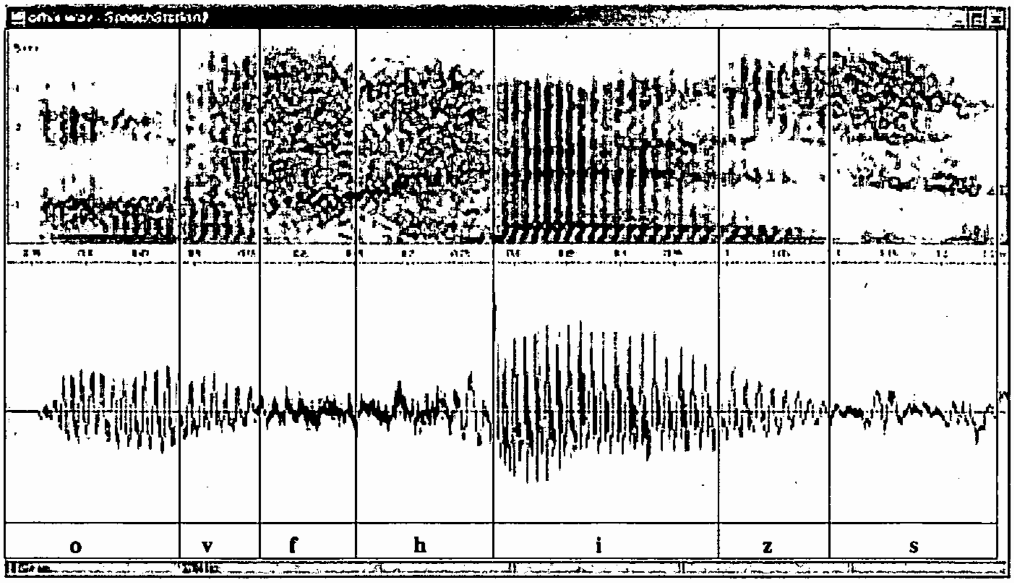

***Figure 8*: English 'of his'; voicing of [v] is preserved partially (transcription shows successive segments)**

In Polish, the choice is limited to fully voiced vs. voiceless consonants, in that voiced fricatives occur in voiced environments. Since members of Polish consonantal clusters have to agree in voicing, and the adjustment always goes in the direction of devoicing, preceding or following voiceless obstruents devoice voiced fricatives (Figure 9):

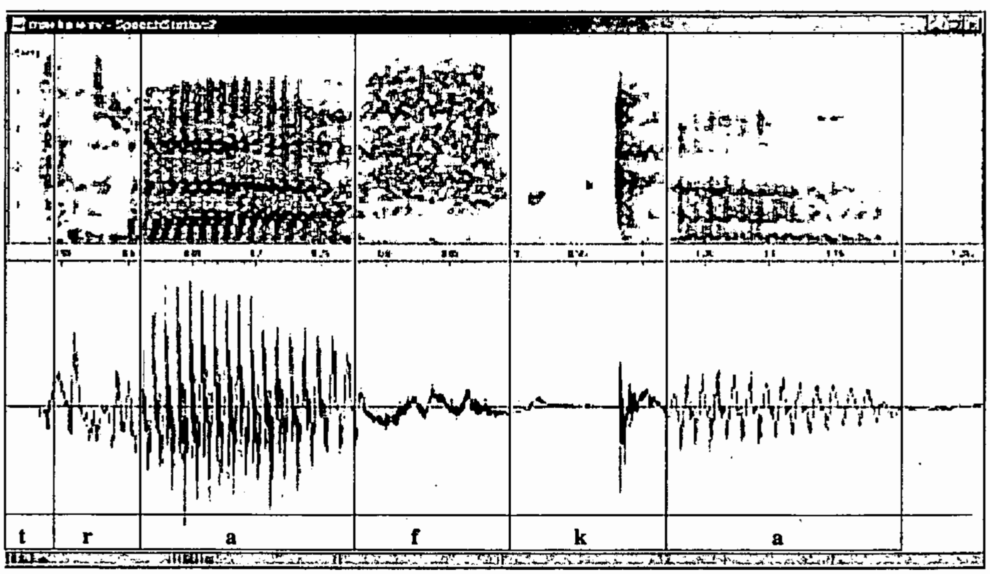

***Figure 9*: Polish 'trawka' [trafká] ('grass', dim.), with fully devoiced /v/**

To sum up this part of the discussion, let us state that for Polish learners of English the correct rendering of voicing in both individual voiceless and fully voiced fricatives is not problematic, as the same sound variants occur in their native language. Problems that appear in other contexts are of two kinds: (1) substitution of English partially devoiced fricatives with Polish voiceless fricatives in clusters with voiceless obstruents and word finally, and (2) correct rendering of "partial (de)voicing".

IV. STOPS

Regarding the realization of voicing in English plosives by Polish learners of English, the crucial contexts are: i) word initial, ii) word medial after a voiceless sound (including clusters with –s), iii) word medial before a voiceless sound, and iv) word final.

IV.1. Word initial position

Similarly to fricatives, word initial stops in Polish are either fully voiced or voiceless, while —as described in numerous textbooks— English requires here a contrast between partially (de)voiced and voiceless aspirated plosives. The control of English voicing by speakers of Polish requires a reshuffling of the timing relations measured with regard to the initiation of voicing and the release of the closure. More specifically, Polish voiced word initial plosives are usually produced with negative VOT (Case b in Fig. 1):

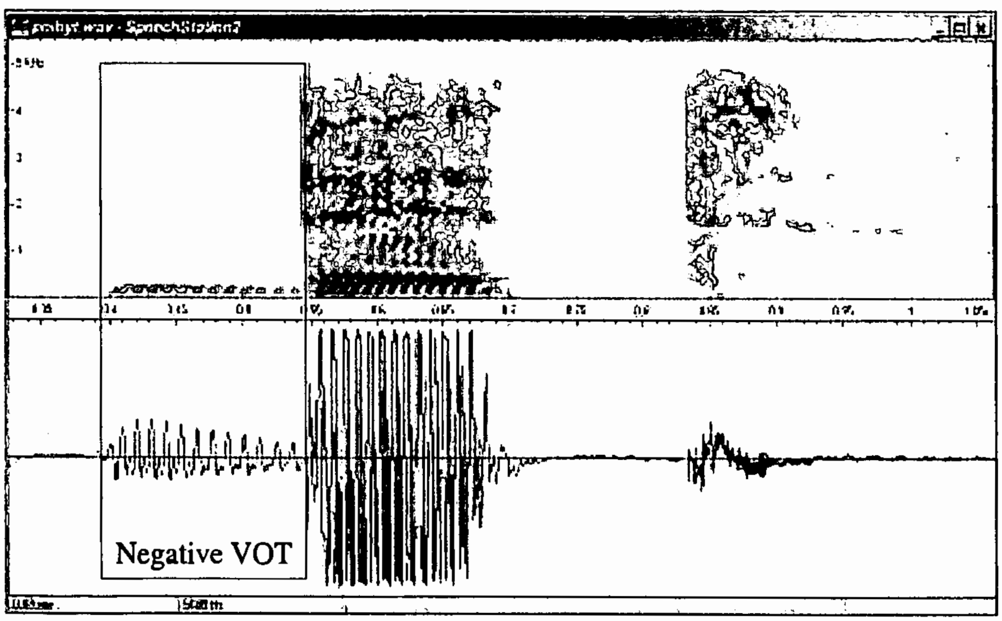

***Figure 10*: Polish word initial voiced plosive in |bIt| with a negative value of VOT**

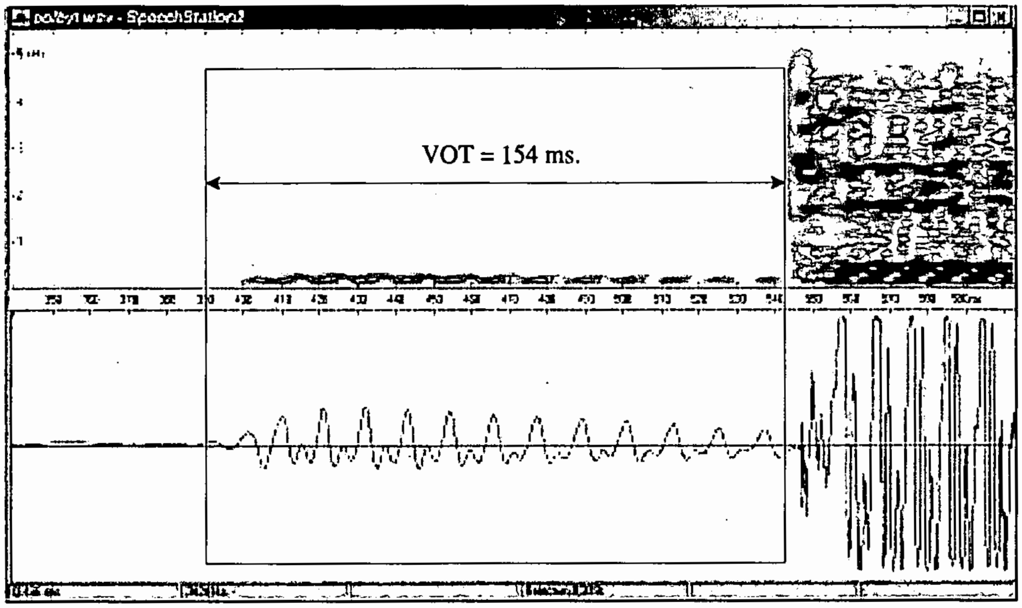

***Figure 11*: Magnification of the relevant part of Fig. 11. for VOT measurement; VOT= minus154 ms.**

Nowocień (2000:41) shows that the mean duration of the pre-plosive and pre-affricate glottal pulsing (prevoicing) in Polish constitutes 70% of the duration of the whole voiced segment associated with the obstruent. Both Gonet (1989) and Nowocień (2000) found native speakers of English who use a similar voicing strategy for English.

Consider now a Polish voiceless plosive (Figures 12 and 13):

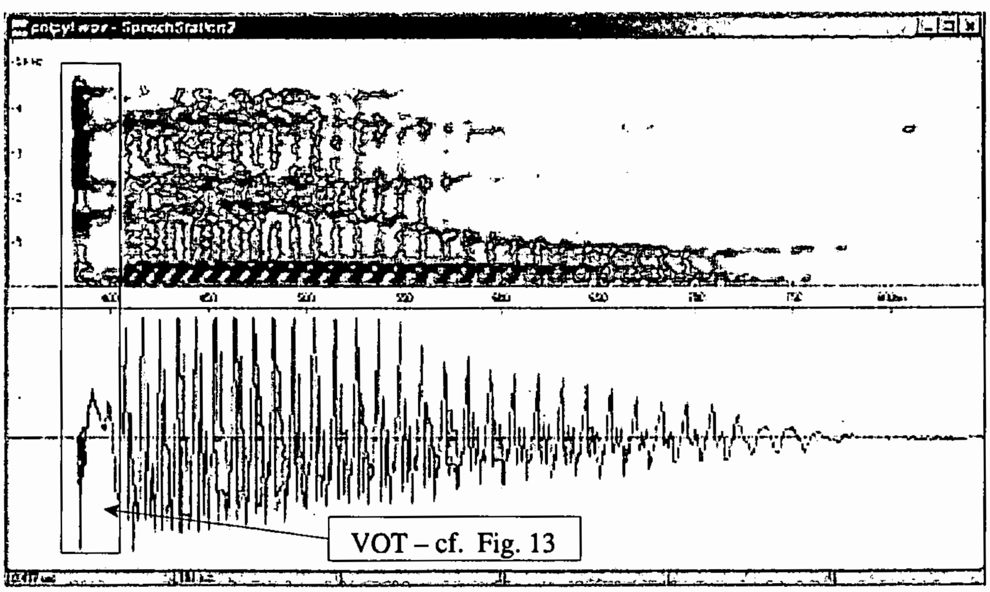

***Figure 12*: Polish [pyw] ('dust')**

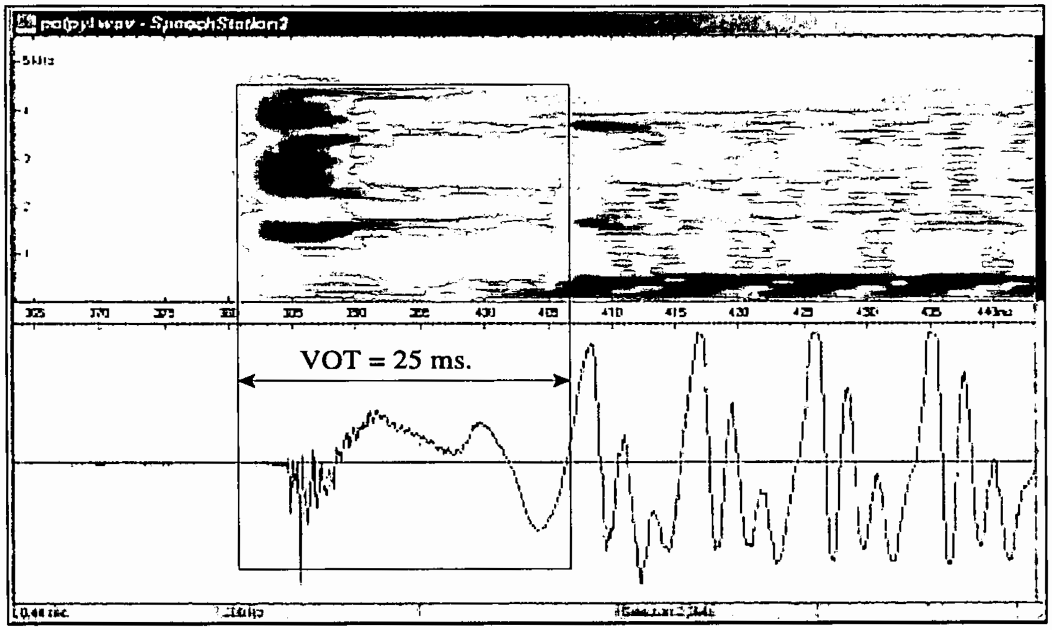

Figure 13: **Polish [pyw] ('dust') — magnification of the relevant part of Fig. 13; VOT=25 ms. The lack of complete correspondence between the spectrogram and the oscillogram is an artefact due to large magnification; both images are complementary.**

Typical "textbook" English voiced word initial plosives require VOT ranging around 0 (from short negative through 0 to short positive):

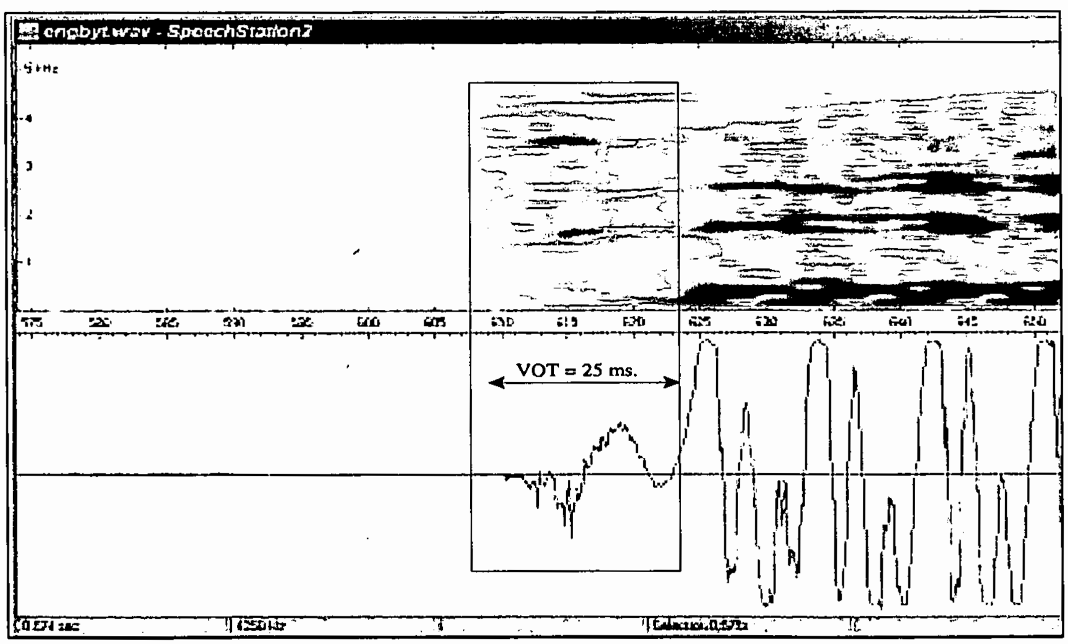

Figure 14: **English word initial voiced plosive 'bit' with short positive VOT=15 ms.**

Such timing of phonation with respect to the release of the closure produces a perceptual effect of "partial voicing", in which serially ordered phenomena are perceived as stable characteristics of sounds. The key to correct rendering of this type of pronunciation by a foreigner lies in the comprehension of the nature of the phenomena involved, and in training backed up by visual feedback provided by the use of speech analysis software; Gonet and Święciński (2001) present a review of programs useful for such a purpose.

English syllable initial fortes that stand before a strongly stressed vowel require 'aspiration' —customarily defined as 'a puff of air'. This definition is harmful to the foreign learner of English as it wrongly leads him to practicing that 'puff of air', thereby making the effect much too strong. Consider a spectrographic and oscillographic image of English 'cow':

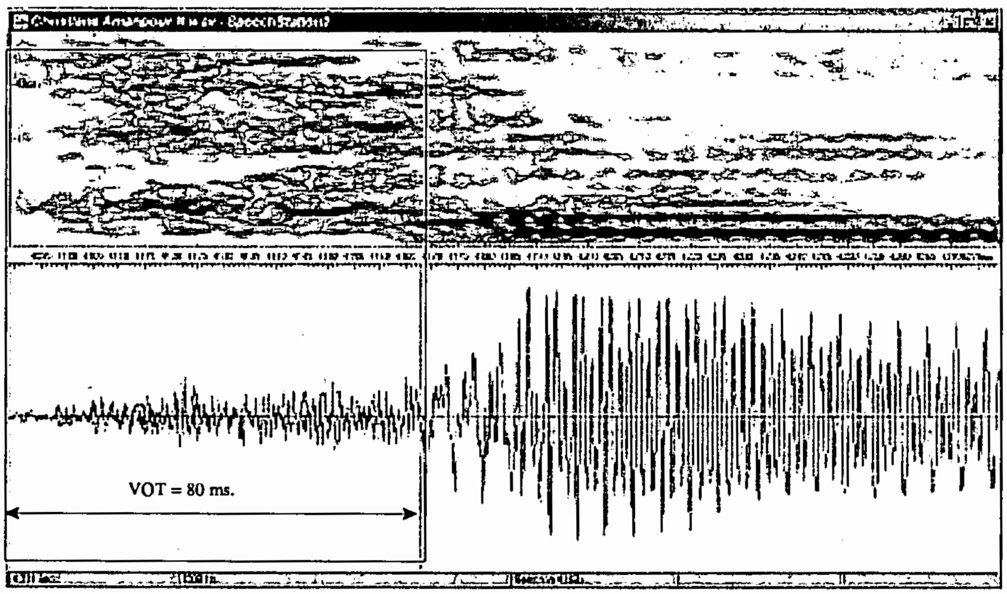

***Figure 15*: English 'cow'; VOT=80 ms., interpreted as 'aspiration'**

The description of aspiration by means of the concept of VOT places it on a par with voicing, indicating that voicing and aspiration function on one axis as various degrees of a property that is used in making a perceptual distinction between the broad categories of 'voiced' and 'voiceless'. One can use VOT measurements to see how strongly 'voiced' sounds are differentiated from 'voiceless' in a given language. Thus, for Polish, a VOT value for a voiceless plosive was –154 ms.(cf. Fig. 11), and the one for a voiced plosive was 25 ms. (cf. fig. 13). Hence the perceptual distance *pd* defined on the VOT axis equals (minus 154)+25=179 ms. For English, the corresponding values are: 15 ms. (cf. Fig. 14) and 80 ms. (cf. Fig. 15); hence the *pd* value for English, calculated on these two examples, equals 80-25=55 ms.; cf. the following diagram[4]:

PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
EEEEEEEEEEEEEE
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
-160 -140 -120 -100 -80 -60 -40 -20 0 20 40 60 80 100
time

Figure 16: **Diagrammatic presentation of voicing distinctions in English (EEE) and Polish (PPP)**

The diagram in Fig. 16 shows two important observations: (1) that the ranges of VOT difference drastically differ in the two languages studied: for Polish, the *pd* difference is large and it reaches 200 ms., while for English it is about one-fourth of this value. This observation prompts explanation of the importance of aspiration in English if the voiced plosive is only partially voiced: aspiration enhances the *pd* low spectral frequency voicing contrast by adding noise placed in the upper part of the spectrum. (2) It also explains why it is often the case that voiced plosives pronounced by native speakers of English are often mistakenly taken by Polish learners of English for voiceless sounds: VOT values for Polish voiceless and English partially voiced plosives overlap (cf. the diagram in Fig. 16).

IV.2. Word medial after a voiceless sound (English: s-)

In both languages a word initial s- cluster requires a following voiceless obstruent; while Polish uses the 'normal' voiceless plosive, English requires an untypical for English unaspirated voiceless plosive. Disregarding strength of articulation, in this context Polish learners of English can use the Polish VOT strategy[5]:

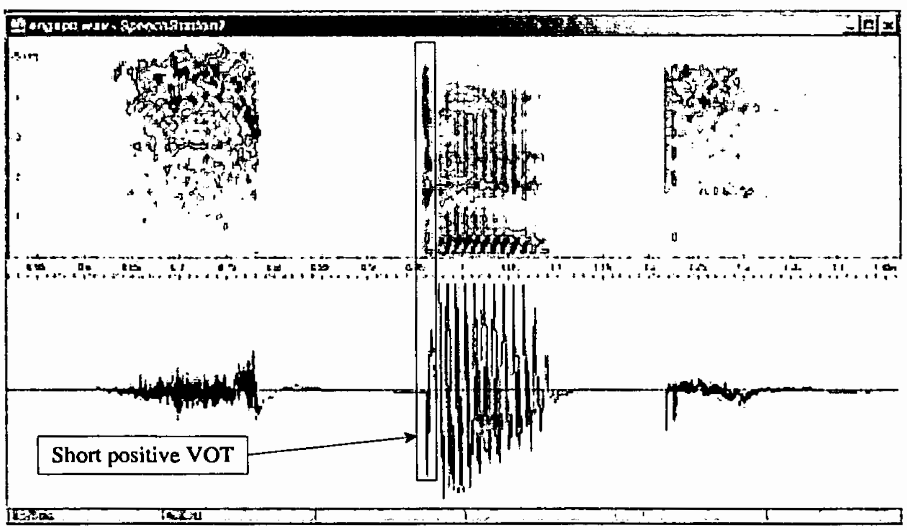

Figure 17: **English 'split': short VOT**

It is now easy to explain why there is no aspiration following a fortis plosive if it is preceded by s-. There have been numerous attempts trying to explain this restriction by claiming that so much effort is expended on the articulation of s- that not much energy is left for aspiration. In fact explanation should be based on a claim that articulatory effort is reduced where it is not necessary[6]. In this case, since s- (which happens to be the only possible first element of a word initial cluster) can be followed only by a voiceless obstruent, and cannot be followed by a voiced obstruent, there is no need to provide an additional cue of 'aspiration' that otherwise serves the function of distinguishing between English 'voiced' and 'voiceless' sounds. Therefore, in the position in which the voicing contrast is suspended (i.e. after s-), /p, t and k/ are not aspirated. Experimental findings show that unaspirated voiceless plosives, when spliced from their natural context and replayed, sound like partially voiced plosives, which strongly supports the observations shown in the diagram in Fig. 16.

IV.3. Word medial voiced plosives appearing before a voiceless sound

In this context English plosives retain their phonemic voicing characteristics, while in Polish they undergo regressive assimilation in voicing whereby the whole cluster becomes voiceless; in fact the process is more general and concerns all obstruents (cf. part 2 above for a description of its implementation on fricatives).

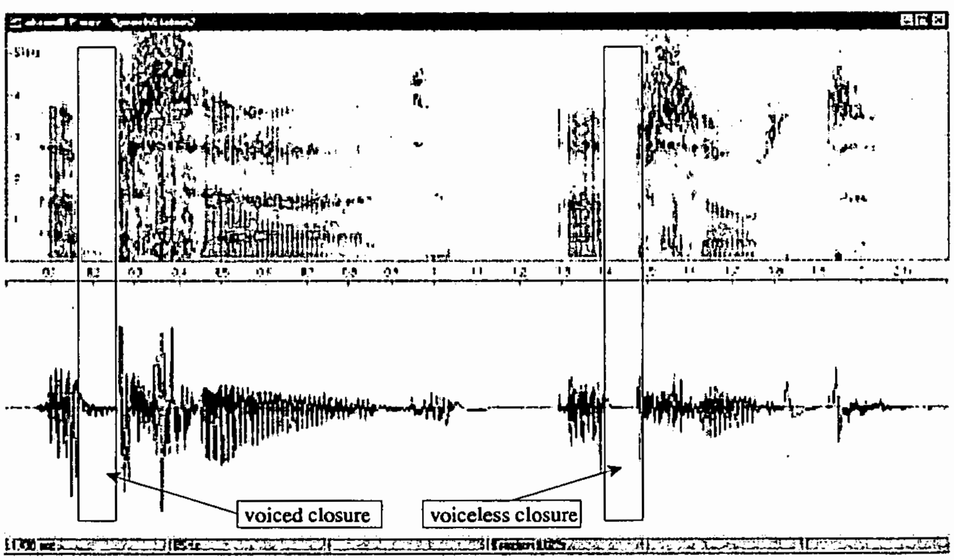

***Figure 18*: English and Polish pronunciation of 'absurd'**

Hence Poles have to learn to retain voicing in clusters if a voiced plosive is followed by a voiceless stop. Access to spectrographic imaging facilitates the acquisition of this initially difficult timing strategy.

IV.4. Word final voiced stops

In the pre-pausal position (i.e. absolute word final position), Polish voiced obstruents lose their voicing, while English voiced plosives retain part of voicing (voicing into closure); in textbook terms, English obstruents in word final position are partially (de)voiced:

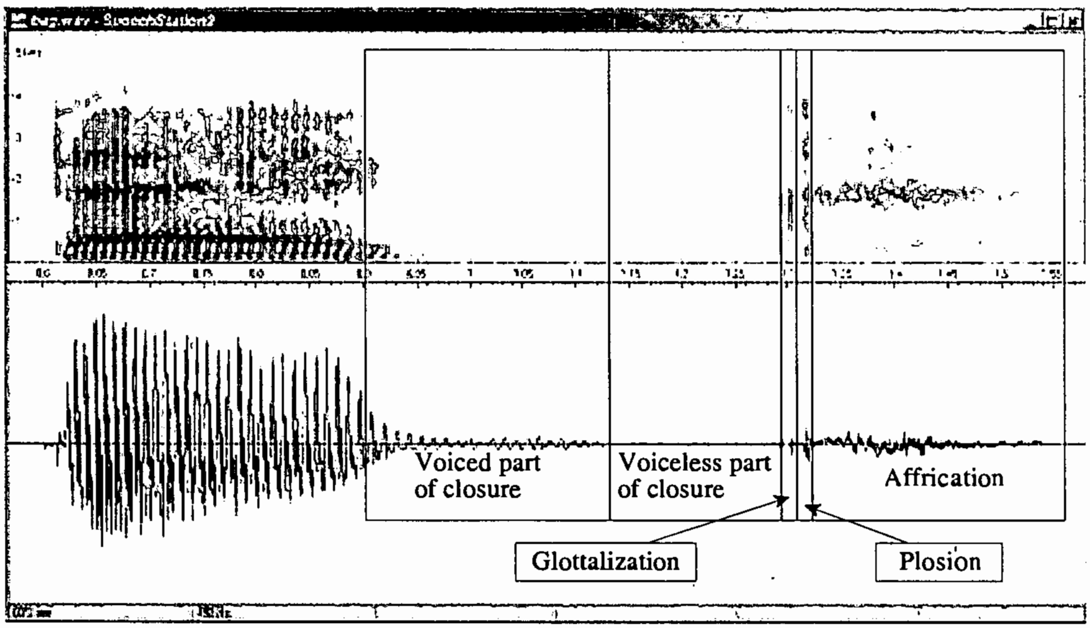

Figure 19: **English 'bag' with a partially voiced [g]; VIC = 219 ms., voiceless part of closure – 165 ms.**

The voicing state of Polish obstruents in this position depends on the geographical accent. In Mid-Central Poland (Warsaw), word final voicing rule is quite general:[7]

$$\begin{bmatrix} -\text{syllabic} \\ -\text{sonorant} \end{bmatrix} \longrightarrow [\,-\text{voiced}\,] \; / \; \_\_ \left\{ \begin{matrix} \begin{bmatrix} -\text{syllabic} \\ -\text{voiced} \end{bmatrix} & (1) \\ \# \# & (2) \end{matrix} \right\}$$

Rule 1: **Regressive devoicing of obstruents – Mid-Central Polish**

Context (2) describes devoicing of all voiced obstruents before a pause (thus, e.g. the word 'zjazd' ('meeting') is rendered as [zjast]. According to Context 1, a voiced obstruent is devoiced before a voiceless consonant immediately following it in the same word, e.g. /v/ in 'wstęp' ('entry') is realized as [f]: [fstemp], or /z/ in 'zjazd' is realized as [s] in [zjast].

In Southern Poland (Cracow-Poznan) the word final obstruent retains its voicing if the following word's initial sound is voiced; the form of the rule is more restrictive than Rule 1:

$$\begin{bmatrix}-\text{syllabic}\\-\text{sonorant}\end{bmatrix} \longrightarrow [-\text{voiced}]\ /\ \_\_\ \left\{\begin{matrix}\begin{bmatrix}\text{syllabic}\\-\text{voice}\end{bmatrix} & (1)\\ \#\#[-\text{voiced}] & (2)\end{matrix}\right\}$$

***Rule 2*: Cracow Voicing Retention**

As can be seen in Rule 2, Context (2) becomes more restricted by confining devoicing only to such cases of connected speech in which the following word begins with a voiceless consonant, e.g. 'wróg ciotki' ('aunt's enemy') is realized as [vrukc'otki], 'grób kolegi' ('colleague's grave') is pronounced as [grupkolegi], 'sad sąsiada' ('neighbour's orchard'), as [satsow~s'ada], etc. Rule 2 implicitly assumes the lack of devoicing of voiced obstruents in other connected speech contexts, i.e. before vowels or before sonorant consonants: 'wróg wujka' pronounced as [vrugvujka] ('uncle's enemy'), 'grób dziadka', as [grubdz'atka] ('grandfather's grave'), 'sad wiśniowy' as [sadvis'n'ovy] ('cherry orchard'), etc.

The occurence of voiced consonants in contexts that usually promote voicelesness can be also due to another Southern Polish derivation mechanism that is shown in Rule 3 below:

$$[-\text{sonorant}] \longrightarrow [+\ \text{voiced}]\ /\ \_\_\ \underbrace{(\#\#)\ \underbrace{\begin{bmatrix}-\text{sonorant}\\+\text{voiced}\end{bmatrix}}_{(1)}}_{(2)}$$

***Rule 3*: Cracow Regressive Obstruent Voicing**

Rule 3 describes voicing taking place in two contexts: (1) in which word boundary '##' is omitted, and (2), in which it *is* taken into account. According to the rule, part (1) causes voicing of the type 'byliśmy' ('we were') realized as [bIliźmy], while part (2) refers to a context that occurs in the next word, e.g. 'gdzieś z waszego' ('somewhere from your...') realizowane jako [gdz'eźzvaSego]; word final /s'/ becomes voiced under the influence of the word initial /z/ in the next word. Spectrogram in Fig. 20 shows a continuity of voicing:

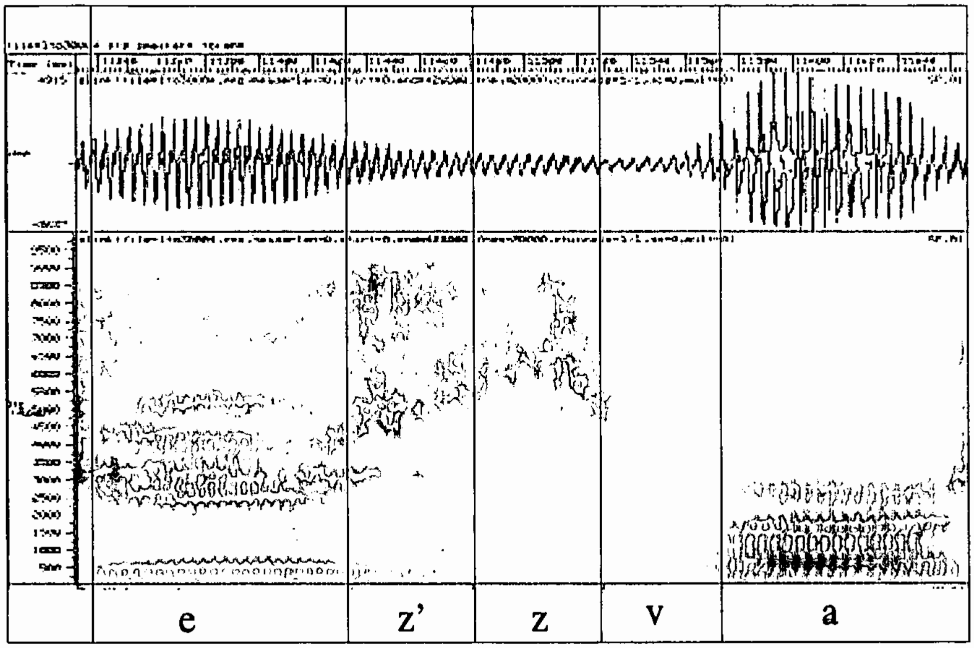

***Figure 20*: 'gdzieś z waszego' realized as [gdz'ez'zvaSego]. Only the non-parenthesized part of the word is shown on the spectrogram**

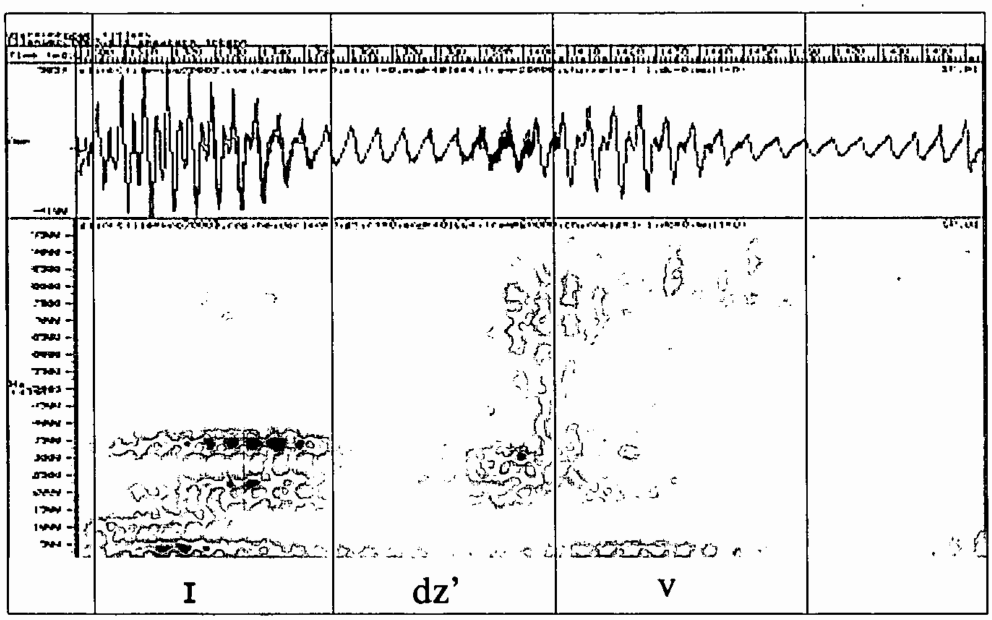

***Figure 21*: 'być w Łodzi' ('be in Lodz') realized as [bIdźvw(odzi)]**

If in the word final position of the first word there is a cluster of voiceless consonants, and the following word starts with a voiced sound, then voicing will concern the whole cluster (through voicing and successive assimilations):

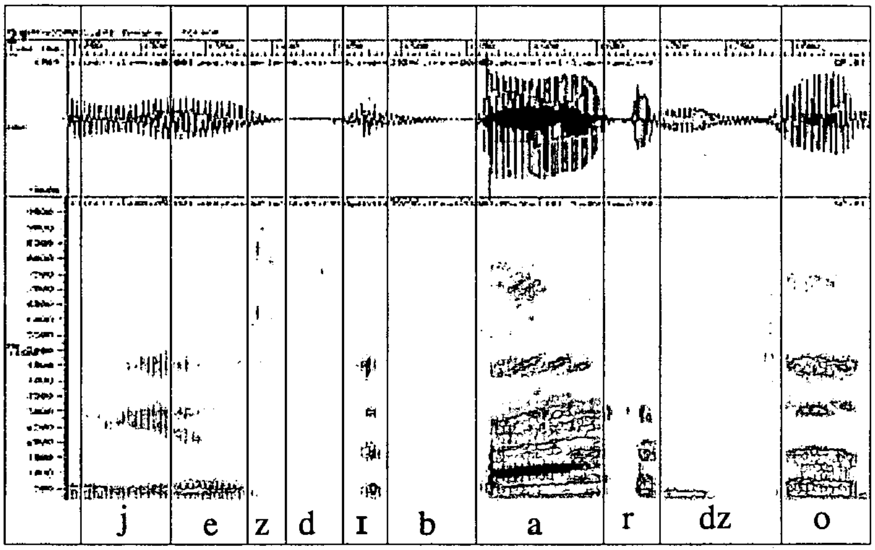

Figure 22: **'jest bardzo' ('is very') realized as [jezdIbardzo]**

As the result of such voicing, the sounds that appear are in fact members of other phonemes; hence it can be said that in this accent variant of Polish, the context of a following voiced consonant causes a neutralization of voicing of word final consonant(s) occurring in the preceding word. The situation can become even more drastic as it can cause the origination of a sound that is not a part of the phonemic inventory of Polish: a voiceless /x/ is voiced to a voiced velar fricative /G/:

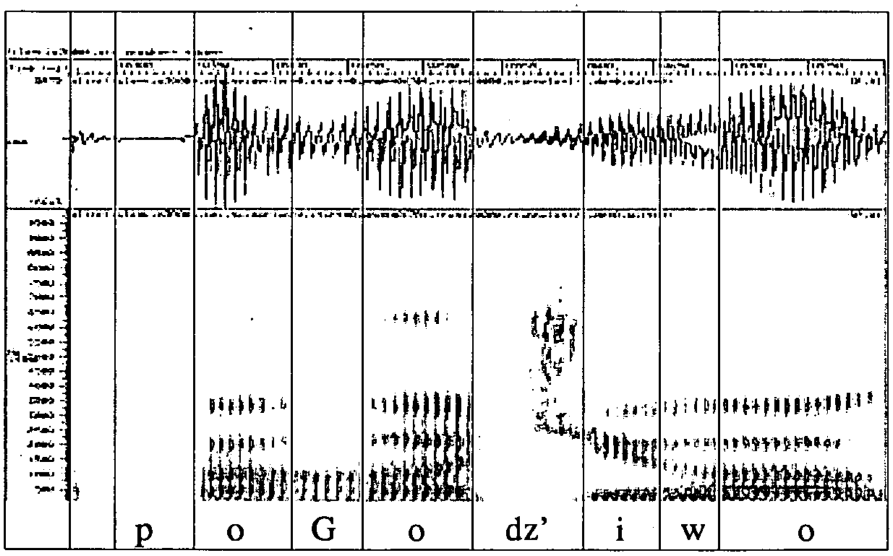

Figure 23: **'pochodziło' realized as [poGodziło]**

Summing up the question of correct rendering of English voicing in Polish learners, there are a number of points which can be regarded as positive phonetic/phonological interference:

(1) Between voiced sounds, English and Polish voiced plosives are fully voiced:
(2) Word final voiceless plosives are voiceless in both languages; optionally, English plosives can be aspirated.
(3) Disregarding force of articulation, an English unaspirated voiceless plosive is identical with a typical Polish voiceless plosive.
(4) If appropriate, Cracow Voicing Retention rule (Rule 2) helps to maintain voicing in word final obstruents.

Negative interference from Polish concerns the following situations:

i) Retention of voicing in word final position;
ii) Retention of voicing before voiceless obstruents;
iii) Correct pronunciation of partial (de)voicing in all appropriate positions;
iv) Cracow Regressive Obstruent Voicing rule (Rule 3).

V. CONCLUSION

Polish admits a two-way contrast, i.e. between fully voiced and fully voiceless obstruents, while English has the following contextual variants of voiced plosives: (i) initially devoiced, (ii) voiceless unaspirated, (iii) voiceless aspirated, (iv) fully voiced, and (v) finally devoiced.

The realization of these facts and practice enhanced by the use of visualization techniques greatly facilitate the acquisition of new pronunciation habits by foreign learners of English. The technique suggested in the present paper can certainly be applied to teaching English pronunciation to learners coming from other language backgrounds. It should be noted that not more than basic knowledge of speech visualization is sufficient to appreciate its pedagogical role.

NOTES:

1. The terms 'partial devoicing' are equivalent: the former emphasizes the result, while the latter, the direction of the process.

2. Cf. Lisker and Abramson (1964), Ladefoged (1975: 124), Port and Rotunno (1975: 654), Cruttenden (2001: 152-153); more references in Gonet (1989: 44-47).

3. According to Jassem (1970), quasi-periodic vibration, noise and the superposition of the latter on the former are three of the four basic types of acoustic events used in speech; the fourth is impulse corresponding to a plosion.

4. The values given here are only illustrative, based on individual measurements. A more extensive study of perceptual distance, based on a large number of examples and evaluated with statistical inference, is under way (Gonet, in preparation).

5. Cf. also Cruttenden (2001:152).

6. For an approach based on interaction between articulatory and perceptual drives consult Boersma (1998).

7. Rule 1 is formulated in the convention of Chomsky and Halle (1968): the slash '/' divides the description of the *change* on its left from the specification of the *context* on its right. The change (or: process) is specified by means of distinctive features that uniquely define the class of sounds undergoing it (non-syllabic non-sonorants à hence obstruents) and its operation (devoicing) The description of the input class, according to the economy convention, is devoid of predictable (redundant) elements; therefore the class of obstruents is not defined here as [+voiced], as devoicing must concern [+voiced] sounds. The context in which the change takes place is indicated by an underscore '___'; in Rule 1, it takes place *before* the specified elements of the context that are disjunctive: either before a consonant (Context 1) or in absolute word final position (i.e. before a pause): '##' (Context 2).

REFERENCES

Boersma, Paul (1998). *Functional Phonology. Formalizing the interactions between articulatory and perceptual drives.* Netherlands Graduate Schoolo of Linguistics.

Chun, D. M. (1998) Signal analysis software for teaching discourse intonation. *Language Learning & Technology*, Vol. 2, No. 1, July 1998, pp. 61-77.

Cruttenden, A. (2001) Gimson's Pronunciation of English. Sixth Edition. London: Arnold.

Gonet, W. (1981) "Legato speech", or the psychology of teaching phonetic fluency. *Lubelskie Materiały Neofilologiczne*, pp. 307-319.

Gonet, W. (1989) *Factorial Analysis of the Duration of R. P. Monophthongs in Monosyllabic Words.* Unpublished Doctoral Dissertation. Lublin: UMCS.

Gonet, W. and G. Pietroń. (1999). Semi-Automatic Continuous Speech Sgmentation and Labelling Procedure. *Speech and Language Technology.* Vol. 3. Poznań: Polish Phonetic Association.

Gonet, W., A. Trochymiuk, M. Goworek and L. Kowalczyk (2001). Protrain© – An Interactive Visual Feedback Pronunciation Training System For Foreign Language And Hearing Impaired Learners. In: Bőttinger, K., S. Dőnninghaus and R. Marzari (eds). Beiträge der Europäischen Slavistischen Linguistik (POLYSLAV 4). München, (Die Welt der Slaven. Sammelbände).

Gonet, W. and R. Święciński. (in press). Speech Lab @ Work and @ Home. *Speech and Language Technology*, Vol. VI. Poznań: Polish Phonetic Society.

Gonet, W. (in preparation). *Articulation and perception of voicing.*

Jassem, W. (1970). *Podręcznik wymowy angielskiej.* Warszawa: PWN.

Ladefoged (1975). *A Course in Phonetics*. New York, Chicago, San Francisco, Atlanta: Harcourt Brace Jovanovich, Inc.

Lisker, L. and Abramson, A.S. (1964). A cross-language study of voicing in initial stops: Acoustical Measurements. *Word* **20**, 384-422.

Nowocień, P. (2000). *Voicing of Polish and English initial lenis obstruents in isolated words.* Unpublished M.A. thesis written under the supervision of Dr. Wiktor Gonet. Lublin: UMCS.

Port, R. F. and R. Rotunno (1979). Relation between voice-onset time and vowel duration. *Journal of the Acoustical Society of America* **66**, 654-62.

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The Acquisition of English Syllable Timing by Native Spanish Speakers Learners of English. An Empirical Study[1]

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ABSTRACT

In this article we present part of the results of an empirical research on contrastive rhythm (English-Spanish). Of the several points dealt with in such a research (syllable compression, foot timing, syllable timing and isochrony of rhythmic units), we refer here to syllable duration in English and Spanish as well as the learning of syllable duration by a group of advanced learners of English whose first language is Spanish. Regarding the issue of syllable timing, a striking result is the equal duration of unstressed syllables in both languages, which challenges an opposite view underlying a teaching practice common among Spanish teachers of English to Spanish learners of that language. As for the interlanguage of the group of Spanish learners of English, we comment on the presence of an interference error represented by a stressed/unstressed durational ratio mid way between the ratios for Spanish and English; we have also detected a developmental error related to the tempo employed by the learners in their syllable timing, which is slower than the tempo produced by native speakers of English.

KEYWORDS: Contrastive prosody, rhythm, timing, SLA, interlanguage phonology.

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I. INTRODUCTION

The contents of the present article are part of the wider scope of an empirical reasearch carried out by me on timing and rhythm in Spanish and English as well as on the rhythmic interlanguage of two groups of learners: a group of native Spanish speakers learners of English and a group of native English speakers learners of Spanish. Of the various research aims and related results obtained in that study, I shall refer here to a contrastive view of the timing of stressed and unstressed syllables in both English and Spanish together with some pedagogical implications for the teaching of English to native Spanish speakers. Linked to the results of this partial study is a tentative explanation of the hypothesis "contrastive perception of syllable timing"; this hypothesis could be considered as part of a more general hypothesis which I have termed "contrastive perception of rhythm" in previous work (Gutiérrez, 1998-99). In accordance with the above-referred scope restriction, I shall only present here those aspects of the overall study -samples, procedures, corpus, results and conclusions- pertaining to the objective singled out for the present report.

II. THE ROLE OF SYLLABLE LENGTH IN ENGLISH AND SPANISH

Syllabic length has two main roles in English and Spanish. The first one, shared with pitch and loudness in various trading relationships, is to act as a correlate of linguistic stress. The second one is to act as a fundamental ingredient in the organization of rhythm and rhythmicality (Crystal 1969). Regarding its status as a stress correlate, syllable duration has been accorded different degrees of importance in the two languages by different authors —always dependent on the other two competing stress correlates, pitch and loudness.

In the competition for ordered priority within a scale of stress correlates, authors seem almost unanimous in ranking loudness as the least important factor. In English, pitch is slightly ahead of duration in most reports (Fry 1955, Bolinger 1958; Adams 1979; Couper-Kuhlen 1986; Kreidler 1989). Regarding Spanish, opinions seem more divided on the issue. Pitch is considered as the main stress correlate by Bello (1949), Real Academia Española (1959), Monroy (1980), Solé (1985), and Figueras & Santiago (1993), while syllable duration would come first according to Gili Gaya (1975), Bolinger-Hoppard (1961), Contreras (1963) and Ríos *et al.* (1988).

The second role of syllable duration has to do with the organization of rhythm. Within the temporal view of linguistic rhythm (Pike, 1945; Abercrombie, 1967) syllable length is central in the structuring of isochrony, be it of stressed-timed units in stressed-timed languages or of syllable-timed units in syllable-timed languages.

As for the non-temporal view of rhythm (Faure *et al.*, 1980), which sees it simply in terms of the alternation of stressed and unstressed syllables, syllable duration is indirectly relevant, since it is one of the three correlates of stress, clearly superseding loudness and in close competition with pitch, as we pointed out above.

According to Jassem *et al.* (1984), with the exception of monosyllabic feet, in which the stressed syllable is longer than in polysyllabic feet, in the latter type of foot both stressed and unstressed syllables have equal duration:

> Individual syllables within a multisyllable NRU [*or "narrow rhythmic unit", which is the equivalent of Abercrombie's rhythmic foot*] tend to be of equal length, i.e., the complete length of a polisyllabic NRU tends to be somewhat equally divided among the constituent syllables
>
> *Jassem et al. (1984: 206)*

Although syllable duration in English is tightly related to the question of foot isochrony and syllable compression as a means for achieving it, both questions fall out of the scope of the present report.

Regarding Spanish, though, when linguists talk about its syllable-timed rhythm or syllabic isochrony, they are basing their rhythmic stand on the assumption that both stressed and unstressed syllables have equal duration or nearly so. O'Connor (1968), Olsen (1972), Hoequist (1983) and several others seek to solve the skewing between postulated isosyllabism and the inevitable variability of physical syllable duration found in several corpora by stating that isosyllabism is ultimately a perceptual construct.

Hoequist (1983) contends that durational variability due to the presence/absence of stress is specific to each language. Olsen offers a stressed/unstressed durational ratio of 1.16 for a half hour talk of a Mexican speaker. Gili Gaya (1940) found a ratio of 1.39 in phonic-group non-final position for a brief prose passage read aloud by a Castilian speaker. Delattre (1966) analysed 5 minutes of spontaneous speech (presumably produced by South American speakers) and found a ratio of 1.23 in non-final position within the phonic group.

Cuenca (1997) offers the following ratios: 2.79 for an English prose passage read aloud and 1.71 for a stretch of English spontaneous conversation; 1.22 for a Spanish prose passage read aloud and 1.10 for a stretch of Spanish spontaneous conversation.

III. ON PHONOLOGICAL LEARNING

The strong hypothesis on contrastive analysis (Lado, 1957) was modulated by the weak version based on error analysis (Wardaugh, 1970). The former attempted to predict interference errors as stemming from L2 items wich were dissimilar to L1 items; the latter explained some errors in terms of interference stemming from L2 items which were similar to L1 items. Errors came to constitute interlanguage features (Selinker, 1972). Both interference and developmental errors (Archibald, 1993; Leather, 1999; Major; 1987) have survived as broad categories amid long-lived discussions on the nature of language learning. Numerous learning hypotheses have been offered to account for phonological learning. Their explanations are based on dichotomies such as difference/similarity between target and mother tongue items, marked/unmarked character of the items to be learned, and rate of learning of the elements specified in the afore-mentioned dichotomies through different learning stages.

Related to the dichotomy difference/similarity we have Flege's *Perceptual Target Approach* (Flege,1981), Kuhl's *Native Language Magnet,* (Kuhl, 1991; Inverson and Kuhl, 1995), and Major's *Ontogeny Model* (Major, 1987). Based on the marked/unmarked dichotomy are Eckman's *Marked Differential Hypothesis* (Eckman,1977), later on modified as the *Structural Conformity Hypothesis* (Eckman, 1991), and Carlisle's *Intralingual Marked Hypothesis*. A combination of the dichotomies similarity/difference and marked/unmarked with rate of adquisition through learning stages underlies Major and Kim's (1999) *Similarity Differential Rate Hypothesis*.

If we mention the main hypotheses which have been used in connection with phonological learning, it is to stress the fact that in practice phonological learning has been restricted to segmental phonological learning, and, to my knowledge, those hipotheses have not been used to account for timing errors, which, by the way, fall within the scope of the present report. The lack of application of such hypotheses to account for rhythmical learning and the learning of timing is probably due to the fact that concepts such as *similarity, dissimilarity, marked and unmarked* are easier to apply to discrete units (segments, syllables, etc.) than to non-discrete ones. Rhythmic learning can best be explained in terms of more or less of features (like stress-timing and syllable-timing) which are increasingly viewed as scalar. We could safely say that prosodic universals are far from established; let alone the related notions of similarity and markedness at the prosodic level. Whatever one has to say about learning rate (and, consequently, about hypotheses contemplating such learning variable) must be based on longitudinal studies, and ours only contemplates a group of advanced SL learners. Therefore, we shall be content with detecting and typifying the timing errors present in our group of English learner's interlanguage as either interference or developmental errors. We will appeal to Flege's hypothesis, though, for a tentative explanation of one of the errors.

IV. OBJECTIVES

As advanced in the introduction, two are the objectives we shall focus on in the present report:

1. A comparison of syllable timing in English and Spanish. It is our intention to find out to what extent there are meaningful intralinguistic and interlinguistic durational differences between stressed and unstressed syllables in the two languages.

2. The pursuit of the previous objective will be supplemented by a consideration of the pedagogical implications for the teaching/learning of English to/by Spanish speakers. To that effect we shall analyse syllable timing in the interlanguage of a group of Spanish speakers learners of English.

V. THE STUDY

Although a summary of the experimental design was first presented in Gutiérrez (1996) and a more detailed account was given in Gutiérrez (1998-1999), we reproduce it here for easier reference but with some fundamental changes in scope. In the two works cited different aspects of three *corpora* produced by as many groups of speakers were analysed:

a. Spanish by native speakers (G-1)
b. English by native speakers (G-2)
c. Spanish by English speakers learners of Spanish (G-3)

In the present study, corpus (a) and (b) are used again but corpus (c) is absent, and instead a corpus of English produced by a group of Spanish speakers learners of English is used under the name G-3 in accordance with the second objective set up in the previous paragraph.

V.1. Samples

Seven Spanish speakers, all of them students in their last year of studies in English Philology at the University of Murcia, Spain, were used in the study, first as members of G-1 (that is, as native readers of a Spanish text), then as members of G-3 (that is, as non-native readers of an English text). The informants, advanced learners of EFL (English as a Foreing Language) were randomly chosen; from the Murcia region, they are all educated speakers of Standard Spanish, in some cases with a light aspiration of [s] in coda position. 7 educated native speakers of English were chosen to form group G-2 (that is, as native readers of an English text). 3 of the British speakers were students at Salford University and the remaining 4 studied at Essex University; they were all RP speakers in their final year of studies.

V.2. Instrument

Two texts were used, an English text and a Spanish text, each consisting in the transcription of a combine of extracts of various televised (80% of the total) or radioed (the remaining 20 %) dialogues, which were illustrative of colloquial speech constrained only by the presence of cameras or microphones during their production. An extract of both texts is shown in the Appendix.

V.3. Procedure

The Spanish text was read aloud by the G-1 informants. The English text was read aloud by both the the G-2 and G-3 informants. The reading output for each of the 3 groups of informants lasts some twenty minutes. Previous to the reading-aloud stage, the informants were allowed to read the text silently in order to get familiarised with its content and thus minimise the number of false starts and pauses during the reading-aloud process. Also previous to their reading aloud, the informants were instructed to read at normal speed, that is, with the speed of somebody speaking spontaneously in public[2]. The readings of the G-1 and the G-3 speakers were recorded in a "Radio Nacional" recording studio in Murcia, using an AEQ mixing deck with a REVOX open-reel master recorder and an AKG-190 unidirectional and cardioid microphone. The recordings were subsequently transferred on to a cassete tape (using a TASCAM 122K cassette recorder) for use in a phonetics laboratory.

Three G-2 members were recorded in a recording studio at Salford University using a SONY F-30 michrophone and a DTC 1000ES mixing deck with a SONY open-reel master recorder whose contents were transferred later on to a cassette tape (using a TAMBERG AT-771) for use in the phonetics laboratory. The other 4 components of G-2 were recorded at the University of Essex using a SONY-DTC-57ES cassette recorder and a 7-730 unidirectional and cardioid michrophone.

Two groups of judges were used in order to determine the actual stress placement in the recorded texts by the 3 groups of readers. One group of judges was formed by 9 educated native speakers of Spanish who had to determine stress placement as produced by the G-1 members (Spanish by native readers). The other group of judges was formed by 9 educated native speakers of English who had to determine stress placement as produced by both G-2 (English by native readers) and G-3 (English by non-native readers) members. Since the judges were linguistically naive, they were asked to tick the syllables which they heard as "prominent" in the speech chain as they listened to the short utterances into which the text had been divided. Each utterance was sounded only twice for the judges in order to minimise their expectancy of stress (only those syllables heard as prominent should be marked, not those the judges thought ought to be prominent). After the stresses had been adjudicated, only those syllables judged as stressed by two thirds of the judges were computed as such by the researcher.

The 3 *corpora* thus obtained (one for G-1, another for G-2 and a third for G-3) were divided into tone units in order to discard from our counts the syllables falling under the 'tonic segments' (or 'nuclear tones') of the tone units. Such a decision surely begs an explanation: we should remember at this stage that the present account —length of stressed and unstressed syllables in English and Spanish— is only a small part of the wider scope of our original research, which covered, among other things, timing of various units and rhythmic organization in the two languages. It is no secret that the constraints on the rhythmic organization of the pretonic segment (or "head") are different from those operating at the tonic segment. In the latter, syllable duration tends to be longer than in the pretonic segment and this holds true for both stressed and unstressed syllables. Furthermore, in the tonic segment durational differences between stressed and unstressed syllables are easily levelled out. Moreover, the unstressed syllables can be noticeably longer than the (stressed) nuclear syllable due to the slurring effect determined, among other things, by their final position within tone unit, by the nuclear-tone type (simple, complex, etc.), and by the number of nuclear tone-bearing syllables. This fact allows the researcher, at least from an operational standpoint, to restrict the analysis of linguistic rhythm to the pretonic segment, where syllable timing and rhythmic organization can be said to be, if not totally independent from intonation, at least not affected by nuclear tones.

For the division of the corpora into tone units the same criteria were used as in Gutiérrez (1983 and 1995); we will simply list them here:

a. Jump to a high pitch level after a falling tone.
b. Jump to a low pitch level after a rising tone.
c. Jump to a high or a low level after a level tone.
d. Extra-length of nuclear tone-bearing syllables.
e. *Anacrusis* after final unstressed syllables in a tone unit.

Omitted from our count were also syllables belonging to rhythmic feet which had been fragmented by the readers' false starts or hesitation pauses. The rest of the syllables, that is, those which had not been affected by the constraints mentioned above were ready for durational measurements. Recordings were digitalised by means of an AD convertor of the type CED-1401, and syllable duration was measured on the oscillographic display using the "Waterfall" program (Cambridge University) to that effect.

The following criteria were adopted regarding durational measurements:

a. All stressed syllables, that is, those at rhythmical "ictus" position were measured.

b. The remiss of all rhythmic feet, that is, the stretch of unstressed syllables in each foot, was also measured. In this way we skipped or minimised the troubles involved in setting boundaries between every single pair of phones in an utterance and —to a great extent— between syllables. It was only necessary to establish the boundaries between ictus and remiss. Dividing total duration of each remiss by the number of unstressed syllables in it, we got average durations for unstressed syllables.

c. Regarding plosive consonants, their measurement started at the plosion stage when they occurred word-initially (i.e., after silence), and at the closing point when followed by silence. In utterance mid-position we followed Well's (1990) criteria for syllable delimitation in English; in Spanish, plosives always occur at syllable heads and were thus computed as part of such heads.

VI. DISCUSSION OF RESULTS

V.1. Results pertaining to groups G-1 (Spanish by native speakers) and G-2 (English by native speakers)

We have compared Spanish stressed and unstressed syllables (as produced by native Spanish speakers) with their English counterparts (as produced by native English speakers). Using a t-test to compare the mean difference in durational values for the non-related groups G-1 and G-2, the following meaningful results were found:

a. The mean duration of tonic syllables is smaller in Spanish than in English.

b. The mean duration of unstressed syllables is the same in both languages.

NSF	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-1	17	211.57	45.51	37	-1.80	0.079
	G-2	22	244.58	63.64			
2	G-1	62	150.80	49.22	161	-6.45	0.000
	G-2	111	206.53	55.97			
3	G-1	158	151.08	49.85	328	-8.73	0.000
	G-2	72	200.56	52.97			
4	G-1	162	148.10	59.20	235	-7.94	0.000
	G-2	75	213.45	58.41			
5	G-1	53	195.60	50.10	81	1.40	0.166
	G-2	30	178.94	54.37			
6	G-1	38	154.19	44.04	47	-2.82	0.007
	G-2	11	195.74	39.35			
7	G-1	13	193.13	101.59	13	0.24	0.813
	G-2	2	175.20	3.96			

Table 1a: t-test to compare the partial mean durational values (for each type of foot) of stressed syllables of groups G-1 y G-2. The mean durations of stressed syllables of group G-1 are shorter than those of G-2, except for 1, 5 and 7-syllable feet (NSF = number of syllables per foot), in which durational differences are not meaningful (for 1-syllable feet, the mean duration is shorter in Spanish than in English; for 5 and 7-syllable feet, the mean duration is longer in Spanish than in English).

	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
Tonic syllable	G-1	509	158.58	57.26	923	-12.33	0.000
	G-2	416	204.80	56.00			

Table 1b: t-test to compare the global mean duration of stressed syllables of groups G-1 and G-2. The mean duration of stressed syllables is significantly shorter for G-1 than for G-2.

NSF	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-1	—					
	G-2	—					
2	G-1	62	111.56	32.32	160.72	-0.13	0.895
	G-2	111	112.46	55.14			
3	G-1	158	115.71	41.31	328	0.91	0.361
	G-2	72	111.72	38.10			
4	G-1	162	117.13	26.46	101.05	-6.18	0.538
	G-2	75	120.45	42.81			
5	G-1	53	116.21	34.51	81	2.57	0.012
	G-2	30	97.93	23.86			
6	G-1	38	119.13	18.11	47	0.72	0.477
	G-2	11	114.31	21.89			
7	G-1	13	112.83	30.59	13	0.37	0.716
	G-2	2	104.50	9.45			

Table 2a: t-test to compare the partial mean durational values (for each type of foot) of unstressed syllables for groups G-1 and G-2. The mean durations of unstressed syllables for group G-1 are the same as those for G-2, except for 5-syllable feet, in which the mean duration of unstressed syllables for G-1 is longer than the mean duration of the unstressed syllables for G-2.

	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
Non-tonic syllable	G-1	492	116.05	33.00	724.36	1.31	0.188
	G-2	394	112.60	42.82			

Table 2b: t-test to compare the global mean duration of stressed syllables for groups G-1 and G-2. The mean duration of unstressed syllables for G-1 is the same as that for G-2.

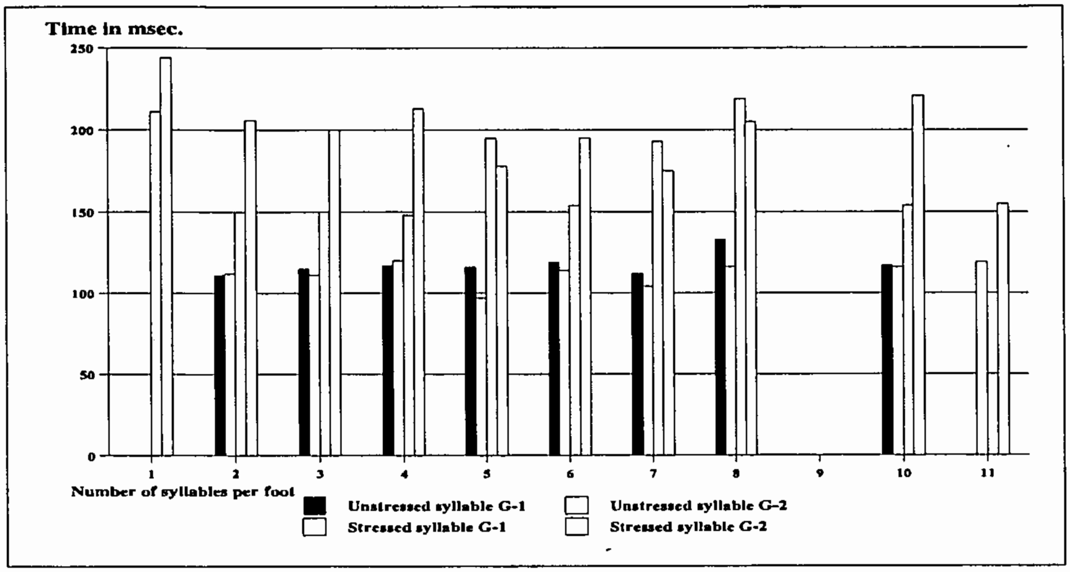

Figure 1: Comparison of tonic and non-tonic syllables by native Spanish speakers (group G-1) and native English speakers (G-2). Inter-group comparison showed a significant difference in length for tonic syllables and no significant difference for non-tonic syllables

The details of the comparison appear in Tables 1A-B (for stressed syllables) and 2A-B (for unstressed syllables). In Figure 1 an histogram shows the same comparison of stressed and unstressed syllables in Spanish (G-1) and English (G-2).

Among the above results, the one relating to the equal mean duration of unstressed syllables in both languages is particularly striking. Since the text-production conditions were the same for both groups of speakers (reading aloud at normal speed), confirmation of this finding in new experiments involving a similar type of speech (reading aloud) in languages other than English and Spanish would bring support to what appears as an emerging phonetic universal regarding the equal duration of unstressed syllables. A serious impediment against such possibility, though, seems to be the interlinguistic durational differences caused by variation in speaking rate as reported by Bertinetto (1981): this author suggests that an increase in the speaking rate brings about a proportional reduction in the duration of both stressed and unnstressed syllables in syllable-timed languages (such as Spanish), whereas the same increase would cause a greater compression in unstressed syllables than in stressed ones in stressed-timed languages (such as English). Since our own study does not include the speaking rate variable, we cannot test Bertinetto's suggestion.

In the meantime a pedagogically far-reaching feature of our finding is that it runs counter to a well-established prejudice among Spanish teachers of English. A common piece of advise heard in EFL classrooms filled with native Spanish-speaking students runs as follows: "you should make English stressed syllables much longer than the Spanish ones and the English unstressed syllables much shorter than the Spanish ones". In the light of our data, the first part of the admonition seems adequate, but the second one would be utterly misleading. Such advice is, no doubt, rooted in the native Spanish speaker's impression of excessive shortening of unstressed syllables in native English speech. Such an impression is triggered by the fact that stressed syllables are markedly longer in English than in Spanish (see Tables 1A-B). The durational difference between English stressed and unstressed syllables is attributed by the Spanish-minded ear partly (and rightly) to the longer length of English stressed syllables in comparison with the Spanish ones, and partly (and also wrongly) to a would be (but non-existent) shorter duration of unstressed syllables in English than in Spanish.

This subjective perception of English timing by native speakers of Spanish is related to what Gutiérrez (1996) calls "contrastive perception of rhythm", and could be termed "contrastive perception of syllable timing".

NSF	GROUP	N	MEAN RATIO	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-1	—					
	G-2	—					
2	G-1	62	1.47	0.64	161	-4.21	0.000
	G-2	101	2.27	1.40			
3	G-1	158	1.51	1.07	328	-4.63	0.000
	G-2	172	2.06	1.07			
4	G-1	162	1.42	1.30	235	-3.52	0.001
	G-2	75	2.00	0.91			
5	G-1	53	1.92	1.23	81	-0.01	0.003
	G-2	30	1.93	0.70			
6	G-1	38	1.34	0.48	47	-2.52	0.015
	G-2	11	1.79	0.65			
7	G-1	13	1.96	1.30	13	0.29	0.773
	G-2	2	1.68	0.11			

Table 3a: t-test to compare partial mean stressed/unstressed durational ratios for groups G-1 and G-2. The mean durational ratios for G-1 are significantly smaller than the mean durational ratios for group G-2, except in 7-syllable feet, in which the ratio for G-1 is greater than the ratio for G-2.

	GROUP	N	MEAN RATIO	STANDARD DEVIATION	df	t-VALUE	PROB
Ratio	G-1	486	1.52	1.11	842.54	-7.48	0.000
	G-2	391	2.08	1.11			

Table 3b: t-test to compare the global mean durational ratios (R) for groups G-1 (Spanish by native speakers) and G-2 (English by native speakers). The ratios are significantly different ($P < 0{,}05$ %). Since H_0: R for G-1 = R for G-2, and H_1: R for G-1 $\neq$ R for G-2, we accept H_1: R for G-1 < R for G-2.

A comparison of the mean durational ratio for stressed/unstressed syllables in English with the same type of ratio for Spanish by a t-test shows that the ratio for Spanish (1.52) is significantly smaller than the ratio for English (2.08). The terms of the comparison appear in Tables 3A-B. The extent of the difference in stressed/unstressed ratios between English and Spanish found in our data confirms Hoequist's statement in the sense that, from among the many factors determining syllable duration, only the presence/absence of stress can determine language-specific durational differences between stressed and unstressed syllables.

It is also possible to consider the contrastive durational ratios of English and Spanish as indexes for the explanation of the contrastive perception of English syllable timing by Spanish ears in the terms referred above. It is as if the durational ratio of English (2.08), substantially greater than the Spanish one (1.52), were misinterpreted by the Spanish listeners in terms of their attributing to English unstressed syllables a shorter duration than they actually have.

V.2. Results relative to group G-3 (English by non-native speakers)

The partial mean durational values (for each type of foot) of stressed syllables were smaller for G-2 (English by natives) than for G-3 (English by non-natives). Through use of a t-test, that difference proved to be significant (Table 4A). The same result obtains when we compare the global mean durational values of stressed syllables for the two groups of informants (Table 4B).

NSF	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-2	22	244.58	63.64	52.42	-2.44	0.018
	G-3	37	290.98	80.75			
2	G-2	101	206.53	55.97	152.24	-4.94	0.000
	G-3	87	256.55	78.81			
3	G-2	172	200.56	52.98	281	-6.77	0.000
	G-3	111	247.73	63.39			
4	G-2	75	213.45	58.41	118	-2.17	0.032
	G-3	45	238.09	62.83			
5	G-2	30	178.10	54.37	58	-2.50	0.015
	G-3	30	214.94	56.10			
6	G-2	38	195.74	39.35	9.45	0.98	0.350
	G-3	11	225.97	80.34			

Table 4a: t-test to compare the partial mean durational values (for each type of foot) of stressed syllables for groups G-2 and G-3. The mean durations of stressed syllables for group G-2 are significantly shorter than those for group G-3, except 6-syllable feet, in which it is longer.

	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
Tonic syllable	G-2	416	204.81	56.10	585.12	-9.36	0.000
	G-3	319	250.47	72.17			

Table 4b: t-test to compare the global mean duration of stressed syllables for groups G-2 and G-3. The mean duration of stressed syllables for group G-2 is shorter than that for group G-3.

Use of a t-test to compare the partial mean durational values of unstressed syllables (for each type of foot) for groups G-2 and G-3 yielded the same result: the mean durations for group G-3 were significantly greater than those for group G-2 (Table 5A). Comparison of the global mean durational values of unstressed syllables also gave the same result: the mean values were significantly greater for G-3 than for G-2 (Table 5B). A graphic representation of syllable duration for each type of foot is shown in Figure 2.

NSF	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-2	—					
	G-3	—					
2	G-2	101	112.46	55.14	167.61	-4.59	0.000
	G-3	87	153.69	66.43			
3	G-2	172	111.71	38.10	169.10	-6.33	0.000
	G-3	111	149.59	58.63			
4	G-2	75	120.45	42.80	118	-2.87	0.005
	G-3	45	141.10	33.84			
5	G-2	30	97.93	23.86	58	-5.90	0.000
	G-3	30	135.85	25.84			
6	G-2	11	114.31	21.88	17	-3.535	0.003
	G-3	8	162.00	36.91			

Table 5a: t-test to compare the partial mean durational values (for each type of foot) of unstressed syllables for groups G-2 and G-3. The mean durations of unstressed syllables for group G-2 are shorter than those for G-3.

	GROUP	N	MEAN DURATION	STANDARD DEVIATION	df	t-VALUE	PROB
Non-tonic syllable	G-2	389	112.6	42.82	509.72	-9.18	0.000
	G-3	282	148.6	54.92			

Table 5b: t-test to compare the global mean duration of unstressed syllables for groups G-2 and G-3. The mean duration of unstressed syllables for group G-2 is shorter than that for group G-3.

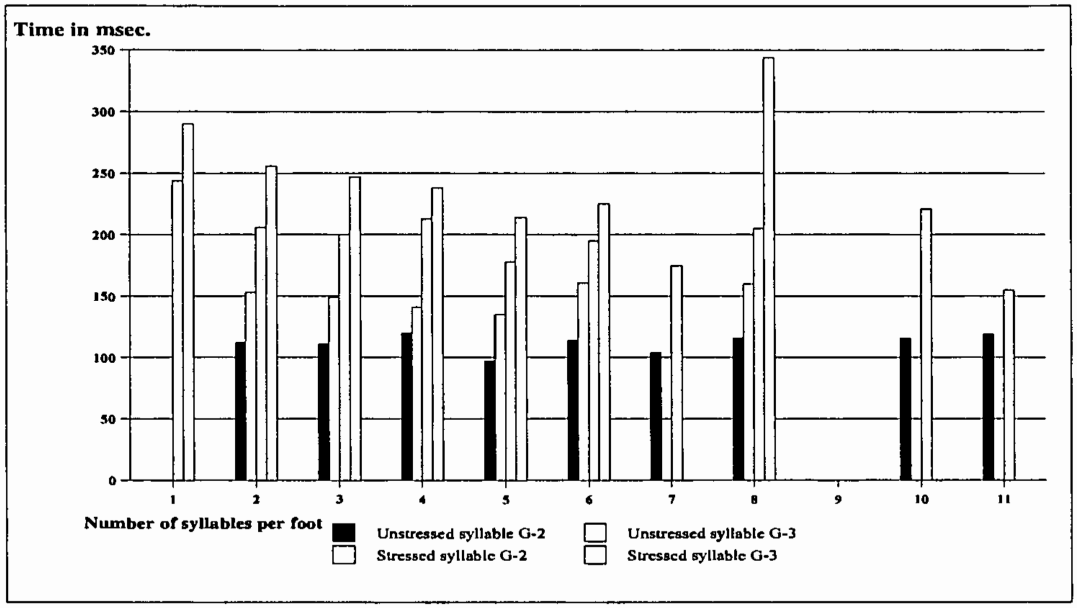

Figure 2: Comparison of tonic and non-tonic syllables by groups G-2 (English by native speakers) and G-3 (English by non-native speakers). Inter-group comparison showed a significant difference in length for both tonic and non-tonic syllables

Though this is not the right place for a detailed account of rhythmic feet and its parts as produced by G-2 and G-3, we would like simply to point out that the global mean durations of foot, ictus (i.e. stressed syllable) and remiss (all unstressed syllables in a foot) were significantly greater for our English learners (G-3) than for English native speakers (G-2). The reason for recalling such data of the broader original research is to give strength to our pedagogical explanation of the greater mean durations of all units involved in the speech of our group of English learners in comparison to what happens in the speech of native speakers (G-2). That overall greater duration is a feature of our advanced learners interlanguge that could be accounted for by a slower reading tempo —remember that the reading-aloud conditions were the same for both groups of speakers— most probably trigered by the learners' lack of fluency in the articulation of segmental sound sequences. It could not be attributed to faulty command of lexigrammatical contents, since, previous to the informants' reading aloud, the researcher made sure that that was not the case. Since that tempo error is also present in the first stages of first language acquisition —as long as learners have deficiencies related to mastery of linguistic components and to skill development—, we can safely assume that in the present case we are dealing with a developmental error related to the acquisition of English syllable timing and caused by a deficient command of canonical articulatory speed.

Comparison for each type of foot of the mean stressed/unstressed ratio for G-3 (1.90) with the ratio that obtained for G-2 (2.08) showed that the former is non-significantly greater than the latter (see Table 6A). Comparison of the same ratios taken globally (i.e. independently of how they are distributed in different foot-types yealds a significantly greater ratio for G-2 (Table 6B). The interesting thing about the learners' ratio (1.90) is that it is intermediate at some point between the Spanish (G-1) and the English (G-2) ratios (2.08 and 1.52 respectively), and that begs an interpretation. Interference from their mother tongue would cause the learners's to fall short of meeting the target ratio; it looks like a weak interference though, since the target attained by the students (1.90) is nearer to the target ratio (2.08) than to the "departure ratio" of their mother tongue (1.52). Perhaps we could force Flege's (1981) hypothesis of *Perceptual Target Approach* to account for the result if we allow the learners' ratio to be interpreted as a "mixed perceptual target", i.e. a sort of compound of the ratios of both the first and the foreign language.

NSF	GROUP	N	MEAN RATIO	STANDARD DEVIATION	df	t-VALUE	PROB
1	G-2	—					
	G-3	—					
2	G-2	101	2.27	1.40	186	0.72	0.475
	G-3	87	2.12	1.51			
3	G-2	172	2.06	1.07	281	1.37	0.171
	G-3	111	1.89	0.91			
4	G-2	75	2.00	0.91	118	1.34	0.181
	G-3	45	1.79	0.71			
5	G-2	30	1.93	0.70	58	1.76	0.084
	G-3	30	1.64	0.55			
6	G-2	11	1.79	0.65	17	1.13	0.275
	G-3	8	1.45	0.64			

Table 6a: t-test to compare partial mean stressed/unstressed durational ratios for groups G-2 and G-3. The mean durational ratios for G-2 are significantly greater than the mean durational ratios for group G-3.

	GROUP	N	MEAN RATIO	STANDARD DEVIATION	df	t-VALUE	PROB
Ratio	G-2	389	2.08	1.11	674	-2.07	0.038
	G-3	282	1.90	1.08			

Table 6b: t-test to compare the global mean stressed/unstressed durational ratios (R) for groups G-2 and G-3 The ratios are significantly different ($P < 0,05$ %). Since H_0: R for G-2 = R for G-3, and H_1: R for G-2 $\neq$ R for G-3, we accept H_1: R for G-2 > R for G-3.

VII. CONCLUSIONS

We will end up by summarising the results and their interpretation:

1. *Conclusions related to syllable length in English and Spanish*

a. The mean duration of tonic syllables is significantly smaller in Spanish than in English.

b. The mean duration of unstressed syllables is the same in Spanish as in English.

c. A "contrastive perception" of English syllable timing by native speakers of Spanish could be at the basis of a long-standing prejudice among many Spanish teachers of English, who keep encouraging their pupils to make English unstressed syllables much shorter than they actually are.

d. The stressed/unstressed syllable durational ratio is significantly greater in English than in Spanish. The mother tongue-biased perception of such ratio could be behind the misperception of the duration of English unstressed syllables by Spanish native speakers' ears.

2. *Conclusions related to syllable timing in the speech of the English learners*

a. In the English speech of Spanish learners of English (group G-3) both stressed and unstressed syllables are significantly longer than the same syllables in the speech of native speakers of English. We consider that such difference can be attributed to a slower tempo in the speech of the former, which in turn is likely to be caused by a lack of full proficiency in the application of canonical articulatory speed, a deficiency also detected in our learners' production of other English speech units such as the rhythmic foot, ictus and remiss. This error is thus developmental.

b. Our learners' mean syllable durational ratio falls between the ratio for Spanish and the ratio for English as produced by their respective native speakers. It is significantly different from both the two others, but is nearer to the English ratio than to the Spanish. At this point our learner's interlanguage shows an atenuated interference or transfer error.

By way of a final observation, it is obvious that much more research is needed in support of a hypothesis that points to the same duration of unstressed syllables as a result of reading aloud at normal speed in English and in Spanish. Bertinetto's stand about varying correlations between speaking rate and syllable duration should be tested in appropiate experiments using reading-aloud outputs in both languages using different language styles.

Psychoacoustic experimentation is also needed to test our hypothesis of 'contrastive perception of timing' as the basis for a 'contrastive perception of rhythm'. Such experimentation would have to aim at establishing the patterning of redistribution of the duration of different English segmental and suprasegmental units carried out by Spanish learners of English during their perception of such units, including the role of transfer substitutions during the perceptual process. Of course the strength of the afore-mentioned hypotheses would be enhanced by testing them in experiments that include other pairs of (first and second) languages.

NOTES:

1. The content of the present article is part of a broader research project financed by the Spanish Minister of Educaction and Science (Ref. BE91-198) and carried out at the Cognitive Phonetics Laboratory, University of Essex (UK). I am grateful to Prof. Mark Tatham for his technical assistance.

2. An advantage of our *corpora* is the naturalness of their language in comparison with the use of distorted or non-linguistic materials in other studies (such as isolated words or non- linguistic stimuli inserted in carrier sentences).

APPENDIX

Fragment of the Spanish text

A: Entre las medidas urgentes, las fundamentales son ahora mismo construir viviendas de protección oficial y, especialmente las que vayan destinadas a aquellas personas que no tienen capital inicial.
B: Yo no estoy de acuerdo con usted, porque, ¡mire usted!, hay ayuntamientos que han clasificado mucho suelo y otros han clasificado poco; en todos por igual ha aumentado el precio de la vivienda y ha aumentado el precio del suelo. El mercado del suelo tiene sus características particulares como casi todos los mercados.

A: Se ha dicho siempre que en España la justicia era lenta, cara e insegura. ¿Sigue siendo así?.
B: Yo pienso que la justicia es lenta; es cierto que es lenta. No es quizás más lenta en España que en otros países europeos. Yso esto siempre lo he dicho.
A: ¿Cómo observa la Presidenta de la Audiencia Provincial de Barcelona la puesta en funcionamiento del jurado popular?.

Fragment of the English text

A: How do you actually recommend people to relax? What's a good exercice for that?
B: Well I think the thing is you can't relax until you recognise tension. You've got to know when your neck is beginning to ache because you've looked down too long.
A: What would you recommend?
B: I believe in sensible eating. I think that so much has been written and talked about it that most of us know about food values and about the things that make us fat ...

A: Would it bother you if other people read your letter if you are not a Cabinet Minister?
B. Frankly, I don't think it would. They re listening to my telephone conversations. That's never bothered me. I've discovered that it's dangerous, and that the chemical process it goes through is as risky as the chemical processes that have been blowing up all over Europe.

REFERENCES

Abercrombie, D. (1967). *Elements of General Phonetics.* Edinburgh: University Press.

Adams, C. (1979). *English Speech rhythm and the foreign learner.* The Hague: Mouton.

Bello, A. (1949). *Gramática de la lengua castellana.* Buenos aires.

Bertinetto, P. M. (1981). *Strutture prosodiche dell'italiano. Accento, quantitá, sillaba, giunture, fondamenti metrici.* Firenze: academia de la Crusca.

Bolinger, D. (1958). *Intonation and its parts: melody in spoken English.* London: Edward Arnold.

Bolinger, D & M. Hoppard (1961). Acento melódico, acento de intensidad. *Boletín de Filología de la Universidad de Chile* 13: 33-48.

Carlisle, R. (1988). The effect of markedness on epenthesis in Spanish/English interlanguage phonology. *Issues and Developments in English and Applied Linguistics* 3: 15-23.

Contreras, C. (1963). Sobre el acento en epañol. *Boletín de Filología de la Universidad de Chile* 15: 223-237.

Couper-Kuhlen, E. (1986). *An introduction to English Prosody.* London: Edward Arnold.

Crystal, D. (1969). *Prosodic systems and intonation in English.:* Cambridge: University Press.

Cuenca, H. (1997). *Estudio comparativo del ritmo inglés y español.* Unpublished Doctoral Dissertation: Universidad de Sevilla.

Delattre, P. (1966). A comparison of syllable length conditioning among languages. *International Review of Applied Linguistics* 4 (3): 183-88.

Eckman, F. (1977). Markedness and the contrastive analysis hypothesis. *Language Learning* 27: 315-30.

Eckman, F. (1991). The structural conformity hypothesis and the acquisition of consonant clusters in the interlanguage of ESL learners. *Studies in Second Language Acquisition* 13 (1): 23-42.

Faure, G., D. Hirst & M. Chafcouloff (1980). Rhythm in English: isochronism, pitch, and perceived stress. In L. Waugh, y C. van Schooneveld (eds), *The Melody of language: intonation and prosody.* Baltimore: University Park Press. 71-80.

Figueras, C. y M. Santiago (1993). Producción del rasgo acentual mediante síntesis de voz. *Estudios de Fonética Experimental* 5: 115-128.

Flege, J. (1981). The phonological basis of foreign accent: a hypothesis. *TESOL Quarterly* 15 (4): 443-45.

Fry, D. (1955). Duration and intensity as physical correlates of linguistic stress. *Journal of the Acoustical Society of America* 27: 765-768.

Gili Gaya, S. (1940). La cantidad silábica en la frase. *Castilla* (Valladolid) 1: 287-98.

Gili Gaya, S. (1975). *Eflementos de Fonética General.* Madrid: Gredos.

Gutiérrez, F. (1983). Aspectos lingüísticos de la segmentación del tono en inglés, castellano y catalán. *Actas del I Congreso Nacional de AESLA* (Universidad de Murcia, 1982). Madrid: SGEL, pp. 179-90.

Gutiérrez, F. (1995). *La función demarcativa de la entonación en inglés, castellano y catalán.* Murcia: Servicio de Publicaciones de la Universidad de Murcia.

Gutiérrez, F. (1998-99). Aprendizaje de la pronunciación del español por anglohablantes: distorsión rítmica y timing. *Revista Española de Lingüística Aplicada* 13:7-26

Hoequist, Ch. (1983). Durational correlates of linguistic rhythm categories. *Phonetica* 40: 19-31.

Inverson, P. & P. Kuhl (1995). Mapping the perceptual magnet effect for speech using signal detection theory and multidimensional scaling. *Journal of the Acoustical Society of America* 97: 553-62.

Jassem, W., D. Hill & I. Witten (1984). Isochrony in English speech. In D. Gibbon & H. Richter (Eds.), *Intonation, accent and rhythm.* Berlin: de Gruyter, pp.303-25.

Kreidler, Ch. (1989). *The pronunciation of English.* Oxford: Blackwell.

Kuhl, P. (1991). Human adults and human infants show a 'perceptual magnet effect' for the prototypes of speech categories. Monkeys do not. *Perception and Psychophysics* 50: 93-107.

Lado, R. (1957). *Linguistics across cultures.* Ann Arbor: University of Michigan Press.

Major, R. (1987). A model for interlanguage phonology. In G. loup & S. Weinberger (Eds.), *Interlanguage phonology.* Cambridge, Mass.: Newbury House, pp. 101-24.

Major, R. & E. Kim (1999). The similarity differential rate hypothesis. In J. Leather (Ed.), *Phonological Issues in Language Learning*. London: Blackwell, pp. 151-184.

Monroy, R. (1980). *Aspectos fonéticos de las vacales españolas.* Madrid: SGEL

Olsen, L. (1972). Rhythmical patterns and syllabic features of the Spanish sense group. In *Proceedings of the 7th International Congress of Phonetics Sciences* (Montreal 1971). The Hague: Mouton.

O'Connor, J. (1968). The duration of the foot in relation to the number of component sound segments. *Progress Report*, Phon. Lab., Univ. College, London, June, 1-6.

Pike, K. (1945). *The intonation of American English.* Ann Arbor, Michigan: University of Michigan Press.

Real Academia Española (1959). *Gramática de la lengua española.* Madrid.

Ríos, A., M. Newman & J. Fragoso (1988). Los correlatos acústicos del acento del español en la sílaba (en habla de laboratorio). Laboratorio de Fonética de la Universidad Autónoma de Barcelona (Unpublished).

Selinker, L. (1972). Interlanguage. *International Review of Applied Linguistics* 10: 209-31.

Solé, M.J. (1984). Experimentos sobre la percepción del acento. In E. Martínez Celdrán & M.J. Solé (Eds.), *Estudios de fonética experimental* I. Barcelona: PPU, pp. 135-42.

Wardhaugh, R. (1970). The contrastive analysis hypothesis. *TESOL* 4(2): 123-30.

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A Comparison between English and Spanish Subjects' Typicality Ratings in Phoneme Categories: A First Report

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ABSTRACT

The purpose of the present study is to report the findings of an experimental task in which both native speakers of English and Spanish learners of English rated different phonetic realisations of the same phoneme (the English vowel / i /) in terms of how good examples of that phoneme those realisations were (i.e. their typicality). Similarities or differences between both groups are also described. This study also investigates the possible determinants of such typicality ratings and differences between the determination of typicality in both groups. Implications of these findings are discussed in relation to the learning of segmental phonological categories by Spanish learners of English.

KEYWORDS: phoneme category / i /, typicality, typicality ratings.

I. TYPICALITY

A central topic in categorisation research for the last three decades has been the phenomenon of *typicality*. Typicality refers to how "typical" different members of a category are within their

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category (e.g. *robin*, *sparrow*, *duck*, *penguin*, or *ostrich* are members of the category "*bird*"). The typicality of members of a category within that category is a type of judgement elicited from subjects. If subjects, for example, are asked to judge how typical members of the category *bird* different types of birds are, they tend to consider *robin* or *sparrow* as more typical birds than *duck*, and *duck* as more typical than *penguin* or *ostrich*. In short, typicality refers to a continuum of category representativeness, ranging from the most typical members of a category and continuing through less typical members to the most atypical ones. Researchers have referred to typicality using a wide variety of names: "typicality", "prototypicality", "representativeness", "exemplar goodness", "graded structure", "internal structure", etc. Consequently, in the extensive literature available, typical members of a category are called "typical", "prototypical", "representative", "good", etc. while less typical members are referred to as "atypical", "non-prototypical", "unrepresentative", "bad", etc.

Traditionally, the standard procedure for obtaining subjects' ratings of the typicality of items as members of categories has been Eleanor Rosch's 7-point rating scale technique (e.g. Rosch 1973b, 1975b). When asked to judge to what extent members of a category can be regarded as good examples of that particular category, subjects respond using a 7-point scale ranging from 1 (=very good example), through 4 (=moderately good example), to 7 (=very bad example). What subjects are instructed to do is to write a number next to different members of a specific category listed on a sheet. This number represents the extent to which they feel each member is typical of its category. Perhaps not too surprisingly, people find it a natural and meaningful task to rate the various the typicality of members of a category in rating tasks as statistical reliability guarantees that subjects do not put random crosses on their answer sheets. Therefore, statistically the order in which the items are rated is highly reliable.

Rosch's questionnaire technique and modified versions of it (reductions or increases of the numerical scale or reversals of its direction with higher numbers representing increasingly more typical examples) have been used dozens of times. Tables 1, 2, and 3 illustrate typicality ratings for some members of common semantic categories. Results are somehow equivalent in that people agree on which members are more typical than others despite differences in the rating scales used.[1]

Significantly, every human category studied so far has been shown to possess typicality and the same kind of statistically reliable responses have been obtained. Most studies have involved common semantic categories similar to those of tables 1, 2, and 3 (e.g. Hampton & Gardiner 1983; McCloskey & Glucksberg 1978; Rosch 1973b, 1975b; Uyeda & Mandler 1980). However, other types of categories have been studied. These include perceptual categories like *colours* (Nosofsky 1988b; Rosch 1973a, 1975c), product categories like *candy bars*, *beers*, etc. (Loken & Ward 1990), goal-derived ad hoc categorieslike *things to eat on a diet*, *what to get for a birthday present*, etc.[2] (Barsalou 1981, 1983, 1985), mathematical categories like *even number* or *odd number* (Armstrong *et al.* 1983), different geometrical designs like *square* or *triangle* (Bourne 1982; Nosofsky 1991), linguistic categories like *simple declarative sentence* (Corrigan

1986), personality trait categories like *helpful*, *sociable*, *dishonest*, etc. (Buss & Craik 1980; Chaplin *et al.* 1988; Isen *et al.* 1992; Read *et al.* 1990; Wojciszke & Pienkowski 1991), stereotype categories like *politician*, *clown*, *comedian*, etc. (Cantor & Mischel 1979; Dahlgren 1985) and other types of categories as heterogeneous as furniture art styles like *Modern* and *Georgian* (Whitfield & Slatter 1979), psychiatric categories like *schizophrenia* or *affective disorder* (Cantor *et al.* 1980), computer programming categories like *sorting* or *searching* (Adelson 1985), emotion categories like *happiness* or *sadness* (Fehr *et al.* 1982; Shaver *et al.* 1987), etc. This body of research suggests that, when encouraged, typicality ratings are ubiquitous and that typicality is a universal characteristic of categories (Barsalou 1985).

Table 1*: Typicality ratings for the members of the category *bird

Category member	Rosch (1975b)	Hampton & Gardiner (1983)
	Mean typicality ratings	
Sparrow	1.18	1.04
Robin	1.02	1.09
Dove	1.46	1.47
Hawk	1.99	1.69
Raven	2.01	1.74
Parrot	2.07	1.83
Pheasant	2.69	1.93
Swan	3.16	2.00
Duck	3.24	2.15
Chicken	4.02	2.17
Turkey	4.09	2.30
Ostrich	4.12	3.04
Penguin	4.53	3.22

Table 2*: Typicality ratings for the members of the category *fruit

Category Member	Rosch (1975b)	Schwanenflugel & Rey (1983)
	Mean typicality ratings	
apple	1.07	6.82
orange	1.08	6.76
banana	1.15	6.32
peach	1.17	6.30
strawberry	1.61	6.04
cherry	1.86	5.88
melon	2.09	5.74
lemon	2.16	5.34
lime	2.45	5.02
papaya	2.58	4.16
pomegranate	3.05	3.8
coconut	4.50	3.56
avocado	5.37	3.34

Table 3*: Typicality ratings for the members of the category *furniture

Category member	Rosch (1975b)	Malt & Smith (1982)
	Mean typicality ratings	
sofa	1.04	6.79
chair	1.04	6.74
table	1.10	6.74
dresser	1.37	6.21
bed	1.58	6.16
bookcase	2.15	5.37
footstool	2.45	4.74
lamp	2.94	4.52
mirror	4.39	3.47
clock	5.48	2.63
picture	5.75	2.58
closet	5.95	2.00
telephone	6.68	1.74

One of the reasons why typicality has been the focus of so much interest and research is its strong influence on performance in a wide range of experimental tasks or naturally-occurring phenomena of roughly three main kinds: cognitive processing and memory, language use and communication, and finally, category learning and conceptual development (this last group, as will be seen later, is relevant for our discussion of the learning of English phonology by Spanish students of English). Typicality is related to virtually all of the major dependent variables used as measures in psychological research. The effects of typicality on those variables are usually called "typicality effects". In addition, subjects also agree with one another significantly on the different tasks.

Typicality effects related to cognitive processing and memory tasks for which there is presently empirical evidence are of at least six types. First, typicality predicts speed of processing. It predicts how long it takes someone to classify an item as a member of a category, with typical members being identified faster than atypical ones.[3] This finding has been obtained in (speeded) category verification tasks in which subjects are asked to verify category membership propositions as rapidly as possible. Thus, people are faster to verify that "a *robin* is a *bird*" than "a *duck* is a *bird*" (e.g. Armstrong *et al.* 1983; Duncan & Kellas 1978; Glass & Meany 1978; McCloskey & Glucksberg 1979; McFarland *et al.* 1978; Rips *et al.* 1973; Rosch 1973b, 1975b, 1975c; Rosch *et al.* 1976; Smith *et al.* 1974). Speed of processing has also been investigated in sentence verification tasks. For example, Keller (1982) found that telegraphic transitive sentences with typical subjects (e.g. "a *robin* has feathers") are verified faster than sentences with atypical subjects (e.g. "a *duck* has feathers").

Second, typicality predicts the direction in similarity judgements between category members varying in typicality. Less typical category members are rated as more similar to typical ones than vice versa (e.g. Tversky & Gati 1978). In a related way, typical members are more likely than atypical members to serve as "cognitive reference points" (Rosch 1975a). When subjects are given sentence frames like "[x] is almost [y]" and two category members varying in typicality, they place the most typical one in the referent [y] slot.

Four additional types of cognitive processing and memory phenomena are also affected by the typicality of a category member in its category. These are: first, strength of inductive (e.g. Osherson *et al.* 1990; Rips 1975) and deductive (Cherniak 1984) inferences about category members, with typical members allowing stronger inductive inferences than less typical members; second, judged probability that instances belong to categories (e.g. Shafir *et al.* 1990), with more typical members of a category more likely to be judged as category members than less typical ones; third, rated degree of truth value of category membership propositions (e.g. Oden 1977) and fourth, ease of encoding items into memory for free recall (e.g. Bjorklund *et al.* 1982; Bjorklund *et al.* 1983; Cantor & Mischel 1979; Greenberg & Bjorklund 1982; Keller & Kellas 1978) with typical members being better recalled after presentation than less typical ones.

Typicality has also been shown to be related to several phenomena related to language use and communication. First, typicality predicts, for example, acceptance of qualifying terms like "true", "technically", "virtually", etc. It has been shown that a given qualifying term is applicable to only a subset of category exemplars determined by degree of typicality (Lakoff 1973). Second, typicality predicts the extent to which the names of category members can be substituted for their related category name in a sentence (e.g Rosch 1977). Typical members are more likely to occupy the place of the category name than less typical members. In addition, typicality predicts subjects' order and probability of production of category members in a free listing task. When asked to produce (name, draw, etc.) category members, people produce typical instances of categories earlier and more frequently than atypical ones (e.g. Hampton & Gardiner 1983; Mervis *et al.* 1976; Rosch & Mervis 1975; Rosch *et al.* 1976). Similarly, typicality affects order and probability of category member production in more natural situations (e.g. Kelly *et al.* 1986). Also, when superordinate category terms are denoted by a short list of exemplars in American Sign Language, only the more typical exemplars are used (Newport & Bellugi 1978). Finally, typicality predicts which category members will be named with general category names by parental input. Parents or caretakers seldom use category names to refer to atypical instances; instead, they are more likely to label typical instances with a category name (White 1982). Parents are more likely, for example, to call a *robin* a "bird" than a *duck.*

The third main group of variables for which typicality has been shown to be a good predictor of performance is that related to developmental and/or category learning phenomena. A wide variety of experimental tasks like non-verbal sorting, non-verbal selection, picture-naming, name-recognition, etc. have shown that typicality predicts the order in which category members are learned. Children learn typical category members at an earlier age than atypical ones (e.g. Bauer *et al.* 1995; Bjorklund *et al.* 1983; Blewitt & Durkin 1982; Carson & Abrahamson 1976; Heider 1971; Lin *et al.* 1990; Mervis & Pani 1980; Mulford 1979; Rosch *et al.* 1976; White 1982). Thus, children are more apt to consider a *robin* as a *bird* than a *chicken.* Also, adults acquiring a new (artificial) category learn typical members before atypical ones (e.g. Mervis *et al.* 1975; Rosch & Mervis 1975; Rosch *et al.* 1976). Second, categories are learned more easily and more accurately if initial exposure to the category is through representative category members (Hupp & Mervis 1981; Mervis & Pani 1980).

To sum up, it seems that typicality effects are as ubiquitous as typicality ratings themselves and that they are found in many different types of experimental tasks and naturalistic phenomena extensively. Furthermore, typicality ratings and effects have been documented not solely in adults but also in children (e.g. Bjorklund & Thompson 1978; Duncan & Kellas 1978; Keller 1982), and, with appropriate experimental techniques, in infants (e.g. Bauer *et al.* 1995; Strauss 1979; Younger & Gotlieb 1988). Furthermore, research on comparative animal psychology is beginning to reveal that other species with extensively demonstrated categorisation abilities also show typicality effects in their categories. Pigeons, for example, consider some members of the category *birds* as better examples of the category than others (Cook *et al.* 1990). Some further research with artificial categories has added strength to the presence of typicality effects in the categories formed by pigeons (e.g. Aydin & Pearce 1994; Huber & Lenz 1996; Jitsumori 1996).

II. TYPICALITY IN PHONETIC AND PHONOLOGICAL CATEGORIES

Given the ubiquity of typicality ratings and typicality effects, it might be surprising to find people's inability to provide typicality ratings for different members of both phonetic and phonological categories. It might also be surprising to find that, if such ratings were obtained (as might be expected), these ratings should not be related to performance on different experimental tasks. However, a long tradition of research on categorical perception seems to speak against typicality particularly in phonetic categories.

Categorical perception refers to a mode of perception in which changes along a stimulus continuum are not perceived continuously, but in a discrete manner. Categorical perception is in direct opposition to continuous perception, which refers to a relatively continuous relationship between changes in a stimulus and changes in the perceptual experience of that stimulus. Categorical perception studies (e.g. Liberman *et al.* 1957; Studdert-Kennedy *et al.* 1970; see also Repp 1984 for a review) claim that listeners can discriminate stimuli only to the extent that they can recognise them as members of different categories.

However, at present there is substantial evidence that the discrimination of stimuli from a given phonetic category with a relatively high degree of accuracy is not all that limited; under certain experimental conditions, listeners can discriminate stimuli within a category remarkably well (Carney *et al.* 1977; Pisoni & Tash 1974; van Hessen & Schouten 1992). Furthermore, growing evidence suggests that within-category stimuli are not only discriminable from one another but are perceived as varying in typicality, with some members of a phonetic category perceived as more typical than others. In a typical experiment, a speech series is created in which a phonetically relevant acoustic property is varied so as to range from one phonetic segment to another. A typical example is the series / bi / to / pi /, with the / b /-/ p / voicing distinction specified by a change in voice onset time (VOT). Then, listeners are presented randomised sequences of the extended series. Next, they are asked to judge the typicality of each sound as a member of the / p / category using a rating scale similar to the ones used in experiments with semantic categories. Such type of studies have shown that subjects can provide typicality ratings for different within-category speech sounds with statistical reliability (e.g. Davis & Kuhl 1992; Grieser & Kuhl 1989; Kuhl 1991; Massaro & Cohen 1983; Miller & Volaitis 1989; Miller *et al.* 1997; Samuel 1982; Volaitis & Miller 1992; Wayland *et al.* 1994).

In addition, as in the case of other types of categories, several typicality "effects" have been obtained in tasks that assess the functional or differential effectiveness of different members of phonetic categories in phenomena such as dichotic competition, selective adaptation, discrimination/generalisation, or category verification. It is now known that some stimuli are more effective adaptors than others in selective adaptation experiments (Miller 1977; Miller *et al.* 1983; Samuel 1982), more effective competitors in dichotic competition experiments (Miller 1977; Repp 1977) or they elicit greater generalisation to other members of the category when they serve as the referent stimulus in category learning tasks (Grieser & Kuhl 1983, 1989; Kuhl 1991). Finally, it has been shown that typical stimuli take less time than less typical ones to be verified as category members in category verification tasks (e.g. Davis & Kuhl 1992; Massaro 1987).

It has also been suggested that various allophones of the same phoneme are more typical of the category than others. Nathan (1986; see also Mompeán-González 1999) considered the English phoneme categories / t / and / d /, suggesting, for example, that alveolar stops (voiceless ones in / t / and voiced ones in / d /) are more typical than other allophones such as voiced alveolar flaps (i.e. [ɾ]). In this respect, the experimental evidence par excellence was provided by Jaeger (1980, exp. 1 and 2), who showed that people were faster to verify the category membership of typical allophones of the category English / k / (e.g. aspirated allophones) than that of less typical allophones (e.g. unaspirated stops). [4]

To sum up, these studies have evinced that the categoricality of phonetic segments in their linguistic function does not imply that they are also categorical in the way they are perceived.[5] Phonetic (and phonological) categories have more typical and less typical members, which contradicts initial studies on categorical perception that predicted that, if within-category sounds are not discriminable, there should not be any differences in typicality between different speech sounds that belonged to the same category. Furthermore, as remarked by Miller (1994), all phonetic categories in which typicality has been investigated so far have yielded reliable ratings and effects. It seems then that typicality is also a characteristic of phonetic categories as in the case of other types of categories. In fact, typicality and typicality effects seem to be so ubiquitous that they have found even with infant subjects. Recent research has even found typicality effects of typicality norms previously provided by adults in infants' prelinguistic vowel categories (e.g. Grieser & Kuhl 1983, 1989; Kuhl 1991) and consonant categories (e.g. Miller & Eimas 1996).

Given current experimental evidence, it might then be surprising that typicality ratings and effects should not be obtained for other phonetic or phonological categories. This study attempted to provide additional support for the generality of typicality with the British English vowel phoneme category / i /, as in the word "flee".

The reason why / i / was chosen is that previous work with infants using / i / (Grieser & Kuhl 1989; Kuhl 1991) has shown that different computer-synthesised variants of / i / differ in typicality demonstrating Kuhl's intuition that, if typicality should be shown to exist at all in vowel categories, as her studies showed, / i / should be an ideal candidate.[6]

The present investigation tried to extend this research in at least three ways: by studying different members of the phoneme category / i / in naturally-produced stimuli, by comparing the ratings of both native speakers of English and Spanish learners of English and by investigating the possible determinants of typicality ratings in both groups. This study was originally motivated in part by an interest in knowing whether different realisations of / i / might be perceived as varying in typicality by both cross-cultural and cross-linguistic groups and, if so, on what basis.

The specific research questions this study investigated were four:

1) do different realisations of / i / differ in typicality as rated by native English and Spanish speakers of English?
2) do the typicality ratings generated by both English and Spanish subjects correlate or do they differ?
3) what determines typicality ratings in both groups?
4) are there any differences in the determinants of typicality in both groups?. If so, of what sort and to what extent?

Three experiments were conducted to try to answer these questions. Experiments 1 and 2 were directed at revealing typicality ratings in both cultural-linguistic groups. Experiment 3 examined possible determinants of such ratings and differences in the determination of typicality for both groups.

II.1. Experiment 1

The purpose of this experiment was to determine whether adult native speakers of English can generate similar typicality ratings for several members (i.e. phonetic realisations) of / i / in spoken English words. Based on the results of previous experiments with phonetic and phonological categories, it is hypothesised that they will do so.

II.1.1. Method

II.1.1.a. Subjects

15 adult native English speakers of British English between the ages of 20-32 (mean age 24 yrs) participated in this study. There were 7 men and 8 women. They were all recruited on the University of Murcia campus. They were all undergraduate or graduate students and were phonetically naive. They all had normal hearing.

II.1.1.b. Stimuli and apparatus

60 naturally-produced words containing / i / were digitally recorded using an audio processing

program called DartPro, implemented on a computer and stored in hard disk file. The stimuli were produced by an English native speaker of British English speaking on a microphone at a normal rate.[7] Each stimulus word was preceded by a number corresponding to the order in which the stimulus word appeared on the recording. There were four seconds between the end of a stimulus word and the number preceding the next stimulus word. There was one second between each number and its corresponding stimulus word. These words were later played at a comfortable listening level (approximately 68 dB SPL). The stimuli were presented to subjects binaurally over stereo headphones. The subjects heard the stimuli in a small sound-treated computer room.

The selection of the stimuli was carefully accomplished. Before the specific stimulus list was obtained, a wide range of different stimulus candidates pronounced with / i / were ruled out due to different factors. First, / i / appears in words up to four syllables long (e.g. "b*ea*t", "f*ee*ling", "tequ*i*la", "pr*e*conc*ei*ving"). Furthermore, / i / may occupy the nucleus of primarily stressed (e.g. "seat"), secondarily stressed (e.g. "pr*e*conceive") or totally unstressed syllables (e.g. "phon*e*me"). In addition, / i / can be spelled in many different ways.[8] To avoid excessive heterogeneity in the sample, the stimuli chosen only included monosyllabic words. As a consequence, / i / appeared exclusively in stressed positions. Also due to the variety of spelling forms -some of which are rather unusual like < ae >, < ay > or < oe >- the stimuli included two of the most common ones, i.e. < ea > (24 items) and < ee > (26 items).[9] In addition, six items did not include any vowel letter in the spelling as they corresponded to the names of letters ("d", "d's", "g's", "p", "v", "v's") and four words contained the spelling < e > (i.e. "e", "e's", "he", "we"). Word length was further controlled by selecting only four syllable structure patterns: V (1 item), CV (8 items), VC (4 items), and CVC (47). Most syllables had a CVC structure, that is, they included both one-consonant heads and codas.[10] Two- or three-consonant clusters were not included in this study either word-initially or word-finally.[11]

The use of stimuli produced by a real native speaker contrasts with those speech-synthesised stimuli of previous experiments investigating typicality in phonetic categories. Certainly, those speech-synthesised stimuli are advantageous in that they allow the experimenter to have precise control over the stimuli the subjects are presented with. Researchers can then study several phenomena without having to worry about other aspects that vary between subjects and that are irrelevant to the hypotheses tested. However, the study of speech sounds in more "naturalistic" contexts (i.e. embedded in real English words and pronounced by real speakers) is also an unavoidable pathway in the study of phonology and with some control may shed light on people's actual perception and categorisation of speech. The type of naturally-produced stimuli used in this study are similar to those used in previous studies (Davis & Kuhl 1992; Jaeger 1980; Jaeger & Ohala 1984).

II.1.1.c. Procedure

Subjects were run individually in this experiment in a session which lasted for approximately twenty minutes. The procedure included a pre-test, a test session and a post-test interview.

In the pre-test phase of the experiment, subjects were seated comfortably in a sound-treated room on a chair in front of a computer. The experimenter (the author of this study) gave each informant four stapled sheets including the instructions of the experiment (page 1) and the answer sheets (pages 2 to 4). The instructions had been carefully designed to direct subjects' attention to the phenomenon of typicality and were similar to those used in previous studies. The answer sheets contained numbers 1 to 60 arranged along the left-hand side of the sheet corresponding to the words on the recording (e.g. "1" for the first word, "2" for the second, etc.). A 7-point scale had been drawn horizontally next to each number. However, following Schwanenflugel and Rey's (1986) or Malt & Smith's (1982) procedure, the poles on Rosch's (1973b, 1975b) typicality scales were reversed. A rating of 1 meant a very bad member of the category while a rating of 7 meant a very typical member of the category.

The experimenter asked subjects to read the instructions carefully. Instructions were as follows:

> This study has to do with how people perceive sounds. However, before explaining the task you have to perform, it is important to tell you that the perception of sounds is, to a great extent, very similar to the perception of other types of stimuli. For example, think of *birds*. Close your eyes and imagine examples of *birds*. You may think of *robin*, *sparrow*, *penguin*, *turkey* or *chicken*. However, if you were asked to give an example of *bird*, you would probably think of *robin* or *sparrow* and it is very unlikely that you would use *penguin*, *turkey* or *chicken*. *Robin* and *sparrow* seem to be better or more characteristic examples of *bird* than *penguin*, *turkey*, or *chicken*. Think now of *fruits*. You could think of *apple*, *orange*, *pomegranate*, *coconut* or even *avocado*. However, if you were asked to indicate a representative, typical, or good example of *fruit* you might probably choose *apple* or *orange*. It is less likely that you might consider *pomegranate*, *coconut*, or *avocado* as good examples of "fruits" as *apple* or *orange*. Notice that this has nothing to do with how well you like the fruit. It has to do with what is generally considered to be a typical example of fruit. You may prefer coconuts to oranges but still admit that *orange* is more typical of *fruit* than *coconut*.
>
> Something similar happens with sounds. For example if you are asked to give good examples of consonantal sounds, you might probably refer to the sound at the beginning of the words "*p*ay" or "*t*ea" as more typical consonants than the initial consonants in "why", or "lie".
>
> In the task you are going to perform, you will be listening to a series of English words. These words contain a type of *sound* (a vowel) that people generally perceive as "the same". This type of vowel is the one you find in words like "need", "each", "see", "cheap", "been", "leave", "she", etc. If you close your eyes for a few seconds and think of how these words are pronounced you may form an idea of how that sound should be.
>
> However, although each (actually pronounced) vowel in those examples is an example of a type of vowel (just as different types of birds are examples of a type of animal, that is, *bird*), there are different auditory differences amongst them. As you listen to the words, what you have to do is to decide to what extent each of the vowels you hear is a good example of the type of sound (i.e. vowel) they represent.
>
> After you hear each word you must indicate your decision using a 7-point scale. Here you have an example of the scale you are going to use.

Worst Examples		Rather Bad Examples		Bad Examples		Moderately Bad/God Examples		Good Examples		Quite Good Examples		Best Examples	
1		2		3		4		5		6		7	

As you can see, a 1 means that the vowel you hear in a word one of the worst examples of that type of vowel. A 7 means that it is one of the best examples you could give. Tick one of the seven numbers for each word you hear according to your decisions. For example, if you hear the word "bee" and think the vowel in that word is quite a good example of the type of vowel it exemplifies, then tick number 6. If, on the contrary, you think it is a rather bad example, tick number 2. You must repeat the procedure for each of the specific vowels in the words you are going to hear.

Please *use all the numbers in the scale* (and not just 1 or 7 for example). You will be listening to 60 words altogether preceded by a number which represents the order in which the words appear (the number is also written on the answer sheets). You'll hear the series twice. If necessary, you can listen to it one more time. Please, pay a lot of attention to the words and remember you must judge how good an example each of the vowel sounds you hear is of the type of vowel it represents. Finally, remember that the meaning of the words or their spelling is not important, just the sound. If, at any moment during the task you want to stop for any reason, tell the experimenter.

After reading the instructions, the experimenter asked subjects whether they had understood the instructions. All subjects answered affirmatively although a few doubts were solved by the experimenter. Next, when subjects said they were ready, they were instructed to put on headphones and play the recording when the experimenter had sat at a distance of 4 metres from them in order not to influence their decisions. During the overt typicality rating task, subjects behaved as instructed. After the recording was over, the computer stopped automatically. The experimenter approached the subjects in order to check for any possible problems and instructed them to repeat the same procedure again. When this had taken place, the experimenter approached the subjects again and collected the answer sheets.
Finally, in a post-test interview, the experimenter asked subjects "which criterion were you following to decide which vowels were more typical than others?". The experimenter wrote down subjects' answers and, after discussing their strategies, the experimenter thanked them for their co-operation.

II.1.2. Results and Discussion

Rank order of items (R), mean ratings of typicality and their associated standard deviations for all instances of / i / are shown in table 4. As the table shows, the standard deviations of subjects' typicality ratings of the different examples of / i / have low variability ($0.50 < SD < 1.18$), which indicates that subjects produced similar responses in the 7-point scale. This confirms the hypothesis of this study. Further confirmation of the hypothesis was obtained by calculating the coefficients of variation for all examples of / i /. As the mean coefficient of variation (19.65%) obtained was relatively low, this also seems to confirm the hypothesis that subjects provided similar typicality ratings for each realisation of / i /. Figure 1 shows, as an example, the two words for which the highest ("leal": 45.56 %) and the lowest ("need": 8.91 %) coefficients of variation were obtained.

II.2. Experiment 2

The purpose of this experiment was to discover whether Spanish learners of English can also generate statistically reliable typicality ratings for the category / i /. It also tried to determine to what extent these ratings were similar to those provided by the English group in experiment 1.

II.2.1. Method

II.2.1.a. Subjects

Subjects were 15 adult native Spanish speakers (mean age 19 yrs). There were 4 men and 11 women. They were all students of "Filología Inglesa" in their first and (beginning of their) second year at the University of Murcia. They all had normal hearing. The criterion for being selected was their obtaining a very high mark (i.e. "sobresaliente") in a course on English pronunciation they had taken during the first four months of the first year. This was to guarantee that / i / was already a well-established part of their interlanguage segmental phonology. However, before they carried out the typicality rating task, a pre-test checked that they actually knew the category. This little test consisted in presenting randomised words containing either / i / or / ɪ /, conveniently called *sound "a"* and *sound "b"*. They were instructed to indicate whether each word exemplified sound "a" or sound "b". All subjects did pretty well in this task so they all qualified for the present experiment.

II.2.1.b. Stimuli and apparatus

The stimuli were the same as those used in experiment 1 and were arranged in exactly the same order.

II.2.1.c. Procedure

The procedure was the same as that used in experiment 1. However, the session was conducted in Spanish and the instructions subjects received were an adaptation (in Spanish) of the instructions given to the English group (these instructions are available from the author).

II.2.2. Results and Discussion

Table 4: **Rank order of items, mean typicality ratings and associated standard deviations for members of / i /: native speakers of English**

R	Item	MTR	SD	R	Item	MTR	SD	R	Item	MTR	SD
1.	need	6.00	0.53	21.	neat	5.27	0.70	41.	peat	3.87	0.91
2.	seed	5.93	0.70	22.	weave	5.27	0.80	42.	peag	3.73	0.80
3.	e	5.93	0.80	23.	e's	5.27	0.88	43.	beam	3.67	1.04
4.	deep	5.87	0.63	24.	v	5.27	0.88	44.	'neath	3.60	0.63
5.	teeth	5.87	0.74	25.	lea	5.27	1.16	45.	keen	3.60	1.05
6.	deed	5.80	0.77	26.	jeep	5.20	0.86	46.	lean	3.53	0.74
7.	heed	5.67	0.72	27.	reef	5.13	0.74	47.	jean	3.27	0.88
8.	weed	5.67	0.72	28.	heave	5.13	0.83	48.	wean	3.27	0.96
9.	p	5.53	1.06	29.	fee	5.13	0.91	49.	mean	3.27	1.03
10.	seethe	5.47	0.63	30.	he	5.13	1.06	50.	eel	3.07	0.70
11.	leap	5.47	0.83	31.	knees	5.13	1.06	51.	e'en	3.07	0.70
12.	seek	5.40	0.50	32.	g's	5.07	0.70	52.	meal	3.07	0.88
13.	d	5.47	1.18	33.	heath	5.00	0.65	53.	heal	3.00	0.76
14.	eat	5.40	0.99	34.	league	5.00	0.76	54.	peel	2.93	0.70
15	teethe	5.4	1.12	35.	leaf	5.00	0.84	55.	veal	2.93	0.70
16	knee	5.40	1.18	36.	weep	4.87	0.83	56.	reel	2.93	0.80
17.	beef	5.33	0.61	37.	d's	4.87	0.91	57.	keel	2.80	0.77
18.	leave	5.33	0.90	38.	v's	4.87	0.91	58.	sheen	2.80	0.94
19	we	5.33	1.04	39.	feel	4.33	0.81	59.	deal	2.67	0.81
20	heap	5.27	0.59	40.	sheaf	3.87	0.74	60.	leal	2.27	1.03

Table 5**: Rank order of items, mean typicality ratings and associated standard deviations for members of / i /: Spanish learners of English**

R	Item	MTR	SD	R	Item	MTR	SD	R	Item	MTR	SD
1.	knees	6.20	0.77	21.	leal	5.47	1.46	41.	lean	4.40	0.63
2.	e's	6.20	0.86	22.	feel	5.40	1.12	42.	beam	4.33	1.04
3.	d's	6.20	1.08	23.	lea	5.33	1.04	43.	sheen	4.33	1.17
4.	v's	6.13	0.83	24.	weed	5.33	1.17	44.	wean	4.13	1.46
5.	leave	6.00	1.13	25.	heed	5.27	1.28	45.	eat	3.47	0.99
6.	teethe	6.00	1.00	26.	heal	5.27	1.22	46.	teeth	3.47	1.40
7.	weave	6.00	1.00	27.	e	5.20	0.94	47.	beef	3.40	1.24
8.	g's	5.87	0.99	28.	he	5.20	0.94	48.	seek	3.40	1.45
9.	need	5.87	1.12	29.	fee	5.13	0.83	49.	'neath	3.33	1.29
10.	meal	5.80	1.14	30.	we	5.07	0.88	50.	neat	3.27	1.62
11.	peel	5.80	1.32	31.	eel	5.07	1.39	51.	jeep	3.27	1.90
12.	seethe	5.80	0.68	32.	v	5.00	1.13	52.	leaf	3.20	1.78
13.	heave	5.73	0.70	33.	p	5.00	1.64	53.	deep	3.13	1.12
14.	keel	5.73	1.16	34.	jean	4.93	1.10	54.	reef	3.13	1.50
15.	deed	5.73	1.33	35.	mean	4.93	1.10	55.	leap	2.87	1.19
16.	seed	5.73	1.03	36.	d	4.67	0.98	56.	heap	2.73	0.80
17.	peag	5.60	1.30	37.	veal	4.60	1.63	57.	heath	2.73	1.39
18.	deal	5.53	0.91	38.	reel	4.53	1.24	58.	peat	2.53	1.55
19.	knee	5.53	1.06	39.	keen	4.47	0.91	59.	weep	2.47	1.19
20	league	5.47	0.99	40.	e'en	4.40	0.99	60.	sheaf	2.40	0.99

The rank order of items (R), mean typicality ratings and their associated standard deviations for each word including / i / are shown in table 5. This table shows that the standard deviations of subjects' typicality judgements of instances of / i / have low variability (0.50 < SD < 1.18). This indicates that subjects generated similar responses when rating the typicality of different realisations of / i /. For example, when a particular example of / i / obtained a high typicality rating, most subjects tended to provide high numbers. When an example of / i / obtained a low typicality rating, most subjects generally provided low numbers. Further confirmation of the hypothesis was obtained by calculating the coefficient of variation for every example of / i /. The mean coefficient of variation was 26.99%, which is again relatively low and confirms the hypothesis that Spanish learners of English produced similar typicality ratings for different instances of / i /. Figure 2 shows the two words for which the highest ("peat": 61.27%) and the lowest ("seethe": 11.66%) coefficients of variation were obtained.

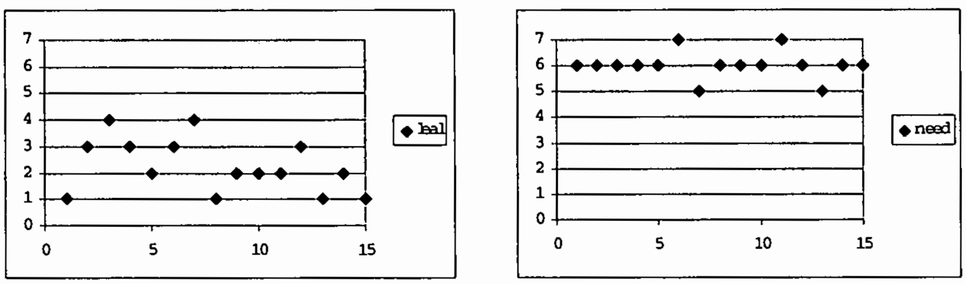

***Figure 1*: Highest coefficient of variation ("leal") & lowest coefficient of variation ("need"): English group.**

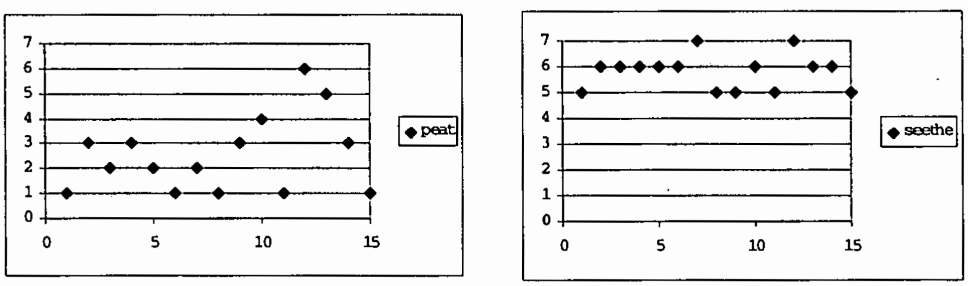

***Figure 2*: Highest coefficient of variation ("peat") & lowest coefficient of variation ("seethe"): Spanish group.**

In order to determine the degree of convergence between the Spanish and English speakers' typicality ratings, *t* tests were calculated. For 39 out of the 60 words including / i / (65% of the sample) the typicality ratings generated by both Spanish and English subjects were significantly different ($p < 0.05$). This indicates that, although for a 35 per cent of the sample both groups produced similar typicality ratings, the two groups followed different patterns of response for most words. This is not surprising as differences in the typicality ratings of members of roughly equivalent common semantic categories by members of different cultural or linguistic communities have been extensively reported. Studies have compared the typicality ratings by British and American subjects (1983), monolingual speakers of English and Spanish (Schwanenflugel & Rey 1986), monolingual speakers of English and French (Segalowitz & Poulin-Dubois 1990), monolingual speakers of English and German (Eckes 1985; Hasselhorn 1990), and monolingual speakers of English and Chinese (Lin & Schwanenflugel 1990; Lin *et al.* 1990). These studies suggest that, although there is a more or less significant convergence in the typicality ratings of English-speaking populations and Spanish-, French-, German-, and Chinese-speaking ones, differences also exist.

Once the typicality of different members of the category / i / has been obtained from both cultural and linguistic groups a logical question to ask is what the source of those typicality ratings might be. Fortunately, the literature on typicality offers no shortcoming of responses. Reports of typicality ratings and effects are frequently accompanied by several possible determinants of typicality. However, although investigators agree about the ubiquity and importance of typicality, they do not concur on its explanation. What determines whether some members are more typical of their category than others is still a matter of debate.

In general we can distinguish two main types of determinants of typicality: materialistic and non-materialistic.

Materialist determinants are those based on either the material structure of the human perceptual apparatus, or the material characteristics of the referents of category members (Geeraerts 1988). There are four main types of materialistic determinants of typicality: similarity, perceptual salience, frequency of instantiation and familiarity with the referents of category members.

Following the work or Rosch and Mervis (1975), there has been widespread acceptance (e.g. Boster 1988; Rosch 1975b, 1978; Rosch *et al.* 1976; Roth & Mervis 1983) that the typicality of a category member depends on its average similarity to other category members (also called its "family resemblance"). The more similar an exemplar is to other category members (in terms of shared attributes), the more typical it will be of its category. *Robin*, for example, is very similar to other members of the category *birds* like *canary*, *sparrow*, etc. In contrast, *penguin* is not as similar to other birds as *robin*. Consequently *robin* is more typical of *bird* than *penguin*.[12]

The typicality of members within categories has also been claimed to be the result of the physiological structure of the perceptual apparatus and inherent properties of human perception. For a limited number of (mainly perceptual) categories like colours (e.g. Heider 1971; Rosch 1973a, 1973b, 1975c), geometrical forms (Rosch 1973a, 1973b), or sounds (Nathan 1986), some members of categories seem to be more typical than others because they appear to be perceptually more salient.

Two further materialistic determinants of typicality are frequency of instantiation and familiarity with the members of categories in the real world. Frequency of instantiation refers to how often subjects have experienced a certain kind of entity as a member of a category while familiarity refers to how often subjects have experienced that entity across all contexts. For example, people are generally more familiar with *chair* than with *log*, having experienced *chair* more often across all contexts (i.e. familiarity). However people have probably experienced *log* more often as an instantiation of *firewood* (i.e. frequency of instantiation). Unfortunately, these two determinants of typicality are very difficult to test. This can best be done in studies with artificially-constructed categories in which subjects' encounter with category members is controlled. In relation to perceived frequency of instantiation such studies have provided mixed evidence. Some work suggests that there is no correlation between typicality ratings and controlled frequency of instantiation (e.g. Rosch *et al.* 1976) although more recent evidence suggests the opposite (Nosofsky 1988b). Familiarity with the referents of category members has been measured with printed word frequency. Again the evidence is mixed, some studies have found no correlation between printed word frequencies and rated typicality (McCloskey 1980; Mervis *et al.* 1976). Still, other research has found more positive evidence in at least social categories (e.g. Dahlgren 1985). However, Malt and Smith (1982) claimed that word frequency does not necessarily reflect how common in the environment an object is or has been experienced by subjects. Dahlgrèn (1985) expressed similar reservations.

Although the four types of factors mentioned account for the typicality of members of some categories satisfactorily, the literature on typicality has evinced materialistic factors are just one set of mechanisms responsible for typicality. Much research suggests that a host of non-materialistic factors related to conceptual knowledge structures account for typicality ratings and effects.

Amongst the many non-materialistic determinants of typicality we can also highlight four: perceived frequency of instantiation of category members, perceived familiarity with category members, perceived frequency of the name of category members and the possession of "ideals" by category members.[13]

Perceived frequency of instantiation refers to the frequency people *believe* they encounter or have encountered members of a category as members of that particular category. Perceived familiarity can be defined as people's subjective estimate of how often they have experienced an entity across all contexts. Although related to frequency of instantiation and familiarity with the referents of category members, these two variables emphasise people's intuitive knowledge about such factors, which may or may nor correspond with actual facts.

Only a few studies have investigated the relationship between perceived frequency of instantiation and typicality. In general, this variable seems to predict typicality (e.g. Barsalou 1985; Loken & Ward 1990). In relation to perceived familiarity, although some research has found weak evidence for it as a determinant of typicality (e.g. Barsalou 1985; Glass & Meany 1978; Hampton & Gardiner 1983; Loken & Ward 1990), some research has found more positive evidence suggesting that people may actually know more about (and therefore be more familiar with) typical than atypical members of categories. Some studies have measured familiarity by asking subjects to list the attributes of category labels. For example, people are able to retrieve fewer characteristics of atypical category members than typical ones (Ashcraft 1978; Malt & Smith 1982). In addition, people rate typical category members as more familiar than atypical ones in familiarity rating tasks (Lin & Schwanenflugel 1990; Lin *et al.* 1990; McCloskey 1980; Schwanenflugel & Rey 1986).

A third possible determinant of typicality (although seldom investigated) is perceived word frequency. Segalowitz and Poulin-Dubois (1990) stressed the importance of distinguishing between objective measures of word frequency such as written word counts, and more subjective measures such as perceived frequency of name instantiation, which they called "linguistic familiarity" and for which they found evidence as a determinant of typicality.

Finally, another possible non-materialistic determinant of the typicality of a category member in its category is the degree to which it possesses ideal characteristics (called "ideals"). These are attributes that category members should have if they are to best serve a goal associated with their category. For example, the ideal characteristic in a category like *foods to eat on a diet* is "zero calories"; consequently, the fewer calories a category member has, the better it serves the goal associated with its category, namely, lose weight and the more typical it will be considered to be. Some research supports ideals as determinants of typicality (e.g. Barsalou 1981, 1983, 1985; Chaplin *et al.* 1988; Read *et al.* 1990).

In light of the evidence mentioned so far and resuming the original question of why some members of / i / might be more typical than others, both materialistic and non-materialistic hypotheses can be put forward.

A materialistic explanation might entail that, in judging typicality, subjects concentrate on one or more acoustic characteristics of the speech signal itself. A non-materialistic explanation would require that subjects rate typicality on the basis of some other information not specified by the acoustic signal itself but rather by more general knowledge about the words they hear. Three possible types of such knowledge may be perceived familiarity with the words, perceived frequency of name instantiation, and spelling. The research on perceived familiarity mentioned earlier testifies to its influence on typicality. Subjects might also draw on their knowledge about the category, like, for example, its conventional spelling representations. It might be that those members of / i / spelled with a certain vowel letter or combination of vowel letters would be more typical than others spelled differently.

In order to find out about the origins of typicality ratings for / i /, experiment 3 was carried out.

II.3. Experiment 3

The purpose of this experiment was to determine whether general knowledge about the words in which / i / is found influences the typicality ratings obtained from the English and Spanish subjects for / i / in experiments 1 and 2. General knowledge was operationalised in two different ways. First, as "familiarity with words" (i.e. reasonable knowledge of or acquaintance with the word) and second, as "perceived frequency of name instantiation in language use" (i.e. how often a word is used in both spoken and written everyday language). Perceived word frequency may be a more sensible measure of familiarity than word frequency, although the latter may also be considered as a measure of cultural importance (Dahlgren 1985). It is hypothesised that, if subjects, as instructed, actually focus on sounds and not on words as lexical items, perceived familiarity with words and perceived frequency of use will not affect people's typicality ratings.

In addition, some statistical operations were calculated to investigate whether there is a systematic correspondence between typicality ratings and spelling form, typicality and vowel length as determined by the type of coda.

II.3.1. Method

II.3.1.a. Subjects

The subjects in this experiment were the same as those employed in the typicality rating tasks of experiments 1 and 2.

II.3.1.b. Stimuli

The stimuli for this study were printed words corresponding to the spoken words of experiments 1 and 2. These words were written along the left-hand side of new answer sheets following the order in which they had appeared in the previous experiments. Subjects were only exposed to these written words not to the spoken ones.

II.3.1.c. Procedure

After subjects finished the typicality rating task, they were told they would be doing a new task (the one reported below). The English subjects were tested in the first place. The order in which individuals were tested was exactly the same as that followed in the typicality rating tasks. Subjects were again run individually. The procedure was very similar to the one used in experiments 1 and 2. It included a pre-test, a test session and a post-test interview.

The experimenter gave each subject eight stapled sheets with instructions (page 1) and answer sheets (pages 2 to 8). The instruction sheet now asked subjects to rate their familiarity with the words printed on the answer sheets (section 1) and the frequency with which they thought the words were used in the language (section 2). As a consequence, there were two types of 7-point scales: one for familiarity with the word and another for perceived word frequency.

Instructions for the English subjects were as follows:

In this task, what you have to do is to read each of the words written on the answer sheets and rate them according to 1) how familiar you are with the word and 2) how frequently you think the word appears in language (spoken and written). As you have to rate two things (how familiar or acquainted you are with the word and how often you think the word is used in the language), you have two sections on the answer sheets and two types of 7-point scales. Here is an example of the scale you are going to use in the section *familiarity with the word.*

Unknown	Almost Unknown	Little Known	Relatively Known	Known	Well-known	Extremely Known
1	2	3	4	5	6	7

As you can see, a 1 means a word that is unknown to you and a 7 means a word which is extremely familiar or known to you. Use other numbers to indicate intermediate decisions.

In the section *frequency with which you believe the word is used*, you also have a 7-point scale. A 1 means a word you think is practically out of use and a 7 means a word you think is extremely frequent. Please do use other numbers to indicate intermediate decisions. Here is an example of the scale.

Not Used	Seldom Used	Little Used	Occasionally Used	Frequent	Quite Frequent	Extremely Frequent
1	2	3	4	5	6	7

Notice that the two things you have to rate (how familiar you are with the word and how often you think the word is used) may not necessarily be similar: you may be very familiar with the word "ostrich" or "artery" and still think that these words do not appear very often in everyday conversations or written texts.

The order in which you are going to read the words is the same as that in which you listened to them in the previous exercise but this time the sounds are not important.

These instructions were adapted for the Spanish subjects (the instructions are also available from the author on request).

II.3.2. Results and Discussion

For the English group, rank order of items (R), mean ratings of perceived familiarity with words (PFW) and their associated standard deviations are shown in table 7. The results for perceived word frequency (PF) are shown in table 8. For the Spanish group, rank order of items (R), mean ratings of perceived familiarity with words and their associated standard deviations are shown in table 9 and the results for perceived word frequency in table 10.

Table 7: **Rank order of items, mean ratings of perceived familiarity with words and their associated standard deviations: English group**											
R	**Items**	**PFW**	**SD**	**R**	**Items**	**PFW**	**SD**	**R**	**Items**	**PFW**	**SD**
1	eat	7.00	0.00	21.	seed	6.47	1.06	41.	heap	5.87	1.72
2	he	6.93	0.26	22.	weep	6.47	1.06	42.	eel	5.67	1.63
3	teeth	6.87	0.35	23.	jeep	6.47	1.12	43.	weave	5.67	1.68
4	we	6.80	0.56	24.	jean	6.40	0.99	44	heed	5.60	1.45
5	beef	6.80	0.56	25	p	6.40	1.35	45	v's	5.53	1.55
6	deep	6.80	0.56	26	fee	6.33	1.11	46	d's	5.40	1.80
7	feel	6.80	0.56	27	lean	6.33	1.17	47	e's	5.26	1.70
8	meal	6.80	0.56	28	deal	6.27	1.28	48	sheen	5.13	1.88
9	e	6.80	0.77	29	leap	6.27	1.39	49	teethe	5.13	1.99
10	knee	6.73	0.59	30.	peel	6.13	1.30	50.	wean	5.07	1.67
11	mean	6.73	0.80	31	heave	6.13	1.36	51.	heath	5.00	1.77
12	knees	6.67	0.72	32	keen	6.13	1.40	52.	seethe	4.73	1.70
13	leaf	6.60	0.63	33	reef	6.13	1.46	53.	lea	4.67	2.09
14	leave	6.60	0.63	34	seek	6.13	1.46	54.	sheaf	4.67	2.12
15	d	6.60	0.91	35	v	6.07	1.62	55.	keel	4.53	1.72
16	league	6.53	0.83	36	g's	6.00	1.19	56.	'neath	4.13	1.68
17	heal	6.53	0.91	37	deed	6.00	1.30	57.	peat	3.80	2.33
18	weed	6.53	1.30	38	veal	6.00	1.41	58.	e'en	1.93	1.67
19	neat	6.47	0.91	39	beam	5.87	1.12	59.	leal	1.80	1.01
20	need	6.47	0.91	40.	reel	5.87	1.68	60.	peag	1.27	0.59

Table 8: **Rank order of items, mean perceived word-frequency ratings and associated standard deviations: English group**											
R	**Items**	**PF**	**SD**	**R**	**Items**	**PF**	**SD**	**R**	**Items**	**PF**	**SD**
1	eat	6.87	0.35	21.	league	5.20	1.61	41.	wean	3.80	0.86
2	he	6.87	0.35	22.	weed	5.13	1.24	42.	teethe	3.73	1.39
3	we	6.67	0.61	23.	lean	5.13	1.46	43.	heave	3.60	0.73
4	feel	6.53	0.63	24.	leap	5.07	1.10	44	v's	3.53	1'64
5	meal	6.53	0.63	25	jeep	5.07	1.49	45	reel	3.33	1.29
6	mean	6.33	0.81	26	deal	5.00	1.07	46	weave	3.27	1.33
7	need	6.33	0.90	27	peel	5.00	1.19	47	g's	3.13	1.84
8	beef	6.27	0.59	28	veal	4.73	1.43	48	heed	2.87	0.91
9	leave	6.20	1.08	29	heap	4.47	1.06	49	eel	2.87	0.99
10	knee	6.13	0.91	30.	keen	4.47	1.24	50.	keel	2.87	1.30
11	teeth	6.07	0.80	31	seek	4.33	1.44	51.	sheen	2.80	1.32
12	leaf	5.87	0.91	32	weep	4.33	1.50	52.	peat	2.67	1.04
13	deep	5.73	1.39	33	d	4.33	1.95	53.	seethe	2.67	1.04
14	neat	5.66	0.91	34	deed	4.20	1.42	54.	heath	2.60	0.73
15	knees	5.66	1.30	35	e's	4.13	1.36	55.	lea	2.40	1.24
16	p	5.40	1.45	36	e	4.07	2.21	56.	sheaf	2.27	0.96
17	jean	5.40	1.88	37	reef	4.00	1.07	57.	'neath	2.13	1.64
18	heal	5.27	0.80	38	beam	4.00	1.19	58.	e'en	1.60	1.35
19.	fee	5.27	1.28	39	d's	4.00	1.68	59.	leal	1.33	0.49
20	seed	5.27	1.16	40.	v	3.93	1.62	60.	peag	1.07	0.26

***Table 9*: Rank order of items, mean ratings of perceived familiarity with word and their associated standard deviations: Spanish group**

R	Items	PFW	SD	R	Items	PFW	SD	R	Items	PFW	SD
1	he	7.00	0	21	jeep	5.73	1.39	41.	leap	3.13	2.07
2	eat	6.93	0.26	22.	knees	5.73	2.19	42.	veal	3.07	1.90
3	e	6.87	0.35	23.	p	5.67	1.63	43.	reel	2.87	1.88
4	leave	6.87	0.35	24.	seek	5.60	1.12	44.	weed	2.87	2.07
5	need	6.87	0.35	25.	beef	5.60	1.24	45.	heath	2.80	1.82
6	teeth	6.80	0.41	26.	keen	5.47	1.80	46.	eel	2.80	1.97
7	meal	6.73	0.59	27.	g's	5.47	2.13	47.	teethe	2.67	1.91
8	feel	6.60	0.74	28.	neat	4.93	1.94	48.	heave	2.53	1.40
9	we	6.60	0.82	29.	heal	4.80	1.52	49.	sheen	2.40	1.59
10	deep	6.53	0.64	30.	weep	4.73	2.12	50.	heap	2.40	1.92
11	league	6.46	0.74	31	leaf	4.73	2.26	51.	keel	2.27	1.49
12	mean	6.46	1.30	32.	seed	4.27	2.12	52.	'neath	2.00	1.36
13	jean	6.40	0.91	33.	e's	4.13	1.92	53.	heed	2.00	1.51
14	deal	6.33	0.72	34.	reef	4.00	2.17	54.	leal	1.93	1.16
15	d	6.27	1.22	35.	fee	3.53	2.41	55.	seethe	1.80	1.42
16	knee	6.00	1.77	36.	beam	3.40	1.45	56.	wean	1.67	0.81
17	v	5.93	1.83	37.	weave	3.40	1.88	57.	e'en	1.60	1.35
18	peel	5.87	1.06	38.	deed	3.40	2.06	58.	peat	1.60	1.55
19	v's	5.87	1.55	39.	lean	3.26	1.90	59.	peag	1.47	1.30
20	d's	5.80	1.37	40.	lea	3.20	1.97	60.	sheaf	1.40	0.91

A close inspection of standard deviations in the four tables shows that for both perceived familiarity with words and perceived word frequency in both groups, subjects' ratings were very similar. However, this study was essentially aimed at finding out whether both familiarity with the word and perceived word frequency influenced typicality ratings in both groups, Pearson product moment correlations were calculated. These correlations are shown in table 11. These results show that, for the Spanish group, there is no significant correlation between typicality and perceived familiarity with words and between typicality and perceived word frequency ($p > 0.05$). However, there is a significant correlation between typicality and perceived familiarity with word ($p < 0.0003$) and between typicality and perceived word frequency ($p < 0.0060$) in the English group. These results confirm our hypothesis that these non-materialistic factors do not influence typicality ratings by the Spanish group but do not confirm it for the English group.

Given that non-materialistic factors like subjects' perceived familiarity with words and perceived word frequency do not seem to determine typicality in the Spanish group (but they do to some extent in the English group), it might be wondered whether other non-materialistic factors could determine or be strongly related to the typicality of different realisations of / i /. A possible influential non-materialistic factor could be spelling. Spelling is a part of people's knowledge about any sound category and, consequently, it could have an influence over perceived typicality ratings. In fact, this has already been shown to be so. In her study of the category "English / k /". Jaeger (1980) showed that when essentially the same phonetic allophone was considered (i.e. voiceless aspirated stops), those allophones spelled with the letter "q" were clearly the least typical examples while those spelled with the letters "ch", "k", and "c" were increasingly more typical (in this order). Jaeger claimed that the reason aspirated allophones spelled with "k" and "c" were the most typical ones could be that "k" is the name most often given to the sound, and "c" the letter most often used to spell it.

Table 10: **Rank order of items, mean perceived word-frequency ratings and associated standard deviations: Spanish group**

R	Items	PF	SD	R	Items	PF	SD	R	Items	PF	SD
1	he	7.00	0.00	21	peel	5.20	1.14	41.	lea	3.20	1.37
2	eat	6.93	0.25	22.	jeep	4.73	1.16	42.	heap	3.13	1.36
3	we	6.93	9.25	23.	neat	4.47	1.46	43.	reel	3.13	1.40
4	meal	6.80	0.56	24.	p	4.40	2.06	44.	veal	3.07	1.48
5	leave	6.73	0.59	25.	leaf	4.13	1.72	45.	weed	3.07	1.58
6	need	6.73	0.59	26.	weep	4.00	1.92	46.	v's	3.00	1.59
7	mean	6.67	0.81	27.	e's	3.80	1.14	47.	heed	2.93	1.22
8	feel	6.60	0.73	28.	e	3.80	2.11	48.	leal	2.87	1.40
9	teeth	6.13	1.12	29.	d	3.80	2.14	49.	heath	2.80	1.08
10	deal	6.00	0.84	30.	beam	3.60	1.40	50.	'neath	2.80	1.32
11	deep	5.93	1.03	31	d's	3.60	1.72	51.	keel	2.73	1.16
12	knee	5.80	1.08	32.	fee	3.60	1.80	52.	sheen	2.67	1.04
13	beef	5.73	1.22	33.	leap	3.60	1.63	53.	heave	2.60	0.99
14	jean	5.67	0.81	34.	weave	3.6	1.40	54.	wean	2.53	1.06
15	knees	5.53	1.36	35.	lean	3.53	1.46	55.	seethe	2.53	1.46
16	league	5.33	1.17	36.	seed	3.53	1.46	56.	eel	2.33	1.04
17	peel	5.20	1.14	37.	deed	3.53	1.64	57.	sheaf	2.33	1.04
18	keen	5.00	1.41	38.	g's	3.53	1.84	58.	peag	2.20	1.32
19	seek	4.93	1.70	39.	v	3.47	1.92	59.	peat	2.13	1.36
20	heal	4.80	1.47	40.	teethe	3.33	1.76	60.	e'en	2.07	0.96

Table 11: **Correlations between typicality and familiarity with word, and typicality and perceived word frequency for both groups**

	English group	Spanish group
Typicality and familiarity with words	42	0.17
Typicality and perceived word frequency	0.31	0.11

In order to find out whether spelling may have been influential in the case of / i /, the means of mean typicality ratings in both groups for equally-spelled instances of / i / were calculated. These data are shown in table 12.

Table 12: **means of the mean typicality ratings for equally-spelled members of / i / in both groups**

Spelling forms (vowel letter(s))	English group	Spanish group
<e>	5.41	5.42
<Ø>	5.18	5.48
<ee>	4.76	4.77
<ea>	4.09	4.36

Table 12 suggests that < e > is the most typical spelling form of / i / on the basis that the mean of the mean typicality ratings of those words in which / i / is spelled with < e > is higher than that for other spelling forms. Why should < e > be a very typical spelling?. One possible reason may be that the letter "e" is perhaps the name most often given to the sound. Not surprisingly, Daniel Jones, referring to / i / said that it was "the so-called 'long' sound of the letter *e*", giving as first examples of the sound the words "tree", "see", "even", "complete", and "immediate", and later stating that / i / was also "the sound of *ea*, *ie*, *ei*, and *i* in many words" (Jones 1989:65). In addition, < e > has been shown to be the most typical spelling form in children's developing spelling skills. Read (1986) showed that children's most frequent spelling of / i / was simply the letter that it names. In children under age six, 46.5 per cent of the spellings of / i / are *e*. Children spell words like "feel" as "f*e*l" or "eagle" as "*e*gle" Also, Treiman (1993) found that first-graders used < e > in 62.2 % of all their attempts to spell / i /. The most likely reason, she thought, was their knowledge of letter names. First-graders know that the name of *e* is / i /. So, in searching for a way to symbolise / i /, children often use *e* because they associate / i / with *e*. In both Read and Treiman's studies < ee > and < ea > were much less frequent spelling forms of / i / (4.7% and 6.1% for < ee > and 0.9% and 1.3% for < ea > in Read and Treiman's studies respectively). To sum up, one of the possible factors making a particular phonetic realisation of / i / be typical may be that is spelled with < e >.

However, the results of this study clearly show that perceived familiarity with words, perceived word frequency and spelling are not the only determinants of typicality ratings. The phonetic context of / i / is extremely important. Table 13 and figure 3 show the means of the mean typicality ratings of / i / grouped by type of coda. In the English group, those realisations of / i / followed by nasal stops and lateral consonants are (in this order) clearly the least typical ones Why could this be so?. First, one possible reason why subjects considered that vowels followed by / m / and / n / are less typical could be that those instances of / i / are slightly nasalised. Jones (1989:212) argued that although slight nasalisation of vowels occurs in English when nasal consonants follow, nasalisation is not sufficient to give the vowels the characteristic nasal timbre. However, if the category *vowel* were investigated, the most typical vowels would probably be [-nasal]. In fact, as is well-known, nasalised vowel phonemes are rare in languages and, when they appear, they are acquired only after oral vowels (Jakobson 1968). Subjects may then consider realisations of / i /, slightly nasalised due to the influence of the following nasal consonant as less typical examples of / i / because, to them, typical vowels should be completely [-nasal]. In fact, previous research has also found a similar effect of nasality on typicality ratings. Davis & Kuhl (1992) obtained average typicality ratings of ten naturally-produced voiceless velar stops followed by / æ /, digitised and edited to include only the initial consonant and the first two pitch periods of the following vowel. These researchers found that examples of / k / followed by a nasalised vowel (as a consequence of the final nasal consonant in the original production) received lower typicality ratings than those examples in which the vowel was not followed by a nasal consonant.

Second, why might examples of / i / followed by / l / be the least typical examples?. One reason could be that the specific allophone of / l / after / i / in the stimuli presented to the subjects, that is, "dark" *l*, implies a raising of the back of the tongue in the direction of the soft palate and therefore it has a back vowel (or velarised) resonance. In addition, the veralisation of [ɫ] often has the effect of retracting and lowering slightly the articulation of a preceding front vowel so that / i / lacks its characteristic tongue height and tongue advancement values. Also, when / i / is followed by [ɫ], a central glide between the vowel and [ɫ] is often noticeable (Gimson 1978:103). Presumably typical examples of / i / should not have such a glide. This is an aspect that many English subjects intuitively mentioned in the post-test interview after the typicality rating task.

***Table 13*: Mean of mean typicality ratings of instances of / i / grouped by type of coda: English and Spanish subjects**

type of coda	English group	Spanish group
voiceless oral stops	5.80	3.02
voiced oral stops	5.40	5.57
voiceless fricatives	4.86	3.60
voiced fricatives	5.19	6.03
nasal stops	3.31	4.40
laterals	3.00	5.32
open syllable	5.38	5.13

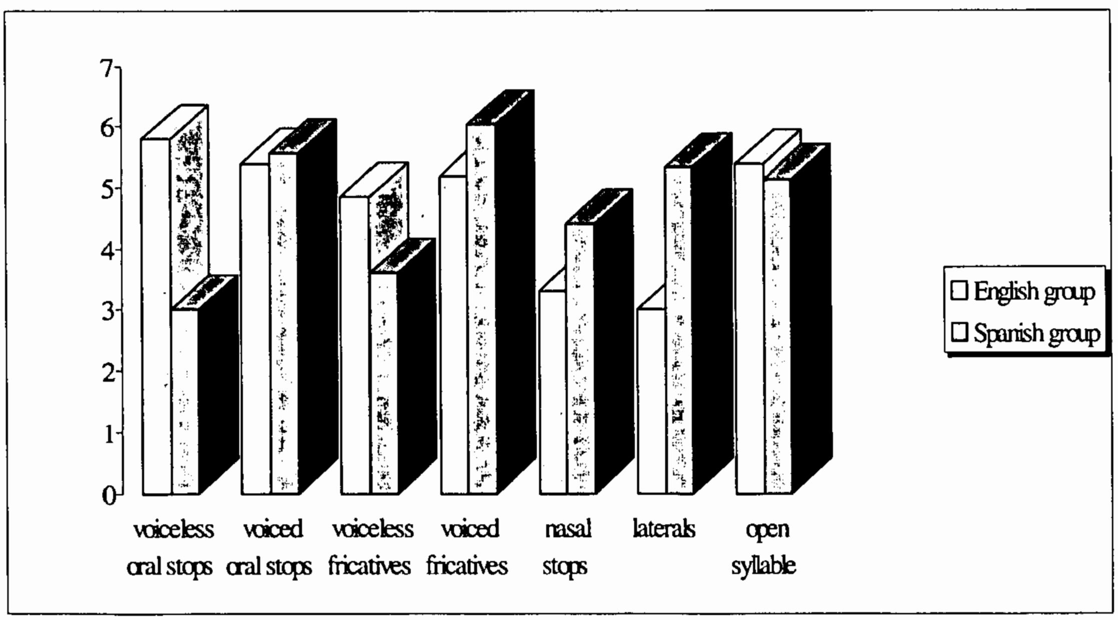

***Figure 3*: Means of mean typicality ratings of instances of / i / followed by a particular type of coda in both groups**

The Spanish group seemed to be focusing on a different phonetic property: length. Although phonologically / i / is considered as a long vowel, phonetically it is sometimes rather short. As is well-known, the reason lies in the effect produced by the coda. Final voiceless (or fortis) obstruents (i.e. stops and fricatives) shorten preceding long vowels and final voiced (or lenis) obstruents lengthen them. Thus, the length of / i / in accented syllables decreases depending on the character of the following consonant as table 14 and figure 4 show.

Table 14: **Mean duration of / i / (in msc) from shortest to longest depending on the phonetic character of the coda**[14].

Type of coda	**voiceless stop**	**voiceless fricative**	**nasal stop**	**open syllable**	**voiced stop**	**voiced fricative**
Mean duration	123 msc	130 msc	195 msc	280 msc	285 msc	360 msc
Example	"seat"	"reef"	"seen"	"see"	"lead"	"leave"

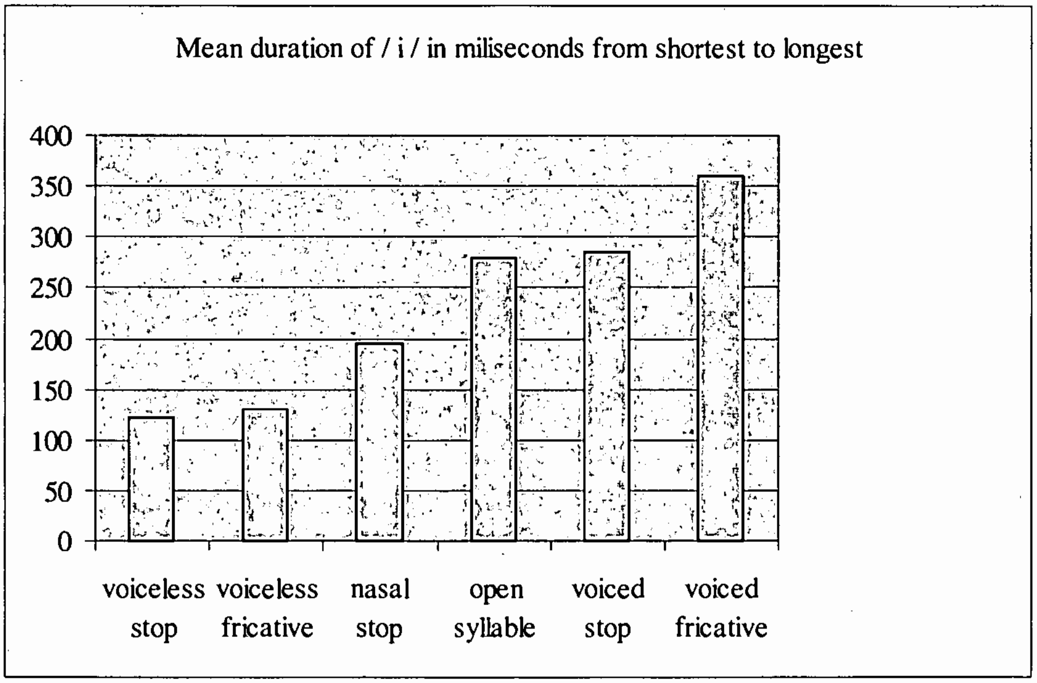

Figure 4**: Mean duration of / i /.(in msc) from shortest to longest depending on the phonetic character of the coda**

A close comparison of the mean duration of members of / i / as determined by the type of coda and the mean typicality ratings for members of / i / followed by the same type of coda reveals that typicality ratings increase as vowel length increases. The longer the mean duration of / i /

in a vowel, the more typical the vowel is considered to be and the shorter the mean duration, the less typical. Length seems then to be an important phonetic feature contributing to make members of / i / as more typical members.

It might be wondered why Spanish learners of English and English native speakers followed different phonetic criteria to rate the typicality of the different realisations of / i /. Apparently, the English group disregarded length as a criterion to decide the typicality of each vowel sound. In fact, the English subjects' vowel-plus-coda group with the highest mean typicality ratings (i.e. / i / followed by voiceless oral stops) is that which has the shortest mean duration of the vowel. The reason why the Spanish group focused on length may have been that the name they learned for the category in an instructional setting was "long *i*". As a consequence, they paid attention, as most of them said in the post-test interview, to how long the vowel was. However, as native speakers of English do not have a conscious knowledge of the / ɪ /-/ i / length contrast (as most of them said in the post-test interview), they focused on other phonetic features like, for instance, nasality. In this respect, an interesting question to investigate in future work could be whether the typicality ratings provided by Spanish learners of English who have not mastered the category yet are similar to the ones obtained for the English subjects in this study.

All these explanations are consistent with the perceptual salience determination of typicality. Following different criteria, both native speakers of English and learners of English consider those realisations of / i / that are longer (in the case of the Spanish), or oral and non-diphthongised (in the case of English) as better examples of / i /. However, the criterion the Spanish group followed seems to be a somewhat mixed determinant of typicality (half materialistic and half non-materialistic). Spaniards might be attending to some acoustic characteristic of the speech signal itself but following conceptual knowledge about the category, that is, their knowledge of the phonological name of the sound. In this respect, length might be a kind of "ideal" characteristic that typical members of / i / should have. Knowing that the sound they are judging is often called "long *i*", Spanish learners of English focus on differences in length to judge typicality.

III. GENERAL DISCUSSION

Two main sets of findings can be discussed in relation to the experiments reported above: those related to typicality ratings and those related to determinants of those ratings. In addition, implications of these findings for the development of an interlanguage segmental phonology are discussed.

Experiments 1 and 2 provide further support to the growing evidence that stimuli considered as members of the same phonetic and/or phonological category are far from equivalent but differ in how typical they are rated as members of their category. However, this study is the first to provide typicality ratings for the same phonological category by two different cultural and linguistic groups: native speakers of English whose / i / category belongs to their mother tongue and Spanish learners of English whose / i / category belongs to their interlanguage phonology and learned it in an instructional setting. An important finding from this study is that, although typicality ratings are highly robust in both groups, there is only partial convergence in the mean typicality ratings generated for each instance of / i /.

Experiment 3 and the several analyses included therein tried to determine whether the typicality ratings obtained in experiments 1 and 2 could derive from several factors like perceived familiarity with stimuli as real English words, perceived word frequency, the spellings of / i / and phonetic influence of the coda.

In the English group evidence for perceived familiarity with words, perceived word frequency, spelling and influence of the coda as determinants of typicality was obtained. Spelling and influence of the coda but not familiarity with words and perceived word frequency seemed to determine typicality in the Spanish group. Although both groups seemed to base their typicality ratings partly on the effect produced by the coda on instances of / i /, they paid attention to different types of influence of codas on preceding vowels.

The present findings provide evidence for multiple determinants of typicality for one and the same category at the same time. This is not surprising as experimental research has suggested that different factors may determine the typicality of the different members of a category at the same time. Barsalou (1981, 1985) and Barsalou and Sewell (1985) found that similarity, perceived frequency of instantiation and ideals predicted typicality in common semantic categories like *bird* and perceived frequency of instantiation, ideals (but not similarity)[15] predicted typicality in goal-derived categories. Nosofsky (1988b) found evidence for both similarity and frequency of instantiation of referents of category members in perceptual categories and Loken and Ward (1990) for similarity, ideals and perceived frequency of instantiation in product categories (Loken & Ward 1990).

Furthermore, the fact that different factors determine the typicality of the members of a category in different groups is also not surprising. It has long been shown that the determinants of the typicality of the members of a particular category may vary depending on the circumstances in which the category is processed. For example, whereas ideals may determine the typicality of category members in one context, similarity may determine their typicality in another (Barsalou 1985, 1987). Therefore, instead of a fixed determinant being responsible for a category's typicality ratings on all occasions, different contexts may cause different factors to determine typicality for one and the same category. The context-dependent character of the determinants of the typicality of members of a particular category suggests that there may be no invariant typicality for a given category. As the determinants of the typicality of category members change, the typicality ratings of those members may also change. In fact, the literature on typicality is full of studies showing that the same group of people or different populations generate different typicality ratings for the same semantic categories depending on a host of factors like the linguistic context in which a category appears (e.g. Roth & Shoben 1983), the points of view people adopt (Barsalou & Sewell 1984), the mood people are in (e.g. Isen *et al.* 1992), the level of abstraction in a taxonomy in which a particular category is processed (e.g. Roth & Mervis 1983), the processing of a category in isolation or in a conceptual combination (e.g. Hampton 1988; Osherson & Smith 1982; Smith & Osherson 1988), or even subjects' age (e.g. Bjorklund *et al.* 1983). Phonetic categories are also sensitive to global context effects (e.g. Diehl & Kluender 1987; Repp & Liberman 1987). The typicality of the members of phonetic categories varies as a function of changes in syllable-internal rate (e.g. Miller & Volaitis 1989, Miller *et al.* 1997; Volaitis & Miller 1992; Wayland *et al.* 1994; see also Miller 1994), syllable-external rate (e.g. Wayland *et al.* 1994) and changes in any of the multiple acoustic properties specifying any given phonetic segment (e.g. Hodgson 1993; Hodgson & Miller 1996; see also Miller 1994 for a discussion).

An extremely important finding in all these studies is that, although typicality structures change, the typicality ratings subjects produce are also statistically reliable, which indicates that typicality is not an arbitrary phenomenon. It simply means that, when subjects make judgements of typicality, they draw upon many different sources of knowledge, depending on the circumstances (Barsalou 1985, 1987; Segalowitz & Poulin-Dubois 1990). It appears that the determination of typicality is a highly flexible dynamic and context-dependent process. Typicality seems to reflect people's current conceptualisation of a category, and to the extent this conceptualisation changes, typicality will change. It is important to remark that typicality refers to behaviour, not to cognitive or conceptual structure. It refers to how people order the members of a category according to how good or typical of the category they think those members are. In this sense, the typicality of the members of the category *bird* is simply the rank ordering of different types of birds from most to least typical; therefore typicality does not carry any conceptual representational assumptions so it does not provide any specific theory of mental representation (Barsalou 1987).[16].

In relation to the present experiments it can be claimed that to the extent that both groups were basing their typicality ratings on different factors (e.g. knowledge of phonological name of the category in the Spanish group, familiarity with words in the English group, etc.) their typicality ratings differed.

Finally, it is interesting to consider some implications of typicality for the learning of English phonology by Spanish learners of English. In this respect, future work will have to determine whether the typicality of members of / i / predicts performance on different experimental tasks and naturally-occurring phenomena in much the same way as typicality predicted performance as reviewed at the beginning of this study. The evidence mentioned above in relation to dichotic competition, selective adaptation, generalisation and category verification in phonetic categories seems to make us hypothesise this will be so.

One of the main groups of variables has to do with category learning and development of category structure. Reports with both visual (e.g. Hupp & Mervis 1982; Mervis & Pani 1980) and auditory categories (e.g. Grieser & Kuhl 1983, 1989; Kuhl 1991) have shown that categories are learned easily and faster if initial exposure to the category is through typical category members. For example, in Grieser and Kuhl's (1989) study, infants learned the categories / e / and / i /. Their generalisation to other members within the same vowel category was tested and it was found that when infants learned the phonetic categories, if the referent stimulus was a good or typical exemplar of the vowel, infants showed greater generalisation to other members of the category than if a poor vowel exemplar served as the referent stimulus. A very typical vowel assimilated more novel variants of the vowel category than a less typical vowel so generalisation to other members of a vowel category was significantly altered by the typicality of the stimulus on which infants were trained. It remains to be determined whether this ease of learning also applies to adult Spanish learners of English. Taking for granted that, as Repp and Liberman (1984) claim, "mastery of a new language does imply the establishment of new phonetic categories", it is likely that if students were to acquire a new category (like / i /), the typicality of the stimuli to which they are first exposed would have a strong influence in shaping the category. Future work will have to determine whether this is so. The selection of the reference keywords first presented to students becomes then a fundamental issue. The hypothesis is that if words containing very typical examples of the category are shown as examples and learning the category proceeds first with these words (and not with less typical examples), learning will take place more easily and faster.

NOTES:

1. Rosch's (1975b) study used a 7-point scale with 1 meaning "most typical" and 7 "least typical". Malt and Smith's (1982) and Schwanenflugel and Rey's (1986) studies used a 7-point scale with 7 meaning "most typical" and 1 "least typical". Hampton & Gardiner's (1983) study used a 5-point scale with 1 meaning "most typical" and 5 "least typical".

2. People often create categories not well-established in memory to achieve a novel goal. These categories are not conventional but rather are made up on the fly for some immediate purpose (i.e. a goal). In this case they are called "ad hoc".

3. For other variables determining reaction time in such tasks see Chumbley (1986).

4. Jaeger also studied the categories [+/-anterior], [+/-sonorant] and [+/-voice] (Jaeger 1980; Jaeger & Ohala 1984). The results showed that 1) labials, labiodentals and alveolars were generally equally typical members of the category [+anterior], while palatals, velars, low back vowels and laryngeals were increasingly less typical. In the case of the category [-anterior], the pattern reversed; 2) nasals and liquids were clearly the most typical instances of the category [+voice], while fricatives and glides were the least typical. Voiceless stops and voiceless fricatives were the best instances of the [-voice] category; 3) approximants and nasals were the best exemplars of the category [+sonorant] with voiced fricatives and voiced affricates as the least typical examples. For the [-sonorant] category, voiceless stops were the most typical members. In addition, Nathan's (1989) study of *sonority*, and its opposite, *consonantality*, in the context

of syllable structure, provided further evidence. Nathan suggested, for example, that a vowel is a very typical example of sonorant and consequently of syllable nucleus while a voiceless stop is, for example, a very good example of non-sonorant and consequently of syllable margin.

5. Massaro (1987) distinguishes between two types of processes in phonetic categorization, *sensory* and *decisional.* Massaro claims that while discrete decision processes cause stimuli to be "partitioned" categorically into either "member" or "not member" of a phonetic category, these processes do not imply that stimuli are perceived categorically. Massaro speaks of "categorical partitioning" to refer to what has generally been called categorical perception. According to Massaro, all sensory processes are continuous, and categorical perception boundary effects arise only because of discrete "decision" processes.

6. The reasons Kuhl (1991) gives are two: / i / is extensively used in the world's languages and it is one of the 3 "point" vowels (the vowels that are at the articulatory and acoustic extremes of the vowel space).

7. We would like to thank Liz Murphy for her co-operation.

8. These include < ae > (e.g. "Caesar"), < ay > (e.g. "quay"), < e > (e.g. "equal"), < ea > (e.g. "beach"), < ee > (e.g. "beef"), < ei > (e.g. "ceiling"), < eo > (e.g. "people"), < ey > (e.g. "key"), < i > (e.g. "ski"), < ie > (e.g. "field"), and even < *œ* > (e.g. "foetus").

9. Homophones differing only in the spelling form of / i / were ruled out to avoid a possible mismatch between lexical items intended by the experimenter and those possibly understood by the subjects. The excluded homophones were "be"-"b", "beach"-"beech", "bean"-"been", "cheap"-"cheep", "feat"-"feet", "leach"/"Leach"-"leech"/"Leech", "leak"-"leek"/"Leek", "leat"-"leet", "meat"-"meet", "peak"-"peek", "peal"-"peel", "read"-"reed", "sea"-"see"-"c", "seam"-"seem", "sea"-"see", "seen"-"scene", "tea"-"tee"-"t", "team"-"teem", "thee"-"the", "weak"-"week", "weal"-"wheel"-"we'll"(and plurals in the case of nouns). Other homophones spelled at least one with < ea >, < ee >, < e > or < ø > and the other with some other spelling form were also ruled out. These were "peace"-"piece" and "seas"-"sees"-"seize". The only exceptions were "e's"-"ease", "p"-"pea"-"pee", "heel"-"he'll"-"heal". Subjects were told that, if they heard any pronunciation which could be more than just one word, the one meant was the letter name (this would focus their attention on "p" and "e's") that was if they found a word that could be either a noun or a verb, the one meant was the verb (this would focus their attention on "heal" vs. "heel").

10. For the type of CV, VC, and CVC syllable structures selected in this study, / i / may be preceded by any consonant except for / ŋ / (in fact this applies to any vowel as / ŋ / constitutes as phonological segmental constraint in English word-initially). / i / is preceded to a limited extent by / ʒ / (ex. "gîte"), and / θ / (ex. "theme"). Similarly, word-finally in monosyllables, / i / is followed, to a very limited extent, by / ʃ / (ex. "niche") / g / (ex. "league") and / dʒ / (ex. "liege", "siege"). It is never followed by either / ʒ / or / ŋ /.

11. The margins of syllables (either the head or the coda) whose nucleus is / i / may be occupied by more than just one consonant. Two-consonant clusters, which are very common, include oral stops or fricatives followed by / l / (e.g. "plead", "bleak", "clean" "glean", "flee", "sleep"), / w / (e.g. "queen" "tweed", "sweet") or / r / (e.g. "preach", "breathe", "tree", "dream", "cream", "Greek", "three", "freak", "shriek"). They also include voiceless oral stops preceded by / s / (e.g. "speak", "steel", or "ski") or nasals preceded by / s / (e.g. "sneeze"). Three-consonant clusters include / s / as the first consonant, a voiceless stop as the second, and / r / (e.g. "spree", "streak", "screen"), / l / (e.g. "spleen") or / w / (e.g. "squeak") as the third. Similarly, two-consonant codas are also found preceded by / i /. These include

fricatives followed by stops (e.g. "yeast", "seized"), nasals followed by fricatives (e.g. "nineteenth"), etc. Three-consonant clusters are extremely rare (e.g. "nineteenths".

12. Another way to view an exemplar's similarity is as its similarity to some sort of central information (e.g. average or modal attribute values) abstracted from category members (e.g. McCloskey & Glucksberg 1979; Rips *et al.* 1973; Rosch *et al.* 1976; Smith *et al.* 1974).

13. Other non-materialistic factors discussed in the literature are "social salience" (e.g. Whitfield & Slatter 1979), higher-order knowledge structures called "idealized cognitive models" (Lakoff 1987) or knowledge of feature correlations (e.g. Malt & Smith 1984).

14. The durations are taken from Wiik (1965).

15. It has also been found that different factors may determine typicality in different types of categories. Barsalou (1985) found that similarity did not predict typicality in goal-derived categories but it did in common taxonomic categories. In seems then that no factor accounts for the typicality of all possible categories.

16. However, at the beginning of the research on typicality, typicality ratings were believed to mirror the structure of a category in mental representations (e.g. Rosch 1975b). The names "internal structure" or "graded structure", occasionally applied to typicality, testify to this early but eventually rejected interpretation (e.g. Rosch 1978). At present, typicality ratings are considered as mere constraints on what representations might be, though bearing profound implications for our understanding of categorization and memory. In relation to phonetic categories, some studies have also explicitly addressed representational (e.g. Grieser & Kuhl 1989; Miller 1977; Oden & Massaro 1978; Repp 1977; Samuel 1982). However, the same caution should be taken not to identify typicality judgements with the representation of sounds in long-term memory.

REFERENCES

Adelson, B. (1985). Comparing Natural and Abstract Categories: A Case Study from Computer Science. *Cognitive Science* 9, 417-430.

Armstrong, S. L., Gleitman, L. R., & Gleitman, H. (1983). What Some Concepts Might Not Be. *Cognition* 13, 263-308.

Ashcraft, M. H. (1978). Property Norms for Typical and Atypical Items from 17 Categories: A Description and Discussion. *Memory & Cognition* 6, 227-232.

Aydin, A., & Pearce, J. M. (1994). Prototype Effects in Categorization by Pigeons. *Journal of Experimental Psychology: Animal Behavior Processes* 20, 264-277.

Barsalou, L. W. (1981). *Determinants of Graded Structure in Categories*. PhD. Diss. Stanford University, Stanford, California.

Barsalou, L. W. (1983). Ad Hoc Categories. *Memory and Cognition* 11, 211-227.

Barsalou, L. W. (1985). Ideals, Central Tendency, and Frequency of Instantiation as Determinants of Graded Structure in Categories. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 11, 629-654.

Barsalou, L. W. (1987). The Instability of Graded Structure: Implications for the Nature of Concepts. In Neisser, U. (ed.). 1987. *Concepts and Conceptual Development: Ecological and Intellectual Factors in Categorization.* New York: CUP, 101-140.

Barsalou, L. W., & Sewell, D. R. (1984). *Constructing Representations of Categories from Different Points of View.* Technical Report N. 2. Atlanta, GA: Emory University, Emory Cognition Project.

Bauer, P. J., Dow, G. A., & Hertsgaard, L. A. (1995). Effects of Prototypicality on Categorization in 1- to 2-Year-Olds: Getting Down to Basics. *Cognitive Development* 10, 43-68.

Bjorklund, D. F., Smith, S. C., & Ornstein, P. A. (1982). Young Children's Release from Proactive Interference: The Effects of Category Typicality. *Bulletin of the Psychonomic Society* 20, 211-213.

Bjorklund, D. F., & Thompson, B. E. (1978). Category Typicality Effects in Children's Memory Performance: Qualitative and Quantitative Differences in the Processing of Category Information. *Journal of Experimental Child Psychology* 26, 328-340.

Bjorklund, D. F., Thompson, B. E., & Ornstein, P. A. (1983). Developmental Trends in Children's Typicality Judgements. *Behavioral Research Methods and Instrumentation* 15, 350-356.

Blewitt, P., & Durkin, M. (1982). Age, Typicality, and Task Effects on Categorization of Objects. *Perception and Motor Skills* 55, 435-445.

Boster, J. S. (1988). Natural Sources of Internal Category Structure: Typicality, Familiarity, and Similarity of Birds. *Memory & Cognition* 16, 258-270.

Bourne, L. E. Jr. (1982). Typicality Effects in Logically Defined Categories. *Memory & Cognition* 10, 3-9.

Buss, D. M., & Craik, K. H. (1980). The Frequency Concept of Disposition: Dominance and Prototypically Dominant Acts. *Journal of Personality* 48, 379-392.

Cantor, N., & Mischel, W. (1979). Prototypicality and Personality: Effects on Free Recall and Personality Impressions. *Journal of Research in Personality* 13, 187-205.

Cantor, N., Smith, E. E., French, R. D., & Mezzich, J. (1980). Psychiatric Diagnosis as Prototype Categorization. *Journal of Abnormal Psychology* 89, 181-193.

Carney, A. E., Widin, G. P., & Viemeister, N. F. (1977). Noncategorical Perception of Stop Consonants Differing in VOT. *Journal of the Acoustical Society of America* 62, 961-970.

Carson, M. T., & Abrahamson, A. (1976). Some Members Are More Equal than Others: The Effect of Semantic Typicality on Class-Inclusion Performance. *Child Development* 47, 1186-1190.

Chaplin, W. F., John, O. P., & Goldberg, L. R. (1988). Conceptions of States and Traits: Dimensional Attributes with Ideals as Prototypes. *Journal of Personality and Social Psychology* 54, 541-557.

Cherniak, (1984). Prototypicality and Deductive Reasoning. *Journal of Verbal Learning and Verbal Behavior* 23, 625-242.

Chumbley, J. I. (1986). The Roles of Typicality, Instance Dominance, and Category Dominance in Verifying Category Membership. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 12, 257-267.

Cook, R. G., Wright, A. A., & Kendrick, D. F. (1990). Visual Categorization by Pigeons. In Commons, M. L. *et al.* 1990. (eds.). 1990. *Quantitative Analyses of Behavior: Behavioral Approaches to Pattern Recognition and Concept Formation. Vol. 8.* Hillsdale, NJ: LEA, 187-214.

Corrigan, R. (1986). The Internal Structure of English Transitive Sentences. *Memory & Cognition* 14, 420-431.

Dahlgren, K. (1985). The Cognitive Structure of Social Categories. *Cognitive Science* 9, 379-398.

Davis, K., & Kuhl, P. K. (1992). Best Exemplars of English Velar Stops: A First Report. In Ohala, J. J., *et al.* (eds.). 1992. *Proceedings of the International Conference on Spoken Language Processing.* Alberta, Canada: University of Alberta, 495-498.

Diehl, R. L., & Kluender, K. R. (1987). On the Categorization of Speech Sounds. In Harnad, S. (ed.). 1987. *Categorical Perception: The Groundwork of Cognition.* New York: CUP, 226-253.

Duncan, E. M., & Kellas, G. (1978). Developmental Changes in the Internal Structure of Semantic Categories. *Journal of Experimental Child Psychology* 26, 328-340.

Eckes, T. (1985). Zur Internen Struktur Semantischer Kategorien: Typikalitatsnormen auf der Basis von Ratings [On the Internal Structure of Semantic Categories: Typicality Norms on the Basis of Ratings]. *Sprache & Kognition* 4, 192-202.

Fehr, B., Russell, J. A., & Ward, L. M. (1982). Prototypicality of Emotions: A Reaction Time Study. *Bulletin of the Psychonomic Society* 20, 253-254.

Geeraerts, D. (1988b). Where Does Prototypicality Come From?. In Rudzka-Ostyn, B. (ed.). 1988. *Topics in Cognitive Linguistics*. Amsterdam: John Benjamins, 207-229.

Gimson, A. C. (1978, 2nd edition). *An Introduction to the Pronunciation of English*. London: Arnold.

Glass, A. L., & Meany, P. J. (1978). Evidence for Two Kinds of Low-Typical Instances in a Categorization Task. *Memory & Cognition* 6, 622-628.

Greenberg, M. S., & Bjorklund, D. F. (1981). Category Typicality in Free Recall: Effects of Feature Overlap on Differential Category Encoding?. *Journal of Experimental Psychology: Human Learning and Memory* 7, 145-147.

Grieser, D. L., & Kuhl, P. K. (1983). The Internal Structure of Vowel Categories in Infancy: Effects of Stimulus Goodness. *Journal of the Acoustical Society of America*, 74 (Suppl.1). S102(A).

Grieser, D., & Kuhl, P. K. (1989). Categorization of Speech by Infants: Support for Speech-Sound Prototypes. *Developmental Psychology* 25, 577-588.

Hampton, J. A. (1988). Overextension of Conjunctive Concepts: Evidence for a Unitary Model of Concept Typicality and Class Inclusion. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 14, 12-32.

Hampton, J. A., & Gardiner, M. M. (1983). Measures of Internal Category Structure: A Correlational Analysis of Normative Data. *British Journal of Psychology* 74, 491-516.

Hasselhorn, M. (1990). Typizitatsnormen zu zehn Kategorien fur Kinder von der Voschule bis zur vierten Grundschulklasse [Category Norms for Verbal Items in Ten Categories for Children in Kindergarten and in Grades 1-4]. *Sprache & Kognition* 9, 26-43.

Heider, E. R. (1971). Focal Color Areas and the Development of Color Names. *Developmental Psychology* 4, 447-455.

Hodgson, P., & Miller, J. L. (1996). Internal Structure of Phonetic Categories: Evidence for Within-Category Trading Relations. *Journal of the Acoustical Society of America* 100, 565-576.

Hodgson, P. (1993). *Internal Structure of Phonetic Categories: The Role of Multiple Acoustic Properties.* Ph.D. Thesis. North-eastern University.

Huber, L., & Lenz, R. (1996). Categorization of Prototypical Stimulus by Pigeons. *Quarterly Journal of Experimental Psychology* 49, 134-147.

Hupp, S. C., & Mervis, C. B. (1982). Acquisition of Basic Object Categories by Severely Handicapped Children. *Child Development* 53, 760-767.

Isen, A. M., Niedenthal, P. M., & Cantor, N. (1992). An Influence of Positive Affect on Social Categorization. *Motivation and Emotion* 16, 65-78.

Jaeger, J. J. (1980). *Categorization in Phonology: An Experimental Approach.* Ph.D. diss., University of California, Berkeley.

Jaeger, J. J., & Ohala, J. J. (1984). On the Structure of Phonetic Categories. *Berkeley Linguistic Society* 10, 15-26.

Jakobson, R. (1968). *Child Language, Aphasia and Phonological Universals.* The Hague: Mouton.

Jitsumori, M. (1996). A Prototype Effect and Categorization of Artificial Polymorphous Stimuli in Pigeons. *Journal of Experimental Psychology: Animal Behavior Processes* 22, 405-419.

Jones, D. (1989, 9th edition). *An Outline of English Phonetics.* Cambridge: Cambridge University Press.

Keller, D. (1982). Developmental Effects of Typicality and Superordinate Property Dominance on Sentence Verification. *Journal of Experimental Child Psychology* 33, 288-297.

Keller, D., & Kellas, G. (1978). Typicality as a Dimension of Encoding. *Journal of Experimental Psychology: Human Learning and Memory* 4, 78-85.

Kelly, M. H., Bock, J. K., & Keil, F. C. (1986). Prototypicality in a Linguistic Context: Effects on Sentence Structure. *Journal of Memory & Language* 25, 59-79.

Kuhl, P. K. (1991) Human Adults and Human Infants Show a 'Perceptual Magnet Effect' for the Prototypes of Speech Categories, Monkeys Do Not. *Perception & Psychophysics* 50, 93-107.

Lakoff, G. (1973). Hedges: A Study in Meaning Criteria and the Logic of Fuzzy Concepts. *Journal of Philosophical Logic* 2, 458-508.

Lakoff, G. (1987a). *Women, Fire and Dangerous Things: What Categories Reveal About the Mind.* Chicago, IL: University of Chicago Press.

Liberman, A. M., Harris, K. S., Hoffman, H. S., & Griffith, B. C. (1957). The Discrimination of Speech Sounds within and across Phoneme Boundaries. *Journal of Experimental Psychology* 54, 358-368.

Lin, P. J., & Schwanenflugel, P. J. (1990). Cultural Familiarity and Language Factors in the Structure of Category Knowledge. Unpublished manuscript. University of Georgia, Athens, GA.

Lin, P. J., Schwanenflugel, P. J., & Wisenbaker, J. M. (1990). Category Typicality, Cultural Familiarity, and the Development of Category Knowledge. *Developmental Psychology* 26, 805-813.

Loken, B., & Ward, J. (1990). Alternative Approaches to Understanding the Determinants of Typicality. *Journal of Consumer Research* 17, 111-126.

Lotto, A. J. (2000). Language Acquisition as Complex Category Formation. *Phonetica* 57, 189-196.

Malt, B. C., & Smith, E. E. (1982). The Role of Familiarity in Determining Typicality. *Memory & Cognition* 10, 69-75.

Malt, B. C., & Smith, E. E. (1984). Correlated Properties in Natural Categories. *Journal of Verbal Learning and Verbal Behavior* 23, 250-269.

Massaro, D. W. (1987). Categorical Partition: A Fuzzy-Logical Model of Categorization Behavior. In Harnad, S. (ed.). 1987. *Categorical Perception: The Groundwork for Cognition*. New York: Academic Press, 254-283.

Massaro, D. W., & Cohen, M. M. (1983). Categorical or Continuous Speech Perception: A New Test. *Speech Communication* 2, 15-35.

McCloskey, M. E. (1980). The Stimulus Familiarity Problem in Semantic Memory Research. *Journal of Verbal Learning and Verbal Behavior* 19, 485-502.

McCloskey, M. E., & Glucksberg, S. (1978). Natural Categories: Well-Defined or Fuzzy Sets?. *Memory & Cognition* 6, 462-472.

McCloskey, M. E., & Glucksberg, S. (1979). Decision Processes in Verifying Category Membership Statements: Implications for Models of Semantic Memory. *Cognitive Psychology* 11, 1-37.

McFarland, C. E., Duncan, E. M., & Kellas, G. (1978). Isolating the Typicality Effect in Semantic Memory. *Quarterly Journal of Experimental Psychology* 30, 251-262.

Medin, D. L., & Shoben, E. J. (1988). Context and Structure in Conceptual Combination. *Cognitive Psychology* 20, 158-190.

Mervis, C. B., & Pani, J. R. (1980). Acquisition of Basic Object Categories. *Cognitive Psychology* 12, 496-522.

Mcrvis, C. B., Catlin, J., & Rosch, E. (1976). Relationships Among Goodness-of-Example, Category Norms, and Word Frequency. *Bulletin of the Psychonomic Society* 7, 283-284.

Mervis, C. B., & Roth, E. M. (1981). The Internal Structure of Basic and Non-Basic Color Categories. *Language* 57, 384-405.

Miller, J. L. (1977). Properties of Feature Detectors for VOT: The Voiceless Channel of Analysis. *Journal of the Acoustical Society of America* 62, 641-648.

Miller, J. L. (1994). On the Internal Structure of Phonetic Categories: a Progress Report. *Cognition* 50, 271-285.

Miller, J. L., Connine, C. M., Schermer, T. M., & Kluender, K. R. (1983). A Possible Auditory Basis for Internal Structure of Phonetic Categories. *Journal of the Acoustical Society of America* 73, 2124-2133.

Miller, J. L., & Eimas, P. D. (1996). Internal Structure of Voicing Categories in Early Infancy. *Perception & Psychophysics* 58, 1157-1167.

Miller, J. L., & Volaitis, L. E. (1989). Effect of Speaking Rate on the Perceptual Structure of a Phonetic Category. *Perception & Psychophysics* 46, 505-512.

Miller, J. L., O'Rourke, T. B., & Volaitis, L. E. (1997). Internal Structure of Phonetic Categories: Effects of Speaking Rate. *Phonetica* 54, 121-137.

Mompeán, J. A. (1999). *A Cognitive Account of the Phenomenon of Phonological Neutralization.* Paper presented at the 6th International Cognitive Linguistics Conference. Stockholm, July 1999.

Mulford, R. (1979). Prototypicality and the Development of Categorization. *Papers and Reports on Child Language Development* 16, 13-25.

Nathan, G. S. (1986). Phonemes as Mental Categories. *Berkeley Linguistic Society* 12, 212-223.

Nathan, G. S. (1989). Preliminaries to a Theory of Phonological Substance: the Substance of Sonority. In Corrigan, R. *et al.* (eds.) 1989. *Linguistic Categorization.* Amsterdam/Philadelphia: John Benjamins, 55-67.

Newport, E. L., & Bellugi, U. (1978). Linguistic Expression of Category Levels in a Visual-Gestural Language: A Flower Is a Flower Is a Flower. In Rosch, E., & Lloyd, B. B. (eds.). 1978. *Cognition and Categorization.* Hillsdale, NJ: LEA, 49-71.

Nosofsky, R. M. (1988a). Exemplar-Based Accounts of Relations Between Classification, Recognition, and Typicality. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 14, 700-708.

Nosofsky, R. M. (1988b). Similarity, Frequency, and Category Representations. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 14, 54-65.

Nosofsky, R. M. (1991). Typicality in Logically Defined Categories: Exemplar-Similarity versus Rule Instantiations. *Memory & Cognition* 19, 131-150.

Oden, G. C. (1977). Fuzziness in Semantic Memory: Choosing Exemplars of Subjective Categories. *Memory & Cognition* 5, 198-204.

Oden, G. C., & Massaro, D. W. (1978). Integration of Featural Information in Speech Perception. *Psychological Review* 85, 172-191.

Osherson, D. N., & Smith, E. E. (1982). Gradedness and Conceptual Combination. *Cognition* 12, 299-318.

Osherson, D. N., Smith, E. E., Wilkie, O., López, A., & Shafir, E. B. (1990). Category-Based Induction. *Psychological Review* 97, 185-200.

Pisoni, D. B., & Tash, J. (1974). Reaction Times to Comparisons within and across Phonetic Categories. *Perception and Psychophysics* 15, 285-290.

Read, C. (1986). *Children's Creative Spelling*. London: Routledge & Kegan Paul

Read, S. J., Jones, D. K., & Miller, L. C. (1990). Traits as Goal-Based Categories: The Importance of Goals in the Coherence of Dispositional Categories. *Journal of Personality and Social Psychology* 58, 1048-1061.

Repp, B. H. (1977). Dichotic Competition of Speech Sounds: The Role of Acoustic Stimulus Structure. *Journal of Experimental Psychology: Human Perception and Performance* 3, 37-50.

Repp, B. H. (1984). Categorical Perception: Issues, Methods, Findings. In Lass, N. J. (ed.). 1984. *Speech and Language: Advances in Basic Research and Practice. Vol. 10.* New York: Academic Press, 243-335.

Repp, B. H., & Liberman, A. M. (1987). Phonetic Category Boundaries are Flexible. In Harnad, S. (ed.). 1987. *Categorical Perception: The Groundwork of Cognition*. New York: CUP, 89-112.

Rips, L. J. (1975). Inductive Judgements about Natural Categories. *Journal of Verbal Learning and Verbal Behavior* 14, 665-681.

Rips, L. J., Shoben, E. J., & Smith, E. E. (1973). Semantic Distance and the Verification of Semantic Relations. *Journal of Verbal Learning and Verbal Behavior* 12, 1-20.

Rosch, E. H. (1973a). Natural Categories. *Cognitive Psychology* 4, 328-350.

Rosch, E. H. (1973b). On the Internal Structure of Perceptual and Semantic Categories. In Moore, T. E. (ed.). 1973. *Cognitive Development and the Acquisition of Language*. New York: Academic Press, 111-144.

Rosch, E. H. (1975a). Cognitive Reference Points. *Cognitive Psychology* 7, 532-547.

Rosch, E. H. (1975b). Cognitive Representations of Semantic Categories. *Journal of Experimental Psychology: General* 104, 192-233.

Rosch, E. H. (1975c). The Nature of Mental Codes for Color Categories. *Journal of Experimental Psychology: Human Perception and Performance* 1, 303-322.

Rosch, E. H. (1977). Human Categorization. In Warren, N. (ed.). 1977. *Advances in Cross-Cultural Psychology. Vol. 1.* London: Academic Press, 3-49.

Rosch, E. H. (1978). Principles of Categorization. In Rosch, E. H., & Lloyd, B. B. (eds.). 1978. *Cognition and Categorization*. Hillsdale, NJ: LEA, 7-48.

Rosch, E. H., & Mervis, C. B. (1975). Family Resemblances: Studies in the Internal Structure of Categories. *Cognitive Psychology* 7, 573-605.

Rosch, E. H., Simpson, C., & Miller, R. S. (1976). Structural Bases of Typicality Effects. *Journal of Experimental Psychology: Human Perception and Performance* 2, 491-502.

Roth, E. M., & Mervis, C. B. (1983). Fuzzy-Set Theory and Class Inclusion Relations in Semantic Categories. *Journal of Verbal Learning and Verbal Behavior* 22, 509-525.

Roth, E. M., & Shoben, E. J. (1983). The Effect of Context on the Structure of Categories. *Cognitive Psychology* 15, 346-378.

Samuel, A. G. (1982). Phonetic Prototypes. *Perception & Psychophysics* 31, 307-314.

Schwanenflugel, P. J., & Rey, M. (1986). The Relationship Between Category Typicality and Concept Familiarity: Evidence from Spanish- and English-Speaking Monolinguals. *Memory & Cognition* 14, 150-163.

Segalowitz, N., & Poulin-Dubois, D. (1990). The Structure of Categories: Typicality Gradients, Perceived Linguistic Familiarity and Cross-Linguistic Comparisons. *Cahiers de Psychologie Cognitive* 10, 491-512.

Shafir, E. B., Smith, E. E., & Osherson, D. N. (1990). Typicality and Reasoning Fallacies. *Memory & Cognition* 18, 229-239.

Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion Knowledge: Further Exploration of a Prototype Approach. *Journal of Personality and Social Psychology* 52, 1061-1086.

Smith, E. E., & Osherson, D. N. (1988). Compositionality and Typicality. In Schifter, S., & Steele, S. (eds.). 1987. *The 2nd Arizona Colloquium on Cognitive Science*. Tucson, AZ: University of Tucson Press, 37-52.

Smith, E. E., Shoben, E. J., & Rips, L. J. (1974). Structure and Process in Semantic Memory: A Featural Model for Semantic Decisions. *Psychological Review* 81, 214-241.

Strauss, M. S. (1979). Abstraction of Prototypical Information in Adults and 10-Month-Old Infants. *Journal of Experimental Psychology: Human Learning and Memory* 5, 618-632.

Studdert-Kennedy, M., Liberman, A. M., Harris, K. S., & Cooper, F. S. (1970). Motor Theory of Speech Perception: A Reply to Lane's Critical Review. *Psychological Review* 77, 234-249.

Treiman, R. (1993). *Beginning to Spell: A Study of First-Grade Children*. New York: Oxford University Press.

Tversky, A., & Gati, I. (1978). Studies of Similarity. In Rosch, E., & Lloyd, B. B. (eds.). 1978. *Cognition and Categorization*. Hillsdale, NJ: LEA, 79-98.

Uyeda, K. M., & Mandler, G. (1980). Prototypicality Norms for 28 Semantic Categories. *Behavioral Research Methods & Instrumentation* 12, 587-595.

Van Hessen, A. J., & Schouten, M. E. H. (19929. Modeling Phoneme Perception. II: A Model of Stop Consonant Discrimination. *Journal of the Acoustical Society of America* 92, 1856-1868.

Volaitis, L. E., & Miller, J. L. (1992). Phonetic Prototypes: Influence of Place of Articulation and Speaking Rate on the Internal Structure of Voicing Categories. *Journal of the Acoustical Society of America* 92, 723-735.

Wayland, S. C., Miller, J. L., & Volaitis, L. E. (1994). The Influence of Sentential Speaking Rate on the Internal Structure of Phonetic Categories. *Journal of the Acoustical Society of America* 95, 2694-2701.

White, T. G. (1982). Naming Practices, Typicality, and Underextension in Child Language. *Journal of Experimental Child Psychology* 33, 324-346.

Whitfield, T. W. A., & Slatter, P. E. (1979). The Effects of Categorization and Prototypicality on Aesthetic Choice in a Furniture Selection Task. *British Journal of Psychology* 70, 65-75.

Wiik, K. (1965). *Finnish and English Vowels.* Turku.

Wojciszke, B., & Pienkowski, R. (1991). Prototypical Structure of Personality Trait Concepts and Person Perception. *Cahiers de Psychologie Cognitive* 11, 213-228.

Younger, B. A., & Gotlieb, S. (1988). Development of Categorization Skills: Changes in the Nature or Structure of Infant Form Categories?. *Developmental Psychology* 24, 611-619.

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Profiling the Phonological Processes Shaping the Fossilised IL of Adult Spanish Learners of English As Foreign Language. Some Theoretical Implications.

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ABSTRACT

In the ever-growing literature dealing with the acquisition by adults of the phonetics and phonology of a foreign language (FL), research has tried to provide an answer to the complex nature of cross-language transfer. The fact that despite idiosyncratic differences and sociolinguistic variation most adults learners of a foreign language (FL) speak with an accent which is a reflection of their native language (NL) and that their progress is impaired at a certain stage prompted a host of questions such as whether adults follow identical or different paths of development in their approach to a foreign language, whether those speaking the same native language are able to identify target language categories in the same way, whether perception and production are interdependent, the nature of the learning abilities and the interplay of transfer with universals. These and other problems relating to foreign language speech have been approached from different angles and theoretical frameworks (see Leather & James (1991) for an overview, and more recently Leather (1999).

The research reported here, based on the oral production of sixty-five Spanish adult learners of English as a FL, tries to shed some light on one of well-known problems related to the acquisition of a foreign language by non-native speakers: the analysis of different types of phonological processes shaping the fossilised interlanguage (IL) of adult FL learners in order to see a) whether they are adhered to by those adult learners sharing identical L1; b) whether

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frozen IL reflects transfer from the learner's L1 or is the result of developmental (i.e. universal) processes. In this connection we shall examine the extent to which the learners' IL reflects the alleged tendency to reduce complex syllabic margins to a Universal Canonical Syllable Structure (UCSS). We shall also discuss the explanatory power of some universal phonological models like Major's Ontogeny Model (1987) and Similarity/Differential Rate Hypothesis (1999) or Ekman's Markedness Differential Hypothesis (1977) and Structural Conformity Hypothesis in connection with some of the processes under analysis. Optimality Theory will be brought in in dealing with some problems encountered under Cluster Simplification. Ultimately, we shall try to explain why adult speakers of a language like Spanish tend to identify target categories in much the same way without necessarily having to resort in all cases to language universals as decisive factors shaping their IL.

KEYWORDS: phonological processes, adult FL acquisition, frozen IL, IL phonology.

I. INTRODUCTION

Right from the dawn of Contrastive Analysis Hypothesis (CAH) , Weinreich (1953) and Lado (1957) envisaged adult foreign language phonological behaviour as being heavily dependent on the learner's L1 structure. The fact that the adult learner of a foreign language (FL) cannot go beyond a certain phonological barrier despite idiosyncratic differences, triggered off a movement based on the technique of comparison-prediction-description as a means to provide a scientific description of the native and the target language alike, all cross-linguistic phonetic differences between the two being resolved in terms of the former. The force of the mother language was manifested in the degree of 'phonic interference' that takes place at the production as well as the perception level. Lado referred to 'distortions' in the first case while perceptually such influence would be manifest in the presence of 'blind spots' (1957: 11) responsible for inhibiting the perception of sounds other than those occurring in one's own language. Such 'phonological sieve' (Trubetzkoy, 1939) is acknowledged as being responsible for two of the most important features that characterise adult oral behaviour: fossilisation and concomitantly 'foreign accent', its perceptual manifestation. Soon the emerging language, generally known as 'interlanguage' after Selinker's 1972 influential paper was seen as an essentially idiosyncratic system. Those 'deviant linguistic systems' —notice the pluralization (Nemser, 1971: 116)[1]— distinct from both the NL (native language) and the TL (target language) have been the object of intense research during the past forty years from psycholinguistic, linguistic, cognitive, sociological, and contextual standpoints (Monroy, 1990; Lalleman, 1996).

A perennial problem since Lado's pronouncement has to do with the core question as to why adults can cope with acoustically different varieties found in their own language and yet are unable to perceive foreign sounds correctly. L1 influence (transfer/interference) and source of error have been key concepts on which much research has hinged. American Structuralism posited a causal relationship between the terms, seeing interference from L1 as the most important source of error. Since then a number of researchers have considered errors as a reflection of processes that take place in the learner's IL whose origin is traceable to the learner's L1. The overriding role played by the speaker's L1 as a fundamental template which conditions to a large extent the type and pace of the learner's output, particularly at the phonetic / phonological level, is well documented and has been widely acknowledged (Scovel, 1969; Tarone[2], 1978, 1980; Flick, 1979; Felix, 1980; Eckman, 1981; Kellerman, 1983; Wode,1980, 1984; Broselow, 1984, 1987; Sato, 1987; Ringbom, 1987; Odlin, 1989; Major, 1994; James, R.A (1996). The impact is so strong that despite the enormous amount of research devoted to L2 and FL acquisition, transfer continues to be considered by many as the most important factor in adult FL acquisition.

The empirical discovery of patterns that apparently are not attributable to one's first language and that are not fully explained on the basis of a simple comparison of L1- L2/FL phonological structures (Nemser, 1971; Johansson, 1973; Flege & Davidian, 1984; Major, 1987) have favoured the view that universal phonological constraints are concurrent if not decisive factors shaping the learner's IL[3]. As a result, a fundamental distinction[4] has been drawn between interference vs developmental (universal) processes which underlies current phonological theories such as Natural Phonology (Donegan and Stampe, 1979) or Hancing-Bahtt and Bahtt's Feature Competition Model (1997) within Optimality Theory (OT). From a universal grammar (UG) perspective, research has focused on the study of the difference between L1-L2/FL acquisition to see if UG grammar is accessible or not to the L2/FL learner. Another important area of research in generative linguistics is the analysis of L1 influence on FL acquisition. This issue has been addressed using the concept of markedness and parameter theory.

Eckman's Markedness Differential Hypothesis (MDH) (1977, 1985) is precisely an attempt to provide an explanation of FL learners' difficulties in terms of markedness differentials or typological characteristics of L1 and the target language: forms in the FL more marked than NL forms are postulated to be more difficult to acquire than those that are different but unmarked. This alternative to CAH predicting the 'directionality of difficulty' (1987: 55) and explaining degrees of difficulty from a universal perspective has had considerable support (Anderson, 1987; Eckman, 1987; Carlisle, 1988; Hammarberg, 1988, but see Sato, 1984; Altenberg and Vago, 1987[5]; Cichoki et al., 1999). However, Eckmam seems to have abandoned it as there is evidence that some learners choose the least marked option in spite of having the marked one in their L1. In his Interlanguage Structural Conformity Hypothesis (1991) he stresses typological markedness further, stating that "the universal generalizations that hold for the primary languages hold also for interlanguages" (1991: 24), which seems to exclude L1 influence altogether. In Eckman and Iverson (1993) typological markedness is seen as paramount in accounting for FL syllable-structure acquisition. Carlisle, on the other hand, envisages in his

Intralingual Markedness Hypothesis (1999) markedness relations within L2 as well as between L1 and FL as possible constraints on transferability of forms from L1 .

Still within typological markedness, syllabic segment variable sonority has being postulated as a correlate of the order of acquisition. Tropf (1987) considers that it is sonority rather than syllable position which determines consonant acquisition. Working within a Universal Canonical Syllable Structure frame he sees degree of sonority as the main conditioning factor of the ordering of all syllable elements. Thus vowels, glides, liquids, nasals, fricatives and plosives depart from sonority in an increasing order. Clements (1990) Sonority Dispersion Scale also predicts that onsets with steady increase in sonority (e.g. /bl...br/ are less marked than those with very steep increase. In fact, sonority-sequencing restrictions are increasingly discussed as part of the information potential of different segments (Prince & Smolensky, 1993; Ohala & Kawasaki, 1997).

Parameter theory (Chomsky, 1981), the other research line within generative grammar's concern with L1 influence on L2 , addresses the issue whether L1 parameter values hold in a FL context. If a parameter consists of a number of characteristics that form part of a UG and languages differ in the value of the different parameters, it is obvious that children acquiring their L1 learn to set the appropriate parameter values. The question arises whether FL learners are capable of resetting (i.e. transferring) parameters that do not tally with those already acquired. There is currently some empirical evidence —mostly restricted to syntactic patterns (but see Broselow and Finer, 1991)— both for and against UG-accessibility by FL learners, particularly in the USA where UG is the dominant theoretical framework. Non-linear phonology in any of its variants (autosegmental, metrical, feature geometry or lexical phonology) is taking promising steps in an attempt to explain whether adults are successful in acquiring an L2/Fl, but the fact that the Principles and Parameters may progressively fade out after a certain period of time makes the theory questionable from a FL perspective. As Lalleman writes, "the conclusions that various researchers draw from their results often contradict each other" (Lalleman, 1996: 49).

As early as 1972, Tarone[6] was concerned with universal constraints affecting the learner's syllable structure in terms of open vs closed syllables. She considered (1980) that the FL learner IL syllable structure is influenced by three main universal processes: transfer of L1 phonotactic patterns into L2/FL, L1 reactivated processes such as syllable deletion, and universal processes of different types, such as simplification towards an open CV syllable. Their dominance is assessed in terms of syllable alterations. Research has apparently confirmed in many cases that the open CV pattern is the most universal syllable type, clusters in coda position being a function of the jakobsonian notion of markedness.

Due to the crucial role played by syllable structure in the production and perception of language, it has been approached as being the result of a number of forces intervening in its acquisition and configuration, hence it has provided the basic frame for typological approaches and universal processes underlying the structure of a FL phonology such as the 'Sonority

Phonological Principle' (Broselow & Finer, 1991; Archibald & Vanderweide, 1997), the 'Markedness Principle' (Ekman, F.R. 1977, 1987; Ekman and Iverson, 1993); Major's Ontogeny Model, 1996), Flege's Speech Learning Model (1988) or Clements' Sonority Dispersion Scale (1990), among others[7].

The interaction of universal processes with transfer[8] has attracted increasing attention due in no small measure to the impact of theoretical linguistic models which underlie much work done in FL phonology. Thus the issue of universal processes was first addressed by Natural Phonology (Stampe, 1969; Donegan & Stampe, 1979) the phonological structure of all languages being envisaged as a 'residue' of a universal set of processes which are innate realisations of implicit phonetic forces. In the case of second or foreign languages, acquisition is seen as consisting of a gradual suppression of those processes which, although part of a universal set characterising human speech, do not occur in the learner's IL. Adult FL learners would apply to the target language those natural processes that shape their L1 together with those which have not been suppressed during their L1 acquisition. At first, the residual processes would govern the perception and production of the target language. Progressively, the interfering processes would give way to those that are present in the FL.

Major's 'Ontogenic Model' (1987, 1996) —a development of Stamp's ideas— sees FL acquisition as a competition between interference and universal or developmental processes. Natural Phonology predicts that those processes not suppressed by the learner's L1 will appear in L2/FL acquisition provided they are reflected in any adult language. At the early stages, Major claims interference prevails over developmental processes while in the course of the acquisition developmental processes increase and then decrease as the learner approaches the target language. Native-like phonological competence is attained when both types of processes are eliminated. He envisages identical acquisition mechanisms for L1 than for L2: natural phonological processes are innate since the order of acquisition of sounds in an L1 context is 'strikingly similar across languages' (1987: 211). And the 'same processes for L1 and L2 learners' (1987: 213) intervene. There is then a universal order underlying L1 and L2/FL acquisition[9], notwithstanding asymmetrical relations due to the fact that some substitutions derive from the learner's native language while others derive from universal principles of order. This is reflected in 'loan phonology', as he calls it, where most terms fit the NL patterns. Some loan terms may enter into a conflict with L1 structure; this is due, according to Major, to universal principles of order or acquisition and markedness. A further universal principle he puts forward refers to precedence, whereby strengthening or fortition processes precede weakening or lenition processes, the former being more typical of formal styles while the later are favoured in casual styles.

This theoretical framework claims to have strong explanatory power in that it integrates synchronic, diachronic and first and second/ foreign language acquisition into one framework (Major, 1986); it can also predict which process can apply to a given sound class. It fails, though, in that it does not predict the type of process intervening on a particular occasion as no implicational relations hold between processes (Donegan, 1978, cited in Leather, 1999).

No empirical evidence has conclusively proved which of these processes —transfer or developmental— is paramount in accounting for FL syllabification nor is there agreement on the number of phonological processes involved and their respective importance. Thus while several researchers (Tarone, 1980; Greenberg, 1983; Kellerman, 1983; Broselow (1984)[10]; Wode, 1984; Sato, 1984); Ringbom, 1987; Hammerly, 1991; James, R.A. 1996) present evidence and subscribe to the view that the majority of errors are a reflection of L1 processes that have been transferred in their integrity, while a variable amount may be ascribed to phonological universals, there are those who consider that L1 and L2/Fl are shaped by different phonological processes. Syllabic suppression, for instance, is a process fairly common in L1 acquisition (e.g. (ba) nana)[11] which does not occur in an L2/FL context (Oller, 1974, cited by Tarone, 1980). Likewise, reduplication processes —also common in child language[12]— are not reported in the IL of the adult learner. On the other hand, a process like epenthesis does not occur in an L1 learning context (Macken & Ferguson, 1981). Still others, like Hecht & Mulford (1987) follow Fergusson and Debose (1977) and Wode (1980) in considering that neither transfer nor developmental processes alone provide an adequate explanation of FL phonological development. Transfer is thought to predominate in the acquisition of fricatives and affricates, whereas developmental processes would best predict sound substitutions for difficult segments. Liquids and stops would stand between these two poles, the former being amenable to transfer whereas stops would be more affected by developmental processes.

In his 'identity hypothesis', Wode (1976) claimed that the phonological processes shaping the learning of an L1 are the same as those intervening in the learning of an L2/FL —a view denied by Schachter (1989) among others. Such processes, considered to be universal, are seen as being governed by perceptual and articulatory restrictions and as applying to an abstract phonological representation[13]. One of the tenets of CA was precisely that the adult learner could not hear sounds different from those found in his/her mother tongue. There are occasions, however, when one is able to hear sounds one is unable to produce. If learning a language means being able to produce its sounds correctly, this presupposes an equally correct perception which must precede all production (Leather, 1999). But production in the case of adult FL learners can be impaired by a number of factors[14] such as the inherent difficulty of certain sounds (Johansson, 1973) —a view questioned by Neufeld (1980)— the development of inaccurate perceptual targets (Flege, 1981) or by universal phonological constraints[15]. What seems obvious is that there must be some articulatory or perceptual constraints that affect most speakers sharing identical L1. Wode (1996) assumes in his Universal Theory of Language Acquisition (UTA) that all humans are endowed from birth with speech perceptual abilities that are non-language specific. They apply across all language domains whenever phonological adjustments are needed to comply with dialectal, sociolectal or stylistic changes. In his view the human auditory system is characterised by points of heightened sensitivity to certain acoustic dimensions, sounds being perceived either 'categorically' or 'continuously'. Both categories are claimed to remain unchanged throughout life (Wode, 1996: 338). Categorical perception is said to capture sounds as belonging to classes and to establishes language-specific stable category boundaries. This type of perception resembles Kuhl's 'native language magnet' (NLM) where L1 phonetic prototypes assimilate nonprototypical members of the same family and constrain adult perceptual abilities to perceive differences in the target language. Continuous perception, on the other hand, allows learners (even slow ones) to detect differences between L1 and L2 categories. In the case of similar sounds, some adjustments are made in the direction of the TL. New phonological elements may be acquired by FL learners in much the same way as L1 learners (original categorical sensitivity, identical continuous perception identical to that of children, identical interaction of categorical and continuous perception). This is claimed to be a mechanism valid for all types of learner irrespective of age. The fact that most adult learners are unable to achieve a native-like mastery of a FL is explained by Wode in terms of L1 intervention: continuous abilities remain unchanged, but he acknowledges that "the interaction of continuous and categorical perception becomes more difficult as the categories of the L1 are established" (Wode, 1996: 334).

Major (1987) draws a distinction between learners with excellent perceptual abilities for non-native sounds and those with poor perception. The former's mental representation for target sounds are posited as being identical to that of the native speaker; the learner's production being the result of interference and developmental processes as he approximates the target forms. Those with poor perception, on the other hand, would have a target identical to their native language or somewhat intermediate between native and target language. They would have to improve both their perception and production, fossilisation occurring the moment the learner is unable to proceed further in perceiving or producing target language forms.

The equation of L1 with L2/FL acquisition processes is, as pointed above, at the base of much research in generative linguistics. If human beings are endowed with innate linguistic abilities to acquire their L1 as part of a Universal Grammar, an attractive issue is to consider whether second/ foreign learners also have access to such knowledge in building up their grammar. Opinions differ[16] as to whether the learner has direct accessibility to such principles and parameters— in which case parameter resetting is possible— or whether UG is indirectly accessible —parameter resetting being then disallowed. The idea that identical UG principles underlie L1 and L2/FL acquisition was favoured by Richie (1978) and is currently maintained by Broselow and Finer (1991) Minimal Sonority Distance Parameter, Eckman's Structural Conformity Hypothesis (1991), Schwartz and Hulk (1996) and others. Empirical evidence —the difficulty of resetting parameters and attaining complete phonological competence in the case of adult learners— has led some researchers to adopt a more realistic standpoint. Thus Clahsen (1988) does not believe in the accessibility of UG to L2/FL learners who might resort to general cognitive strategies instead of universal language properties. Felix (1985) claims in his Competition Model that the FL has only partial access to UG as the LS (language specific) cognitive system gives way to a general problem-solver (PS) system. Klein (1990) adopts a more drastic standpoint suggesting the rejection of generative grammar if UG principles do not apply to L2/FL learners. A compromise between interference (L1 overriding effect) and universal or developmental processes is Hancing-Baht's Feature Competition Model (1997). Using Optimality Theory as a theoretical framework, a theory that relies on ranked constraints rather than rules to define an optimal output, she envisages two paths for FL/L2 acquisition: an L1-mediated and a direct route, linked to the principles and parameters of UG.

After this brief presentation of some fundamental trends in L2/FL acquisition, we set out to describe the main phonological processes that underline the IL of our adult students in order to see the effect of L1 transfer and developmental processes. In doing this we shall consider some of the theoretical pronouncements presented above in conjunction with the speakers' verbal behaviour. In particular we shall see the extent to which syllable restructuring towards a universal canonical pattern is confirmed by our data. References to Major's Similarity/Dissimilarity Hypothesis and his Ontogeny Model will be made in relation to certain substitution processes. Substitutions and cluster reduction will also lead us to formulate some remarks about Eckman's MDH and Structural Conformity Hypothesis.

II. AIMS

Taking for granted that L1 transfer occurs and that it exerts a powerful influence in the mastery of a foreign phonology, we decided to test the degree of NL phonological dependence and the types of phonological processes involved in FL production.

The difference between this and other similar studies lies in that our focus is not on a particular intermediate stage of the IL continuum, but rather on the output of FL learners who, irrespective of individual differences and length of formal instruction, consider themselves to have reached a high degree of fossilisation in their IL. This happens when the adult learner of an FL cannot go beyond a certain phonological barrier irrespective of the length of exposure to the target language. It is a fixed stage in pronunciation habits which, irrespective of the length of formal instruction, unmistakably betrays a learner as speaker of a given language —Spanish in our case. Thus rather than dealing with an idiosyncratic behaviour, we are faced with a general phenomenon affecting the speech of most adult learners, if not all as Scovel (1969, 2000) claims, sharing identical L1 to such an extent that not only NL speakers may correctly identify a speaker of an FL as a member of their community: native FL speakers, using phonological information, can easily ascribe a given foreign accent to its corresponding NL. And although such a barrier can be at variable distance from the target language, adult learners undergoing formal instruction for a number of years reach a common plateau that can be described as a kind of 'Typical Conversational IL' showing features that are shared by a large number of adults with identical L1. In this cross-sectional research we shall be delving into the nature of such IL in order to discover what is language (L1) specific and what is not. More specifically, we seek

1. To identify those phonological processes underlying the fossilised IL of adult Spanish speaking learners of English as a FL in order to see the extent to which they are adhered to by all informants, and to ascertain the degree of phonological dependence of such processes on L1 phonotactic patterns and syllabic structure.

2. To discover whether the output of our informants conforms to a universal tendency towards a Canonical Syllable Structure (CV) due to its unmarked character as postulated by Tarone (1987) among others.

3. To discuss if the rules needed to explain the IL behaviour of our informants are all governed by principles of typological markedness as posited by Eckman's MDH (1977) and his Interlanguage Conformity Hypothesis (1991).

4. To check the validity of Major's Ontogeny Model (1987) which sees FL acquisition as a competition between interference and developmental processes. In particular, we examine the extent to which interference prevails over developmental processes in the frozen IL of our informants. An interesting issue that we shall be discussing elsewhere is to examine whether there is any implicational relationship among such processes in the sense that the occurrence of a process in a given learner implies the presence of another process but not the converse.

5. Finally, to test Major's Similarity/Dissimilarity Hypothesis according to which dissimilar sounds are more successfully mastered than sounds that have similar counterparts in the TL. (Valdman, 1976; Flege and Hillenbrand, 1987; Major, 1987; Major and Kim (1999).

Despite the descriptive character of this paper, we are aware of a number of methodological problems related to the difficulty of operationalising key terms which underlie different proposals. 'Phoneme acquisition' is a controversial concept. It is usually assumed that sounds are acquired following a progression line and with no setbacks. The reality is, however, much more complex. Sounds are, to begin with, context dependent, so that the learning of a given sound in a particular position does not imply its correct production in another context. There is evidence from child language acquisition of phonemic instability linked to context (Hernández Pina, 1978)[17]. Selinker's 'backsliding' (1972), a term that refers to a fortuitous setback in forms apparently already learned, has not been sufficiently taken into account. Incidentally, such setbacks, which experience corroborates (also present in L1 acquisition), is a serious argument against all universalistic approaches which take as axiomatic that any rule that has become part of the learner's competence is immune to any distortion or erosive process.

Unlike accuracy, intelligibility appears as a fuzzy concept. Intelligible speech is the minimum requirement for a FL speaker. Abercrombie's 'comfortably intelligible pronunciation'

(1963: 37) does not clarify things much despite his explanation that by comfortable he means little or no conscious effort on the part of the listener. There are so many variables (non-verbal ones included) which can contribute to or impair intelligibility that the concept is not of too much help to the applied consumer. Faulty pronunciation, phonological, grammatical, lexical or discoursal mistakes all play a role in profiling the listener's impression. The fact that lack of intelligibility can occur between L1 speakers, despite their alleged competence, clearly reveals that it needs further refinement in order to be a valid concept. Meanwhile we shall consider a stretch of language intelligible if it can be understood by the native speaker whatever the degree of phonetic deviance from the TL.

A related expression that is equally difficult to pin down is 'foreign accent'. While it is true that it is linked to a specific linguistic behaviour diverging from sounding native it is much more difficult to operationalise its characteristics as there is no demarcation between the IL phonology of the learner and his lack of mastery of the target language. If communication is granted, foreign accent will range between near native proficiency as regards both segmental and suprasegmental patterns and an IL variable continuum where syllabic accuracy would play an overriding role. As no suprasegmentals are considered here, we shall stick to TL syllable structure divergence in phonological terms[18] as the key criterion for accentnesss.

III. METHODOLOGY

III.1. Informants

For this study 65 Spanish undergraduates were chosen. They were all Third Year students of English as a foreign language in the Department of English Philology at Murcia[19] University. They spoke Spanish tinged with Murciano, the local accentual variety characterised, among other things, by the instability of /s/ in coda position.

All had undergone formal instruction in English for more than ten years averaging a total of no less than 1800 hrs. of formal training, which goes well beyond the class time required for an average student to break the resistance level of most languages of the world (Diller, 1978). Two native English speakers defined their command of oral English as 'intelligible', without further qualification. All students participating in the experiment acknowledged that their level of phonological mastery of English had reached stalemate and that they did not envisage any further improvement in their pronunciation.

III.2. Materials and procedure

One outstanding feature of FL research is the enormous variation in the data reported. Indeed a large number of contributions focusing of L2 or FL pronunciation problems rely basically on formal procedures to obtain data, which is in sharp contrast with those whose observations about FL learner's phonological competence derived from a natural speech situation. Only two out of the twenty studies appearing in Ioup and Weinberger's *Interlanguage Phonology* (1987) resorted to unprepared natural speech (Tench, 1996), unlike the rest of the papers where imitation, reading tests and other formal techniques were used as data to confirm or disprove their claims. And of the eight contributions to J. Leather's *Phonological Issues in Language Learning* (1999), only Munro and Derwing used as samples the description made by their informants of a cartoon page. Reading was the technique most favoured and interpretations of the results were made disregarding the effect, positive or negative, that orthography might have on pronunciation.

This methodological disparity —reading in particular— has obvious side effects on the research outcomes. The use of formal procedures, while stringent on specific phonological issues, may be heavily tinged by the orthographic format of the FL. Current research confirms the impact orthography has on phoneme awareness (Altenberg and Vago, 1987; Giannini and Costamagna, 1997; Young-Shoulten, 1997; Keiko Koda, 1998). On the other hand, formal speech, besides 'put[ting] people on their best behaviour' (Tench, 1996: 250), is not to be equated with informal, colloquial language, the most neutral and general register (Crystal, 1969) and where the 'most systematic patterns occur' (Major, 1999: 125). It is a fact that reading, by its reliance on the written support of a system, is a much more formal operation than ordinary spoken language. It is not surprising, therefore, and tautological to a large extent, to claim that FL learners achieve greater accuracy as style becomes more formal, as Gatbonton (1978) or Sato (1985) suggest. A rigorous study of register is, therefore, a methodological necessity if results are to be trusted.

Since the analysis of the informants' oral output production was our main concern, each subject was interviewed individually for five minutes by two members of the staff who asked them to talk naturally about the most frightening experience in their lives. In this non-structured setting, they were allowed four minutes to think about the topic so that they could organise their thoughts. As a warm-up the students were asked to read a five-line text and then they were encouraged to speak freely. It was assumed that being a topic involving the student more personally, it would make them less self-conscious about the language they were using and would produce samples more closely resembling a real life communication situation.

Each conversation was tape-recorded and transcribed using IPA symbols by a trained phonetician. Although the technique may be anxiety provoking, this was minimised by using a small cassette that was operated by one of the interviewers. Evaluation of accentnesss was carried out by three judges independently, two native speakers of English and one of Spanish, all of them university teachers at the Department of English Philology. The sum of agreements and disagreements by at least two of the judges was used a reliability criterion. The sampling was carried out discarding systematically the first minute of the recording. Data were selected by extracting from each sample the first ten tokens that showed some type of phonological error.

Following Briére 1968; Greenberg, 1983; Carlisle, 1999 and others, we decided to take the phoneme within the syllable as the basic unit, but without losing sight of the word as a concurrent operational unit. There are three main reasons for this. Firstly, in spite of the difficulty of delimiting single syllable boundaries in English it is intuitively a clear operational unit for Spanish speakers. This is all the more evident when we consider a process operating across word boundaries where Spanish is a very versatile language. Secondly, in an FL context, the learning of written language is inextricably entwined with the syllable whose limits are fairly often coincidental with word boundaries. Finally, the syllable would not be as good as the word to capture certain accentual, durational and rhythmical aspects in a FL context.

The standard against which the testees' performance was measured was careful colloquial RP English as reflected in Daniel Jones' 16th edition of his *English Pronunciation Dictionary* edited by Peter Roach and James Hartman (CUP).

III.2.1. Spanish vs English syllabic structure

Spanish is characterized as being a language with a simple syllabic structure with a clear preference for the CV type, the overall shape being (C) (C)+ (V)(V) V + (C)(C) (Monroy, 1979). An examination of Olsen's syllabic typology for Spanish (1969) yields a percentage of 58.45 % of the CV type, followed at a certain distance by the CVC structure (27.35 %) and a much more distance by the CVV type (6.34 %). It shares with English an optional two-phoneme head and coda, but it will not allow initial three-phonemic clusters nor final combinations of more than two segments. Furthermore, the final biphonemic sequence is allowed only word internally, otherwise only four single consonants can occur: /l,m,n,s/. Moreover, syllable boundaries are constrained by certain conditions, so that if a consonant occurs in a checked position and a vowel follows, the former will automatically be assigned to the following syllable (ambysyllabic principle). There is little doubt that this structural simplicity accounts for the fairly clear intuitions Spanish speakers have about syllable boundaries in the language.

English, on the other hand, has a much complex syllabic structure. As said above, clusters of up to three phonemes are allowed syllable initially, whereas a consonantal sequence of up to four phonemes can occur in syllable final position (O'Connor and Trim, 1953). It is theoretically possible for a sequence of as many as seven consonants to occur across word boundaries (Gimson-Cruttenden, 2001). Besides, syllabification rules in English are much more controversial than in Spanish to the extent that "there exist three rival and incompatible views of English syllabification" (Wells, 1990: XX). This obviously impinges on the analyst's view when confronted with learners' problems in perceiving and producing English as an FL.

The following table reflects the usual combinatory phonotactic possibilities within the syllable in both languages (British and Castilian varieties):

SYLLABIC STRUCTURE			
		(British) English[20]	**(Castilian) Spanish**
ONSET	**1 cons.**	All but /ŋ/, /ʒ/ very rare	All but /r/
	2 cons.	/k/ + /l, r, w, j/ /p, b, f/ +/l, r, j/ /t, d/ +/r, w,j/ /s/ +/l, w, j/, /p, t, k, f, m, n/ /g/ +/l, r/ /θ/ +/r,w/ /ʃ/ +/r/ /h, m,n,l/ +/j/	/k/ + /l, r, (w, j)/ /p, b, f/ + /l, r, (j)/ /t, d/ + /r, (w, j)/ /s/ + /(w, j)/ /g/ + /l, r/ /θ/ + /r, (w)/ /m, n, l/ + /(w, j)/
	3 cons.	/s/ +/p/ +/r, j/ +/t/ +/l, r, w, j/ +/k/ +/r, j/	
PEAK	**1 vowel**	Short: /ɪ, e, æ, ʌ, ɒ, ʊ/ Long: /iː, ɜː, ɑː, ɔː, uː/	/a, e, i, o, u/
	2 vowels	Dipth: /ɪə, eə, ʊə, eɪ, aɪ, ɔɪ, aʊ, əʊ/	/ai, au, ei, eu, oi, ou, wa, we, wo, ja, je, jo, wi, ju/
	3 vowels	Tripth: /eɪə, aɪə, ɔɪə, əʊə, aʊə/	/jai, jei, wai, wei/
CODA	**1 cons.**	Except /h, r, w, j/, all consonants (called 'final')	End word: /l, r, n, s/ End syll.: also /p, b, k, d/
	2 cons.	/m, n, ŋ, l, s/ (called 'pre-final') + 'final' cons. 'Final'+/s, z, t, d, θ/ (called post-final)	Only end of syllable: /ns, bs, ks, rs/
	3 cons.	Pre-final + final + post-final Final + post-final + post-final	
	4 cons.	/l + f + θ + s/ (*twelfths*) /m + p + t + s/ (*prompts*) /k + s + θ + s/ (*sixths*) /k + s + t + s/ (*texts*)	

III.3. Results

After the pooling of the data, ten main phonological processes (see Figure 1) emerged in the IL syllable structure of our students. Five affecting vowels (prothesis, vocalic epenthesis, vowel fusion (synaeresis), vowel substitution (quality) and vowel substitution (duration)) and five related to consonants (consonantal insertion (epenthesis), consonant substitution, consonant assimilation, voicing/devoicing and cluster simplification (apocope). All of them are manifestations of the three macro-processes of addition, subtraction and substitution, which happen to occur across many languages. Their concrete manifestations were in all cases coincidental with the phonological processes shaping the learners' L1. Thus, under addition we found both prothesis, or word initial vowel insertion, and epenthesis which refers to either vowel or consonant insertion word medially or final. They represent a trend to accommodate to a Spanish syllable structure, not necessarily of a universal CV syllable type, as we shall see.

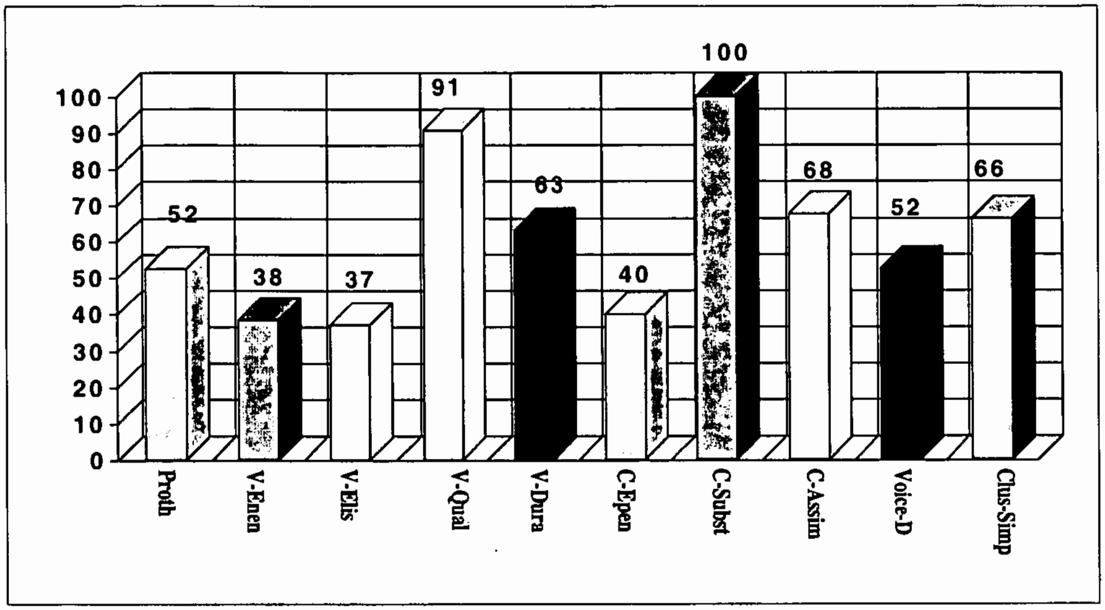

Figure 1: **Phonological Processes in the Frozen IL of Spanish speakers**

The same is valid for consonant cluster reduction and synaeresis or vowel elision corresponding to the macro-process of subtraction or deletion, an extremely widespread syllable structure processes in L1 acquisition. Equally common in the phonology of Spanish children are substitution processes such as vowel substitution, consonant substitution, voicing/devoicing and consonant assimilation found in the IL of our informants. In the following pages we shall discuss the nature of the ten processes in order to see whether there is a systematic phonological relationship between the learners' IL and their L1 (Spanish) or, on the contrary, whether there are other factors of a universal nature that impinge on the learner's output.

III.3.a. Prothesis

Vowel insertion is analysed here under two headings depending on whether insertion takes place initially in the syllable and medially; in the first case we talk about prothesis, being the second instances of epenthesis[21].

Let us consider prothesis first.

***Table 1a*: Prothesis**

IL FORMS	TL FORMS	PROTH.	IL FORMS	TL FORMS	PROTH
I.			**II.**		
			a)		
[es'tei]	[steɪ]	e	[di(e) 'splendid]	[ðə 'splendɪd]	ø/e
[es'lip]	[sli:p]	e	[tu(e) 'spend]	[tə spend]	ø/e
[es'pein]	[spein]	e	[tu (e) 'slip]	[tʊ 'sli:p]	ø/e
[es'peʃiali]	['speʃli]	e	['beri(e) s'peʃal]	['veri 'speʃl]	ø/e
[es'pendiŋ]	['spendɪŋ]	e	[tu (e)'stop]	[tə 'stɒp]	ø/e
[es'pik]	[spi:k]	e	['beri 'streins]	['verɪ 'streɪndʒ]	ø
[es'plendid]	['splendɪd]	e	[a spor]	[a spɔ:t]	ø
[es'tʌdi]	['stʌdi]	e	**b)**		
[es'tand]	[stænd]	e	[seɪm es'ku:l]	['seɪm 'sku:l]	e
[es'treins]	['streɪndʒ]	e	[mʌtʃ es'tʌdi]	[mʌtʃ 'stʌdi]	e
			[wɒs es'teɪɪŋ]	[wəs ‿'steɪɪŋ]	e
			[ɪs es'treins]	[ɪs ‿'streɪn(d)ʒ]	e
			[wɒs es'pikiŋ]	[wəs ‿spi:kɪŋ]	e

A glance at the samples above reveals interesting issues from an implicational viewpoint and more in particular from the Universal Canonical Syllable Structure (UCSS). According to Vennemann (1988), a canonical syllable is defined as a structure consisting of a single C as an optimal onset, a nucleus structure, and a cero coda. In terms of sonority, the nucleus is considered the most sonorous component of the syllabic structure, followed by onsets ranked in sonority from the first to the last in an increasing order, markedness increasing with the length of onsets and codas (Clements, 1990).

It has been hypothesised (Sato, 1984; Tarone, 1987; Riney, 1990) that there is a universal tendency to reduce complex syllabic margins —considered more marked— to more simple, unmarked ones, and also to produce open CV syllables because of their unmarked character. Jakobson (1949) was the first to point out this fact on the grounds that CV is the only syllabic pattern found in all languages and the first that children learn even in languages with other syllabic structures. Such naturalness is captured by Eckman's Interlanguage Structural Conformity Hypothesis (ISCH) which predicts that "the universal generalisations that hold for the primary languages hold also for interlanguages" (1991: 24). The preference for the simple open syllable should, therefore, be evident in the IL of FL adult learners. Confirmation of this goes back to Tarone's study when she reported that her informants broke the English SCC cluster into "simple CV patterns" (1980: 142).

The opposite trend, i.e. the violation of the CV universal tendency, has been found in studies where Spanish subjects were involved (Tropf, 1987; Carlisle, 1991; Carlisle, 1999). It is well documented that Spanish[22] is reluctant to onsets beginning with S+CC, a typical word initial syllable English onset, and that Spanish syllable structure conditions require a vowel insertion rule whereby ∅ →e / # __ sCC, the extrasyllabic consonant /s/ becoming coda to the new syllable. Carlisle (1999) is one of the few who have studied the IL of Spanish learners of English in order to analyse epenthesis among other things. He regards this phenomenon as "nearly the sole means that Spanish NSs use to modify /sC(C / onsets" (1999: 75) considering it in terms of onset modification and the effect of the environment. Ours being a descriptive study based on free speech samples, we are not in a position to adhere or not to the ISCH in the sense that frequency of modification is onset-length dependent, rather we shall discuss prosodic resyllabification or syllabic dynamic shift typical of casual speech.

The prothetic process is generally acknowledged to be language specific and, therefore, part of the phonological competence of all Spanish speakers irrespective of their provenance. But despite being considered in the literature an important syllable modification process, 47.69 % of our informants did not resort to it at all. This being the case, we cannot talk of the primacy of vowel epenthesis as a key process in IL phonology as Oller (1974) claimed. All the evidence is that prothesis is governed by L1 syllabic constraints rather than by processes showing a tendency towards a universal open syllable as we shall discuss below.

***Table 1b*: Prothesis**

Num. Errors	Frequency	%
0	31	47.69
1	29	44.62
2	3	4.62
3	2	3.08

A glance at Table 1a shows certain facts that are worth discussing. We notice in the second part of this Table a list of forms environmentally conditioned where a prothetic vowel appears as either a compulsory (block b) or as an optional element (block a). Obligatory prothesis takes place whenever the Spanish learner is confronted with a word ending in consonant followed by another consonant acting as head of the following word. When this happens, there is resyllabificationn, the coda consonant becoming head of the new syllable with the prothetic vowel as nucleus and the onset consonant acting as coda (e.g. *[wɒ.ses.pi:.kɪŋ]). This resyllabification across word boundaries is an overriding feature of the initial IL of adult Spanish speakers who transfer the Spanish pattern of consonantal resyllabification within and across word boundaries whenever a single consonant is flanked by vowels. Prothesis is so strong in these cases that is triggered off even in instances where identical[23] sibilants intervene, as in /wɒs steɪɪŋ/ realised as *[wɒ.ses.teɪ.iŋ] when one might expect *[wɒs.teɪ.ɪŋ], with fusion of the two sibilants into a single one followed by prosodic resyllabification. This rule accounts for identical syllabification of otherwise different underlying structures as in *las salas* (the rooms) vs *las alas* (the wings) both realised as /la.sa.las/ unless a pause is introduced after the first sibilant.

A different case occurs in the presence of vowels. As Table 1a, block a) illustrates, prothesis is a facultative phenomenon whenever an onset is preceded by a vocalic element. Not with all vowels certainly, since English disallows most short vowels in final position, but the ones allowed word finally *might* attract the first element of a word initial S+CC English cluster. As a result, /s/ becomes coda to a syllable whose nucleus is not a prothetic vowel but the final vowel of the preceding word as reflected in [tus.ˈpend] or [tus.ˈlip]. And yet, the same expressions can be heard (they *were* heard) with a prothetic vowel (*[twes.pend], *[twes.lip], etc.). It is difficult to tell which of the two options may prevail, as both are the reflection of two apparently contradictory Spanish processes: vowel insertion and vowel fusion. Prothesis is likely to occur in contexts where onsets beginning by S+C are preceded by a vowel, all elements being uttered at a moderate, andante speed. The opposite happens in free, rapid colloquial speech. In this context, vowel reduction is noticeably strong whenever simple one-member onset syllables are followed by checked, onset-less syllables. A number of fusion rules apply whereby some vowels —high and low in particular— attract weaker vowels. Colloquial forms like *yastán* (for *ya están*), *tústas* (for *tu estás) casistuve* (for *casi estuve*), etc., are a reflection of those rules. It so happens that /e/ appears to be the weakest of all vowels in Castilian Spanish (Monroy, 1980: 73). So when confronted with a sequence like [ˈveri sˈpeʃl], the Spanish learner can resort to two different phonological processes: (s)he may insert a prothetic element after a preceding vowel (e.g. [ˈve.ri.es.ˈpeʃl]) as a result of hiatus (i.e. pause), slow speech or even orthographic influence; alternatively, (s)he may resyllabify ([ˈve.ris.ˈpeʃl]), extrasyllabic /s/ acting as coda to the preceding syllable either because the preceding vowel serves as nucleus of the newly-formed syllable or because this new syllable is the result of the conflation of two underlying nuclei, one of them with prothetic /e/. The fact that /e/ is elided in the vicinity of another vowel, provides an explanation for the surface prothesis-free IL forms.

To conclude, this insertion process used by 52.31% of our informants does not appear to be consistent with implicational universals in one important respect: that open syllables are less marked than closed syllables[24] as the emergence of a prothetic vowel followed by coda clearly reveals. The fact that all instances in our data reverse this tendency, showing total preference for a closed syllable rather than an open one, appears to be a clear argument against the universality of this process. This is all the more surprising if we consider that Spanish shows a strong tendency towards the open syllable as pointed out above.

III.3.b. Vocalic epenthesis

Although closely related to prothesis, we discuss vowel epenthesis separately on the grounds that it has different surface manifestations. Unlike prothesis, /e/ is not the only vocalic element inserted, /o/ and /a/ and, occasionally /i/ can also make their appearance, although /e/ is the most likely candidate (see Table 2a).

***Table 2a*: Vowel epenthesis**

IL FORMS	TL FORMS	EPENTH	IL FORMS	TL FORMS	EPENTH
[a'nojed]	[ə'nɔɪd]	e	['ordinari]	['ɔ:dn̩ri]	/i/a
['dident]	['dɪdn̩t]	e	['oupen]	['əupn̩]	e
['garden]	['gɑ:dn̩]	e	['person]	['pɜ:sn̩]	o
['hazent]	['haezn̩t]	e	['prison]	['prɪzn̩]	o
['havent]	['hævn̩t]	e	['sadenli]	['sʌdn̩lɪ]	e
[inte'restiŋ]	['ɪntrəstɪŋ]	e	['teribol]	['terəbl̩]	o
['kuden]	['kʊdn̩t]	e	[fraiten]	['fraɪtn̩]	e
['hospital]	['hɒspɪtl̩]	a			
['midel]	['mɪdl̩]	e			

Looking at these forms in terms of the UCSS we notice that there are cases which clearly abide by it, but they seem to be the exception rather than the rule. A word like ['ɔ:dn̩ri], appears realised as *['ordinari], with epenthesis of /i/ and /a/ thus breaking the negative syllable-structure conditions of /dn/ into two canonical CV syllables. Curiously enough, the same process is not applied in the case of ['sʌdn̩lɪ] where only one epenthetic element is introduced. Here resyllabification applies forming a closed syllable (['sa.den.li]) instead of the expected CVCV structure (i.e ['sa.de.ne.li]). Interestingly, a word like [inte'restiŋ] has an epenthetic vowel betweeen /t/ and /r/, despite the fact that /tr/ is a perfectly admissible Spanish onset as a word like *entraste* (you went in) testifies. And yet, the sequence is resolved as a CV CV. One could argue that this was expected as it conforms to the UCSS and markedness relationships whereby open syllables are less marked than closed syllables, something that should have a reflection in the IL of the FL learner. Counter-evidence, however, comes from the rest of the examples in Table 2a where no single case of vocalic epenthesis occurs in final position. The result is that all English words with a two-member coda are realised as closed syllables with an epenthetic nucleus, its quality depending on orthographic (['hospital], ['person]) or perceptual similarity (['garden] ['teribol]). More strikingly, a single epenthetic vowel is inserted even in cases of final three-member codas as reflected in the following forms: ['dident], ['hazent], ['havent], etc.

***Table 2b*: Vowel epenthesis**

Num. Errors	Frequency	%
0	40	61.53
1	17	26.16
2	6	9.23
3	2	3.08

Non-word initial vocalic epenthesis did not appear to be an overriding syllable modification process; in fact 38.47% of the sample resorted to it. Cluster splitting took place breaking the TL pattern CVCCC (*hasn't*) into CV#CVCC. While the first syllable seems to adhere to UCSS, the three-consonant coda did not split into three open syllables (*ha.se.ne.te) as UCSS predicts. Besides, these and similar examples provide little support to the alleged primacy of vowel epenthesis as a key process in IL phonology. All the evidence is that epenthesis is governed by L1 syllable constraints rather than by processes showing a tendency towards a universal open syllable. The only variability found was the optional dropping of the final consonant, but not a single instance was found of a CV realisation with the final consonants in the output of our informants.

A further conclusion that follows from these samples is that vowel epenthesis is not a phenomenon restricted to onset and environmental constraints (Carlisle, 1999). Syllabic codas seem to play an important role too, a role that needs to be further investigated in order to see whether they are more powerful than environmental or onset variable constraints.

III.3.c. Vowel elision (synaeresis)

We cover under this name those instances of vowel supression that take place medially in a word, synaeresis being the rhetorical name to refer to medial elision of vowels in ordinary speech[25]

***Table 3a*: Vowel elision (synaeresis)**

Num. Errors	Frequency	%
0	41	63.08
1	15	23.08
2	5	7.69
3	4	6.15

Vowel elision —a reflection of the macro-process of reduction— has not attracted much attention in IL literature. This may be due to the little impact it has had in contrastive studies where not many examples may be found and also to its elusive character which makes it difficult to handle it in contexts other than casual speech, its natural habitat. In free, casual conversation, it is a very frequent phenomenon both in English and Spanish. In the former, vowel elision affects the schwa basically (Gimson & Cruttenden, 2001: 287), while in Spanish vowels enter into a dominance relationship where some may disappear in the presence of other stronger elements (Monroy, 1980, ch.4). Vowel elision is at its highest in colloquial Spanish whenever two identical vowel segments co-occur, particularly if they are unstressed (e.g. /kopera'tiba/ for '*cooperativa*') or a stressed syllable is followed by an unstressed one or vice versa (e.g. /al'kol/ for '*alcohol*'). This fusion of two contiguous vowels belonging to different syllables, called synaeresis, is a potent phonetic phenomenon in Spanish both within and across word boundaries[26]

Table 3b: **Vowel elision (synaeresis)**

IL FORMS	TL FORMS	SUBST
['djaðer]	[ðɪ 'ʌðə]	ɪ'ʌ→ja
[in'dʒoiŋ]	[ɪn'dʒɔɪɪŋ]	ɪɪ→ɪ/i
[fraiŋ]	['fraɪɪŋ]	ɪɪ→ɪ/ɪ
[kraɪŋ]	['kraɪɪŋ]	ɪɪ →ɪ/i
[pleɪŋ]	['pleɪɪŋ]	ɪɪ →ɪ/i
['rjaliti]	['rɪ'æləti]	ɪ'æ→ja
[steɪŋ]	['steɪɪŋ]	ɪɪ →i/i

The IL forms recorded in Table 3a evince a process that affects 37% of our participants and seems to be a reflection of the learners' L1 influence. The syllabic structure CV(V) # VC is resyllabified as CVVC as shown in [fraiŋ], [kraɪŋ], [pleɪŋ], etc., with elision of one of the two identical segments and the merging of the two nuclei into a single nucleus. Synaeresis affects contiguous identical vowels belonging to different syllables, particularly if they are nouns (e.g. *azahar=azar*)[27]. In the case of verbal forms (e.g.*pasé-pasee-paseé*) where paradigmatic oppositions intervene, vowel elision can optionally occur. It is not surprising, therefore, that most of the IL forms recorded in Table 3b should instantiate synaeresis. Synaeresis too, underlies the pronunciation of *reality* as ['rja.li.ti]. Unlike English, which disallows /ɪ + ae/ as a diphthongal sequence, Spanish conflates the two nuclei into one, the high vowel becoming a semivowel that combines with the low vowel yielding the opening sequence /ja/.

Contiguous non-identical vowels across word boundaries (synaloepha) are also amenable to vowel fusion in Spanish the result being a non-canonical syllable CVC if the second conflated syllable is checked (e.g. *ya están* = [jas.'tan])[28]. In Table 3b there is an instance that exhibits this pattern but for the coda which is lacking: [dja.ðer]. The mechanism used —syllable fusion by weakening the unstressed, high vowel— is identical with that found in the case of non-dipthongal sequences as seen in our *reality* example.

Although examples are not abundant, we have again evidence that a process like synaeresis (an also synaloepha) yield a language-specific syllabic string that violates the UCSS. Far from keeping the initial open syllable apart from the following one by hiatus or a semivocalic element, a number of our participants resorted to synaeresis which involves the conflation of both syllables into a single closed syllable, a process fully operative in their L1.

III.3.d. Vowel substitution (quality)

Substitution processes appeared in consonants as well as in vowel forms. We decided to group them into two sections, discussing here problems related to quality dealing with duration in the next section.

Table 4a: Vowel substitution (quality)

IL FORMS	TL FORMS	SUBST	IL FORMS	TL FORMS	SUBST
['famili]	['fæməli]	æ→a	['onli]	['əʊnli]	əʊ→o
[flat]	[flæt]	æ→a	[hol]	[həʊl]	əʊ→o
[ai kan]	[aɪ 'kæn]	æ→a	[no]	[nəʊ]	əʊ→o
['mʌner]	['mænə]	æ→a	['kloθis]	['kləʊðz]	əʊ→o
[polisman]	[pə'li:smən]	ə →a	['sirjəs]	['sɪərɪəs]	ɪə→ i
[a'nɔɪd]	[a'nɔɪd]	ə →a	['serjus]		ɪə→ju
['(h)ospital]	['hɒspɪtəl]	ə →a	[e(k)'spirjens]	[ɪk'spɪərɪəns]	ɪə→ i
[a'naðar]	[ə'nʌðə]	ə →a			ɪə→je
			[tu'geðer]	[tə'geðə]	ə→u
['basinis]	['bɪznəs]	ɪ→a	['marβelus]	['mɑ:vələs]	ə→u
		ə→i	[tu 'gou]	[tə 'gəʊ]	ə→u
[de]	[ðə]	ə →e	[su'pouz]	[sə'pəʊz]	ə→u
[e'genst]	[ə'genst]	ə →e	['difikult]	['dɪfɪkəlt]	ə→u
['gaðered]	['gæðəd]	ə →e			
['proβlem]	['prɒbləm]	ə →e	[an'tidi]	[ʌn'taɪdi]	aɪ→i
			['bridʒgrum]	['braɪdgru:m]	aɪ→i
[for'get]	[fə'get]	ə →o	['oriθon]	[hə'raɪzn̩]	aɪ→i
[polisman]	[pə'li:smən]	ə →o			
['prison]	['prɪzən]	ə →o	['flowers]	['flaʊəz]	aʊə→owe
['oriθon]	[hə'raɪzn̩]	ə →o			
['faʃion]	['fæʃ(ə)n]	ə→io	[a'fred]	[ə'freɪd]	eɪ→e
[tele'βision]	['telɪvɪʒ(ə)n]	ə→io	['sandai]	['sʌnd(e)ɪ]	eɪ→aɪ
[es'korsion]	[ɪk'skɜ:ʃ(ə)n]	ə→io	['adʒensi]	['eɪdʒənsi]	ei→a
			['dandʒer]	['deɪndʒə]	ei→a
['broðer]	['brʌðə]	ʌ →o			
[non]	[nʌn]	ʌ →o	[si'tweiʃon]	[sɪtju'eɪʃn̩]	u'ei→wei
[kom]	[kʌm]	ʌ →o	[a'prisjeit]	[ə'pri:ʃi'eɪt]	i'eɪ→jei
[blod]	[blʌd]	ʌ →o			
			[pro'maist]	['prɒmɪst]	ɪ→aɪ
['famili]	['fæməli]	ə→i	[eks'prest]	[ɪk'sprest]	ɪ→e
			['voises]	['vɔɪsɪz]	ɪ→e
['forenes]	['fɒrɪ/ənəz]	ɪ/ə→e			
			[a'peərd]	[ə'pɪəd]	ɪə→eə
['mena]	['mænə]	æ→e	['realaizd]	['rɪəlaɪzd]	ɪə→eə
['proɣram]	['prəʊgræm]	æ→a	[es'pirjens]	[ɪk'spɪərɪəns]	ɪə→i/ ie
['ambjulans]	['æmbjuləns]	æ→a	[ka'rear]	[kə'rɪə]	ɪə→eə
			['dʒuswali]	['ju:ʒʊəli]	ʊə→ua
			['puar]	[pʊə]	ʊə→ua
			[skuər]	[skweə]	eə→ʊə
			['parents]	['peərənts]	eə→a
			['kerful]	['keəfʊl]	eə→e

187

It is a well-known fact that adult learners of a foreign language have difficulty in achieving a native-like level of accuracy with individual sounds. Phonological competence involves the mastery of FL phonetic categories in such a way that the learner's output falls within the perceptual latitude acknowledged by native speakers as typical of their own system. This does not preclude the existence of an accent, something that all speakers of a given language have one way or another, but rather that any accent is not recognised as 'foreign' by native speakers. Syllable nuclei production is precisely one of the key elements which indicate the learner's level of mastery of the TL forms.

In the early days of CA, one basic tenet was that learning "sounds that are physically similar to those of the native language, that structure similarly to them and that are similarly distributed [...] occurs by simple transfer without difficulty" (Lado, 1957: 12). Contrary to this viewpoint, Oller and Ziahosseiny (1970) claimed that similar sounds between NL and TL are harder to learn than dissimilar sounds on the grounds that dissimilarities are much more noticeable than similarities. Flege's study (1987b) gave support to this view following identical line of argument: that different or new sounds are easier to learn because learners are much more aware of the differences while they may merge the phonetic properties of native and target language sounds inaccurately perceived as equivalent. And Major & Kim (1999) formulated the Similarity Differential Rate Hypothesis (SDRH) which predicts not just that similar sounds are more difficult to acquire than dissimilar sounds, but that a dissimilar phenomenon is acquired faster than a similar one. Since our data do not reflect rate of acquisition we cannot test this aspect of the hypothesis[29], so let us focus, therefore, on Major's contention about degree of difficulty involved in the learning of similar / dissimilar sounds and other aspects of his Ontogeny Model.

As Table 4b reveals, only 9.23% of the sample reflected learners' competence in this particular process. All the rest characterised by varying degrees of fossilisation that basically affected three monophthongs and most diphthongs (see Table 4a). Schwa happened to be the most frequently substituted monophthongal element, which was replaced by /a/ ([po'lisman]), by /o/ (initial syllable of previous example), by /e/ ([de], *the*), by /i/ (['faemili]) and by /io/ ([tele'βision]). /o/ was substituted for /ʌ/ in a few cases ([kom], [blod], etc.). More common was the substitution of /a/ for /æ/ ([aɪ kan], ['proɣram], etc.) and, occasionally, for /e/ (['mena] - *manner*). Diphthongal substitution was fairly common and affected most diphthongs. Thus, /aɪ/ happened to be replaced by /i/ (['oriθon]), /eɪ/ by /e/ or /a/ ([a'fred], ['dandʒer]), /ɪə/ by /ea/ ([a'peard]), /ʊə/ by /ua/ (['puar] - *poor*) and /əʊ/ by /o/ (['onli]).

***Table 4b*: Vowel substitution (quality)**

Num. Errors	Frequency	%
0	6	9.23
1	19	29.23
2	28	43.08
3	8	12.31
4	4	6.15

The first issue to address is to see whether fossilised language reflects a higher level of competence with dissimilar sounds compared with similar ones. Major and Kim (1999) corroborate this hypothesis on the grounds that beginning and advanced learners produced /dʒ/, the similar sound, more accurately than the dissimilar sound /z/. The case of adult learners with frozen IL is different. They are not beginners, for they have studied English for a period of time, and they are not advanced learners either. They belong to that vague category of people whose language is, in Corder's words, 'comfortably (?) intelligible'. But before we proceed, let us first clarify what we mean by 'similar' and 'dissimilar' sounds. When Major and Kim state that "similar sounds are more difficult to acquire than dissimilar sounds" (1999: 159) they are relying on two abstract concepts that are never operationalised . Similarity is a very elusive construct as it may be defined from a visual, acoustic, articulatory or cognitive standpoint. Besides, it is a concept that cannot be easily ascribed to two dichotomous linguistic poles, as there are degrees of similarity depending on whether phonological, phonetic and graphemic aspects are taken into account. A word like *person*, could be considered very similar to the Spanish *persona.* The question is similarity on what grounds? Orthographically speaking, they are identical but for the final segment. Phonologically though, they only share three phonemes (/p, s, n/ —British pronunciation), two of which (/s, n/) hold different phonotactic restrictions from their Spanish equivalents. The vocalic element in /pɜː--/ is totally different (vowels in general are virtually always different across languages due to their unique articulatory settings). And if we look at the phonetic shape of both strings, we will discover that there is not a single element in common: /p/ is aspirated in initial position in English, unlike Spanish; /s/ is more apico-alveolar than the equivalent in Castilian standard, and the syllabic character of English /n/ makes it phonologically different from Spanish /n/. The concept of similarity (and the same applies to dissimilarity) needs, therefore, further qualification. Major is undoubtedly aware of this deficiency when he states that "Although the role of similarity and dissimilarity seems well documented and convincing [...] what constitutes similar and dissimilar is not always clear" (1999: 156).

Indeed it is not. One could argue that /æ/ substitutions for /a/ are based on a certain degree of similarity between the two sounds and that, as a result of this, Spanish learners find more difficult to pronounce it correctly than /ə/ for instance, a sound totally foreign to Spanish phonology. Experience does confirm that /æ/ is a problematic phoneme for most Spanish learners, due no doubt to the fact that Spanish /a/ may cover most of the phonemic space allocated in English to /æ/, /ʌ/ and /ɑː/; negative transfer can then be evoqued to explain the nonlearning of /æ/. But /ə/ turns out to be just as difficult a phoneme as /æ/ as evinced by the different substitutions made by our participants (see Table 4a). Such substitutions, typical of the learning process for dissimilar sounds, should progressively approach the TL, the stages being, in Major's opinion (1995), similar or identical to those happening if L1 acquisition.

One wonders about the usefulness of the similarity/dissimilarity distinction in an area characterised by continuity rather than polarity and where sound identity is practically non-existent. We expressed above our doubts about the usefulness of similarity /dissimilarity as a criterion to provide a plausible explanation to frozen IL. In acquiring a FL one is faced with an inventory of sounds at varying degrees of acoustic distance depending on their distribution. Perceptually though, during the initial stages, they are all ascribed to the phonetic categories the learner already possesses. In this sense they present different degrees of similarity depending on specific contexts. Thus word final /ə/ resembles Spanish /a/ more closely than when checked by a velar consonant (e.g *again*). Depending on the individual's perceptual abilities, some learners will be aware of certain acoustic differences while others will not. As perception governs production, the less capable learner will not be able to produce sounds other than those he is familiar with: those of his mother tongue with which he identifies the TL sounds. The more capable learner will be in a position to hit the target unless articulatory or neuro-biological constraints intervene.

If similar sounds are more difficult to acquire than dissimilar ones (excepting true beginners), it follows that the frozen IL of the adult FL learner should have a higher mastery of dissimilar forms than of similar ones. However, as reflected in Table 4a, dissimilar sounds such as /æ/, /ə/ and all English centring diphthongs pose problems to 90.77% of the participants while 'similar' sounds such as /e/, /i/, /ʌ/, etc., do not appear as problematic. One possible explanation is, no doubt, the methodology used. While focusing on one specific phoneme position (Major and Kim, 1999) may be revealing, results cannot be extrapolated to cover the learner's behaviour with other phoneme distributional variants. English /e/ is supposedly very similar to Spanish /e/ if we compare Spanish *sed* with English *said.* But English /e/ is not so similar when it occurs checked by /l/ where the vowel becomes much more open than its Spanish equivalent. In spite of this, does this mean that the acquisition of /e/ is much more difficult than that of, say /ə/? Two points need clarification before answering this question. We have, firstly, to know what is meant by 'more difficult' —a variable that remains undefined. Do we interpret it in terms of rate of acquisition as Major's SDRH? Ideally, a longitudinal analysis of individual learners would show us whether or not this is the case. But then, what is the level of proficiency required? Native-like accuracy is beyond the scope of most adult learners, so we would have to agree on a lower proficiency level to see if learners have spent more time learning similar than dissimilar sounds. The other point is the learner's experience with the language. Any language learner needs a number of instantiations (Leather, 1999) of the different phonetic contrasts in order to establish the corresponding sound boundaries in the TL. Sounds considered more difficult tend to be practised much more than those apparently more similar. Needless to say that similarity is not to be equated with identity, but it is closer to the basic intelligibility level than dissimilar sounds, therefore it is not surprising that more time should be spent practising new sounds than more familiar ones. This would explain why FL learners seem to be at a disadvantage with similar sounds: the number of instantiations would be far less than the time spent with dissimilar sounds. So it seems to me that it is amount of exposure and not degree of similarity that might explain the apparent counter-intuitive claim that similar sounds are harder to acquire than dissimilar ones.

The polar opposition 'similar-dissimilar' introduces another important dimension. Sounds considered similar have supposedly some L1 equivalent forms that are responsible for positive transfer, unlike dissimilar sounds that have no L1 equivalence. In terms of Major's Ontogeny Model (1987) similar sounds would be the result of L1 influence whereas dissimilar ones would be due to developmental (i.e. universal) tendencies. Our data do not reflect substitution processes that may not be traced back to the learners' L1. If we look at diphthongs, L1 influence is clear in cases like [ˈoriθon] (*horizon*), [ˈadʒensi] (*agency*), /aɪ/ and /eɪ/ being replaced by /i/ —most probably due to spelling influence, a factor extremely influential with adults who have acquired their FL in a formal setting. Centring diphthongs, however, are unfamiliar sounds to Spanish speakers, and yet far from reflecting universal constraints, they were all rendered by the Spanish sounds perceived as closest to the target forms. All this leads us to think that a great deal of research is needed to clarify what we mean by similarity between two sounds and upon which criteria cross-language similarity judgements are based.

III.3.e. Vowel substitution (duration)

As pointed out above, we decided to split up the vowel substitution macro-process into the processes of vowel quality and vowel quantity. Most of what has been said about the former is valid for the latter, but duration introduces a new perspective that needs to be discussed.

Vowel duration is a feature as typical of RP English as it is unknown in Spanish, hence its importance in analysing the role that universal factors may play in FL acquisition. We shall begin with Major's Ontogeny Model (1987) which hinges precisely on the interrelationship of transfer and universal processes. As seen above, the influence of transfer is considered strong during the initial stages of learning but later on it is superseded by developmental factors which progressively increase and finally decrease.

***Table 5a*: Vowel substitution (duration)**

IL FORMS	TL FORMS	SUBST	L FORMS	TL FORMS	SUBST
[ˈoful]	[ˈɔ:fəl]	ɔ:→o	[past]	[pɑ:st]	ɑ:→a /ʌ
[baniŋ]	[bɜ:nɪŋ]	ɜ:→a/ʌ	[ˈperson]	[pɜ:sn̩]	ɜ:→e
[esˈkursjon]	[ɪkˈskɜ:ʃn̩]	ɜ:→u	[ˈservant]	[ˈsɜ:vənt]	ɜ:→e
[ˈkasel]	[ˈkɑ:sl̩]	ɑ:→a/ʌ	[esˈport]	[spɔ:t]	ɔ:→o
[ˈfaðer]	[ˈfɑ:ðə]	ɑ:→a/ʌ	[tern]	[tɜ:n]	ɜ:→e
[fest]	[fɜ:st]	ɜ:→e	[tok]	[tɔ:k]	ɔ:→o
[ˈfornitʃer]	[ˈfɜ:nɪtʃə]	ɜ:→o	[toˈwars]	[təˈwɔ:dz]	ɔ:→a
[ˈgarden]	[ˈgɑ:dn̩]	ɑ:→a/ʌ	[words]	[wɜ:dz]	ɜ:→o
[ˈgel frend]	[ˈgɜ:l frend]	ɜ:→e	[workiŋ]	[ˈwɜ:kɪŋ]	ɜ:→o
[haf]	[hɑ:f]	ɑ:→a /ʌ	[west]	[wɜ:st]	ɜ:→e
[ˈhorsis]	[ˈhɔ:sɪz]	ɔ:→o	[ˈwoter]	[ˈwɔ:tə]	ɔ:→o
			[θerd]	[θɜ:d]	ɜ:→e

Both types of process have been widely reported within an L2 context. Eckman (1981) and Flege and Davidian (1985) have found evidence for Spanish that there are processes that are not attributable to the learner's NL. Vowel duration is an interesting area of study to see whether the IL behaviour of Spanish speakers confirms their findings. Spanish differs in this respect from English (RP variety) quite markedly. While duration is distinctive in RP English establishing two different types of monophthongs, long vs short, in Spanish length is an optional element with no distinctive value in the system (Monroy, 1980). The closest to a durational effect is found in cases like *azahar* or *alcohol*, with two identical vowels combining their respective values, but, as pointed out above when synaeresis was discussed, they may be freely reduced in colloquial speech to the value of a single vowel so that *azahar* (orange blossom) can be homophonous with *azar* (chance). Length is therefore non-distinctive in Spanish. On the other hand, the tendency towards vowel compresion is fairly strong in colloquial Castilian and is responsible for most cases of synaeresis and synaloepha in the language. But again, it is non-distinctive as nucleus-lengthening in some South American varieties (e.g. Argentinian) testifies. And yet, duration is a potential area of difficulty for Spanish speakers. A glance at Table 5b clearly reveals that more than half of the sample (63.08%) failed to use it correctly.

***Table 5b*: Vowel substitution (duration)**

Num. Errors	Frequency	%
0	24	36.92
1	20	30.76
2	14	21.54
3	2	3.08
4	5	7.69

Following Major's OM hypothesis, one would expect interference to play a major role during the early stages of learning; also because "is more likely in colloquial speech" (Major, 1987: 219) which is what we have analysed. The recorded IL forms in Table 5b do reflect instances of interference with no trace of developmental errors. The learners substituted the long vowels /ɔ:/-/ɑ:/-/ɜ:/ for Spanish /o/-/a/ in the first two cases, and in the case of schwa for Spanish /e/, /o/ or /a/ depending on the environment. Under no circumstances did developmental errors make their appearance, which is all the more surprising considering that the learners' NL does not exert specific constraints on length. Moreover, Spanish is usually considered a syllable-time language and, unlike stress-timed languages, 'vowel reduction is much less prevalent' according to Major (1987: 218) . So one wonders why there is no trace of developmental errors in our informants. A possible answer might be that frozenness has occurred before the onset of universal processes so that only interference is present, but Major's model envisages the presence from the start of both types of process with L1 processes prevailing over —not surpressing— developmental ones.

The conclusion then is that as far as vowel duration is concerned, the frozen IL of our Spanish informants does not reflect processes other than those that mould their L1.

III.3.f. Consonant insertion (epenthesis)

This process ranked low in the IL of our participants: only 35% (see Table 6b) failed to produce the phonetic forms of the TL correctly. We shall be focusing on onsets and codas modification in order to see, once again, the possible effect of interference and developmental processes, and the conformity of the resulting syllables to the UCSS.

***Table 6a*: Consonantal insertion (epenthesis)**

IL FORMS	TL FORMS	EPENTH	IL FORMS	TL FORMS	EPENTH
[ai ˈɣwos]	[aɪ wəz]	g	[in ˈdis ˈɣwei]	[ɪn ˈðɪs weɪ]	g
[anderstan]	[ʌndəˈstænd]	r	[tolk]	[tɔ:k]	l
[aŋ gwen...]	[ən wen...]	g	[ˈordinari]	[ˈɔ:dn̩ri]	r
[ˈdeŋ gwi...]	[ˈðen wɪ...]	g	[ˈperson]	[ˈpɜ:sn̩]	r
[ˈderti]	[ˈdɜ:ti]	r	[ˈsʌmgwan]	[ˈsʌmwʌn]	g
[ˈdogter]	[ˈdɔ:tə]	g	[ˈservan]	[ˈsɜ:vənt]	r
[ˈenti]	[ˈempti]	p	[toˈwars]	[təˈwɔ:dz]	r
[ˈfaðer]	[ˈfɑ:ðə]	r	[ˈwɒtər ɣwos]	[ˈwɒtə wəz]	r
[ferst]	[fɜ:st]	r	[gweŋ ˈgwos..]	[wen wəz]	g
[for mi]	[fə mi:]	r	[ɪs gwers]	[wɜ:st]	g
[ˈgarðen]	[ˈgɑ:dn̩]	r	[ˈworkiŋ]	[ˈwɜ:kɪŋ]	r
[ˈhorsis]	[ˈhɔ:sɪz]	r			

Consonantal epenthesis affected /g/ and /r/ and only marginally /l/. One thing that stands out from our sample is the fact that apparently only one-member onsets are amenable to modification. Such modification would consist of inserting /g/ as an epenthetic consonant initially in a word, the resulting sequence conforming to the UCSS in terms of sonority. A closer examination reveals that the underlying phonetic facts are much more complex. Unlike English, Spanish /w/ is word initially not a consonant, but the first element of a diphthong (eg. /ˈweko/ -*hueco (gap)*), and as such it may be preceded by a single coda (/ˈgwapa/ -*guapa (pretty))*. The interesting thing is that the epenthetic consonant /g/ can only be inserted across word boundaries, and only if /w/ is preceded by a consonant —particularly if nasals and liquids are present, but not exclusively (*haz hueco* -leave room). So the function of consonantal epenthesis here is not to "make syllabifiable unsyllabifiable sequences" (Carlisle, 1999: 69), which is not the case for the two are perfectly syllabifiable, but to avoid a syllabification which if abiding by the canonical syllable would contravene a phonotactic rule whereby a consonant flanked by vowels syllabifies with the following one. Here is how this apparently paradoxical situation originates:

1. la huerta /la ˈwer.ta/ (the orchard) with the syllable string[30] CV# wVC# CV
2. un huerto /u.nwer.to/ (an orchard)—after applying a resyllabifiction rule whereby a consonant between vowels syllabifies with the following vowel as in *ar.bol-*

ar.bo.les (*tree- trees).* As this syllabification is not allowed by the system, new resyllabification takes place yielding

3. un huerto /un.gwer.to/ with epenthesis of /g/ (the system disallows the linkage of a single consonant with word initial /we/).

All Spanish vowels are in fact eligible as syllable nucleus devoid of both onset and coda, but /u/ is the one which more restrictions presents. Unlike the rest of the monopththongs, it cannot occur on its own across word boundaries unless followed by /o/ (e.g. *uno u otro*). In these circumstances, ambisyllabicity occurs, /u/ optionally syllabifying with the preceding /o/ (*u.nou.o.tro*) or with the following /o/ (*u.no.uo.tro*) or, if hiatus intervenes, it may constitute a separate, margins-less syllable (*u.no.u.o.tro).* Thus, while Spanish allows *un.nue.vo* (*a new*...) and /uŋ gwe.βo/ *(un huevo* -an egg) it disallows the string /u.nwe.βo/ as the correct syllabification for *an egg*. One might consider velarization of a preceding /n/ to be responsible for the presence of /g/ —a widespread tendency in colloquial Castilian. But the fact that /g/ is also inserted after a vowel (e.g./'kar.nei.gwe.bos/ *meat and eggs*) as a reinforcer of /we/, disallows such an interpretation. It rather seems that epenthetic /g/ is introduced by a phonological rule that prevents the dynamic shift of the intervocalic consonant with the opening dipththong /we/, and to a lesser extent with /wi/[31] (Monroy, 1980, ch.V). The phenomenon is so widespread that a phonetician like Malmberg (1965) posited a labio-velar phoneme /gw/ for Spanish (1965: 54-55).

This process of velar epenthesis was fairly frequent (40 %, see Table 6b) in the IL samples of our informants, expressions like [aŋ gwen...], ['deŋ gwi...], [ai ɣwos] etc., being mirror image of similar sequences in Spanish. It provides further support for Carlisle' s contention (1999) —which he only applies to vowels— that environment exerts a strong influence on the frequency with which epenthesis occurs word initially. The question that remains to be answered is the extent to which epenthesis in Spanish is more or less frequent before vowels compared with consonants.

***Table 6b*: Consonant insertion (epenthesis)**

Num. Errors	Frequency	%
0	39	60.00
1	14	21.54
2	8	12.31
3	42	6.15

Epenthesis in coda position was restricted to the presence of /r/. Spelling played, apparently, an important role here, for being RP a non-rhotic accent there were several examples where our informants pronounced /r/ in medial, closed syllables in the Spanish way. It is a well known fact that adult Spanish speakers are perceptually and in terms of production more at ease with rhotic than with non-rhotic varieties of English due precisely to the closer relationship between spelling and pronunciation in non-rhotic accents. Spelling influence appears to be so strong that it nullifies the effect that UCSS might exert on such syllables. Thus words like *person, garden, dirty, talk*, etc., were pronounced with epenthesis of /r/ (and the last one of /l/) in coda position instead of abiding by the universal canonical syllable structure. This, no doubt, runs counter to the 'natural' preference for open syllables posited by Tarone (1980).

III.3.g. Consonant substitution

The consonant substitution process appeared to be the most powerful in IL development. As shown in Table 7b, all subjects made mistakes of this type, its frequency of occurrence reaching in one case 80% of an individual's sample. 18.46 % incurred in up to four mistakes of consonant substitution, this process being particularly active in syllable initial position and, above all, between vowels. It was less operative in word final position, apart from voicing that shall be discussed below. Liquids, nasals and sibilants in particularly were the segments more amenable to undergo substitution, but in a way that differs from the behaviour found in L1 learners.[32] Consonant change seems to us particularly revealing in the open syllable issue. Clearly the alleged universal preference for a CV syllable type was not borne out. Very significantly, our data reveal that when confronted with an unfamiliar single coda, subjects opted for substituting a familiar phoneme for it rather than suppressing the unfamiliar one as one might expect.

***Table 7a*: Consonant substitution**

IL FORMS	TL FORMS	SUBST	IL FORMS	TL FORMS	SUBST
[a'γou]	[ə'gəʊ]	g→γ	['nes ðei]	['neks deɪ]	d→ð
[an den...]	[ən ðen...]	d→ ð	[o'keison]	[ə'keɪʃn]	ʃ →s
[aŋ gwi...]	[ən wi:...]	n→ŋ	['orins]	['ɒrɪndʒ]	dʒ→s
[deθ]	[ded]	d→θ	['proβlens]	['prɒbləmz]	m→n
['eβriβođi]	['evribɒdi]	v→β	['proγram]	['prəʊgræm]	g→γ
		b→β	['reiðjeu]	['reɪdiəʊ]	d→ð
		d→ð	['reinin]	['reɪnɪŋ]	ŋ→n
			['samboði]	['sʌmbədi]	d→ð
[es'treins]	[streɪndʒ]	dʒ→s	[sen'seison]	[sen'seɪʃn]	ʃ →s
['βeri 'βiγ]	['verɪ bɪg]	v→β	['serβan]	['sɜ:vənt]	v→b
		b→β	['ʃautin]	['ʃaʊtɪŋ]	ŋ→n
['beri]	[veri]	v→b	[tain]	[taɪm]	m→n
['fraitenin]	['fraɪtənɪŋ]	ŋ→n	['traβel]	['trævl]	v→b
['goβermen]	['gʌvnmənt]	v→β	['trajedi]	['trædʒədi]	dʒ→ɲ
['haβent]	['hævnt]	v→β	[tu 'ðu]	[tʊ du:]	d→ð
[ha'weβer]	[haʊ'evə]	v→β	[tu 'γou]	[tə 'gəʊ]	g→γ
['iŋglis]	['ɪŋglɪʃ]	ʃ→ s	[tu'γeðer]	[tə'geðə]	g→γ
[job]	[dʒɒb]	dʒ→ɲ	[wɒsen dear]	[wɒznt ðeə]	ð→d
			[wil 'βi]	[wɪl 'bi:]	b→β
['ju:suali]	['ju:ʒʊəli]	ʒ→ s			
['mornin]	['mɔ:nɪŋ]	ŋ→n			
[a'pier]	[ə'pɪəd]	d→r			

Substitutions represent another good basis for checking Major's hypothesis and see whether they are the result of transfer from Spanish phonology (for instance, use of alveolar fricative /s/ for the palato-alveolar /ʃ/), developmental, or TL forms which the learner has already acquired. A look at Table 7a reveals that substitutions took place within as well as across word boundaries. The use of [β] for [v] was the most common substitution among our participants (8 tokens) followed by the use of [ð] for [d] (7 tokens). This 'everybody effect' is so entrenched in the IL of adult Spanish speakers that it is perhaps one of the more lasting interference features and one that best reveals the Spanish origin of the learner. The replacement affects voiced plosives [b,d,g] which are rendered as their corresponding fricatives [β,ð,ɣ] when flanked by vowels, a key substitution phenomenon in Spanish phonology. Also, as Spanish lacks the opposition voiced/ voiceless found in the case of English labio-dentals /v, f/, /v/ is substituted by [β] too as shown below

CONSONANT SUBSTITUTION		
/b/ ↓	/d/ ↓	/g/ ↓
/v/ ⟶ [β]	[ð]	[ɣ]
/m/ ↓	/n/ ↓	/ŋ/ ↓
[n]	[ŋ]	[n]

Nasals too enter into an interplay of substitutions where perhaps the most remarkable are the use of /ŋ/ for /n/ (as in /aŋ gwi.../) and, conversely, the use of /n/ for /ŋ/ (as in /ˈfraitenin/).

Transfer is apparent in the replacement of /m/ by /n/ as in /tain/ (*time*), Spanish being reluctant to have a bilabial nasal finally in a word with the exception of *álbum* (generally pronounced *álbun).*The realization of /ŋ/ as /n/ (e.g. /ˈʃautin/) obeys identical phonotactic constraints —although a number of speakers habitually use the velar variety on all occasions (Monroy, 1980: 193). The use of /ŋ/ for /n / is context dependent: any following velar will trigger off the velarization of a preceding nasal both within and across word boundaries. All nasal substitutions therefore involved transfer processes.

As stated above, fricativization of voiced plosives was highest with /d/ (7 tokens), followed by /g/ and /b/. Environment is a crucial factor here too. English labio-dentals underwent substitution processes depending on their place in the utterance. Thus, /ˈberi/ maintained the plosive value due to its position of initial segment preceded by pause or nasal consonant. The latter was responsible for the non-fricativization of /d/ in [an den..] or [ˈwɒsen dear]. Otherwise, they were all systematically replaced by their corresponding fricative values as in [ˈβeri βiɣ], [tuˈɣeðer], etc.

Looking at these facts from a MDH perspective, we observe that substitutions affect basically nasals and voiced fricatives. It appears that within the nasal group /n/ is the least marked element, followed by /m/ and [ŋ]. The replacement of /m/ for /n/ and of [ŋ] for /n/ are correctly predicted by the hypothesis, but this is not the case of /n/ for [ŋ] where the latter is the more marked element. It is true that one possible explanation might be that for a number of Spanish speakers both [n] and [ŋ] are in free variation word finally, but markedness relations do not envisage such a possibility as they do not show identity of features: while both elements share the feature [+nasal], /n/ unlike /ŋ/ is [+coronal] and [-back]. Therefore, this does not provide us with a valid explanation. And the same holds for the voiced obstruents /b, d, g/. The theory of markedness predicts that once the nasal-oral distinction applies, place of articulation follows. As the intervening voiced pairs share identical point of articulation features, it is manner that differentiates them. The marking conventions specify that plosives are less marked than their corresponding fricatives so they should not be replaced as the latter are marked for the feature [+continuant]. This replacement is context dependent though, for it only takes place when voiced plosives are flanked by vowels. Thus the markedness hypothesis does not seem to make the correct prediction in terms of directionality since both consonant types are functional in Spanish. It does predict that the markedness value for [-continuant] is ignored between vowels.

***Table 7b*: Consonant substitution**

Num. Errors	Frequency	%
0	0	0.0
1	9	13.85
2	19	29.23
3	14	21.54
4	12	18.46
5	6	9.23
6	2	3.08
7	1	1.54
8	2	3.08

A third group of substitutions involved English palato-alveolars /ʃ, ʒ/ and voiced affricate /dʒ/. The three are foreign phonemes to Spanish learners and have the feature sibilance in common, a feature shared by Spanish /s/. The IL forms of our informants reflected this fact. Accordingly, the three English phonemes were replaced by Spanish /s/ (e.g. [ˈju:suali], [oˈkeison], [ˈorins] *(usually, occasion, orange)*. On only one occasion (*tragedy*) was /J/ substituted for /dʒ/, friction prevailing over stridency. All these phenomena are an indication that transfer from the learners' L1 was overriding since no substitutions were found that could be considered developmental in nature.

This has interesting implications for Major's OM (1987b, 1999) according to which transfer errors will decrease while developmental increase and then finally decrease. The IL of our participants was plagued with errors, but some of them far from being developmental, which is what one would expect after the long exposure to English of all the informants, were clearly due to transfer. Major's model does predict the learner's course of development from the initial stages to a final stage when the learner can produce target-like utterances, both processes intervening in varying degrees in the shaping of the learner's IL, but the model fails to account for incomplete attainment as in our case. It would be interesting to know which of the two prevail in frozen speech in order to gauge how far off IL is from the target forms. This failure to spot developmental processes in the substitutions of our informants is all the more surprising when one considers that Major (1999) has supported the claim for the presence of both processes analysing the IL of four adult beginners for a period of just eight weeks (1999: 133), which markedly contrasts with the ten years' exposure of our participants. One might be tempted to consider developmental the presence of consonant clusters in final position like the ones found in [esˈtreins] or [job] on the grounds that they do not occur finally in a word. Their presence, however, as Spanish syllabic codas (e.g. *ins.truir, ob.jeto,* etc.) disqualifies them as manifestations of a purely developmental process.

III.3.h. Consonant assimilation

Another type of substitution process whose presence in the IL of our informants was fairly significant (67.69% made mistakes linked to this process, see Table 8b) was consonant assimilation, a process in FL acquisition which has not been much studied as Macken & Ferguson acknowledge (1981). Although its effect is more noticeable at word boundaries, it was also found word internally reflecting in both cases language-specific rules. In English assimilation processes are "usually regressive, involving a variation in the place of articulation" (Gimson-Cruttenden, 1994: 259). In Spanish, too, assimilation is usually regressive and affects place of articulation.

***Table 8a*: Consonant assimilation**

IL FORMS	TL FORMS	ASSIM	IL FORMS	TL FORMS	ASSIM
[aɪ ˈθɪn dət...]	[aɪ ˈθɪŋk ðət...]	n‿d	[aŋ gwen...]	[ən wen...]	ŋ‿g
[ˈenti]	[ˈempti]	n‿t	[aiŋ goiŋ...]	[aɪm gəʊɪŋ...]	ŋ‿g
[diden nou]	[dɪdnt nəʊ]	n‿n	[deŋ gwi...]	[ðen wi...]	ŋ‿g
[an den]	[ən ðen]	n‿d	[aŋ gwi...]	[ən wi...]	ŋ‿g
[in ˈdis gwei]	[ɪn ðɪs weɪ]	n‿d			
[ˈorɪn juːs]	[ˈɒrɪndʒ dʒuːs]	n‿j	[nes samer]	[ˈnekst ˈsʌmə]	s‿s
[ˈprɒblens]	[ˈprɒbləmz]	n‿s	[ai ˈdoun θin sou]	[aɪ ˈdəʊn θɪŋk səʊ]	n‿s
[hɪnself]	[hɪmˈself]	n‿s			

A glance at Table 8a, shows, however, that both types of process are present in the learners' speech reflecting, once again, the influence of the informants' L1. Thus in the first IL column we come across some instances of progressive assimilation such as [an den] (*and then*) or [aɪ ˈθɪn dət...], where /ð/ (then, that) undergoes assimilation to the place of articulation of the preceding nasal. This is a reflection of a Spanish syllabic rule whereby voiced plosives become fricatives when preceded by consonants other than nasals (e.g. [sin.du.ða] -*without any doubt* vs [la.ðu.ða]. The remaining examples are instances of regressive assimilation: [ˈprɒblens], [nes samer], etc. The IL forms [aŋ gwen...], [deŋ gwi...] constitute typical cases of velar reinforcement as seen above which trigger off the assimilation of the preceding nasal to an identical point of articulation as the first element of the following word.

***Table 8b*: Consonant assimilation**

Num. Errors	Frequency	%
0	21	32.31
1	23	35.38
2	15	23.08
3	6	9.23

III.3.i. Voicing/devoicing

Voicing/ devoicing , applied here to phonologically contrastive units sharing an identical point of articulation, appears to be a widespread phenomenon in the IL of our informants. As a variety of consonant assimilation, this process had a moderately high frequency of occurrence per subject: nearly half of the sample (47.69%) produced target-like forms while the rest of the subjects made one or more mistakes (see Table 9b).

***Table 9a*: Voicing/devoicing**

IL FORMS	TL FORMS	V/D	IL FORMS	TL FORMS	V/D
[faif]	[faɪv]	v →f	[ekˈsampel]	[ɪgˈzɑ:mpl̩]	gz→ks
[of]	[əv]	v →f	[ekˈsam]	[ɪgˈzæm]	gz→ks
[ˈbisnis]	[ˈbɪznəs]	z →s	[esˈtreins]	[ˈstreɪndʒ]	dʒ→ns
[wos]	[wəz]	z →s	[ˈhostitʒis]	[ˈhɒstɪdʒɪz]	dʒ→tʃ
[biˈkos]	[bɪˈkɒz]	z →s			z →s
[noisis]	[ˈnɔɪzɪz]	z →s	[ˈmarritʃ]	[ˈmærɪdʒ]	dʒ→tʃ
[ˈhɔrsis]	[ˈhɔ:sɪz]	z →s			
[gels]	[gɜ:lz]	z →s	[ˈjusuali]	[ˈju:ʒʊəli]	ʒ →s

Various studies have focused on sound replacements of Spanish learners of English as a FL (Michaels, 1974; Hammerly, 1982) where voice has been approached as part of the general process of sound substitution. That sound substitution —and voicing /devoicing in particular— is far from being an arbitrary choice is clear from the data presented in Table 9a. In all the words listed, the feature [-voice] is maintained in cases where the TL demands a [+voice] realization. By applying Eckman's MDH (1987) and his Structural Conformity Hypothesis (1991), we see in the first place that the difference between English and Spanish fricatives lies here in the presence of a voice contrast in English which is not functional in Spanish. The hypothesis predicts an area of difficulty word initially that increases directionally to word medial and word final sibilant fricatives, the last ones occupying the most marked position (Eckman, 1987). For a Spanish speaker this would represent, therefore, an increasing difficulty in the mastery of the voice contrast from initial to final position.

***Table 9b*: Voicing/devoicing**

Num. Errors	Frequency	%
0	31	47.69
1	18	27.70
2	10	15.38
3	5	7.69
4	1	1.54

Although our data do not reflect the three possibilities (there were no samples with a voice contrast word initially or word medially), experience tells us that Spanish speakers find word initial voice contrast as difficult to master as in medial or final position. Eckman (1987) mentions that initial voice contrasts 'should not be difficult' for English speakers learning French /ʃ-ʒ/. As such contrasts do exist word medially in English, it may have a facilitating effect that is totally absent in the case of Spanish speakers where the language lacks (sibilant) voice contrasts in any position[33]. In our teaching experience, English word initial voice contrast (as in *zed – said*) represents a degree of difficulty for our students as high as word medially or word finally. Target-like voice forms may no doubt be obtained in any position through proper training, but, to our knowledge, no one has quantified the amount of time needed to master such contrasts so that we cannot confidently state that Spanish learners of English acquire them in a particular direction.

Resort to first language acquisition does not seem to confirm directionality in terms of typological markedness. Thus in the empirical study on Spanish acquisition carried out by Hernández-Pina (1984) in which she systematically analysed her child's output from zero to three years, the first sibilant recorded occurred in word final position (*papas*= food) at fourteen months. A word initial sibilant appeared at sixteen months (*sol*= sun) and in medial position at seventeen months (*oso*=bear). Curiously enough, at eighteen months Rafael did not pronounce /s/ either word initially ([téta] *silleta*=small chair) or word medially ([kitá] *cristal*= glass) or word finally ([paaβa], *paraguas* =umbrella). The correct pronunciation of these forms occurred at a later stage with the following ordering: *paraguas* (19 months), *cristal* (23 months), *silleta* (24 months) (1984: 174-175).

Quite independently of the backsliding effect or the non-linear progression of these examples, such behaviour seems to contravene typological markedness in the sense that it does not bear out a parallelism between first and second/foreign language acquisition. There is no reason to believe that a Spanish-speaking learner will follow this order and make such errors learning a foreign language. Among other reasons, because the MDH does predict frequency of errors but not *types* of errors. All we can say is that the MDH predicts that voice errors are L1 dependent to the extent that the difference between L1 and TL in terms of voicing is marked in English whereas there is no such contrast in Spanish. In our data at least, the resulting errors are clearly due to interference in all cases. If typological markedness is a measure of degree of difficulty as it is claimed, English word final voice sibilants should be acquired at a later stage than, say, word medial or word initial voice contrasts. Admittedly, this cannot be guessed from the examples in Table 9a which reflect frozen IL forms at a given stage, but other procedures would also be fraught with difficulties as there is no way of knowing how many instantiations the learner has been exposed to before mastering a particular contrast.

III.3.j. Cluster simplification

In a paper published in 1974, Oller reflected on the L2/FL literature concluding that while epenthesis was a favoured strategy for FL/L2 learners, consonant deletion was favoured for L1 learners. Independently of the validity of his assertion that epenthesis occurs frequently in L2/FL speech (denied by Sato, 1987), consonant deletion happens to be a common process in the IL of Spanish adult learners. That and epenthesis constitute the main processes responsible for cluster modification. In this section we shall be looking at consonant simplification both in syllable onset[34] and coda positions from a markedness perspective. Anomalous clusters (asterisked in the Table below) will be briefly discussed within the framework of Optimality Theory.

Deletion was the third and final macro-process appearing in the IL of our participants. As reflected in Table 10b, 33.85% of the students made no mistakes in cluster reduction. The remaining 66.15% were reductions that affected word final consonants due to the fact that Spanish allows syllable final but not word final clusters.

Since the irruption of universal theories, coda simplification has been the subject of a number of studies in an attempt to show how IL consonant patterns reflect universal tendencies. One serious problem that speakers of Spanish face when learning English as a FL is the mastery of English codas due to their degree of complexity. Whereas RP English displays 116 consonant word final consonant clusters (Gimson-Cruttenden, 2001: 240-43), Spanish only allows four single consonants in that position: /n, s, l, r/. These consonants are, moreover, potentially ambisyllabic in the sense that they become heads the moment a vowel follows either within a word or across word boundaries.

***Table 10a*: Cluster simplification (apocope)**

IL FORMS	TL FORMS	APOC.	IL FORMS	TL FORMS	APOC
[ai doun θin sou]	[dəunt θɪŋk səʊ]	t/k	['hapen]	['hæpənd]	d
['aksiden]	['æksɪdənt]	t	['hazent]	['hæznt]	*
[a'rraif]	[ə'raɪvd]	d	['havent]	['hævnt]	*
[a:s(k)]	[ɑ:skt]	t	[hɪnself]	[hɪm'self]	*
['darnes]	['dɑ:knəs]	k	[im'portan]	[ɪm'pɔ:tənt]	t
[dres]	[drest]	t	[is'perjens]	[ɪk'spɪəriəns]	k
['difikul]	['dɪfɪkəlt]	t	[ɪs gwers]	[ɪz wɜ:st]	t
['enti]	['emptɪ]	p	[jas]	[dʒʌst]	t
[e(k)'spirjens]	[ɪk'spɪərɪəns]	k	[las]	[lɑ:st]	t
[es'prest]	[ɪk'sprest]	k	[lif]	[lɪvd]	d
[e'gens]	[ə'genst]	t	[nai]	[naɪt]	t
[es'pen]	[spent]	t	[nes]	[nekst]	k
[es'perimen]	[ɪk'sperɪmənt]	t	['ones]	['ɒnɪst]	t
[es'port]	[spɔ:t]	d	['orins]	['ɒrɪndʒ]	*
[es'tand]	[stænd]	*	['pregnan]	['pregnənt]	t
[es'treins]	['streɪndʒ]	*	['proβlens]	['prɒbləmz]	*
['flowers]	['flaʊəz]	*	['servan]	['sɜ:vənt]	t
[frens]	[frendz]	d	[tern]	[tɜ:n]	*
[for 'istans]	[fər 'ɪnstəns]	n	[tok]	[tɔ:k]	*
[gels]	[gels]	*	[ʃort]	[ʃɔ:t]	*
[ges]	[gests]	t	[to'wars]	[tə'wɔ:dz]	d
			['wen 'houm]	['went..]	t
			[work]	[wɜ:k]	*
			[wors]	[wɜ:dz]	d

A glance at Table 10a shows a number of syllabic modifications that deserve a comment. Cluster simplification is most evident after /n/ plus /t/ and, less frequently, /d/ or /k/, especially in word final position as in [ai doun θin sou] or ['aksiden]. This confirms Anderson's study (1987) who also found that /t, d/ were the consonants most often deleted by her informants[35]. /t/ deletion extends to cases where an obstruent follows /l/ (e.g. ['difikul]) or /s/ (e.g. [las] (*last*), [lif] (*lived*). Obstruents were systematically deleted in syllabic codas beginning with /s/ as in [dres] (*dressed*) —and more drastically in [nes] (*next*). In all these instances the resort to a deletion process —never to epenthesis— was evident to adapt TL forms to conform to a native language structure. This could be explained as a reflection of an L1 Consonant Deletion Rule whereby occurrences of sibilant plus plosive are realised with the dropping of the plosive. But this cannot be extended to other two-consonant clusters: there are a number of instances that did not undergo such simplification strategy. Eckman's markedness hypothesis (1987: 152) establishes that three-consonant clusters are more marked that two-consonant clusters, that fricative+stop is less marked than stop+stop and that fricative+stop (or vice versa) is less marked than fricative +fricative. He further claims that cluster reduction follows a predictable pattern. Thus we would expect cluster reduction to apply to a word like *next* [kst] to yield a fricative + stop sequence ([sk —unlikely for a Spanish speaker— o vice versa ks]) rather than the more marked fricative +fricative [ss]. The drastic reduction to a one-consonant coda [s] would support Eckman's hypothesis in that a fricative and not a stop is maintained as the former is more marked than the latter. The same is valid for *guests*, pronounced [ges]. An alternative pronunciation would surely introduce a stop ([gest]) but it seems more unlikely to hear [gets] as a simplified form for *guests,* surely due to the sonority hierarchy which predicts that fricatives are more sonorous than plosives.

Now if we look at clusters consisting of liquid plus /s/ (*girls, flowers*) or /r/ plus /k, t/ (*work, short*) we notice that they were not simplified to L1 patterns by any of our informants. Nor were codas consisting of /n/ plus /s/ (e.g. [e(k)'spirjens]). Are these two-consonant codas obeying any universal principle whereby nasals and liquids followed by fricative are not amenable to further reduction (I have never heard Spaniards saying [gis] for *girls* or [experies] for *experience*)? A possible suggestion could be to explain coda maintenance in cases like these in terms of sonority as information potential (Ohala & Kawasaki, 1997). The main idea is that segments can occur together provided that each other do not mask the acoustic signals that constitute their informational potential. It is usually acknowledged that [s] has an anomalous behaviour. It has the capacity to appear in unexpected contexts and it may violate phonotactic and sonority restrictions. On the other hand, it is auditorily a specially perceptible sibilant (Laver, 1994: 260). [n] and [l] characterise by a high sonority too. Their combination with [s] produces a strong contrast, occasionally strengthened by the introduction of an intrusive [t] by same native speakers of English (e.g. [ɪk'spɪəriənts]) due to its stop character. As to [r], Laver (1994: 297-299) includes it together with the semivowels. Perhaps the mixed nature of approximants and their radical difference with obstruents would justify its capacity to combine with [t, k].

***Table 10b*: Cluster simplification (apocope)**

Num. Errors	Frequency	%
0	22	33.85
1	20	30.77
2	18	27.69
3	4	6.15
4	1	1.54

The pronunciation of an otherwise impossible L1 sequence consisting of liquid plus sibilant or liquid plus obstruent could be explained as instances of developmental forms in Major's model if not of orthographic influence (spelling pronunciation) considering the strong association that adult learners establish between spelling and pronunciation. This explains the IL forms with /r/ in coda position despite the non-rhotic character of RP. But there is not a ready explanation within Eckman's model as to why cluster reduction is not fulfilled in these and other cases where /r/, and to a lesser extent /l/, are not simplified to a one-member coda (e.g. *work, short*). One thing is certain though: that they do not correspond to any similar underlying cluster in Spanish. Only in the case of /n/ +/s/ one could argue that they do exist word medially in this language, although such realization is linked to stylistic considerations: in formal speech both segments are fully pronounced (e.g. *ins.tin.to*) whereas /n/ is dropped in casual speech *(is.tin.to)* —which is what we find in the first syllable of *instance* in our sample. However, our informants pronounced both consonantal elements with no reduction. This could be a simple case of phonological mastery due to practice if not a manifestation of orthographic mimetism. Another possible explanation might be to consider those word endings as samples of an internal syllable structure within a larger structural pattern (e.g. *for instance to come....*) in which case the phonological realisation of /n +s/ would accommodate to the word non-final pattern already seen. It could be argued that if this was the case, one might come across realisations of *instance* as *[ínstan] or *[ínstas] in parallel with the pronunciation [ˈɪns--] / [ˈɪs--] found in our informants. As this did not materialise, and experience confirms that these are not likely IL forms for Spanish speakers, it may well be a case of developmental substitution, although again one cannot lose sight of the fact that the cluster is not totally foreign to the Spanish learner.

The case of obstruent deletion is different. By resorting to this process, the learner transforms an otherwise illicit coda into a perfectly acceptable L1 structure. From an Optimality Theory (OT) perspective, the lack of obstruents in word final position derives from constraints acting on surface representations, constraints such as (a) the barring of obstruents in word final position (NO OBS WF), (b) maximization of consonants in the input (MAX (C)), and (c) input dependence of the vowels in the output (DEP (V)). The first constraint restricts more marked forms whereas b) and c) are faithfulness constraints in that they establish a correspondence between input, or underlying representation, and output. Both are linked by a universal function called EVAL, which compares input and output an assigns faithfulness violation marks. Optimality Theory has to provide an answer as to which of the surface representations is optimal according to the constraint ranking operating in a given language.

There is a problem however with NO-OBS-CODA constraint used by Broselow, Cheng and Wang (1998) for it would exclude *all* obstruents from coda position when all we want in fact is to exclude just those from word final position. The simper solution would be to posit an ad hoc NO-OBS-WF constraint (no obstruents word finally). This applies, unlike NO-CODA-OBS (*et.nia, at.mós.fe.ra*, etc), to all words except a few linguistic loans like *pub, club,* so it would not make much sense that the learners would obey NO-CODA-OBS. Markedness universals would justify the ranking position of NO-OBS-WF. However, it is reasonable to assume than an FL learner starts not from a neutral ranking constraint but from the one assumed by his/her L1. It is immaterial within OT though to discuss whether the suppression factor is universal or L1 related as it is related to both. Prince & Tesar (1999) hold the view that when acquiring an L1 there is an innate tendency to avoid markedness constraints degradation (like NO-OBS-WF) below faithfulness (like MAX and DEP). That is, there is an innate tendency to avoid the acquisition of unnecessarily marked forms. The fact that NO-OBS-WF is not violated in Spanish has two sources: one, universal (it is a markedness constraint and occupies, therefore, the top of the ranking provided this is not changed in the opposite direction); the other is L1 specific (that the learner has not acquired any word that has led him to downgrade NO-OBS-WF below MAX and DEP). Any decision as to whether suppression is due to L1 influence or to universal factors evolves around either choice between action (the universal tendency to place NO-OBS-WF high in the ranking) or omission (the fact that Spanish does not alter such configuration).

Thus if an input contains a voiceless stop word finally, as in *accident*, we cannot satisfy constraint a) without being unfaithful to the input (/ˈæksɪdənt/); the surface form without the final stop ([ˈæksɪdən]), though, violates constraint b). Another possibility could be to introduce an epenthetic vowel at the end ([ˈæksɪdənte]) , but this would violate c) which penalises the addition of vowels. The form chosen by the speaker will depend on which constraint is more highly ranked and therefore stronger in his/her IL. Thus while the native speaker of English will rank b) and c) higher than a), a Spanish learner of English who pronounces *accident* as [ˈaksiden] with /t/ deletion, is ranking a) higher than b) and c) as illustrated below

	/ˈæksɪdənt/	NO OBS WF	DEP (V)	MAX (C)
	a. ˈæksɪdənt	*!		
☞	b. ˈaksiden			*
	c. ˈæksɪdənte		*!	

We see then that OT does not envisage language-specific rules: GEN supplies a number of possible surface forms that correspond neither to the NL nor the TL and that incorporate universal processes such as deletion, substitution, epenthesis, etc. All the learner has to do is to check which of the surface forms best satisfies the set of universal constraints as they are ranked in his/her language. Of the two basic processes that might reflect the universal function GEN —deletion and epenthesis— the former turned out be more common (66.15%, see Table 10b) than the latter (49.23%, see Table 2b). These results contradict Broselow, Chen & Wang (1998) and their claims about the *emergence of the unmarked* in second language phonology. In their paper they claimed that, given that faithfulness had to be violated, learners chose the least marked unfaithful forms. Under the label 'WD-BIN' they seem to encapsulate three basic metrical constraints: i) FT-BIN: "Feet are binary under moraic or syllabic analysis" (Kager 1999: 156); ii) GRWD=PRWD: "A grammatical word must be a prosodic word" (Kager 1999: 152); and iii) PARSE-SYL: 'Syllables are parsed by feet' (Kager 1999: 153). Surprisingly, epenthesis is a far better choice from the markedness viewpoint: [ˈæksɪdənte] can be analysed as a prosodic word with two feet [(ˈæksɪ)(dənte)] so that FT-BIN, GRWD=PRWD and PARSE-SYL are respected. Let us see in tableau format how epenthesis would win if the emergence of the unmarked took place:

	/ˈæksɪdənt/	FT-BIN	GRWD=PRWD	PARSE-SYL
☞	a. (ˈæksɪ)(dənte)			
	b. (ˈæksɪ)(dən)	*!		
	c. (ˈæksɪ)(dən)			*!
	d. (ˈæksɪdən)	*!		

The deletion of the obstruent is consistent with the high ranking of NO-OBS-WF, but it does not reduce metrical markedness. We are left with a three-syllable word that cannot possibly be optimally parsed into feet. Either we violate FT-BIN by creating a foot that consists of three syllables or leave one syllable metrically unparsed, thus violating PARSE-SYL. Other constraints will have to be considered to account for the fact that, in spite of increased markedness, deletion is the preferred option.

Reality, though, is much more complicated that this sketchy analysis may lead one to think. The fact that 33.85 % of our informants produced all forms correctly, and in the case of epenthesis, half of the sample did not make any mistakes at all, requires an explanation that involves the reranking of constraints. But it is interesting to know the prevailing type of ranking in the frozen IL of FL learners.

IV. CONCLUSIONS

In this paper I have presented and analysed some basic patters of the frozen IL of adult Spanish learners of English. The study of their oral output has yielded ten fundamental phonological processes shaping their IL which ultimately are reflections of the three universal macro-processes of addition, subtraction and substitution. In our study, consonant substitution errors turned out to be the hardest to eradicate (100%), closely followed by vowel quality (80%). At the other end of the scale, synaeresis or vowel elision, vowel epenthesis and consonant epenthesis ranked lowest (37%, 38 % and 40% respectively). Middle range values corresponded to prothesis and voicing/ devoicinig (both 52.31%), vowel substitution (duration) (63%), cluster simplification (66%) and consonant assimilation (68%). No specific acquisition order is claimed for such processes in the sense that one may deduce a universal ranking order for them.

I have discussed each of them in turn providing evidence of the degree of phonological dependence of such processes on L1 phonotactic patterns. Thus, prothesis is analysed under the light of the universal canonical syllable or tendency to reduce complex syllabic structures to an unmarked CV pattern as predicted by Tarone (1980) among others. Far from confirming such a tendency, our data increase the number of studies, mainly those in which Spanish subjects were involved, that report the violation of the CV universal pattern. But this needs some qualification, while a prothetic vowel is a compulsory element whenever the previous word ends in a consonant, in full agreement with the Spanish pattern of consonant resyllabification, a prothetic vowel is not so critical if the final element of the preceding word is itself a vowel. In these circumstances, the Spanish learner may optionally introduce prothetic /e/, particularly in slow speech or because of hiatus. Alternatively, (s)he may resyllabify with extrasyllabic /s/ acting as coda. In either case the resulting pattern is not the allegedly universal CV but a CVC structure despite the fact that Spanish is characterised by a strong preference for the open syllable.

Violation of the canonical CV syllabic structure is also evident in most instances of vowel insertion (epenthesis) in word medial and word final position. Unlike prothesis where /e/ was the only allowed vowel, here we come across some instances with epenthetic /o/ and occasionally /i/ or /a/. While some examples did abide by the universal canonical syllable in word medial position alternating with samples that did not, violation of the CV pattern was systematic in word final position, even in cases of three-consonant codas. These examples provide little support for the alleged primacy of epenthesis as a key process in the IL phonology.

Not much attention has been paid to synaeresis in the IL literature, due no doubt to is low occurrence in other than casual speech. Even here it was the phonological process with least incidence in our data as pointed out above. And yet it is a relatively frequent phenomenon in English, although it affects schwa basically, and a very frequent one in Spanish. The IL forms recorded were mostly instances of elision of identical vowels. The resulting resyllabified syllable structure with the conflation of the two nuclei into one (CVC) is a clear manifestation of a powerful L1 process which again violates the universal canonical syllable in that it shows preference for a closed syllable instead of keeping the CVV# VC pattern.

Substitution of one vocalic segment for another is a common process both in L1 and FL acquisition. It has usually been invoked in support of the interaction of developmental and transfer processes. We have drawn a distinction between substitutions affecting vowel quality and those affecting vowel quantity. Qualitatively speaking, vowel substitutions ranked very high. Substitutions in general are a good example to test both Major's Similarity /Dissimilarity Hypothesis, according to which dissimilar sounds are more successfully mastered than similar sounds, and Major and Kim's Similarity Differential Rate Hypothesis which predicts that dissimilar sounds are acquired faster than similar ones. To begin with, we argue against the similarity/dissimilarity distinction on the grounds that it is a very elusive dichotomy since it needs to be fully operationalised if it is going to have any real value as a criterion to provide a convincing explanation of frozen IL. Moreover, the similarity /dissimilarity distinction rests on the individual's perceptual target, heavily influenced by the learner's L1 phonemic structure, which in turn governs production. It also seems to rest to a variable degree on orthographic mimetism, particularly in the case of vowels. Our data certainly did not reflect the fact that dissimilar sounds were easier to learn than similar ones, nor that the former were acquired faster than the latter. Should this be otherwise, the frozen IL of our informants would have shown a higher mastery of dissimilar than similar vowel forms as reflected in the acquisition of, say, schwa vs /æ/. This did not materialise. A related issue refers to the role played by transfer vs. developmental processes in the acquisition of vowel quality. Positive transfer was expected in the case of similar sounds whereas dissimilar sounds were supposed to be due to developmental tendencies. Since all substitution processes were related to the learners' L1, there is no room for such dichotomy as far as this phonological process is concerned.

Vowel substitution in terms of duration was also analysed in the light of Major's Ontogeny Model in order to see the impact of transfer and developmental processes. Vowels being length non-distinctive in Spanish, and L1 therefore not exerting any specific constraints on length, one would expect to find little difficulty here for the Spanish learner. However, it turned out to be a problematic area for 63% of our informants. As in the case of vowel quality substitutions, far from seeing IL as a competition of interference and developmental processes, no trace of the latter was found. English long vowels were in all cases systematically replaced by those Spanish monophthongs whose values were considered more closely related to the target language forms.

Under consonant insertion we argue that the function of consonant epenthesis, when occurring across word boundaries, is not to make unsyllabifiable sequences syllabifiable but to avoid a syllabification that, although faithful to the universal canonical syllable, would contravene a powerful Spanish phonotactic rule whereby single consonants between vowels syllabify with the following vowel. Medially and finally in a word, consonant epenthesis was restricted to /r/ despite the fact that RP is not a rhotic accent. Apparently L1 syllable structure coupled with spelling influence seem to counteract the universal tendency to form open syllables.

Consonant substitution was the most powerful process shaping the IL phonology of our informants for all of them made errors of this type. From such errors we discover the reluctance of Spanish speakers to eliminate unfamiliar single codas and produce a canonical CV pattern. Instead they all resorted to consonant substitution replacing the unknown sound with a familiar one. Consonant substitution also has a bearing on Major's hypothesis in that it can be used to see wether the sounds involved are the result of transfer or of a developmental nature. Not a single case was found that could not be explained by resorting to the learners' L1. Consonant substitution affected basically English voiced plosives and nasals. The former underwent fricativization whenever they occurred between vowels. This 'everybody effect' was most powerful when flanked by vowels and it was at his highest with /d/. Nasals were also susceptible to substitutions, /m/ being replaced by /n/, /n/ by [ŋ] and vice versa depending on the specific environment. It is important to note those substitution processes —and the same goes for consonant assimilation— did not reflect anything but L1 transfer. As to Major's hypothesis that transfer errors will decrease while developmental increase and then finally decrease nothing of this was found in the IL of our informants. Admittedly, frozen IL does not reflect the final stage of mastery in language acquisition, but some kind of developmental errors should be evident at any IL non-initial stage. Substitutions are, moreover, a good case to test Eckman's MDH. If less marked elements are supposedly acquired before more marked ones, one would expect to find voiced plosives rather than the corresponding voiced fricatives in the learners' output since the former are less marked than the latter. True, the presence of voiced fricatives (more marked) implies the presence of voiced plosives (less marked) and both are present in Spanish, but the hypothesis ignores the role of environment which constrains the presence of the less marked element in Spanish and, as a result of transfer, in English. Neither does this behaviour adhere to Eckman's Structural Conformity Hypothesis which predicts that less marked elements (voiced plosives in our case) are easier to acquire than more marked ones (voiced fricatives). Fricativization stubbornly remains as a prominent feature of our learners despite the presence of voiced plosives in their L1.

We approached voicing/devoicing in the light of Eckman's typological markedness that predicts an increasing difficulty in the mastery of voice contrasts from word initial to word final position. While our data only capture word final voice problems encountered by the Spanish learners, it is not clear that the difficulties are greater here than in any other position of the word. Evidence from Spanish child language does not seem to support directionality as claimed by Eckman, nor does our experience reveal that learners are better off acquiring word initial than word final voice contrasts. Be this as it may, the resulting errors were all L1-dependent where, unlike English, no voice contrasts occur.

Eckman's markedness hypothesis was also applied to the final process, cluster simplification, in order to see to what extent cluster reduction followed a predictable pattern. It was found that Eckman's prediction is fulfilled in encounters of stop+ fricative +stop, the cluster being reduced to the less marked string of stop + fricative and ultimately to a fricative. But this is not the case with clusters where the first element is a liquid + /s/ *(flowers)* or /r/ +/k,t/ *(work)* which were never simplified to an L1 pattern by none of our informants. Spelling pronunciation has no doubt a lot to do with this, and also some insights may be gained from Optimality Theory as it is briefly discussed.

In summary, unlike much research which considers that adult learners of a foreign language do not always produce foreign sounds which have a clear counterpart in their native language, the results presented here show that, as far as adult Spanish speakers are concerned, it is not clear that processes represent universal constraints unequivocally. Rather it appears that L1 exerts an overriding role in the acquisition of the phonology of English as a foreign language as reflected in the majority of the processes under analysis.

NOTES:

1. It is amazing how a fundamental term like 'interlanguage', has very often been approached as if it was an 'état de langue' despite its essentially evolving nature (Tench, 1996: 245). The idea is much better captured by labels such as Nemser's 'approximative systems' (1971), Corder's 'idiosyncratic dialects' (1967) or Ch. Adjemian's 'Interlanguage Systems' (1976).

2. Tarone (1980) shows evidence of native language influence as the prevailing shaping force, but with certain patterns that may reflect a universal preference for the open syllable.

3. These are not the only sources of error. Besides transfer and universal constraints, errors can be attributed to spelling pronunciation (Altenberg and Vago, 1987), overgeneralization of a TL rule (Selinker, 1972; Beebe, 1980), hesitation phenomena, etc.

4. Major acknowledges that the distinction is not a clear-cut one. See Beebe's discussion (1984, cited by Major (1987b) and Major himself (1987a).

5. According to Altenberg and Vago (1987: 159) "the MDH is not able to predict difficulties in those areas where a subordinate markedness relationship cannot be established between the NL and the TL".

6. The philosophical debate over language universals has a long history. Trubetzkoy's typology of vowel systems, Jakobson's universal hierarchy of structural laws or Greenberg's implicational universals for glotalized consonants are well-known examples of phonological universals (Macken & Ferguson, 1981).

7. These models have been considered 'descriptively and theoretically incomplete' (James, 1994: 190) on the grounds that Process models take phonological representation for granted. And structure models take learning processes lightly. In fact, he says, types of process and types of structure determine learning, but separately.

8. As Gass pointed out (1984: 129), "Language universals serve as an overall guiding principle in second language acquisition, interacting with the native language and the target language systems, at times resulting in violations of a proposed universal, at times being consistent with a given universal".

9. Stampe assumes, according to Major (1987), that the child's mental representation of his/her L1 is much the same as the adult native speaker (cf Waterson, 1971, for a different view), therefore any failure to hit the target is due to the production mechanism. On the contrary, failure in the adult FL learner may be due to both perception and production. Interference seems more likely when there are slight phonetic differences between L1 and FL whereas gross differences are more easily perceived. In a FL context perception seems to go ahead of production and conditions to a large extent success in the target language.

10. Broselaw (1994) considers that the transfer of mother tongue patterns is a valid method for error prediction in the learner's syllable structure. In a later paper (1997) she states that "the inability to predict the occurrence and nature of many errors may well stem from inadequacies in our understanding of native speaker's competence rather than from the failure of the CAH itself'. It is likely, she goes on, that a more sophisticated linguistic theory may in fact allow us to predict many of the systematic phonological errors made by the speakers of a second language".

11. Cases of syllable suppression in L1 acquisition are very common.. See Hernández Pina's Appendix in her *Teorías psico-sociolingüísticas y su aplicación al español como lengua materna* (1984) for a list of examples.

12. Hernández Pina (1984) gives some examples of both reduplication and consonant harmony found in her child's speech: [ka kaka] meaning both *la caja* (the box) and the rocking horse (*la jaca*). [satáta] (Fuensanta, his mother's name), [papápa] *las papas* (the food), [pa'βaβa] *paraguas* (umbrella), etc.

13. See note 8.

14. Fossilization, considered inevitable by most people following Scovel (1969) has received different interpretations (see Tarone (1980) for a summary). It has been interpreted in physiological terms either as the result of cerebral lateralization of cortical functions (Lenneberg, 1967) or simply due to habit formation or muscle atrophy (Tarone, 1980) after practising a given set of patterns for years. A psychological explanation was favoured by Krashen (1977), who envisaged the end of the 'critical period' as the beginning of "learning" an FL and the end of phonological permeability. Psychological inability due to habit formation (Tarone, 1978) could also play a part in adult phonological fossilisation: perception and production would be so influenced by L1 that they would never be free again to capture other phonological input correctly. Although general, this view has been questioned among others by Neufeld (1980) who mainteins that 'native-like proficiency at all linguistic levels is attainable by adults' provided we expose them to the appropriate learning situation.

15. Language specific hierarchies and hierarchies of phonological difficulties are by now means new. Already in 1950 Hans Wolf (1950) discussed a range of difficulties encountered by Puerto Ricans learners of English as an FL. Weinreich, U. (1953) established a four grade scale which Lado (1957) took over. The most explicit of all was Stockwell and Bowen (1965) who devised a six-point scale of degrees of phonological difficulties English speakers might have in learning Spanish. This was soon followed by Prator's universal phono-structural hierarchy (1967) and

by Brière's hierarchy (1968). They aimed at ranking the difficulties of a foreign of second language from a deductive, aprioristic standpoint. It was this equation of difficulty prediction, not always fulfilled, what lead researchers to favour a much more attenuated version of CA. In terms of phonological hierarchies this meant a change from a predictive to a much more interpretive view of reality as reflected, for instance, in Hammerly's Hierarchy of Difficulty (1982). More recently, there have been proposals from a universal standpoint such as Broselows' sonority hierarchy (1987) or Ekman's universal hierarchy (1987) among others.

16. See Young-Scholten (1994: 195) for a summary of different proposals ranging from the unavailability to UG to different degrees of availability through the learner's L1.

17. In *Teorías psico-sociolingüísticas y su aplicación a la adquisición del español como lengua materna* (Siglo XXI, 1984) where she carried out a longitudinal study on the acquisition of Spanish by Rafael from cero to three years, she reports (p.173) that although the informant was able to say *papá* (daddy) and *caja* (box), he was unable to say *paja* (straw).

18. We are aware that criteria differ in this respect and that phonetic inaccuracy is interpreted by the native speaker as a phonemic distortion and therefor e as a source of accent.

19. Considering the specific character of pronunciation and its social dimensions, one should be more rigurous when talking about the phonological behaviour of L1 speakers. Although it is true that they share certain fundamental phonetic and phonological features, it is not less obvious that there is not a single, homogeneous inventory valid for all the speakers of a language. This is, I think, a very important methodological point which has not been fully considered when making statements about the specific phonological behaviour of our informants. Thus, a comparison of British and American varieties of English will yield systemic as well as non-systemic differences (O'Connor, 1973: 180) which are evident even within a given accent. RP, for instance (the target variety that we shall use), is systemically different from Northern accents. And the same applies to Spanish, where besides a broad categorization between European and non-European varieties —with various subdivisions— we can consider two main accentual varieties within Spain (Menéndez Pidal, 1942: 69 passim): a Castilian proper, spoken in Old Castile and the Court, and a Southern variety fragmented into several accents, Murciano (the one used by our informants) being among them. This distinction is very important since it crucially affects, among other things, the syllabic structure of both varieties.

20. Information taken from *English Phonetics and Phonology. A Practical Course* (2nd edition) by P. Roach (C.U.P.) pp. 768-74.

21. There are a number of authors (e.g. Carlisle, this volume) who consider vowel insertion initially in a word as epenthesis. As this behaviour differs markedly from vowel insertion in medial position, we prefer to tell both types of insertion apart by calling them differently.

22. Other languages like Hausa, Hindi or even Pidgin English favour this process but the resulting syllable accommodates to UCSS. Thus English *scholar* is rendered as /sùkó:là/ in Hausa, and *stick* is pronounced /sitik/ in Pidgin English (Hyman, 1975: 196). The same was found for Iraqi (Broselow, 1983). But as Carlisle points out, Standard English syllabic structure violates the UCSS (Carlisle, 1997: 67).

23. Phonologically, they are not identical, but due to regressive assimilation they can "assimilate to the place of the following word-initial consonant" (Gimson, 1994: 259).

24. When we affirm that open syllables are less marked than closed ones we are not comparing various possibilities within the two categories. Open syllables refer to one type of syllables, whereas closed syllables can be of different types depending on the phonemic load of their codas. In Spanish at least, there is a big difference between a one-member closed syllable an one with two members. Positionally, there is also a difference between one-member coda structures. A closed syllable followed by a C (e.g. *talco* (talc)) presents more difficulties to the Spanish native speaker than the same coda finally in a word followed by a vowel (e.g.*peral* (pear tree). Pluralization requires an ealy mastery of those ambisyllabic consonants. As early as 24 months Hernández-Pina (1984: 237) reports the acquisition of consonant pluralization (*ratones* -mice) by her informant.

25. Elision takes different names depending on the part of the word affected. The rhetorical names are 'aphesis' when elision takes place in word initial position, 'syncope' which refers to word medial elision, and 'apocope' or word final vowel suppression (Crystal, 1980: 129). Here we use 'synaeresis' to refer to medial elision of vowels, unlike syncope which may refer to consonants as well.

26. When elision takes place across word boundaries it is called synaloepha. Spanish abounds in examples of this sort. Thus the utterance *Iba a Alicante* (I was going to Alicante) can be optionally reduced to the value of a single vowel: /ˈibalikante/ in colloquial, allegro speech. In the IL samples or our participants occasional instances of synaloepha were found. Thus /ðɪ ˈʌðə/ or /rɪˈæləti/ were pronounced /ˈðja.ðə/ and /ˈrja.liti/ respectively.

27. The phonetic facts are far more complex than this sketchy information may lead to think of. See Monroy (1980: Ch. 4).

28. The author has recently suffered the inconvenience of syllable merging. I phone my doctor for an appointment. The assistant told me to come a las 'doce y media' (12.30) —[ˈdo.θ.i.me.ðja]. When I turned up a las 'dos y media' (2.30) which is what I understood, I was told that I was obviously very late.

29. Although Major's Similarity Differential Rate Hypothesis (SDRH), which predicts that dissimilar phenomena between L1 and target language are acquired faster than similar ones, has been supported by Major himself in his longitudinal study of four American English (1986), is not clear whether Major and Kim's (1999) is based on a longitudinal study despite rate of acquisition being pivotal to the hypothesis.

30. Being /w/ a labio-velar sound, it can also undergo consonantal epenthesis (e.g. [la.ɣwer.ta]) if the speaker stresses the velar component, a feature typical of casual speech.

31. A clear instance of /wi/ with a glottal reinforcement is the English loan word *sandwich,* pronounced in Spanish [ˈsaŋgwitʃ], never *[ˈsaŋwitʃ]. Epenthetic /g/ is not inserted, however, when word initial /wi/ is affected by hiatus. When this happens, the diphthong splits into two separate syllables. Thus, *han huido* (they have run away) is resyllabified as [a.nuˈ.do], never *[a.ŋwi.do]. /we/ and /wi/ are the only dipththongs starting with /w/ that can occur initially in a word in Spanish. /wa/ cannot stand on its own and must be preceded by /g/ (e.g. *guapa*), and /wo/ occurs across words (*uno u otro*) or word-medially (e.g. *linguo-dental*), but never word initially.

32. This process is not exactly matched in L1 acquisition pace Major who suggests that "there is no fundamental difference in the mechanism of substitutions in children acquiring L1 and adults acquiring L2" (1987b: 105). According to Hernández Pina (1984) the syllabic structure CCV with liquids as a second element (e.g. *grande, tren)* was realised in the emerging language of her Spanish informant either with omission or reduplication of the consonants involved ([gát-te, ten]. Omission and reduplication were the only phonological processes found in CVC syllables checked by nasal, liquid or sibilant as in [sáta] *(salta*), [kát-ta] *(canta)*, [saté] (*sarten)*, [gút-ta] *gusta* (pp. 180-181). A process like reduplication was not found in the IL or our adult informants.

33. Occasionally, one finds statements (e.g. Quilis, *Curso de Fonética y Fonología Españolas* (1972: 97) in the sense that the Spanish linguo-alveolar fricative /s/ has a voiced allophone when this phoneme precedes a voiced consonant as in *mismo, desde*, etc. Although some voicing may take place, this is not by no means a systematic realisation (Quilis acknowledges that such realisation 'is not constant'). Spanish learners of English find little comfort in their L1 when confronted with a word like *Lisbon* as far as /s/ pronunciation is concerned. On the other hand, it is a well-known fact that the alleged voiced segment is pronounced as a voiceless aspirated fricative in large areas of Spain and South America.

34. Except S+CC structures dealt with under Epenthesis.

35. Deletion of t/d is, according to Bayley (1996: 98) "one of the most extensively studied variable phenomena in English". He mentions several studies standing out Labov's description of t/d deletion by native speakers in some dialects of English.

REFERENCES

Abercrombie, D. (1963). *Problems and Principles in Language Study.* London: Longman.

Adjemian, K.C. (1976). On the nature of interlanguage systems. *Language Learning, 26*, 297-320.

Altenberg, E.P. & Vago, R.M. (1987). Theoretical Implications of an Error Analysis of Second Language Phonology Production. In G. Ioup & S.H. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system*, pp.148-164. Cambridge, MA: Newbury House.

Anderson, J. (1987). The Markedness Differential Hypothesis and syllable structure differences. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology* (pp. 279-291). Rowley, MA: Newbury House.

Archibald, J. (1994). A formal model oflearning L2 prosodic phonology. *Second Language Research, 10*, 215-240.

Archibald, J.. (1998). Second language phonology, phonetics, and typology: *Studies in Second Language Acquisition, 20*, 189-211.

Bailey, N., Madden, C. & Krashen, S. (1974). Is there a 'natural sequence' in adult second language learning? *Language Learning*, 24, 235-244.

Barlow, J.A. & Gierut, J.A. (1999). Optimality Theory in Phonological Acquisition. *Journal of Speech and Hearing Disorders, 42*, 1482-1497.

Beebe, L. M. (1980). Sociolinguistic variation and style shifting in second language acquisition. In Ioup, G. & Weinberger, S. H. (Eds.) *Interlanguage Phonology* (pp. 378-389). Rowley, MA: Newbury House.

Benson, B. (1988). Universal preference for the open syllable as an independent process in interlanguage phonology. *Language Learning, 38*, 221-242.

Bohn, O.S. (1997). There's more to learning nonnative vowels than establishing gestural and acoustic targets. In J. Leather & A. James (Eds.), *New Sounds 97: Proceedings of the Third International Symposium on the Acquisition of Second-Language Speech* (pp. 38-46). Klagenfurt: University of Klagenfurt.

Brière, E. (1968). *A psycholinguistic study of phonological interference.* The Hague: Mouton.

Broselow, E. (1983). Non-obvious transfer: On predicting epenthesis errors. In Gass & Selinker (Eds.), *Language Transfer in Language Learning* (pp. 269-280). Rowley, MA: Newbury House.

Broselow, E. (1984). An investigation of transfer in second language phonology. *International Review of Applied Linguistics, 22*, 253-269.

Broselow, E. (1987). An investigation of transfer in second language phonology. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 261-278). Rowley, MA: Newbury House.

Broselow, E. & Finer, D. (1991). Parameter setting in second language phonology and syntax. *Second Language Research, 7*, 1, 35-59.

Broselow, E. & Park, H.B. (1995). Mora conservation in second language prosody. In J. Archibald (Ed.), *Phonological acquistion and phonological theory* (pp. 151-168). Hillsdale, NJ: Lawrence Erlbaum.

Broselow, E., Chen, S.I., & Wang, C. (1998). The emergence of the unmarked in second language phonology: *Studies in Second Language Acquisition, 20*, 261-280.

Browman, C. P. & Goldstein, L.M. (1986). Towards an articulatory phonology. *Phonology Yearbook, 3*, 219-252.

Browman, C. P., & Goldstein, L. M. (1992). Articulatory phonology: An Overview. *Phonetica, 49*, 155-180.

Carlisle, R. S. (1988). The effect of markedness on epenthesis in Spanish/English interlanguage phonology. *Issues and Developments in English and Applied Linguistics, 3*, 15-23.

Carlisle, R. (1991). The influence of syllable structure universals on the variability of interlanguage phonology. In A. D. Volpe (Ed.), *The Seventeenth LACUS Forum 1990* (pp. 135-145). Lake Bluff, IL: Linguistic Association of Canada and the United States.

Carlisle, R. S. (1994). Markedness and environment as internal constraints on the variability of interlanguage phonology. In M. Yavas (Ed.), *First and second language phonology* (pp. 223-249). San Diego, CA: Singular.

Carlisle, R.S. (1999). The Modification of Onsets in a Markedness Relationship: Testing the Interlanguage Structural Conformity Hypothesis. In Leather, J. (Ed.), *Phonological issues in language learning* (pp.59-93). Blackwell: Oxford.

Catford, J. C. (1987). Phonetics and the teaching of pronunciation: A systemic description of English phonology. In J. Morley (Ed.), *Current perspectives on pronunciation: Practices anchored in theory* (pp. 87-100). Washington, DC: TESOL.

Chomsky, N. (1981). Principles and Parameters in Syntactic Theory. In N. Hornstein & D. Lightfoot (Eds.), *Explanations in Linguistic Theory: The Logical Problem of Language Acquisition.* London: Longman.

Cichocki, W., House, A.B., Kinloch, A.M., & Lister, A.C. (1999). Cantonese Speakers and the Acquisition of French Consonants. In J. Leather (Ed.), *Phonological Issues in Language Learning* (pp. 95-121). Oxford: Blackwell.

Clahsen, H. (1988), Parameterised grammatical theory and language acquisition. In S.Flynn & W. O'Neil (Eds.), *Linguistic Theory in Second Language Acquisition.* Kluwer: Dordrecht.

Clements, G. N. (1985). On the geometry of phonological features. *Phonology Yearbook, 2*, 225-252.

Clements, G. N. (1990). The role of the sonority cycle in core syllabification. In J. Kingston & M. Beckman (Eds.), *Papers in laboratory phonology I* (pp. 283-333). Cambridge, UK: CUP.

Clements, G. N., & Hume, E. v. (1995). The internal organization of speech sounds. In J. Goldsmith (Ed.), *The handbook of phonological theory* (pp. 245-306). New York: Blackwell.

Comrie, B. (1990). Second language acquisition theory and language universals research. *Studies in Second Language Acquisition, 12*, 209-218.

Corder, S.P. (1967). The significance of learners' errors. *International Review of Applied Linguistics, V*, 161-170.

Cruttenden, A. (1986). *Intonation.* Cambridge, MA: Cambridge University Press.

Crystal, D. (1969). *Investigating English Style.* London: Longman.

Crystal, D. (1980). *A First Dictionary of Linguistics and Phonetics.* London: Andre Deutsch.

Delattre, P. & Olsen, C. (1969). Syllabic Features and Phonic Impression in English, German, French and Spanish. *Lingua*, XXII, 160-175.

Diller, K.C. (1978). *The Language Teaching Controversy.* Massachusetts: Newbury House.

Donegan, P. (1985). How learnable is phonology? In W. U. Dressler & L. Tonelli (Eds.), *Natural phonology from Eisenstadt* (pp. 19-31). Padova: CLESP.

Donegan, P., & Stampe, D. (1979). The study of Natural Phonology. In D. Dinnsen (Ed.), *Current approaches to phonological theory* (pp.126-173). Bloomington, IN: Indiana University Press.

Dressler, W. U. (1984). Explaining natural phonology: *Phonology Yearbook, 1*, 29-51.

Dressler, W. U. (1996). Principles of naturalness in phonology and across components. In B. Hurch & R. Rhodes (Eds.), *Natural Phonology: The state of the art* (pp. 41-51). Berlin: Mouton de Gruyter.

Dulay, H.C., & Burt, M.K. (1972). Goofing: an indicator of children's second language learning strategies. *Language Learning, 22*, 235-52.

Dziubalska-Kolaczyk, K. (1987). Phonological rule typology and second language cquisition. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 193-206). Dordrecht: Foris.

Eckman, F. R. (1977). Markedness and the contrastive analysis hypothesis. *Language Learning,* 27, 315-330. Also in G. Ioup & S. H. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 55-69). Cambridge, MA: Newbury House.

Eckman, F. R. (1981). On the naturalness of interlanguage phonological rules. *Language Learning, 31*, 195-216.

Eckman, F.R. (1985). Some theoretical and pedagogical implications of the markedness differential hypothesis. *Studies in Second Language Acquisition, 7*, 289-307.

Eckman, F. R. (1987). The Reduction of Word-final Consonant Clusters in Interlanguage. In A. R. James, & J.H. Leather (Eds.), *Sound Patterns in Second Language Acquisition* (pp. 143-162). Dordrecht: Foris Publications.

Eckman, F. R. (1991). The structural conformity hypothesis and the acquisition of consonant clusters in the interlanguage of ESL learners. *Studies in Second Language Acquisition, 13*, 23-41.

Eckman, F. R. (1996). A functional-typological approach to second language acquisition theory. In W. C. Ritchie & Tej K. Bhatia (Eds.), *Handbook of second language acquisition* (pp. 195-211). New York: Academic Press.

Eckman, F. R., & Iverson, G. K (1993). Sonority and markedness among onset clusters in the interlanguage of ESL learners. *Second Language Research, 9*, 234-252.

Eisenstein, M. (1986). Alternatives in Second Language Research: Three Articles on the State of the Art. *Tesol Quarterly*, vol. 20, 4, 683-687.

Eliasson, S. (1984). Toward a theory of contrastive phonology. In S. Eliasson (Ed.), *Theoretical issues in contrastive phonology* (pp. 7-26). Heidelberg: Groos.

Ellis, N. (1996). Sequencing in SLA: Phonological memory, chunking and points of order. *Studies in Second Language Acquisition,* 18, 91-126.

Ferguson, C. E. (1989). Language teaching and theories of language. In J. E. Alatis (Ed.), *Georgetown University Round Table on Language and Linguistics* 1989 (pp. 81-88). Washington, DC: Georgetown University.

Ferguson, C.A. & Debose, C.E. (1977). Simplified registers, broken language and pidginization. In A. Valdman (Ed.), *Pidgin and Creole Languages.* Bloomington: Indiana University Press.

Felix, S. (1980). Interference, interlanguage and related issues. In S. Felix (Ed.), *Second Language Development:* Tübingen: Gunther Narr.

Felix, S. (1985). More evidence on competing cognitive systems. *Second Language Research, 1,* 47-72.

Flege, J. E. (1981). The phonological basis of foreign accent: A hypothesis. *TESOL Quarterly, 15,* 443-455.

Flege, J.E. (1987a). Effects of equivalence classification on the production of foreign language speech sounds. In A. James & J. Leather (eds.), *Sound patterns in second language acquisition*, pp. 9-39. Dordrecht: Foris.

Flege, J.E. (1987b). The production of 'new' and 'similar' phones in a foreign language: evidence for the effect of equivalence classification. *Journal of Phonetics, 15,* 47-65.

Flege, J.E. (1995). Second-language speech learning: Theory, findings, and problems. In W. Strange (Ed.), *Speech perception and linguistic experience: Theoretical and methodological issues* (pp. 233-273). Timonium, MD: York Press.

Flege, J.E. & Davidian, R. (1984). Transfer and developmental processes in adult foreign language speech production. *Applied Psycholinguistics, 5,* 323-347.

Flege, J. E., Bohn, O.S., & Jang, S. (1997). The production and perception of English vowels by native speakers of German, Korean, Mandarin and Spanish. *Journal of Phonetics, 25,* 437-470.

Flege, J.E. & Hillenbrand. J. (1987). Differential use of closure voicing and release burst as cue to stop voicing by native speakers of French and English. *Journal of Phonetics, 15,* 203-208.

Flege, J.E., & Munro, M.J. (1994). The word unit in second language speech production and perception. *Studies in Second Language Acquisition, 16*, 381-411.

Flege, J.E., Munro, M. J. & MacKay, Ian. R. A. (1996). Factors Affecting the Production of Word-initial Consonants and a Second Language. In R. Bailey and D.R. Preston (Eds.), *Second Language Acquisition and Linguistic Variation* (pp.47-73). Amsterdam: John Benjamins.

Flick, W. (1979). A multiple component approach to research in second language acquisition. In R.W. Andersen, (Ed.), *New Dimensions in Second Language Acquisition Research* (pp.297-212). Rowley, Mass: Newbury House.

Gass, S. (1984). Development of speech perception and and speech production abilities in adult second language learners. *Applied Psycholinguistics, 5*, 1, 51-74.

Gatbonton, E. (1978). Patterned phonetic variability in second language speech: a gradual diffusion model. *Canadian Modern Language Review, 34*, 335-47.

Giannini, S. & Costamagna, L. (1997). Language learning strategies in interlanguage phonology of Italian as L2. A case history: The acquisition of consonant length. In J. Leather & A. James (Eds.), *New Sounds 97: Proceedings of the Third International Symposium on the Acquisition of Second-Language Speech* (pp. 103-108). Klagenfurl: University of Klagenfurl.

Gimson, A.C. (1994). *An Introduction to the Pronunciation of English.* Arnold: London.

Gimson's Pronunciation of English (revised by A. Cruttenden, 2001). Arnold: London.

Greenberg, C. (1983). Syllable structure in second language acquisition. *CUNY Forum* (City University of New York), 9, 47-64.

Grunwell, P. (1997). Natural phonology. In M. J. Ball & R.D. Kent (Eds.), *The new phonologies: Developments in clinical linguistics* (pp. 35-76). San Diego, CA: Singular.

Hammarberg, B. (1988). Acquisition of phonology. *Annual Review of Applied Linguistics, 9*, 23-41.

Hammerly, H. (1982) . Contrastive phonology and error analysis. *IRAL*, vol, XX/1, 17-30.

Hammerly, H. (1991). *Fluency and Accuracy.: Toward Balance in Language Teaching and Learning.* Clevedon: Multilingual Matters.

Hancin-Bhatt, B. (1994). Segment transfer: A consequence of a dynamic system. *Second Language Research, 10*, 241-269.

Hancin-Bhatt, B., & Bhatt, R. (1997). Optimal L2 syllables. Interactions of transfer and developmental factors. *Studies in Second Language Acquisition, 19*, 331-378.

Hardison, D.M. (1999). Bimodal Speech Perception by Native and Nonnative Speakers of English: Factors Influencing the McGurk Effect. In Leather, J. (Ed.) *Phonological issues in language learning* (pp.213-284). Blackwell: Oxford

Heilenman, L.K. & McDonald, J.L. (1993). Processing Strategies in L2 Learners of French: The Role of Transfer. *Language Learning, 43*, 4, 507-557.

Hernández Pina, F. (1984). *Teorías psico-sociolingüísticas y su aplicación a la acquisición del español como lengua materna.* Madrid: Siglo XXI.

Hecht, B. & Mulford, R. (1987). The acquisition of a second language phonology: interaction of transfer and developmental factors. In G. Ioup & S.H. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp.213-228). Cambridge, MA: Newbury House.

Hieke, A. E. (1987). Absorption and fluency in native and non-native casual English speech. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 41-58). Dordrecht: Foris.

Hodne, B. (1985). Yet another look at interlanguage phonology: The modification of English syllable structure by native speakers of Polish. *Language Learning, 35*, 405-422.

Hooper, J. (1976). *Introduction to Natural Generative Phonology.* New York: Academic Press.

Hyman, L. (1975). *Phonology:theory and analysis.* New York: Holt, Rinehart and Winston.

Ioup G., Boustagui, E., El Tigi, E., & Moselle, M. (1994). A case of successful adult second language acquisition in a naturalistic environment. *Studies in Second Language Acquisition, 16*, 73-98.

Ioup, G & Weinberger, S. H. (Eds.)(1987). *Interlanguage phonology: The acquisition of a second language sound system.* Cambridge, MA: Newbury House.

Jakobson, R. (1949). On the identification of phonemic entities. *Travaux du Cercle Linguistique de Copenghague, 5*, 205-213.

James A. R. (1987). The acquisition of phonological representation: A modular approach. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 225-249). Dordrecht: Foris.

James, A. R. (1988). *The acquisition of a second language phonology.* Tubingen: Gunter Narr.

James, A. R., & Leather, J. H. (Eds.). (1987). *Sound Patterns in Second Language Acquisition.* Dordrecht: Foris Publications.

James, A. R., & Leather, J. H. (Eds.). (1997). *Second language speech: Structure and process.* Berlin: Mouton de Gruyter.

Jordens, P. & Lallemann J. (Eds.)(1996). *Investigating Second Language Acquisition.* Berlin: Mouton.

Kager, R. (1999). *Optimality Theory.*Cambridge: CUP.

Keating, P. (1989). The phonetics-phonology interface. In F. Newmeyer (Ed.), *Linguistics: The Cambridge Survey* (Vol. 1, pp. 281-302). Cambridge, MA: Cambridge University Press.

Kellerman, E. (1983). Now you see it, now you don't. In Gass, S. & Selinker, L. (Eds.). *Language Transfer in Language Learning* (pp. 15-34). Rowley, MA: Newbury House.

Kenstowicz, M. (1994). *Phonology in generative grammar.* Cambridge, MA: Blackwell.

Klein, W. (1990). A theory of language acquisition is not so easy. *Studies in Second Language Acquisition, 12*, 219-231.

Koda, K. (1998). The role of phonemic awareness in second language reading. *Second Language Research, 14*, 2, 194-215.

Kohler, K. (1981). Contrastive phonology and the acquisition of phonetic skills. *Phonetica, 38*, 213-226.

Koster, C. J., & Koet, T. (1993). The evaluation of accent in the English of Dutchmen. *Language Learning, 43*, 69-92.

Krashen, S. (1977). The monitor model of adult second language performance. In M. Burt, H. Dulay, & M. Finocchiaro (Eds.), *Viewpoints on English as a Second Language* (pp. 152-161). New York: Regents.

Kuhl, P. K. (1993). An examination of the 'perceptual magnet' effect. *Journal of the Acoustical Society of America, 93*, 2423-2436.

Ladefoged, P. (1975). *A course in phonetics.* New York: Harcourt.

Lado, R. (1957). *Linguistics across cultures.* Ann Arbor, MI: University of Michigan Press.

Laeufer, C. (1997). Towards a typology of bilingual phonological systems. In A. James & J. Leather (Eds.), *Second-language speech: Structure and process* (pp. 325-342). Berlin: Mouton de Gruyter.

Lalleman, J. (1996). The state of the art in second language acquisition research. In P. Jordens and J. Lalleman (Eds.) *Investigating Second Language Acquisition* (pp. 3-69). Berlin: Mouton de Gruyter.

Laver, J. (1994) *Principles of Phonetics.* Cambridge: CUP.

Leather, J.H. (1983). Second language pronunciation learning and teaching. *Language Teaching, 16*, 198-219.

Leather, J.H. (1997). Interrelation of perceptual and productive learning in the initial acquisition of second-language tone. In A. James & J. Leather, (Eds.), *Second-language speech: Structure and process* (pp. 75-101). Berlin: Mouton de Gruyter.

Leather, J.H. (1999). Second-language Speech Research: An Introduction. In J. Leather (Ed.), *Phonological Issues in Language Learning* (pp. 1-56). Oxford: Blackwell.

Leather, J.H., & James, A.R. (1987). Sound patterns in second language acquisition. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 1-6). Dordrecht: Foris.

Leather, J. H., & James, A. R. (1991). The acquisition of second language speech. *Studies in Second Language Acquisition 13*, 305-341.

Lenneberg, E. (1967). *Biological Foundations of Language.* New York: Wiley.

Long, M. H. (1990). Maturational constraints on language development. *Studies in Second Language Acquisition, 12*, 251-285.

Macken, M.A. & Ferguson, Ch.A. (1981). Phonological Universals in Language Acquisition. In H. Winitz (Ed.), *Native Language and Foreign Language Acquisition* (pp.110-129). New York: N.Y. Academy of Sciences.

Mairs, J. L. (1989). Stress assignment in interlanguage phonology: An analysis of the stress system of Spanish speakers learning English. In S. M. Gass & J. Schachter (Eds.), *Linguistic perspectives on second language acquisition* (pp. 260-283). Cambridge, MA: Cambridge University Press.

Major, R. (1987a). The natural phonology of second language acquisition. In A. James & J. Leather (Ed.), *Sound patterns in second language acquisition* (pp. 207-224). Dordrecht: Foris.

Major, R. (1987b). A model for interlanguage phonology. In Ioup, G & Weinberger, S. H. (Eds.). (1987). *Interlanguage phonology: The acquisition of a second language sound system* (pp.101-124). Cambridge, MA: Newbury House.

Major, R. (1994). Chronological and stylistic aspects of second language acquisition of consonant clusters. *Language Learning, 44*, 655-80.

Major, R. (1996a). Markedness and second language acquisition of consonant clusters. In R. Bayley & R. Preston (Eds.), *Variation linguistics and second language acquisition* (pp. 75-96). Amsterdam: John Benjamins.

Major, R. (1996b). Markedness universals. *Studies in Second Language Acquisition,* 18, 69-90.

Major, R. (1998a). Interlanguage phonetics and phonology: An introduction. *Studies in Second Language Acquisition, 20,* 131-137.

Major, R. (Ed.). (1998b). *Studies in Second Language Acquisition* 20: *Special issue on interlanguage phonetics and phonology.*

Major, R.C.(1999). Chronological and Stylistics Aspects of Second Language Acquisition of Consonant Clusters. In Leather, J. (Ed.) *Phonological issues in language learning* (pp.123-150). Blackwell: Oxford.

Major, R.C. & Kim, E. (1999). The Similarity Differential Rate Hypothesis. In Leather, J. (Ed.). *Phonological issues in language learning* (pp.151-184). Blackwell: Oxford.

Malmberg, B. (1965). *Estudios de Fonética Hispánica.* Collectanea Phonetica. Madrid: CSIC.

McAllister, R. (1997). Perceptual foreign accent: L2 users' comprehension ability. In A. James & J. Leather (Eds.), *Second-language speech: Structure and process* (pp. 119-132). Berlin: Mouton de Gruyter.

Menéndez Pidal, R. (1942) . *La lengua de Cristóbal Colón.* Madrid: Espasa Calpe.

Michaels, D. (1974). Sound replacements and phonological systems. *Linguistics, 176*, 69-81.

Mohanan, K. (1993). Fields of attraction in phonology. In J. Goldsmith (Ed.), *The last phonological rule* (pp. 61-116). Chicago: University of Chicago Press.

Monroy, R. (1980). *Aspectos fonéticos de las vocales españolas.* Madrid: SGEL.

Monroy, R. & Hernández Pina, F. (1983). Un interrogante al esquema universalista de Jakobson sobre la adquisición fonémica infantil. *Actas del I Congreso Nacional de Lingüística Aplicada* (145-154). Universidad de Murcia.

Monroy, R. (1992). Procesos universales y marcos contextuales en el dominio de una lengua extranjera por adultos. *Actas del VII Congreso Nacional de Lingüística Aplicada*. Universidad del País Vasco. San Sebastián.

Monroy, R. (2000). Paradigmas de investigación y su incidencia en la enseñanza de lenguas extranjeras. In J.M. Ruiz, P.H. Sheering & C. Estébanez (Eds.), *Estudios de Metodología de la Lengua Inglesa* (pp. 41-62). Universidad de Valladolid.

Moravcsik, E. A., & Wirth, J. A. (1985). Markedness: An overview. In F. R. Ekman, E. A. Moravcsik, & J. A. Wirth (Eds.), *Markedness* (pp. 1-11). New York: Plenum Press.

Morley, J. (1996). Second language speech/pronunciation: Acquisition, instruction, standards, variation and accent. *Georgetown Univ. Round Table on Languages and Linguistics,*, 140-160.

Munro, M. J. & Derwing, T.M. (1999). Foreign Accent, Comprehensibility, and Intelligibility in the Speech of the Second Language Learners. In Leather, J. (Ed.) *Phonological issues in language learning* (pp.285-310). Blackwell: Oxford

Neufeld, G.G. (1980). On the adult's ability to acquire phonology. *TESOL Quarterly, 14*, 285-298.

O'Connor, J.D. (1973). *Phonetics*. Penguin Books.

Odlin, T. (1989). *Language Transfer: Cross-Linguistic Influence in Language Learning*. Cambridge: Cambridge University Press.

Ohala, J.J. & Kawaki-Fukumori, H. (1997). Alternatives to the sonority hierarchy for explaining segmental sequential constraints. In S. Eliasson & E.H. Jahr (Eds.), *Studies for Einar Haugen* (pp. 343-365).

Oller, J. & Ziahosseiny, S. (1970), 'The contrastive analysis hypothesis and spelling errors', *Language Learning, 20*, 183-89.

Pennington, M., & Richards, J.C. (1986). Pronunciation revisited. *TESOL Quarterly, 20*, 206-226.

Pienemann, M.& Johnston, M. (1996). A brief history of processing approaches to SLA: reply to Mellow. *Second Language Research, 12*, 3, 319-334.

Pisoni, D. B. (1992). Talker normalization in speech perception. In Y. Tohkura, E. Vatikiotis-Bateson, & Y. Sagisaka (Eds.), *Speech perception, production and linguistic structure* (pp. 143-151). Tokyo: Ohm sa.

Pisoni, D., & Lively, S. (1995). Variability and invariance in speech perception. In W. Strange (Ed.), *Speech perception and linguistic experience* (pp. 433-462). Timonium, MD: York Press.

Prince, A. S., & Smolensky; P. (1993). *Optimality theory: Constraint interaction in generative grammar* (Tech. Rep. No.2). Piscataway; NJ: Rutgers University; Cognitive Sciences Center.

Prince, A. & Tesar, B. (1999). Learning phonotactic distributions. ROA-353, downloadable from the Rutgers Optimality Archive: http://roa.rutgeers.edu.

Riney, T. (1990). Age and open syllable preference in interlanguage phonology. In H. Burmeister & P. Rounds (Eds.), *Variability in Second Language Acquisition: Proceedings of the Tenth Meeting of the Second Language Research Forum*, Volume II (pp. 667-684). Eugene, OR: University of Oregon Linguistics Department.

Riney, T. J., & Flege, J. E. (1998). Changes over time in global foreign accent and liquid identifiability and accuracy. *Studies in Second Language Acquisition, 20*, 213-243.

Ringbom, H. (1987). *The Role of the First Language in Foreign Language Learning.* Clevedon: Multilingual Matters.

Ritchie, W. (1968). On the explanation of phonic interference. *Language Learning, 18*, 183-197.

Ritchie, W.C. and Bhatia Tej K. (Eds.)(1996). *Handbook of second language acquisition.* New York: Academic Press.

Rochet, B. (1995). Perception and production ofL2 speech sounds by adults. In W. Strange (Ed.), *Speech perception and linguistic experience: Theoretical and methodological issues* (pp. 379-410). Timonium, MD: York Press.

Ross, S. (1994) . The ins and outs or paragoge and apocope in Japanese-English interphonology. *Second Language Research, 10*, 1, 1-24.

Rubach, J. (1984). Rule typology and phonological interference. In S. Eliasson (Ed.), *Theoretical issues in contrastive phonology* (pp. 37-50). Heidelberg: Groos.

Sato, C. (1984). Phonological processes in second language acquisition: Another look at interlanguage syllable structure. *Language Learning, 34*, 43-57.

Schachter, J. (1989). A new look at an old classic. *Second Language Research, 5*, 30-42.

Scovel, T. (1969). Foreign accents, language acquisition and cerebral dominance. *Language Learning, 19*, 245-253.

Scovel, T. (2000). A critical review of the critical period research. *Annual Review of Applied Linguistics, 20*, 213-223.

Selinker, L. (1972). Interlanguage. *International Review of Applied Linguistics, X*, 209-230.

Selkirk, E. (1984). On the major class features and syllable theory. In M. Aronoff & R. Oehrle (Eds.), *Language sound structure* (pp. 107-136). Cambridge, MA: MIT Press.

Sharwood-Smith, M., & Kellerman, E. (1986). Crosslinguistic influence in second language acquisition: An introduction. In E. Kellerman & M. Sharwood-Smith (Eds.), *Crosslinguistic influence and second language acquisition* (pp.1-9). Oxford: Pergamon Press.

Singh, R., & Ford, A. (1987). Interphonology and phonological theory. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp. 163-172). Dordrecht: Foris.

Skehan, P. (1989). *Individual differences in second-language learning.* London: Edward Arnold.

Stampe, D. (1969). The acquisition of phonetic representations. *Papers from the Fifth Regional Meeting. Chicago Linguistics Society*, 5, 443-454.

Stockwell, R. & Bowen, J.D. (1965). *The Sounds of English and Spanish.* Chicago: The University of Chicago Press.

Stockman, I.J. & Pluut, E. (1999). Segment Composition as a Factor in the Syllabification Errors of Second-Language Speakers. In Leather, J. (Ed.), *Phonological issues in language learning* (pp.185-212). Blackwell: Oxford.

Tarone, E. (1972). A suggested unit for interlingual identification in pronunciation. *TESOL Quarterly, 6*, 325-331.

Tarone, E. (1987). The phonology of interlanguage. In In G. loup & S. Weinberger (Eds.), *Interlanguage phonology* (pp. 70-85). Rowley, MA: Newbury House.

Tarone, E. (1980). Some influences on the syllable structure of interlanguage phonology. *International Review of Applied Linguistics, 16*, 143-163.

Tench, P. (1996). Methodology in phonological interlanguage. *IRAL, XXXIV/3*, 241-260.

Trammell, R.L. (1999). English Ambisyllabic Consonants and Half-Closed Syllables in Language Teaching. In Leather, J. (Ed.), *Phonological issues in language learning* (pp. 311-356). Blackwell: Oxford.

Tropf, H. (1987). Sonority as a variability factor in second language phonology. In A. James & J. Leather (Eds.), *Sound patterns in second language acquisition* (pp.173-191). Dordrecht: Foris.

Trubetzkoy, N. (1958). *Grundzuge der Phonologie* (Travaux du Cercle Linguistique de Prague 7). Gottingen: Vandenhoek & Ruprecht. (Original work published 1939).

Valdman, A. (1976). *Introduction to French Phonology and Morphology.* Newbury House.

Varonis, E. M., & Gass, S. (1982). The comprehensibility of nonnative speech. *Studies in Second Language Acquisition, 4*, 114-136.

Vennemann, T. (1988). *Preference laws for syllable structure and the explanation of sound change.* New York: Mouton de Gruyter.

Wales, K. (1991). *A Dictionary of Stylistics.* Longman: London.

Weinberger, S. (1987). The influence of linguistic context on syllable simplification. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 401-417). Rowley, MA: Newbury House.

Weinberger, S. (1997). Minimal segments in second language phonology: In A. James & J. Leather (Eds.), *Second-language speech: Structure and process* (pp. 263-311). Berlin: Mouton de Gruyter.

Weinreich, U. (1953). *Languages in contact.* The Hague: Mouton.

Weinreich, U. (1957). On the description of phonic interference. *Word, 13*, 1-11.

Wheeler, D. W., & Touretzky, D. S. (1993). A connectionist implementation of cognitive phonology. In J. Goldsmith (Ed.), *The last phonological rule* (pp. 146-172). Chicago: University of Chicago Press.

Wode, H. (1976). Developmental sequences in naturalistic L2 acquisition. *Working Papers on Bilingualism, 11*, 1-13.

Wode, H. (1983). Phonology in L2 acquisition. In H. Wode (Ed.), *Papers on language acquisition, language learning and language teaching* (pp. 175-187). Heidelberg: Groos.

Wode, H. (1984). Some theoretical implications of L2 acquisition research and the grammar of interlanguage. In A. Davies, C. Criper & A.P.R. Howatt, (Eds.), *Interlanguage*. Edinburgh University Press.

Wode, H. (1996). Speech perception and L2 phonological acquisition. In P. Jordens & J. Lallemann (Eds.), *Investigating Second Language Acquisition.* Berlin: Mouton.

Yavas, M. (1994). Final stop devoicing in interlanguage. In M. Yavas (Ed.), *First and second language phonology* (pp. 251-265). San Diego, CA: Singular.

Young-Scholten, M. (1997). Interlanguage and postlexical transfer. In A. James & J. Leather (Eds.), *Second-language speech: Structure and process* (pp. 187-210). Berlin: Mouton de Gruyter.

Young-Scholten, M. (1999). A new research programme for the L2 acquisition of phonology. Klagenfurt: University of Klagenfurt.

Wells, J. (1990). *Longman Pronunciation Dictionary.* London: Longman.

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L2 Evidence for the Structure of the L1 Lexicon

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ABSTRACT

In this paper I suggest that L2 research could provide answers to questions concerning the structure of L1 grammars that cannot, as a matter of logic, be answered by only examining L1 data and intuitions. In other words, L2 data from an individual P can provide 'external' evidence bearing on the structure of P's L1 grammar, $L1_p$. This type of evidence will be particularly welcome where competing theories of $L1_p$ are extensionally equivalent where they generate the same output representations. I am proposing, therefore, that L2 research need not restrict itself to maintaining consistency with work in theoretical linguistic modeling. Instead L2 research can itself make unique contributions to the general theory of grammar.

In addition to potentially leading to fruitful results, the issues that provide the background to the discussion warrant examination on other grounds, since they help clarify the goals of linguistic research and the compatibility of various frameworks of linguistic theory with their own stated goals.

KEYWORDS: homophony, ambiguity, underspecification, external evidence, Richness of the Base.

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I. THREE PROBLEMS

From the linguistic viewpoint the problem facing a child is to acquire the grammar determined by the innately given language faculty[1] (Universal Grammar) in conjunction with the input provided by the environment, also referred to as 'experience'. It is perhaps misleading to call this a 'problem' since all evidence indicates that the child learns language as effortlessly as it grows hair and gets taller (as pointed out over the years by Chomsky). However, I will refer to the acquisition of a grammar as the HUMAN'S PROBLEM as a rhetorical convenience to compare it with two other processes.

These two other processes correspond to two distinct research programs carried out by professional linguists. However, we shall see that linguists, themselves, are not always clear about which of these tasks they are engaged in. One topic of research can be called the ARTIFICIAL INTELLIGENCE PROBLEM, and it belongs to sub-branches of linguistics like Natural Language Processing and Speech Recognition. Such work attempts the simulation of human intelligence in recognizing and processing linguistic data without regard to whether or not, the model matches the computational methods used by humans. A model that perfectly matched the input-output mappings of a human in some domain of linguistic behavior would be called 'weakly equivalent' to the system actually used by the human. Such a model will generate the same utterances as the human, say, but may do so using completely different algorithms. In such a case we can also say that the human's grammar and the simulation grammar are EXTENSIONALLY equivalent in that; they generate the same surface patterns. They are not INTENSIONALLY equivalent, in that they arrive at these patterns via different algorithms, and perhaps encode different types and levels of representation.

The third issue to discriminate corresponds to the research program of generative linguistics in the Chomskyan mentalist tradition. For convenience, but perhaps at the risk of alienating linguists working in other traditions, I refer to this research program as the LINGUIST'S PROBLEM. The Linguist's Problem involves figuring out which mental grammar an individual has internalized using the typically insufficient and indeterminate data available. In other words, the Linguist's Problem is to figure out what the solution to the Human's Problem is. The purpose of this paper is to suggest a way of enriching the generative linguist's data set. If valid, this source of data will contribute in a modest way to progress on the Linguist's Problem. To restate things in a slightly different fashion, the (generative, mentalist) linguist's constructed grammar is intended to be the best hypothesis currently available concerning the nature of the solution to the Human's Problem.

We summarize in (1) the discussion thus far:

(1) Three Problems that need to be distinguished

• *The Human's Problem*: Acquiring the grammar determined by UG + Experience.

• *The AI Problem*: Simulation of human intelligence without regard to whether the model proposed matches the computational methods used by humans (weak equivalence). (See Pylyshyn 1984, Chapter 4.)

• *The Linguist's Problem*: Using insufficient/indeterminate data, figuring out which grammar a human acquires.

It is clear that the tradition of using the term 'grammar' in a systematically ambiguous fashion to refer both to the knowledge state of an individual's language faculty and to a linguist's model of that knowledge is potentially confusing. In the former usage a 'grammar' is taken to be an object in the world (the solution to the Human's Problem), whereas the latter usage implies a possibly incomplete and inaccurate model of such an object (the current solution to the Linguist's Problem).

Quine (1972) claimed that it is incoherent to attempt to choose among competing grammatical models that are extensionally equivalent, since, by definition they are indistinct with respect to the set of utterances they generate. However, Chomsky (1986) argues that Quine's pessimism is unwarranted. First, the object of study within the Chomskyan program is 'I-language', the system of knowledge internalised in individual minds/brains. Thus, even if we cannot determine the exact form of an individual's I-language, this does not imply that there is not a coherent answer to the question of which grammar it is. Our ability to find the correct answer, and the existence of a correct answer, are logically independent issues.

Furthermore, the choice among extensionally equivalent grammars may be broachable not only in principle, but in practice, as well. As Chomsky points out, our theories of differentL1 grammars should be mutually constraining, since, although partially determined by experience, each is a development from the same initial state (S_0) of the language faculty (UG):

> Because evidence from Japanese can evidently bear on the correctness of a theory of SO, it can have indirect-but very powerful-bearing on the choice of the grammar that attempts to characterize the I-language attained by a speaker of English.
>
> *Chomsky (1986: 38)*

So, not only is the question of the linguist's choice among competing models of grammar a valid one in principle, but there are empirical facts that can bear on this choice.

To make the discussion more explicit, consider the following idealized situation. Imagine we could model the structure and acquisition of Japanese in two competing ways, involving two theories of S_0, UG_1 and UG_2, and two resulting models of the adult grammars based on these models of S_0, J_α, and J_β, respectively. Now imagine we could similarly model the structure and acquisition of English in two competing ways, involving two theories of S_0, UG_2 and UG_3, and two resulting models of the adult grammars based on these models of S_0, E_γ and E_δ, respectively. At this point, the best theory of the human language faculty would be one that posited UG_2 as the correct model of S_0, and the associated J_β and E_γ, as the correct models of the I-languages of Japanese and English speakers. The study of the structure and acquisition of English and the study of the structure and acquisition of Japanese should be mutually constraining. The goal of linguistics is not merely to simulate Japanese and English type output. However, we will now see that some current theoretical work is tending in this direction, apparently unintentionally.

II. RICHNESS OF THE BASE AS A CONFUSION OF GOALS

It appears that Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993 Kager 1999) has tacitly, and perhaps inadvertently, rejected the distinction between the three Problems in (1) by adopting the principle of RICHNESS OF THE BASE (RoB) as a central tenet of the theory.

According to Kager (p. 19), RoB demands that "no specific property can be stated at the level of underlying representations". There are no restrictions against certain sequences of segments or against certain feature combinations, in fact there are no morpheme structure constraints (MSC's) of any kind.

Kager (p. 31-32) shows that, using any combination of nasal and non-nasal vowels in underlying forms, a single OT constraint ranking for English could generate the correct output forms [sæd] 'sad' and [sæ̃nd] 'sand'. That is, the ranking produces the right output for any of the lexicons in (2):

(2) Ranking: $*V_{ORAL}N >> *V_{NASAL} >>$ IDENT-IO(nasal)

	INPUT		OUTPUT
LEX1:	/sæ̃d/ & /sæ̃nd/	>	[sæd] & [sæ̃nd]
LEX2:	/sæd/ & /sæ̃nd/	>	[sæd] & [sæ̃nd]
LEX3:	/sæd/ & /sænd/	>	[sæd] & [sæ̃nd]
LEX4:	/sæd/ & /sænd/	>	[sæd] & [sæ̃nd]

The most highly ranked constraint is violated when an oral vowel occurs directly before a nasal consonant. The next constraint is violated by the appearance of nasal vowels in output forms. The lowest constraint demands input-output identity for the feature [nasal]. This is typical of how OT generates allophonic variation: a context-sensitive markedness constraint is ranked above a potentially conflicting context-free markedness constraint; and both are ranked above a relevant faithfulness constraint. Without being tied to a unique view of what the lexical items are, the proposed ranking generates the right results.

It is not completely clear what Kager's data is meant to show. One possibility is that the grammar licenses all of these derivations, they are all equally 'psychologically real'. Another possibility is that the data is meant to show that several extensionally equivalent choices exist, and that there are no grounds for choosing among them. In other words, it is unclear whether a theoretical point concerning the nature of grammars is being made, or whether the point is a metatheoretical one concerning the limits of our knowledge. In fact, Kager's discussion is a useful demonstration of an interesting mathematical property of OT grammars, but I will argue that it is psychologically uninteresting.

Before proceeding to the relevance of RoB to the three Problems, it is worth pointing out that it is odd to consider RoB as a part of OT. RoB actually just lists properties that other theories may have, but OT does not. There is an infinitely long list of properties that any particular version of OT does not have. For example, none have lust or interest rates, but we clearly do not want to encode this infinite list explicitly in finite human minds. This problem of defining grammars in negative terms is discussed further in Reiss (2000).

However, there are more insidious aspects of RoB. These include explicit appeals to this non-principle, as well as the fact that some OT analyses are dependent upon RoB not being valid. That is, they only make sense if MSC's and constraints on underlying phoneme inventories are included in the grammar!

McCarthy (1999a:6) invokes RoB to avoid selecting a single underlying representation for a given morpheme: "with faithfulness bottom-ranked, the choice of input [among three alternatives] doesn't matter, since all map to [the same surface form]. So there is no need to restrict the inputs." McCarthy has solved the Artificial Intelligence Problem, since his constraint ranking generates the same (correct) output representation for all three of the input forms he considers. However, generative linguistics is not Artificial Intelligence, and McCarthy turns his back on the Linguist's Problem by claiming that the choice between competing input forms "doesn't matter". The Human learner must have stored something, and it is the phonologist's job to tell us what.

We could, following McCarthy, also posit that there may be *bananas*, not representations of bananas, but actual bananas, in the underlying representation of words. Since the language faculty presumably cannot assign a pronunciation to a banana, we never get direct evidence that the banana is there. It seems perverse to leave the door open to the possibility that it 'doesn't matter' whether we choose the bananaful or the banana-free representation, but this is basically what McCarthy is doing.

Generative grammar as cognitive science is interested in the solution to the Human's Problem: if McCarthy is right in saying that the choice among underlying forms does not matter, then cognitive science does not matter. I assume that we can reject this possibility. What

McCarthy is doing is confusing various issues in advocating no restrictions on inputs.

There is no question of 'restricting' the inputs in the sense of positing MSC's as part of the grammar, but rather a question of figuring out which inputs the learner constructs given the observed data. It is something of a perversion of terms to label our hypothesis about what the *LAD* does a 'restriction', when in fact we mean 'arriving at a solution, given data and a learning algorithm'.

A supposed benefit of incorporating RoB in a theory of grammar is that the surface inventory (both in phonology and morphosyntax) is then taken to be predictable from the constraint ranking. This is taken as support for the notion that differences among languages reduce to differences in ranking. Consider two more discussions of RoB in the OT literature:

> The set of possible inputs to the grammars of all languages is the same. The grammatical inventories of languages are defined as the forms appearing in the structural descriptions that emerge from the grammar when it is fed the universal set of all possible inputs. Thus, systematic differences in inventories arise from different constraint rankings, not different inputs. The lexicon of a language is a sample from the inventory of possible inputs; all properties of the lexicon arise indirectly from the grammar, which delimits the inventory from which the lexicon is drawn. There are no morpheme structure constraints on phonological inputs, no lexical parameter that determines whether a language has *pro*.
>
> *Tesar & Smolensky (1998: 252)*

> We can also see that it is inevitable that light do exists in [English], given the constraint rankings.
>
> *Grimshaw (1997: 387)*

It is apparent that RoB gets things exactly wrong: if we accept an OT model of grammar, then the inventory present in the PLD will determine how the learner ranks the constraints. All learners start out with the same constraints in the same ranking relationships (under an OT view of UG). The way learners come to acquire different grammars is due to the differences in their experience-the inventories they are exposed to. This confusion of cause and effect reflects more general problems with existing models of acquisition in OT discussed by Hale & Reiss (1998).

If we can now agree that we care about making hypotheses about what constitutes knowledge of language, and how that knowledge comes to be instantiated in human minds —and not just what can make a system act like it has knowledge of language— then we are ready to tackle the vexing problem of HOMOPHONY in natural language.

III. HOMOPHONY IN PHONOLOGY

The practice of phonological and morphological analysis involves modeling two kinds of situation: (a) deriving surface distinctions from identical substrings of underlying representations;

and (b) demonstrating that identical surface strings can correspond to underlyingly distinct representations. In phonology, these two aspects of analysis are fairly well understood. The first (a) is achieved by positing context-sensitive processes which selectively affect parts of representations in accordance with the contexts in which they appear, and the second (b) by positing neutralization processes.

(3) Phonological analysis

a. *One-to-many mappings* —deriving surface distinctions from identical inputs-context sensitive processes.

b. *Many- to-one mappings* —demonstrating that identical surface strings can correspond to underlyingly distinct representations-neutralization processes (phonologically-based homophony)

After illustrating these two phonological patterns, we will turn to their correspondents in morphology.

III.1 Phonological relationships in Old Icelandic

A simple case of the derivation of a surface distinction from a single underlyingly representation is provided by the Old Icelandic noun paradigms in (4).

(4) Assimilation of *-r* to coronal sonorant (Reiss 1994)

case	'home'	'stone'	'wagon'
NOM	/heim-r/ → *heimr*	/stein-r/ → *steinn*	/vagn-r/ → *vagn*
ACC	/heim-Ø/ → *heim*	/stein-Ø/ → *stein*	/vagn-Ø/ → *vagn*

Masculine nouns of this class bear the suffix -r in the nominative singular and no overt suffix in the accusative singular: *heim-r/heim* 'home nom./acc. sg.', *arm-r/arm* 'arm nom./acc. sg'. The masculine singular marker assimilates to a preceding coronal sonorant under certain well-defined conditions (see Reiss 1994 for an analysis), so that the nominative singular of the stem *stein-* 'stone' is steinn and the accusative is *stein*. We thus see that the surface distinction between nominatives with *-r* and nominatives with gemination of the final coronal sonorant can be derived phonologically from a single underlying suffix.

Compare this situation to that of stems ending in a consonant cluster of increasing sonority, like *vagn-* 'wagon' and *fugl-* 'bird'. Here the nominative suffix is deleted. Like the case of gemination just discussed, this deletion process is purely phonological. The nominatives are *vagn* and *fugl*, not **vagnr*, **fuglr* or **vagnn, *fugll*. In other words, the nominative ends up being identical with the accusative in its overt phonetic realization: the nominative and accusative are homophonous. However, common practice, and common sense too, tell us that there are two different sets of morphosyntactic features corresponding to each string —one marked nominative (e.g., *vagn*[NOM]) and one marked accusative (*vagn*-[ACC]). The surface homophony, or ambiguity, in such a situation is derived.

Instead of accepting the phonological account of the homophony of the nominative and accusative of *vagn-*, we might propose that masculine nouns take the nominative ending *-r*, except in the case of stems ending in certain clusters. However, it then would be treated as an accident that these clusters can be described as a natural class using universally required linguistic primitives. And we might predict that any random list of stem shapes could be similarly exceptional. The ability to capture generalizations is a standard argument against adopting such a hypothesis.

IV. HOMOPHONY IN MORPHOLOGY

In morphology, situation (a), in which surface distinctions between strings which overlap in meaning or morphosyntactic distribution, but which cannot be derived from the 'lower' phonological level, is attributed to one of two causes. Either we are looking at a case of root suppletion (ai), or else the overlap in meaning results from the concatenation of one constant element with different lexical items in different contexts (aii).

(5) Morphological analysis

a. *One-to-many mappings* —deriving surface distinctions from identical inputs

i. root suppletion: *go/went*

ii. context dependent suppletion of inflectional morphemes: Hungarian *hajó-k* 'boats' *hajó-i-m* 'my boats'

b. *Many-to-one-mappings* —demonstrating that identical surface strings can correspond to underlyingly distinct featural representations, or alternatively, demonstrating that the inputs are actually identical-the problem of **morphological homophony**.

As noted, example (5ai) represents typical root suppletion. The present and past tense forms of this verb are not synchronically relatable by productive morphological or phonological processes. Example (5aii) is in essence identical to the preceding one, and is separated here only because such cases are not typically referred to as suppletion. The plural marker on Hungarian nouns is *-ok* (or harmonic variants) on nouns that are not marked with a possessive suffix, but the plural marker is *-i-* when the noun also bears a possessive suffix. Thus, the choice of marker depends on the morphological context. The difference is that unlike *went*, Hungarian *-i-* does not express in an unanalyzable unit a combination of root and inflectional features.

The principles of linguistic analysis in situation (5b) are most difficult to explicitly characterize. This is the situation where potentially distinct morphosyntactic structures are realized by identical phonological strings. Often the crucial question is actually whether or not the phonological constant does correspond to multiple morphosyntactic structures. In other words, our understanding of the treatment of potential HOMOPHONY is unacceptably vague. The present paper does not attempt a thorough treatment of morphological homophony. Instead, I will define this type of homophony, demonstrate that it in fact exists, and then suggest how L2 data could help us to recognize it.

An example, again from Old Icelandic, will help. This language distinguishes up to four cases overtly in noun paradigms. The nominative and accusative have already been mentioned. In addition, there are overtly marked genitives. A full paradigm for the masculine noun 'home' is given in (6).

(6) A masculine noun paradigm

	SING.	**PLUR.**
NOM.	*heimr*	*heimar*
GEN.	*heims*	*heima*
DAT.	*heimi*	*heimum*
ACC.	*heim*	*heima*

In contrast to the masculines, Old Icelandic never distinguishes nominative and accusative in neuter nouns, either in the singular or the plural, as illustrated by the paradigm for the noun meaning 'ship' in (7). In this particular case, singular and plural forms are identical, but this is not the case for all neuter nouns.

(7) A neuter noun paradigm

	SING.	PLUR.
NOM.	*skip*	*skip*
GEN.	*skips*	*skipa*
DAT.	*skipi*	*skip*
ACC.	*skip*	*skip*

The question now arises whether Old Icelandic has, for example, just one singular form skip that is neither nominative nor accusative but shares the features common to both usages, or two separate forms, one nominative and one accusative, that happen to be homophonous. The first possibility will be referred to as the theory of *vague* or *general* representations. The vague representation would be something like this: *skip*–[SG NOUN ANIMATE]. Implicit in this view is a theory of underspecification —surface forms may be partially underspecified for the features of the morphosyntactic context into which they are inserted. The second possibility will be referred to as the theory of *ambiguous* or *homophonous* representation. The string skip would be part of two distinct representations: *skip*–[NOM SG NOUN ANIMATE] and *skip*–[ACC SG NOUN ANIMATE]. The first three terms (*vague, general, ambiguous*) are discussed by Bresnan (1999, q.v. for references) who adopts the stand that grammars make great use of vague representations. This choice allows Bresnan to incorporate her underspecified representations into a theory of formal markedness.

According to Bresnan (1997), the use of *vague* or *general* interpretation means that unspecified features are necessarily absent from a representation; and *ambiguous* interpretation refers to a situation with a set of (potentially) overlapping structures which differ with respect to certain features. I adopt the term *ambiguous* in deference to tradition, but in fact the term involves a mixing of levels of analysis. A phonological string is called 'ambiguous' if it corresponds to more than one morphosyntactic feature structure. Taken as a linking of a phonological representation and a morphological feature structure, lexical items cannot be ambiguous. Instead we are just looking at homophony. So 'ambiguous' can be read as a synonym for *homophonous* in the following discussion[2].

A third logical possibility exists, in addition to vague and ambiguous representations. This view is less often considered in the morphological literature and it holds that there may exist a single form which is specified for features that are compatible with all contexts in which a string appears. For example, the string *skip* corresponds to a feature structure which is *both* nominative and accusative. This third alternative will not be considered below, but see Dalrymple and Kaplan (2001) for interesting arguments in favor of this view. For now, we concentrate on the first two possibilities in the Icelandic case and in similar cases from a variety of languages.

Note that the three views sketched here are not mutually incompatible. Languages could possibly contain representations of all three types. However, the task of the linguist will be to discover the principles governing the nature of a representation in each particular instance. Ultimately these principles should be defined in terms of the learning path of language acquisition. In this paper, I am concerned with merely identifying the problem and suggesting a potentially useful source of relevant data.

Before proceeding, it is worth distinguishing an issue which is related to, but not identical to the issue under discussion. This is the issue of phonologically null morphemes. For example, we could imagine the existence of a stored lexical item *skip* which has no case or number features, and only receives them in combination with potentially phonologically null inflectional affixes. Alternatively, we could imagine that a form *skip* is stored with inherent case and number features matching those contexts in which the form is inserted. For our purposes, we can often sidestep this issue, since our primary concern is to compare the morphosyntactic features associated with actually occurring pronounced words. This discussion must be clearly fine-tuned for compatibility with different theories of morphology.

V. TWO LOGICAL EXTREMES

V.1. Radical vagueness

An extreme version of the theory of vague representations, which is probably not explicitly held by any scholar, could be formulated as follows:

(8) Radical vagueness

> There is no homophony (other than that which can be derived phonologically). In a given language, a single underlying phonological representation (input to the phonology, UR) Σ corresponds to a single morphosyntactic feature description which subsumes the description of all the morphosyntactic environments in which Σ can appear.

According to radical vagueness, there is just one Old Icelandic word (that is, one featural representation) *skip* that denotes nominative and accusative for both singular and plural. This seems plausible enough, but radical vagueness has other implications.

It is obvious that if we admit the existence of phonologically null morphemes, then radical vagueness will require that each language contain only a single one. This is because phonologically null morphemes will always have the same (null) underlying representation, and any two would thus be homophonous, *contra* radical vagueness.

Even if we exclude the case of phonologically null morphemes, we can still demonstrate that (8) is untenable. It would require that the phonological string found in English *well* correspond to a single lexical entry. In other words, the noun in *a deep well* and the adverb in *I* *sing well* would have to be stored with a single vague set of morphosyntactic features that were compatible with both uses. The existence of clear, accidental homophony in natural language, as well as the fact that it is unlikely that appropriate featural representations could be constructed for a single lexical item like *well* in this model, make the theory of radical vagueness untenable.

V.2. Radical ambiguity

The opposite logical extreme from radical vagueness would be radical ambiguity. Instead of the lower limit of zero ambiguity and full vagueness, this theory adopts the upper limit of ambiguity (homophony) allowed by UG. Then, somewhat pretheoretically, we can state the doctrine of radical ambiguity as in (9).

(9) Radical ambiguity

> If there are n morphosyntactic contexts in which a string Σ appears which can be distinguished using the set of all morphosyntactic features provided by Universal Grammar, then Σ is n-ways ambiguous; that is, Σ corresponds to n (listed or derived) lexical items.

Under radical ambiguity, the so-called nominative/accusative of Old Icelandic neuter nouns actually corresponds to distinct forms, a nominative one and an accusative one. Informally, there are two singular words *skip*, not one, and two plural forms, for a total of four homophonous forms.

However, radical ambiguity does not stop here. The theory demands that *any humanly possible* distinction is potentially encoded. We can use English words to illustrate. The distinction between DUAL and PLURAL is never encoded overtly on English nouns. However, UG provides us with these features. Therefore, the proponent of radical ambiguity would require that the string *cats* correspond to *at least* two feature structures, one marked as DUAL and one as PLURAL. In fact, there would be many, many more possible feature structures, including ones to encode different definiteness and case distinctions.

V.3. Discussion

It might be tempting to make Radical Vagueness slightly more plausible by factoring out clearly accidental homophony of lexical items like *well, knight/night* or *(to) fly/(a) fly)*, assuming we could figure out how to do this in principled fashion. However, in the next section I show that there must be even more homophony/ambiguity than just these clear cases. This discussion might then tempt us to embrace Radical Ambiguity. A moment's reflection should show that no language internal evidence can lead us to reject Radical Ambiguity —we can always construct extensionally equivalent grammars that make use of various amounts of ambiguity. English will *sound* the same whether we model it with one or more lexical items *you*. At the end of the paper we will see how L2 data can bear on these issues, and we will find arguments that the truth lies somewhere between the two logical extremes.

VI. ARGUMENTS FOR THE NECESSITY OF HOMOPHONY

A reasonable goal of morphological analysis is to reduce the number of lexical items ('morphemes' in a traditional sense) needed to account for the surface forms of a language. This goal entails demonstrating that a single form fulfills functions in the grammar which can be distinguished by the analyst. In practice, however, many morphologists recognize the existence of homophonous (ambiguous) forms. For example, the past tense of *hit* must contain a phonologically null past tense morpheme, since it surfaces as *hit* and not **hitted* The problem is that no explicit mechanism has been proposed for deciding that *hit* is an ambiguous string (that is, it corresponds to two different morphological feature sets), whereas, say Old Icelandic *skip* is a non-ambiguous form, unspecified for case. This lack of explicitness is unacceptable in a formal theory, though we find it in a variety of frameworks from Distributed Morphology to Lexical Functional Grammar.

While it is not the case that scholars who advocate broad use of vague representations deny the possibility of homophony, it is useful to demonstrate that homophony is present in cases more subtle than, say, English *well*, a string which corresponds to both a noun and an unrelated adverb, or *knight* and *night*. In this section, I present five distinct arguments that homophonous or ambiguous representations must be allowed in morphological theory. This evidence should serve to steer us further and further away from radical vagueness.

VI.1. First argument: Blocking of productive morphology

English has a productive marker of plurality in nouns: *rodent-s, banana-s, linguist-s*. Following early discussion of blocking in morphology (Aronoff 1976), the form *feet* can be said to block the derivation of **foots*. In other words the existence of a stored form FOOT-PLURAL prevents the concatenation of the independently listed FOOT and PLURAL lexical items.

A more interesting case is that of the 'irregular' noun *sheep* which could potentially be treated as ambiguously singular or plural (corresponding to two representations), or as unmarked with respect to number (i.e., vague in interpretation). However, in this case, there must be a lexical item '*sheep* [PLURAL]' in order to block the productive process of plural formation from generating **sheeps*. Therefore, we can conclude that at least in some cases, forms which are superficially ambiguous as to whether they are marked for a given category, are in fact ambiguous. Without a (possibly phonologically null) featural distinction, there is no mechanism available to block the productive morphology from generating **sheeps*[3].

VI.2. Second argument: identical subsumption structures

Vague representations must be formulated in such a manner that the features they contain are compatible with all the environments in which the representation is used. I assume that listing disjunctive subsets of features associated with a single phonological representation is a notational variant of positing distinct, homophonous representations. Vague representations, therefore, must contain, some subset (possibly not a proper subset) of the set derived by the intersection of the environments in which they can be used[4]. Depending on the set of features used and depending on whether an attempt is made to make representations as 'economical' as possible, theories of morphology have appealed to a principle, such as the Elsewhere Principle, that specifies which representation is chosen if more than one is compatible with a given context. We consider now potentially problematic cases for such a theory.

Consider the paradigm in (10) which is typical of Old French masculine nouns. The example is the word 'wall'.

(10) An Old French problem for vague representations

	NOM.	OBL.
SING.	*murs*	*mur*
PLUR.	*mur*	*murs*

We see that the nominative singular and oblique plural are both *murs*, whereas the oblique singular and nominative plural are both *mur*. Therefore, we have to recognize that the same phonological form corresponds to different feature specifications in these paradigms.

To show that this is not an isolated case, a further example of this situation can be supplied by Scots Gaelic (Calder 1923: 81, 101).

(11) A Scots Gaelic problem for vague representations

	NOM.	OBL.
SING.	*àl*	*àil*
PLUR.	*àil*	*àl*

The nominative singular and genitive plural of the word for 'brood' have a so-called 'broad vowel' form, whereas the genitive singular and nominative plural show a 'slender infection' [*sic*].

We can now define the general case illustrated by these examples. Given a paradigm defined by contrasting pairs of features (or feature values) F and G, and A and B, the theory of vague specification runs into trouble if it is the case both (1) that the exponents of [F, B] and [G, A] are identical, say X, and (2) that the exponents of [F, A] and [G, B] are identical, say, Y:

(12) A hypothetical problem for vague representations

	A	**B**
F	*Y*	*X*
G	*X*	*Y*

The positions filled by X correspond to [F, B] and [G, A], which means they share no features. Their intersections for the relevant features is the null set. The positions filled by Y are [F, A] and [G, B] which also share no relevant features and thus, their intersection for the relevant features [A, B, F, G] is also the null set[5]. So the underspecified 'vague' representations for X and Y are identical, both are the empty set.' Therefore, there is no way for the morphology to choose among them without resorting to disjunctions like "Choose Y if either [F] and [A], or [G] and [B]". This just moves the responsibility for keeping track of the correct form from the lexicon to an *ad hoc* rule of lexical selection. Given the fact that X and Y can, in principle, be morphologically complex and show the effects of phonological neutralizations, it is unclear how such a rule could be formulated. It is also impossible to choose X or Y as more marked, that is more specific, using set intersection as the procedure to determine which features each item is specified for.

VI.3. Third argument: neutralization in morphophonologically definable contexts

An example from English suggests further that the practice of collapsing homophones that share a 'significant' portion of their featural makeup is excessively superficial. Many dialects of English do not distinguish phonologically the possessive and non-possessive forms of regular plural nouns: *the girls left* and *the girls' mother left* both contain the phonological string [grl̩z]. A theory that demands the collapse of subject and object forms of English nouns, would seem to require the collapse of the possessive and non-possessive plurals. Furthermore, it seems that we would also need to collapse the possessive singular form *girl's* which is homophonous with the other two. This leaves the form *girl* as the most marked member of the paradigm, requiring explicit encoding of non-plurality and non-possessiveness —a conclusion we assume is odious to believers in markedness. Of course, one could conclude that this is exactly the point of markedness, and take such a case as evidence of the marked nature of bare noun stems like *girl* in English. Note, however, that this collapse will not be posited for cases like *children's*. The analysis fails to capture the effects of accidental homophony.

VI.4. Fourth argument: Lexical splits

Toivonen (2000) demonstrates that the long-standing problem of the distribution of the Finnish possessive suffixes can only be solved by recognizing that the suffixes represent, in fact, pairs of homophonous forms. For the first and second person suffixes the argument is based primarily on principles internal to Lexical- Functional Grammar, the framework Toivonen adopts, though the conclusions may be compatible with other theories. In brief, in the absence of an independent pronoun the first and second person suffixes have a PRED feature and thus are pronominal suffixes, whereas when an independent pronoun is present the suffixes must lack a PRED feature. This avoids a PRED clash, since the pronouns have their own PRED feature. In such a case, the suffixes are merely agreement markers. For these persons, the representation of the agreement marker is contained in the representation of the form which has a PRED.

The third person suffix *-nsa/nsä* provides a further compelling demonstration. Toivonen shows that in the third person, in contrast to the first and second, the representations of the agreement marker and the form used without an independent pronoun are in fact distinct —neither representation subsumes the other. The agreement marker agrees only with a third person, HUMAN pronoun:

(13) (a) *Pekka näkee hänen ystävä-nsä.*
P. sees his/her friend-3Px
'Pekka sees his/her friend'

(b) **Pekka näkee hänen ystävän.*
P. sees his/her friend. ACC
'Pekka sees his/her friend'

(c) *Pekka näkee pojan ystävän.*
P. sees boy.GEN friend.ACC
'P. sees the boy's friend'

(d) **Pekka näkee pojan ystävä-nsä.*
P. sees boy.GEN friend-3Px

(e) *Minä annan koira-lle sen ruokaa.*
I give dog.ALL it.GEN food
'I give the dog its food'

(f) *Minä annan koira-lle sen ruokaa-nsa.*
I give dog.ALL it.GEN food-3Px

In (13a), the possessive suffix *-nsa/nsä* agrees with the third person, HUMAN pronoun *hänen*. In (b), the sentence is ungrammatical without the suffix. In (c), we see that no suffix is present when there is a full lexical NP possessor. In (d) the suffix is meant to agree with the full lexical NP possessor, which is obviously not a pronominal form-this is ungrammatical. In (e) there is a pronoun, but it is *sen*, which cannot refer to humans, so the sentence is grammatical without the suffix; and (f) is ungrammatical with the suffix, because of the non-human pronoun *sen*.

In contrast to such cases, the suffixed pronominal form, which must be anaphoric with the subject, is not restricted to reference with humans. It can corefer with any third person even those that are non-human and non-animate, and its antecedent need not be a pronoun:

(14) (a) *Hän näkee ystävä-nsä.*
He sees friend-Vx
'He$_i$ sees his$_i$ friend'

(b) *Poika näkee ystävä-nsä*
boy sees friend-Vx
'The boy$_i$ sees his$_i$ friend'

(c) *Se heiluttaa häntää-nsä.*
it wiggles tail-3Px
'It$_i$ wiggles its$_i$ tail'

Thus, the morphological features of the homophonous 3rd person possessive suffixes are distinct. Slightly simplifying Toivonen's discussion, we can represent the features of the agreement marker as in (15):

(15) Features of agreement marker *-nsa/nsä*

$$\left[\begin{array}{c}\text{HUMAN}\\ \text{3rd}\\ \text{PRONOUN AGREEMENT}\end{array}\right]$$

And we can represent the features of the pronominal suffix as in (16):

(16) Features of pronominal suffix *-nsa/nsä*

PRED
SUBJECT ANTECEDENT
3rd

The surface form *-nsa/nsä* is thus ambiguous —there are two homophonous forms. It is possible to list, say, a disjunctive statement of where the putative 'vocabulary item' *-nsa/nsä* is inserted. However, this is equivalent to listing two separate items.

VI.5. Fifth argument: Evidence for zero derivation

It is well known that English has at least two verbs *fly*. One appears in sentences like *That bird flies out of the barn whenever the cat comes in*. Another appears in sentences like *The pitcher flies out to right field every time he bats*. The past tense of these verbs differ. The first corresponds to irregular *flew*, whereas the baseball term can only have the past tense form *flied*. Irregularness is a feature of roots, and the first verb is based on a verbal root which is linked to the irregular *flew*. The baseball verb, however, is (synchronically) productively derived from the noun *fly (ball)* and thus is not a stored form. For our purposes, what is relevant is the obvious point that despite their homophony and intuitive similarity in meaning, the two verbs *fly* must correspond to distinct representations. Therefore, the phonological form *fly* is ambiguous, not vague.

VII. SOLVING THE LINGUIST'S PROBLEM—L2 DATA TO THE RESCUE

It is now clear that there is some homophony, so radical vagueness is untenable. As mentioned above, we do not have any explicit algorithm for determining exactly how much homophony there is, yet it is intuitively wrong that English has distinct DUAL and PLURAL forms of every noun. We cannot come to a complete solution to the determination of how much homophony each language has and what principles determine this, but it seems that languages lie somewhere between the two logical extremes in the mapping between phonological strings and lexical entries. (See Reiss (2000) for discussion of explicit learning algorithms that differ in the amount of homophony that they lead to). In this section, I will just show how L2 data can bear on the issue of homophony in particular cases by helping us decide if a given phonological string corresponds to one or more lexical entries.

Since, for example, an Old Icelandic grammar with two distinct (homophonous) words pronounced *skip* will be extensionally equivalent in terms of the phonological strings generated to a grammar that contains a single vague item pronounced *skip*, internal evidence can never be used to choose among the two (by definition). There is the possibility, however, of appealing to external evidence from SECOND LANGUAGE ACQUISITION (SLA).

The errors that SLA learners make may reflect aspects of the L1. Consider the following (impressionistic) observations: speakers of a language like Hungarian, which does not distinguish gender in third person pronouns make many errors in using English *he/she*, whereas English speakers do not appear to have a problem learning not to be able to distinguish the genders. If Hungarian *ö* corresponded to two separate representations, one [3 SG MASC] and another [3 SG FEM], we might expect the mapping to the English system to be easier than it apparently is. Similarly, English speakers learning Marshallese have a hard time learning to make the DUAL/PLURAL contrast, so this may indicate that this distinction has been collapsed in English grammars. In other words, we can reject, on the basis of external evidence, the idea (Radical Ambiguity) that no collapse of initial full specification occurs. Hungarian speakers do not have two (or more) third person pronouns, and English speakers do not have a covert DUAL. So not every distinction allowed by UG remains encoded in every grammar.

L2 data also provides further evidence some covert distinctions do exist. Do English speakers have a problem learning distinctions like the French *tu/vous* contrast? My intuition is that they do not. If correct, this can be taken as evidence that distinctions that are made anywhere in the language, such as SINGULAR VS. PLURAL, are maintained in all relevant representations. In other words, the evidence from English speakers learning French or Spanish suggests that English has at least two pronouns that are pronounced *you*. The question of whether there are more than two is discussed further in Reiss (2000). This conclusion may be contrary to the intuitions of many morphologists, but it is based on an explicit form of reasoning and can be empirically tested. Therefore, it should be taken seriously.

Another example, is perhaps easier to swallow. In Italian, the string *sono* corresponds to both *I am* and *they are*. Here, I think, the intuitions of linguists are in agreement that this case is one of accidental homophony, but it is not clear that this intuition has ever been justified. However, consistent with the intuition is the fact that Italian learners of English will not confuse *am* and *are*, as we might expect them to if there were a one-to-two mapping from Italian lexical items to English ones. So, *sono* is ambiguous —it corresponds to two homophonous items in the Italian lexicon.

The general point is just this: one-to-one and many-to-one mappings fromL1 to L2 are easier than one-to-many mappings. In other words, it is easier to map to the correct form if there is only one output choice than if there is more than one. The error patterns of L2 learners can give us insight into the nature of the mappings, and thus into the nature of theL1 grammar.

Only by taking issues of L2 acquisition into account, can we start to solve the *Linguist's Problem* of the indeterminacy of the data and arrive at a theory of how the *Human's Problem* is solved. Such simple arguments suggest that theoretical linguists would do well to consider L2 data more carefully.

NOTES:

1. It is not even worth arguing about this assumption of the nativist hypothesis —nobody denies that there is something innate that makes us able to learn languages and does not allow chickens to do so upon comparable exposure.

2. Note the same sloppy terminology is rampant in syntax. We consider a sentence to have a hierarchical structure, as well as a linear order. Therefore, sentences cannot be structurally ambiguous, only strings can be structurally ambiguous.

3. Of course, one could stipulate that the plural morpheme is linked to a list of roots which it cannot attach to. This kind of 'negative subcategorization' is typically not considered in generative analyses and we will not pursue the idea here.

4. Given the likelihood that the relevant morphosyntactic features are organized somewhat, and not elements of an (unstructured) set, it would be more appropriate to talk about subsumption relations than mere subset relations. However. I forego this (ultimately necessary) distinction here, for the sake of expository convenience.

5. Obviously, the relevant lexical items, X and Y are specified, in fact they are identically specified, for further features not listed here.

REFERENCES

Aronoff, M. (1976). *Word Formation in Generative Grammar. Linguistic Inquiry Monograph no. 1.* Cambridge, MA: MIT Press.

Bresnan, J. (1997). Explaining morphosyntactic competition. To appear in *Handbook of Contemporary Syntactic Theory*, ed. by Mark Baltin and Chris Collins. Oxford: Blackwell.

Calder, G. (1972). *A Gaelic grammar*. Glasgow: Gairm Publications.

Chomsky, N. (1986). *Knowledge of Language*. Westport: Praeger.

Dalrymple, M. & R. Kaplan (2001). *Feature structures*. Language.

Grimshaw, J. (1997). Projection, heads, and optimality. *Linguistic Inquiry 28*, 373-422.

Hale, M. & C. Reiss (1998). Formal and empirical arguments concerning phonological acquisition.

Linguistic Inquiry 29, 656-683.

Kager, R. (1999). *Optimality Theory*. Cambridge: Cambridge University Press.

McCarthy, J. (1999). Sympathy, Cumulativity, and the Duke of York Gambit. *ROA-315*.

Prince, A. & P. Smolensky (1993). *Optimality theory: constraint interaction in generative grammar*. Technical Report RUCCS, Rutgers University, New Brunswick, N.J.

Pylyshyn, Z. (1984). *Consciousness and the Computational Brain*. Cambridge, MA: MIT Press.

Quine, W.V. (1972). Methodological reflections on current linguistic theory. In G. Harman and D. Davidson (eds.) *Semantics of Natural Language*. New York: Humanities Press.

Reiss, C. (2000). Homophony. Ms. Concordia University.

Reiss, C. (1994). The outcome of /lr/ and /nr/ in Old Icelandic. *Linguistic Review 11*, 329-350. Warning: This article is full of important typos and misprints! Ask me for a corrected copy if it interests you.

Tesar, B. & P. Smolensky (1998). Learnability in Optimality Theory. *Linguistic Inquiry 29*, 229-68.

Toivonen, I. (2000). The Morphosyntax of Finnish Possession. *NLLT 18*: 579-609.

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Finnish-English Phonetics and Phonology

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ABSTRACT

This paper first gives a summary of the theoretical approaches to the role of phonetics and phonology in language learning and teaching as developed by the Finnish-Englsih Cross-Language Project at the University of Jyväskylä. In the Finnish project, the analysis was extended over the the chains of connected speech to deal with all the phenomena that give them their rhythm in speech. The project did not find it sufficient to produce simple one-to-one equations between the best structural descriptions of the two languages because many of learners' difficulties in pronunciation cannot be assigned to phoneme paradigms. The paper also includes a survey of the findings of Finnish-English contrastive phonetics and phonology, and a description of potential sources of difficulties in Finns' pronunciation of English.

KEYWORDS: contrastive phonetics, contrastive phonology, pronunciation, prosody, stress, speech rhythm, speech rate, fluency, speech perception, error analysis

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I. INTRODUCTION

Languages sound different because they have specific phonetic structures of their own. Many of these differences in phonetic structures are known to be cumbersome for language learners: it may be a foreign or unusual sound, a strange combination of sounds, or certain aspects of speech rhythm, stress patterning, or intonation that are problematic.

Even greater problems may be involved for language teachers, because it is not possible to give instructions, by means of straightforward reference to traditional phonetic descriptions, as to how to correct misguided pronunciation. Direct use of phonetic descriptions easily results in inaccurate and erroneous assessments of pronunciation or futile attempts to correct deviations detected. Teachers must be able to analyze utterances and break them up into their constituent particles at different levels of linguistic description, and they must also be acquainted with the structural similarities and differences between the native language of the learners and the foreign language. They must also know which the most common errors are and what the causes of them are. Only then can they diagnose various phenomena in the foreign language and analyze errors in pronunciation. This is a prerequisite for proper error correction. Teachers also need this kind of information to be able to plan their teaching to make it possible for learners to avoid the most obvious mispronunciations.

Below we will first discuss the role of phonetics and phonology in language learning and teaching and the theoretical approaches to contrastive analysis developed by the Finnish-English Cross-Language Project at the University of Jyväskylä. This discussion will be followed by a summary of the research work in the area of Finnish-English contrastive phonetics.

II. THE ROLE OF PHONETICS AND PHONOLOGY IN LANGUAGE LEARNING AND TEACHING

The term 'phonology' refers to the patterns of phonetic elements used in the phonological forms of meaningful entities of a language. These elements, ie. phonemes, are abstractions and have no content. They are described in opposition to each other: change of a phoneme in a word creates a different word (eg. /kæp tæp læp/).

Errors in pronunciation can be either allophonic or phonological. When, for instance, the word *pit* is perceived as *bit* by the listener, the error is phonological; when the word *drill* is pronounced with the clear /l/ instead of the dark, the word can be perceived correctly and the error is allophonic. Individual phonological errors, like the one above, do not very often occur in real conversation, because the redundancy embedded in the context makes it possible for listeners to amend what they hear.

The importance of phoneme contrasts is often overemphasized in teaching at the cost of some other, more important aspects of phonology. Phenomena that are important to learn are, for instance, "the way in which the foreign language links phonemes together, physically carries out sequences of sounds in stressed and unstressed positions in connected speech, shapes words and builds up word combinations, and gives them their rhythm in sentences and longer stretches of discourse" (Lehtonen et al. 1977: 9-10).

The phoneme paradigm constituting the phonological system of a given language makes part of the native speaker's competence. It makes it possible for him to expect certain types of constructions and recognize certain physical differences of sounds. The phonemic system of the language also allows the speaker-hearer to subconsciously overlook differences and constructions that could be predicted theoretically. There is a great deal of redundancy as a result of the phonological rules and rules of grammar as well as various constraints that are imposed on the exchange of messages. This redundancy is an unavoidable feature of all natural communication. It is for this reason that it is not possible to evaluate the importance of individual phonological oppositions.

Interpretation of an utterance calls for the processing of phonemic, syntactic, and semantic cues of perception. The information contained in the perceptual auditory input can only be used properly if the units signalled by the sound waves in speech are familiar. Lehtonen (Lehtonen et al. 1977:10-12) has compared the functioning of the phonological structure of languages to the game of chess: The chess pieces could be of any shape as long as they are identifiable and different from each other. The shapes of the pieces have no bearing on the rules of the game; only the rules that govern their conduct are important, not their external appearance. The chess player has to learn to recognize the chess pieces by their outward characteristics but also have access to the rules that govern their conduct on the chessboard. >From very early on in our childhood, we learn to play a certain type of game on a board that resembles a chessboard. Later on, if we are supposed to be acquiring a new game to be played on the same board, we easily confuse the unfamiliar pieces of the new game with those of the original one. We also tend to move the pieces according to the rules of the original game and judge and interpret the opponent's moves and the ensuing situation on the board in terms of the rules of the original game.

For the purposes of speech communication, we have to be able to produce the pieces we want to move each time we intend to make moves. If we do not know the pieces used in the game, we cannot interpret the moves of our opponent, even if we know the rules of the game; if we are not acquainted with the rules of the game, recognition of the pieces is not sufficient; if the shape of the pieces that we use makes it impossible for the opponent to recognize our moves, the opponent will find it difficult to grasp the meaning of our intention in the game. In the game of speech communication two or more people make moves in response to those of the interlocutor. It is important for both parties to understand what the fellow speaker is aiming at.

But there is a striking difference between chess and speech game: the purpose of speech game is not to checkmate the opponent. "A seasoned player —the native speaker— can easily see what is meant even when the moves are faulty as long as the pieces used can be recognized" (Lehtonen et al. 1977:12). The native speaker can make use of all of the redundancy available in the language. A language learner is in a much more problematic situation: he must necessarily learn to understand what the native speaker says, because the native speaker can only marginally, and for short periods of time, change the way he speaks and in this way make more understandable what he says. It is practically impossible for him to produce the kind of changes that would make his speech sound faulty 'in the right way' for the non-native speaker to understand him. In ordinary everyday communicative situations it is practically impossible for a foreign speaker of English to influence the rate or quality of what a native speaker says.

Here we have the reason why one of the most significant skills is that of listening comprehension, especially at the phonemic level. The ability to extract the phonological structure of a chain of speech from what is heard is an integral element in the 'the process of understanding'. In the studies of the difficulties experienced by Finnish-speaking and Swedish-speaking students in the learning of English, it was found out that the Finnish-speaking Finns scored distinctively poorer in listening comprehension tests, while in pronunciation tests, for example, no such difference was found (Ringbom 1987:3). This can be explained by the fact that native speakers of Swedish, a language historically related to Swedish, can make use of certain information in English input on the basis of their experience with their own native language. Because of the complexity of the phenomena related to reception, materials are needed for language teaching that include exercises which are not based on simplified phonological descriptions. Such descriptions may possibly be sufficient for productive skills.

Difficulties in the learning of pronunciation arise from two major sources: (1) actual production of English sounds, eg. [ʤ] or [θ], by means of the correct articulatory processes, and (2) interrelationship between the written forms of words and their equivalents in spoken English. In this way, errors in pronunciation may be either errors in how a sound is pronounced, or errors resulting from misguided interpretation of the pronunciation of written words.

An example of the latter kind of problem is the pronunciation of the word *bosom* as [bɔzəm] instead [bʊzəm]. The wrong pronunciation arises from the spelling of the word, but the error is morphophonetic: the morpheme {bosom} is given the wrong phonological form [bɔzəm]. Errors of the same kind can also be found in the area of word stress when the stress is assigned to a wrong syllable as in **inte'resting* or **sub'sequent.*

Correctness of pronunciation cannot always be easily assessed. Pronunciation errors become a real problem when they have an impact on the comprehensibility of the message or when they irritate the listener. Attempts have been made to grade errors in this respect (Johansson 1975). In language teaching, the situation is complicated by the fact that non-native teachers and native teachers evaluate errors differently: for instance, many foreign features of Finnish English that are noticed without exception by a native speaker remain systematically unheard by a Finnish teacher. Here we are not concerned with the characteristics of sounds only;

various elements in prosody, rhythm, intonation, pitch, and voice quality join in.

Pronunciation teaching has traditionally been concerned with the acceptable production of speech sounds. In communicative interaction, the roles of the speaker and the hearer alternate, and it may be more often the case that the communicative performance fails because of the hearer's inability to understand what the other party is saying. An idealised model of native speaker speech performance based on an approximation of received pronunciation (RP) is not sufficient for the teaching of receptive skills, because only a minority of native speakers of English use this variety and non-native speakers with different language backgrounds have accents of their own: there is a great deal of variation among native speakers of English, and there are not many who speak the way in which the language is described in textbooks. In this respect, pronunciation differs from morphology, syntax, and semantics, where it is mostly possible to tell what is acceptable. A certain part of what a non-native speaker says may sound strange to a native speaker, but he cannot often be sure whether it is really wrong or why it sounds strange.

Moreover, natural features of a fluent speech chain are mostly disguised by an unnaturally slow spoken form of RP. In natural varieties of speech, in any language, the speech chain includes a large number of simplifications and deletions, which make the chain divert from its ideal phonological representation.

It is an interesting aspect of human communicative interaction that what is included in the linguistic code may be seriously distorted phonologically but it still remains intelligible. As was pointed out above, the phonological representation is not sufficient alone for the interpretation of the message. Interpretation of messages is based on a complex of phonological, syntactic, semantic, and pragmatic cues embedded in the message and various sociolinguistic, situational, and personal information as well as varying amounts of experience and world knowledge. Production and reception are not reverse processes, mere mirror images of each other: perception of a chain of speech actually means parallel construction of what there is in the speaker's utterance by means of all available cues, linguistic and non-linguistic. If persons, such as married couples, who are interacting with each other have a great deal of common experience with mutual interactive situations, they often can extensively predict each other's interventions.

Non-native speakers are handicapped by the fact that they have to pay a great deal of attention to the surface phenomena of their speech production and speech reception. This means that they often sound too perfect. It takes a long time before learners gain the awareness as to when and where they can take liberties with the phenomena related to the chain of speech. It also requires a great deal of experience with actual situations where English is used in naturalistic communication before learners can tune themselves to the variety of cues that they need to be able to pick up the meaningful information and disregard those that are not necessary for correct interpretation.

III. CONTRASTIVE ANALYSIS AND CONTRASTIVE PHONETICS

The phonological systems of two languages differ in a number of ways (Lehtonen et al. 1977:9, Wiik 1965, 1966). The difference is *physical* when certain target language speech sounds are physically new to a learner (e.g. the English /θ, δ / are physically new to a Finn). The difference is *relational* when similar sounds in both languages are related to each other in a phonologically different way (e.g. [v] and [w] are allophones in Finnish, but in English they are different phonemes /v/ and /w/). When the distribution of similar sounds in both languages is not the same, the difference is *distributional* (in English the distribution of the dark allophone of /l/ is different from that of the Finnish /1/). A *difference in segmentation* occurs when phonetically similar fragments are found in both languages but they are segmented into phonemes in different ways (reduced vowels between consonants are in Finnish perceived as belonging, in a way, to the consonant segments, while in English they are perceived as vocalic ones, Fi [silimän] <silmän> 'of the eye' vs. E [sili mäen] <silly man>).

As is obvious on the basis of what has been said above, however, the contrasting of two languages cannot be a simple one-to-one equation between the best possible structural descriptions of the two, if we want to produce material for the purposes of language learning and teaching. There is a very obvious reason for this: many of the difficulties in language learning and language use in the area of pronunciation cannot be accredited to phoneme paradigms. What is necessary for us to be able to explain the reasons for the difficulties is a more profound view of language reception and production and of the actual operations that are needed when speakers are faced with the need to produce or receive chains of speech. Within this kind of approach, contrastive linguistics means the study of how people communicate in two or more languages and what the consequences are for language learners and foreign language users when the systems of the languages clash in foreign language learning situations or situations of foreign language use.

Most of the criticism of contrastive analysis has been concerned with its inability to meet its non-theoretical objectives (Lehtonen & Sajavaara 1984:86). This does not mean that the idea of contrasting languages for the purposes of language teaching is wrong. It is just that an analysis of parameters that are linguistic in the narrow sense of the term is not sufficient for the study of problems which involve a large number of elements that are not linguistic. As was pointed out very early by Fisiak (1971), products of theoretical contrastive analysis need not necessarily be applicable for practical purposes. In contrastive phonology in particular, most of the research has been concerned with linguistic entities such as distinctive features and segmentable elements of the speech chain, while in many cases the learner's problems lie elsewhere.

In addition to the linguistic codes being assigned their proper locations in the communicative processes across the languages to be studied, attention will have to be paid to the mapping of similarities and differences in the processes of communication, in the rules of interaction, and in the use of non-verbal means of communication in the two sociocultural settings. In this way the analysis reaches well beyond the confines of grammatical structures (including those of phonology) to deal with the ways in which messages are conveyed through the chains of communication in two or more languages.

The problem with grammars is that they are descriptions of structures and not of processes, while communicative interaction involves language in action, that is, processes which are language-bound. A phonological rule, irrespective of the theoretical approach adopted, describes a certain regularity in the structure of a language. It cannot be taken to be a model of the actual processes taking place in the nervous system of the language user. This is the basic reason why phonological rules cannot be used exclusively to predict all interference phenomena resulting from the collision of two languages in action. This does not mean that all previous work on misperceptions and problems of acquisition on the basis of traditional analyses of structures in two languages is useless or wrong: it is simply insufficient as a method to be used in the comparison of the entire systems of the languages and for the establishment of the actual contact between the systems. The phenomena that we are dealing with are dynamic (Sajavaara & Lehtonen 1980), and these dynamic phenomena do not take place in the structures but *in the nervous system of the language user* (in the 'mind' of the user).

Lehtonen and Sajavaara (1984:88) abstract a certain number of principles that can be used to find out whether a phoneme in one language is equivalent to a phoneme in another: cogency of similar letters; similarity of phonetic descriptions and conventions of transcriptions; use of phonological criteria; and perceptual similarity. They point out that all of these must be used to explain phenomena of a contrastive character, but they end up emphasizing the importance of perceptual processes, "the mechanism which is used to transform the linguistic information of the phonological segment string into the actual speech signal and the mechanism which is used by the listener to detect the corresponding phonological information".

One of the problems in the analysis of processes is the fact that the recognition and production of speech sounds do not proceed lineally from phone to phone. The cues necessary for the identification of single phones are spread out over a number of acoustic segments or a single segment can bear the cues for several successive segments. Detection of phonetic properties may also depend on higher-level constructs such as syllables and entire word structures. There is also evidence of retroactive reworking effects: information coming up later in the chain of speech is used to reorganize the information that has been received earlier. A fair amount of incoming information is received as percept skeletons which serve as "direct input to the lexical access and to the parallel phonological identification process" (Lehtonen & Sajavaara 1984:90-91). What this means is that the 'phonological' elements are established, 'heard', after the lexical elements have already been detected, and what enters the language user's awareness largely resembles the elements in the written variety of the language, ie. sequences of words.

> In normal fluent speech perception, lexical items are identified directly on the basis of acoustic cue information. If, however, the word is difficult, the identification proceeds via phonological categorization. Thus, in fluent perception the identification of the phonological form of the input signal is an auxiliary strategy which is automatically available if the cue pattern embedded in the input signal matches no items in the memory as activated in the context and the grammatical and other constraints derived from the preceding structures and discourse history. Phonological mediation is also needed in the recognition process in instances in which morphological decomposition is necessary for the recovery of the information embedded in the affixes of morphologically complex derivative word forms ... both of the channels are 'open' all the time ... the phonological process fades away simultaneously with the entering of a new input chunk.
>
> *Lehtonen & Sajavaara (1985:91-92)*

This 'dual code hypothesis' posits the identification of phonological segment strings as "a possible stage in a fluent perception process, but not obligatory, and not even one which functions under normal circumstances" (see also Foss & Blank 1980).

It is much more difficult to access the phenomena that take place in the processes of language production. Since the speaker has to be able to produce, to a degree at least, the same cues that the recipient needs for the processes of interpretation, and if the latter process works the way it is described above, a linear, sequential production of the necessary information is not possible.

The foreign language learner's exposure to his mother tongue has produced a feature detection system which makes it possible for him to exploit all parameters embedded in the sound waves such as "allophonic variation, coarticulatory variation, phonetic reduction, compensatory phenomena in phonotactic clusters, timing phenomena, and other types of phonetic variation" (Lehtonen & Sajavaara 1984:94). For the acquisition of a foreign language this detection system has to be reorganized, so that new perceptual caagories can be adopted that relate to the grammatical system of the new language. Before the system is fully functional, it is quite natural that there occurs various types of interference from the system previously acquired. It is obvious that a learner's phonetic processing is initially dependent on knowledge that has been picked up in first language contexts. It is however important not to exaggerate the role of interference on the phoneme level at the cost of other possible types of interference. It is also important to remember that the whole process of perception is, for the most part, subconscious, and the development of the new cueing mechanism takes place through a continuous process of completion and reorganization which gradually distances the system from that of the mother tongue. Since there is relatively little optionality in the area of phonological elements, it can be predicted that the degree of interference is the greatest in this level of linguistic analysis.

Below, some properties of the Finnish and English sound systems will discussed, and potential sources of errors in Finns' pronunciation of English will be described. The main body of the research work on the theoretical basis of contrastive analysis in general, and on contrastive phonology and phonetics in particular, was made at the beginning of the 1970s, primarily within the Jyväskylä Finnish-English Cross-Language Project (Sajavaara & Lehtonen (eds.) 1977, Lehtonen & Sajavaara (eds.) 1979). This project also produced a textbook of spoken English, aimed at Finnish students (Lehtonen et al. 1977). Not many studies have been reported later. Various aspects of prosody are discussed by Nevalainen 1990. A textbook of segmental phonetics, written for Finnish students of English, has also been published (Morris-Wilson 1992). Questions of the teaching of (English) pronunciation are also discussed in Iivonen & Nevalainen (eds.) 1998 and Nevalainen 1998.

IV. CONTRASTING SEGMENTAL PROPERTIES: VOWELS AND CONSONANTS

The English vowel sounds are relatively unproblematic for Finns, as was shown in an early contrastive study by Enkvist (1963) and the first contrastive phonetic study by Wiik (1965). The Finnish sound system includes eight vowels /a o u i e œ y æ/. All of them may be short or long. The quality of the vowels is not affected by the duration of the vowel as much as as it is in English. Short vowels, also in unstressed positions, have approximately the same quality as long and stressed ones (Heikkinen 1979). Some difficulties can be expected in learners' perception and production of duration and quality (Marjomaa 1985). This was already shown in Wiik's (1965) pioneering spectrographic study of Finnish and English vowels: his subjects had difficulties in detecting the distinction between the tense and lax vowel qualities in English or in perceiving the reduced vowel quality in /ə/.

The consonantal system of English may cause greater problems for Finns in spoken production (Tommola 1975, Moisio & Valento 1976, Paananen 1998). The learning of the stop system of English involves a number of difficulties. An obvious difference between the two systems is that originally there was no voice distinction between the Finnish stops, and the stops of the Finnish system were the voiceless ones /p t k/ only. The voiced counterparts were introduced through the adoption of loanwords, initially in written language. The alveolar /d/ was established first, from the nineteenth century, and /b/ and /g/ soon followed when the number of loanwords, such as *banaani* 'banana' or *byrokratia* 'bureaucracy', increased. Even today, the voiced stops have not been fully nativized and are heard in very formal speech varieties only. Dialectally, but also in everyday conversation, an unvoiced pronunciation of /b/ or /g/ is common. The situation with /d/ is more complex: in loan words in behaves like /b g/, while in standard Finnish it has been introduced word-internally in positions where it does not occur in dialectal or colloquial varieties. Partly because of their social history, the way in which the stop sounds are pronounced is a strong social marker: the voiced pronunciation of /b d g/ is prestiged and some types of the unvoiced pronunciation are rather heavily stigmatized.

It is rather obvious that the English stop system may present difficulties for beginning Finnish learners of English. The precise nature of the difficulties, however, was not properly understood before in a series of studies Suomi (1976, 1979, 1980; see also Hänninen 1979) examined the voice distinction in Finnish and English stops. Because of the rather recent introduction of voiced stops in Finnish, it was often argued that it was precisely these sounds that were difficult in English pronunciation for Finns: Finnish speakers' articulation was expected to shift towards the production of /b d g/ as unvoiced. Suomi showed convincingly, however, that the difficulty did not lie in the voicing of /b d g/ alone —as a matter of fact his subjects produced consonants that were 'too voiced'. For the most part, the difficulty seems to be derived from some other phonetic aspects of the distinction, such as production of aspiration in /p t k/ sounds, because aspiration does not occur in Finnish, and management of the durational differences involved, such as lengthening of vowels before stops that are perceived as voiced, or recognition of other differences arising from the phonetic context. The studies by Suomi illustrated successfully how the actual difficulties in the learning of English by Finns could not be predicted by reference to the results of a theoretical contrastive phonological analysis alone. He also made it clear that the complexity of phonetic features and contextual factors had to be considered as a whole.

Other types of consonants have been studied less systematically. Some problems of differentiation, and pronunciation, are to be expected as a result of the fact that there is only one sibilant sound, a voiceless alveolar /s/, in Finnish, in contrast to four sibilants in English. Finnish also lacks affricates, and therefore /ʤ/ and /ʧ/ can be expected to be difficult sounds. Similarly, there are no dental fricatives in Finnish, which means that those in English may be initially problematic. The other fricatives of English tend to be less difficult, but there may be some difficulties to perceive and produce the sounds that are equivalents to <v>: there is a fricative in English but a semi-vowel in Finnish. The English nasals and laterals do not present any major problems but some minor differences in pronunciation may appear, such as production of clear syllable-final /l/ sounds instead of 'dark' ones (Wiik 1966) or of a voiced lateral after a plosive where a voiceless one is required (Morris-Wilson 1992:109). As for the /r/ sounds of the two languages there is a marked difference in the standard pronunciation, even if both languages have only one phoneme: the Finnish /r/ is a fairly strong tremulant, while the English one is mostly produced as an approximant or a flap. However, Finnish speakers rarely use their native /r/ pronunciation in English (Morris-Wilson 1992:116).

V. PROSODY: CONTRASTING SYLLABIC, WORD-LEVEL, AND UTTERANCE-LEVEL FEATURES

Finnish is a quantity language. *Duration* is a distinctive feature for both vowels and consonants, resulting in word pairs like *tuli* 'fire' — *tuuli* 'wind' or *tuli* 'fire' — *tulli* 'customs'. In terms of phonology, Finnish is different in this respect from English, where the distinction exists for vowels only. The phonological quantity distinction is problematic for many learners of Finnish but it does not seem to be a problem for Finns who are learning English. But some difficulties may rise from the fact , pointed out above, that the English distinction between short and long vowels is also a distinction between tense and lax vowel quality or it may be a cue to imply a distinction between subsequent voiceless or voiced stops. For vowel sounds, Finns can be expected to produce a distinction based on duration only and not, or less, on quality. It is also interesting that even if duration plays such an important role in Finnish, Finns learn to observe the lengthening of vowels before 'voiced' stops only after the phenomenon is pointed out to them.

In Finnish *word stress* is regular and always located on the initial syllable, while secondary stresses fall on every second syllable after the initial stress . English word stress, however, has a distinctive function and can thus be placed on any syllable. As a result of this difference, beginning Finnish students of English may tend to move the stress onto the first syllable. Moreover, some phonetic differences in the realization of stress can be expected for the reason that stress is manifested by different complexes of phonetic features, such as duration, pitch, or loudness, in different languages. Errors made by Finnish speakers in the production of English stress are studied in Niemi 1979.

The *intonation* of Finnish learners of English has been studied by Hirvonen (1967, 1970) and, more recently, by Toivanen (1999). Finnish intonation lacks a systematic grammatical function. Thus the changes in intonation patterns are not used systematically to signal, for example, questions or statements. Hirvonen (1967, 1970) already indicated the obvious difficulties of Finnish students in the learning of the utterance-final rising intonation pattern in questions. He suggested that at least partly these problems may be due to difficulties in the 'unlearning' of the highly automatized processes of vocal fold regulation, since there is no sharply rising utterance-final intonation pattern in Finnish. Finnish intonation is also fairly level, lacking sharp rises or falls, and this general patterning, when transferred over to English while not incorrect or ungrammatical as such, may sound pragmatically or sociolinguistically inappropriate, contributing to a 'Finnish accent'. Toivanen (1999), for example, is of the opinion that it is important for Finns to learn to use the rising tone more often, partly for linguistic but also sociolinguistic and pragmatic reasons.

The prosodic phenomena also include a complex of utterance-level or even discourse-level features, variably referred to as eg. sentence stress, tempo, speech rate, rhythm or similar. All contribute to the impression of how the flow of speech is accentuated and how fluent it is (for theoretical considerations see Sajavaara 1987). An example of these phenomena is, for instance, the dichotomy in traditional phonetics between stress-timed and syllable-timed languages. English was classified as a stress-timed language, which implies that the duration of syllables is determined by stress: stressed syllables are longer and unstressed ones are shorter. In contrast, Finnish was considered to be a syllable-timed language, in which all syllables, regardless of stress, are of equal length. As has been recently shown by O'Dell and Nieminen (1998), Finnish does not fit this dichotomy but exhibits signs of both stress-timing and syllable-timing.

In the area of *speech rate*, Lehtonen (1979) showed that Finns were considerably slower than native speakers in both reading and (quasi)spontaneous speech tasks (cartoon description tasks) in English when speech rate was measured either in terms of the absolute reading time (sec/passage) or of words/minute in spoken narrative. Lehtonen argued that this was due to the transference of the native speech rhythm and the emphasis given by Finns to words as units of production. Similarly, he showed that Finns had a significantly higher number of pauses than native speakers in descriptions of cartoons. All these phenomena were expected to contribute to the impression of non-fluent speech performance. Finnish speakers' fluency in English has been also studied by Lehtonen and Koponen (1977), Lamminmäki (1979), and Koponen (1992), and speech rate by Marjomaa (1984).

Moreover, there are a number of studies that try to fathom the features of English as spoken by Finns at a more discursive or conversational level. These studies include an exploration of paralinguistic features (Saario 1980) which indicated that Finnish students were more subdued in their use of paralinguistic features than native speakers of English. Conversational patterns of Finns have been discussed, and the myth of the 'silent Finn' deconstructed, in two papers by Kari Sajavaara and Jaakko Lehtonen (Lehtonen & Sajavaara 1985, Sajavaara & Lehtonen 1997). In addition, the norms of English pronunciation teaching (Nevalainen 1998) and the intelligibility of different Englishes for Finnish speakers (Pihko 1997) have also been discussed.

VI. CONCLUSION

It is to be regretted that there does not seem to be much interest in Finland today to explore the cross-language problems in the areas of study where we are concerned with how speech chains are received and produced. Most of the research that is going on today takes place at universities of technology and is concerned with automatic speech reception and production.

Yet there is a great deal of work to be done before we are able to have a full picture of the phenomena involved, particularly if we are trying to consider the complex of phenomena from the viewpoint of communicative interaction and discourse. In such a context a great deal of the earlier work on contrastive phonetics and phonology may even look rather simplistic and trivial.

The psycholinguistics of speech reception and speech production is still rather undeveloped, which is why it is rather difficult to build up models of speech behaviour across languages. There is plenty of experimental research work to be done in this area.

It is no longer possible to make use of idealized native speakers as models of production, particularly in the teaching of English. We need more information about the ways in which different kinds of non-native and non-standard varieties of English are produced and received in true communicative situations.

BIBLIOGRAPHY

Enkvist, N.E. (1963). The English and Finnish vowel system: a comparison, *VIA* III, Turku: Suomen englanninopettajien yhdistys.Engelska språklärarföreningen i Finland, 44-49.§

Fisiak, J. (1971). The Polish-English Contrastive Project, *Papers and Studies in Contrastive Linguistics* 1, 7-13.

Hänninen, R. (1979). The voiceless-voiced opposition of English consonants: difficulties of pronunciation and perception in communication between native and Finnish speakers. In J. Lehtonen & K. Sajavaara (Eds.) *Papers in contrastive phonetics,* Jyväskylä Cross-Language Studies 7, Jyväskylä: University of Jyväskylä, 15-52

Heikkinen, H. (1979). Vowel reduction in the English of Finnish learners. In J. Lehtonen & K. Sajavaara (Eds.) *Papers in contrastive phonetics,* Jyväskylä Cross-Language Studies 7, Jyväskylä: University of Jyväskylä.

Hirvonen, P. (1967). *On the problems met by Finnish students in learning the rising interrogative intonation in English.* Turku: University of Turku.

Hirvonen, P. (1970). *Finnish and English communicative intonation.* Turku: University of Turku.

Iivonen, A. & T. Nevalainen (Eds.) (1998). *Vieraan kielen fonetiikan opetuksen näkökohtia.* Publications of the Department of Phonetics, University of Helsinki. [Approaches to the teaching of the phonetics of a foreign language]

Johansson, S. (1975). *Papers in contrastive linguistics and language testing.* Lund Studies in English 50. Lund: Gleerup.

Koponen, M. (1992). Glottal boundary markers and aspects of disfluency in Finnish English and an epilogue (from 1990 to 1992). Unpublished Licentiate thesis. Department of Englishm, University of Jyväskylä.

Lamminmäki, R. (1979). The discrimination and identification of English vowels, consonants, junctures and sentence stress by Finnish comprehensive school pupils. In J. Lehtonen & K. Sajavaara (Eds.), *Papers in contrastive phonetics,* Jyväskylä Cross-Language Studies 7, Jyväskylä: University of Jyväskylä, 165-191.

Lehtonen, J. & M. Koponen (1977). Signalling of morphophonological boundaries by Finnish speakers of English: preliminary findings. In K. Sajavaara & J. Lehtonen (Eds.), *Contrastive papers,* Jyväskylä Cross-Language Studies 7, Jyväskylä: University of Jyväskylä, 75-87.

Lehtonen, J & K. Sajavaara (Eds.) (1979). *Papers in contrastive phonetics.* Jyväskylä Cross-Language Studies 7. University of Jyväskylä.

Lehtonen, J. & K. Sajavaara (1984). Phonology and speech processing in cross-language communication. In S. Eliasson (Ed.), *Theoretical issues in contrastive phonology,* Heidelberg: Julius Groos, 85-99.

Lehtonen, J. & K. Sajavaara (1985). The Silent Finn. In D. Tannen & M. Saville-Troike (Eds.), *Perspectives on silence,* Norwood, NJ: Ablex, 193-201.

Lehtonen, J., K. Sajavaara & A. May (1977). *Spoken English: the perception and production of English on a Finnish-English contrastive basis.* Jyväskylä: Gummerus.

Marjomaa, I. (1984). Speech rate and quantity of vowels in English and Finnish. In H. Ringbom & M. Rissanen (Eds.), *Proceedings of the Second Nordic Conference for English studies*, Turku: Åbo Akademi, 39-47.

Marjomaa, I. (1985). It's not how long you make them —or is it? Englishmen and Finns producing one another's vowels, *CDEF 84: Papers form the conference of Departments of English in Finland*, Turun yliopiston englantilaisen filologian julkaisuja 7, Turku: University of Turku, 177-189.

Moisio, R. & E. Valento. (1976). *Testing Finnish school-children's learning of English consonants.* Jyväskylä Contrastive Studies 3. Jyväskylä: University of Jyväskylä.

Morris-Wilson, I. (1992). *English segmental phonetics for Finns.* Helsinki: Finn Lectura.

Nevalainen, T. (1990). Some aspects of convergence in Finnish and English prosody. In K. Wiik & I. Raimo (Eds.), *Nordic prosody*, Turku: University of Turku, 236-255.

Nevalainen, T. (1998). Which English? Englannin kielen ääntämisnormien kehitys ja variaatio. In A. Iivonen & T. Nevalainen (Eds.), *Vieraan kielen fonetiikan opetuksen näkökohtia,* Publications of the Department of Phonetics, University of Helsinki, 95-111. [Development and variation in the teaching of English pronunciation].

Niemi, J. (1979). Noun and noun phrase stress: a phonetic study of English supplemented with an error analysis using Finnish speaker-hearers 1: Production, *Language and Speech* 22, 221-235.

O'Dell, M. L. & T. Nieminen (1998). Reasons for an underlying unity in rhythm dichotomy, *Proceedings of the Finnic Phonetics Symposium,* August 11-14, 1998, Pärnu, Estonia, Linguistica Uralica 34, 178-185.

Paananen, M. (1998). Englannin kielen obstruentit ja suomenkielinen peruskoululainen. In A. Iivonen

& T. Nevalainen (Eds.), *Vieraan kielen fonetiikan opetuksen näkökohtia,* Publications of the Department of Phonetics, University of Helsinki, 113-126. [English obstruents and a Finnish-speaking comprehensive school pupil]

Pihko, M.-K. (1997). *"His English sounded strange": the intelligibility of native and non-native English pronunciation to Finnish learners of English.* Jyväskylä: Centre for Applied Language Studies, University of Jyväskylä.

Ringbom, H. (1987). *The role of the first language in foreign language learning.* Clevedon, Avon: Multilingual Matters.

Saario, A. (1980). Interactional activities in discourse between native and Finnish speakers of, English. In K. Sajavaara & J. Lehtonen (Eds.), *Papers in discourse and contrastive discourse analysis,* Jyväskylä Contrastive Studies 5, Jyväskylä: University of Jyväskylä, 57-82.

Sajavaara, K. (1987). Second language speech production: factors affecting fluency. In H.W. Dechert & M. Raupach (Eds.), *Psycholinguistic models of production,* Norwood, NJ: Ablex, 45-65.

Sajavaara, K. & J. Lehtonen (1980). Prisoners of code-centred privacy: reflections on contrastive analysis and related disciplines. In K. Sajavaara & J. Lehtonen (Eds.), *Papers in discourse and contrastive discourse analysis,* Jyväskylä Contrastive Studies 5, Jyväskylä: University of Jyväskylä, 7-26.

Sajavaara, K. & J. Lehtonen. (1997). The silent Finn revisited. In A. Jaworski (Ed.), *Silence: interdisciplinary perspectives,* Berlin: Mouton de Gruyter, 263-283.

Sajavaara, K., J. Lehtonen & A. May. (1977). *Spoken English.* Jyväskylä: Gummerus.

Sajavaara, K. & J. Lehtonen (Eds.) (1977). *Contrastive papers.* Jyväskylä Contrastive Studies 4. Jyväskylä: University of Jyväskylä.

Suomi, K. (1976). *English voiceless and voiced stops as produced by native and Finnish speakers.* Jyväskylä Contrastive Studies 2. Jyväskylä: University of Jyväskylä.

Suomi, K. (1979). The English /ptk/ - /bdg/ distinction: data and discussion. In J. Lehtonen & K. Sajavaara (Eds.), *Papers in contrastive phonetics,* Jyväskylä Cross-Language Studies 7, Jyväskylä: University of Jyväskylä, 53-91.

Suomi, K. (1980). *Voicing in English and Finnish stops: a typological comparison with an interlanguage study of the two languages in contact.* Turku: University of Turku.

Toivanen, J.H. (1999). *Perspectives on intonation: English, Finnish and English spoken by Finns* 1-2. Ph.D. dissertation. University of Oulu.

Tommola, J. (1975). *On the relationship between discrimination and production of English sounds by Finnish learners*. Publications in English Studies 5. Turku: University of Turku.

Wiik, K. (1965). *Finnish and English vowels: a comparison with special reference to the learning problems met by native speakers of Finnish learning English.* Annales Universitatis Turkuensis. Turku: University of Turku.

Wiik, K. (1966). *Finnish and English laterals: a comparison with special reference to the learning problems met by native speakers of Finnish learning English.* Turun yliopiston fonetiikan laitoksen julkaisuja 1. Turku: University of Turku.

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An Applied Interlanguage Experiment into Phonological Misperceptions of Adult Learners

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ABSTRACT

The aim of the experiment described here was to attempt to measure adult learners' percetual interlanguage in phonology. The implementation of a methodology involving context-less lists of English words selected for their potential phonological problems is described, and the way in which learners process words they are listening to is discussed. The results of 13 Korean adults' perceptions and misperceptions are analysed: the most misperceived vowels were /ɔ:/ and the short vowels /ʊ, ʌ, ɪ, ɛ, ɒ, æ/; consonants were mainly misperceived in word-final position, but /θ, v, b, p, r/ were misperceived to some extent in any position, and /s, j/ before the vowel /i:/; consonant clusters involving /f, l, r/ were particularly subject to misperception. These findings have implications for the design of English pronunciation teaching materials for Koreans.

KEYWORDS: interlanguage, phonology, perception, Korean learners.

INTRODUCTION

It is very encouraging to see a noticeable rise in interest in the phonological dimension of interlanguage studies in the decade or so since the publication of Ioup & Wertheimer (1987). However, it is also very noticeable that phonological studies of interlanguage have concentrated

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on learners' productive competence —how accurately and/or intelligibly they can pronounce— to the neglect of learners' perceptive competence —how accurately or efficiently they can decode the phonetic signals they receive from others. This discrepancy is found even in James (1998: 141): "we have dealt with only two of the four types of substance errors: we have not discussed misperceptions nor miscues at any length". Perhaps, this is because less research has been directed to these types of errors. What is reported here is an attempt to describe the misperceptions of one group of adults learning English.

The question that this experiment attempts to address is: how well does a learner interpret the phonological encoding of someone else's utterance —how well do they 'hear'? Efficient interpretation of an utterance heard depends on a multiplicity of factors: the hearer's level of competence in the syntax, lexis, discourse, pragmatics of the language (and culture, and situational context) involved, and the amount of exposure to, and experience in, that language. But it also depends on the hearer's level of phonological competence —not just of productive competence (saying) but also of processing competence (understanding). Thus the perceptive dimension of interlanguage phonology is a relevant issue in the language teaching/learning enterprise.

In a natural (ie non-experimental) language situation, interpretation of someone else's utterance engages the hearer's competences in every component of language. If we are to investigate specifically a hearer's *phonological* competence —as, for instance, in other contexts we isolate their *grammatical* competence —then a technique needs to be developed that isolates a learner's competence in phonology and does not involve any contribution from their competence in the other components of language.

One such technique might be to use nonsense items that capture a range of phonetic and phonological features in a systematic way. Its disadvantage is the sheer artificiality of the event.

The experiment reported here used real English words, but in isolation, with no context. Very often in a natural language event, the context supplies sufficient clues for the learner to overcome phonological deficiencies —which is fine! But to continuously operate with phonological deficiencies is inefficient —the hearer needs extra processing time to arrive at a suitable interpretation, and the learner will make mistakes, such as confusing *colour* with *collar* in an utterance like *We have shirts with this kind of colour, or with no colour at all (!).*

The selection of words in this experiment was the result of a contrastive analysis (CA). The phonology of Korean was contrasted with that of British (RP) English (Ahn, 1997), which yielded a list of phonological items likely to be problematical to Korean learners of English. Thus, for instance, the vowel / ɪ / was identified as a potential problem — not only in production, but also in perception— because no equivalent vowel is found in Korean, and the English contrast with / iː / is not matched by any similar contrast in Korean. We hypothesised that Korean learners would have difficulty in distinguishing between *heat* / hiːt / and *hit* / hɪt /. That was certainly borne out in the experiments that Ahn conducted into Korean productive competence; the 25 Korean learners achieved only a 65% rate of success in convincing British judges that they were attempting to pronounce a word like *hit* rather than *heat* (Ahn 1997:155). In this way, Ahn was able to investigate actual competence of phonological production. If she had used *hit* in a context like *You hit the egg with a spoon*, and the learners had pronounced *hit* as / hi:t /, the British judges would have used the contextual clues and would no doubt have succeeded in 're-interpreting' / hi:t / as *hit*, knowing that spoons do not *heat* eggs!

Table 1

	Word	Phonological features being tested	Subjects' responses		
1	hit	perception of / ɪ / in contrast to / i: /	hit	hit	hit
2	mass	/ æ / in contrast to / ɛ /	**must**	**nuts**	mass
3	spot	/ ɒ / in contrast to / ɔ: /	spot	**sports**	spot
4	bought	/ ɔ: / in contrast to / əʊ /	bought	Bought	bought
5	pull	/ ʊ / in contrast to / u: /	pull	Pull	**pool**
6	hut	/ ʌ / in contrast to / ɜ: /	**hot**	**Heart**	**hot**
7	contain	perception of / ə /	contain	Contain	contain
8	coin	/ ɔɪ / in contrast to / aɪ /	coin	Coin	coin
9	waste	/ eɪ / in contrast to / ɛ /	waste	Waste	**whist**
10	bite	/ b / initially	bite	Bite	bite
11	found	/ f / initially in contrast to / p /	found	Found	found
12	clear	/ k / initially	clear	Clear	**clip**
13	rope	/ p / finally	rope	**Roof**	**loop**
14	kilt	/ t / finally	kilt	Kilt	-
15	duck	/ k / finally	duck	Duck	**duct**
16	bulb	/ b / finally	bulb	**Bold**	**board**
17	mad	/ d / finally	mad	**Met**	mad
18	vague	/ g / finally	vaig	**Day**	**bay**
19	perch	/ tʃ / finally	perch	Perch	-
20	badge	/ dʒ/ finally	badge	Badge	-
21	tongue	/ ŋ / finally	tongue	**Turn**	-
22	tail	/ l / finally	tail	Tail	tail
23	reed	/ r / initially	read	**Lead**	**weed**
24	pure	/ p / initially	pure	Pure	**pour**
25	strife	/ f / finally	strife	Strife	**strike**
26	vest	/ v / in contrast to / b / initially	vest	**Best**	**best**
27	faith	/ θ / finally	faith	**Face**	**face**
28	breathe	/ ð / finally	breathe	**Breeze**	**breed**
29	hiss	/ s / finally	**heath**	**His**	**heath**
30	buzz	/ z / finally	buzz	**Bus**	buzz
31	looser	/ s / intervocalically	**Ruther**	Looser	looser
32	sheet	/ ʃ / initially	sheet	Sheet	sheet
33	leisure	/ ʒ/ intervocalically	leisure	Leisure	leisure
34	claps	/ k / initial cluster	claps	Claps	-
35	sphere	/ sf / initial cluster	sphere	**Sheer**	-
36	let's	/ ts / final cluster	let's	let's	-

Ahn also conducted a small 'pilot' experiment into the Korean learners' perception of a set of English words articulated by an educated British speaker with a near-RP accent. The following 36 items were chosen to test their ability to interpret correctly the phonological features detailed in Table 1. The table also indicates the measure of success of the three subjects who participated; **bold** indicates a failure to interpret correctly.

The subjects were played a recording of the 36 items and were asked to write down the word they thought they heard. In the case of no.1 *hit*, as it happens, all three wrote down the correct word, but in the case of no.2 *mass*, only Subject 3 interpeted it correctly, while Subject 1 interpreted it as *must* and Subject 2 as *nuts*. This was not regarded as a spelling test; hence the mis-spelling of *vague* as **vaig* still indicated an accurate case of perception. Homophonous spellings of *waste, reed* were also, obviously, acceptable. 'Invented' words like **Ruther* for *looser* are particularly revealing.

The sample is, of course, too small to generalize from, especially as Subject 3's failure to record 7 items would skew any attempt at doing so. Nevertheless, some patterns of perception and misperception do emerge: whereas all 3 perceived *hit* correctly, none of them identified *hut*, or *hiss*. However, before I venture into further discussion, and before I present the findings of a fuller experiment, it would be worthwhile reviewing the way a listener processes items from a word list.

I. PROCESSING ITEMS FROM A WORD LIST

A word list is, admittedly, not a genre typical of natural, spontaneous, spoken discourse, except as a way, for instance, of checking or counting the presence of individual people, or such things as the availability of goods in stock; there are, thus, only occasionally, situations in which a list of individual words is an appropriate form of discourse. However, for the purposes of investigating phonological competence it is an invaluable tool, because the individual items in a list are divested of any meaningful context, so that an awareness of grammar, lexis, discourse management or any message cannot interfere with or distort the data. Orthographical interference can be reduced to a minimum by careful selection of the items.

Although the use of a word list in (non-experimental) spoken discourse may not be common, when it does occur, it does have a meaningful context, either formally (eg alphabetically) or semantically (the actual subject matter). But the kind of word list envisaged for phonological investigations must be seen as having no such meaningful context, ie it is composed solely on phonological criteria which are not revealed to the subjects.

If a listener's phonological competence matches that of the speaker who performs the word list, no problem with interpretation is expected —assuming also that there is no external interfering noise. Thus, for the sake of argument, an RP listener will be expected to have no phonological problem in interpreting a British RP speaker. Their phonological competence is identical: the system of phonemes, their realization, distribution and selection in specific lexical items, and word prosody.

If a listener's phonological competence does not match that of the speaker, the degree of intelligibility depends on the degree of divergence. The divergence may be systemic (eg presence/absence of /ʌ/), realizational (eg /u:/ as [u:], [ʊu], [ʉ:], [ʉu], etc), distributional (eg presence/absence of / j / in *beauty*), lexical (eg /æ/ or /ɑ:/ in *glass*), or prosodic (eg stress placement in *inquiry*). The listener's knowledge about the language variation possibilities is then engaged in the process of interpretation. A single point of divergence requires a minimal effort at interpretation; on the other hand, multiple points of divergence in a combination of all categories will produce an enormous hindrance to intelligibility. This latter situation is not infrequent even amongst native speakers of the same language who nevertheless employ very different accents. (Personal anecdotes will no doubt abound in the minds of many readers.)

If either the listener or the speaker are not native users of the language, then either perception or production is likely to be adversely affected by the phonological 'filter' of the native language(s). The degree of effectiveness is directly related to the level of phonological competence.

If neither the listener nor the speaker are native users of the language, two filters will be in operation. Jenkins (1995, 1996, 2000) provides excellent examples of this situation. One such is of Japanese and Swiss German learners of English engaged in a task in a language school, in which one sought to describe to the other the content of a single picture which the other then, on the basis of the given information, had to identify from a set of six similar pictures. They were of upper intermediate/lower advanced ability. On one occasion, the listener (Swiss German)

> ... had problems in completing the task successfully because the speaker told him that in her picture there were 'three / led / cars'. This was borne out by the follow-up discussion (also recorded), where the following exchange took place:
>
> A: I didn't understand the let cars. What do you mean with this?
> B: Let cars? [very slowly] Three red / red / cars
> A: Ah, red.
> B: Red / red /
> A: Now I understand. I understood car to hire, to let.
> Ah, red, yeah I see.
>
> This breakdown in communication occurred even though only one picture contained any cars, the cars were red and there was no evidence to suggest that they were for hire.
>
> *Jenkins (1996:36)*

The Japanese phonological filter had produced [led] for / red / and the Swiss German filter had perceived the [led] as [let] —and this despite the context!

The process of interpreting an item read out aloud from a word list relies very heavily on matching phonological competences; but other factors may come into play too, such as the listener's assessment of the likelihood of an item (eg "It sounded like *forced,* but I bet it was supposed to be *first*"), and the tendency to try and find some meaningful connection with other items in the list (eg if *chick* followed *chest*, a listener might be tempted to interpret [tʃɪkʰ] as "obviously meant to be /tʃi:k/)". These lexical, non-phonological interpreting processes show the importance of care in the selection and sequencing of items.

The listener receives the speaker's signal, interprets it according to their own phonological competence and attempts to match it to the mental spoken form of an item in their own lexicon. If the listener and speaker share a common phonology and lexicon, an interpretation can be confidently assessed as correct. A possible exception involves the case of homonyms and homophones: the signal /raɪt/ might be interpreted as *right* (= not left) or *right* (= not wrong), or as *rite*, *write*, or *wright.* If, on the other hand, the hearer and speaker share a common phonology but not a common lexicon, the listener might either interpret a signal as an unfamiliar lexical item,eg "/mɑ:ˈmɔ:rɪəl/? I don't know this word!"; or might attempt a re-interpretation to find a familiar item, eg "/mɑ:ˈmɔ:rɪəl/? I suppose they mean *memorial*".

If the listener and speaker do not share a common phonology, but do share a common lexicon, the amount of processing depends on the degree of divergence, eg the signal /glæs/ will be interpreted as /glɑ:s/, or vice versa. On the other hand, a signal like [flʌɾʔn] might not be comprehended at all.

If either the listener or the speaker, or both, operate an interlanguage phonology through the filter of their mother tongue, then the scope for misperceptions and misinterpretations increases; the extent of potential misperceptions depends on the level of the respective interlanguage competences. For example, a Korean beginner learning English might well fail to distinguish /θ/ from /s/ at all; but an intermediate learner might have established the /θ~s/ contrast in initial and medial position, but not yet in final position. The interpreting process, however, is likely to be hampered not only by phonological mismatching but also by a restricted lexicon. For example, the signal [veɪg] is provided; the hearer's phonology might not recognize the initial / v / but perceives it as [b]; however, /beɪg/ does not match anything in their lexicon, and as they puzzle over the wrongly perceived signal, they search for the nearest matching item and might find *bay.* If the search requires more than the critical period of the 5 seconds for which the brain can retain an accurate acoustic image of an unfamiliar item (Rivers, 1964:106, Dodson, 1967:19), then the processing loses the acoustic image and resorts to other strategies like guessing. In such a case, a segment originally and clearly perceived as [g] is abandoned in favour of establishing a meaning to the item as a whole. However, sometimes the guessing by the language learner reveals a strategy akin to that of a native speaker who assumes that they have encountered a new unfamiliar word ("*Ruther*"? I don't know this word, but I suppose it must exist in the target language").

II. EVIDENCE OF MISPERCEPTIONS IN THE TRIAL EXPERIMENT

In the trial experiment reported by Ahn (1997), there is evidence of phonological mismatching, re-interpretation within an interlanguage lexicon, the invention of unknown words, and judgment-refusal.

II.1. Vowels

The vowel /æ/ was mistaken for /ʌ/ by two of the subjects. This might be because the phonetic realization is typically more open, [a], in UK than in USA, which is the accent more current in Korea. Not recognizing the closer, American, vowel might have led to a perception of a different vowel altogether. Furthermore, there is considerable evidence of indeterminacy in the judgements of all 3 subjects of /ʌ/ itself, cf. *hot* and *heart* for *hut*; *bold* and *board* for *bulb*; and *turn* for *tongue*.

For one subject, there is also a misperception between /ɒ/ and /ɔ:/, cf *sports* for *spot.* Although all 3 subjects perceived /ɪ/ in *hit*, there was clearly less confidence with the /ɪ/ in *hiss*. The final /s/ may well have been a distraction; /s/ does not occur in word-final position in Korean.

One subject perceived /eɪ/ as /ɪ/, cf. *whist* for *waist;* but the overwhelming evidence in the rest of the experiment suggests that this diphthong does not usually cause a problem, cf. the all-correct perceptions in *contain*, *vague, fail* and *faith.* That same subject, alone, perceived /ɪə/ in *clear* as [ɪ].

One subject misperceived /ʊ/ as /u:/ (*pool* for *pull*) and two /əʊ/ as /u:/, but in the latter case, lexical re-interpretation may have played a role.

The evidence suggests that the main problems that the Korean subjects had in perceiving the vowels of British RP might be amongst the short vowels, particularly /ʌ/ and /æ/ and to a lesser extent /ɪ, ʊ, ɒ/. There seems to be no problem with /ɛ,ə/ and relatively few problems with long vowels and diphthongs.

II.2. Consonants

The misperceptions of consonants in initial position were confined to /l, r, v/ and the clusters /pj, sf/. Initial /l/ was mostly well perceived, cf. *lets*, *leisure, claps* and *clear* and, for two of the subjects, *looser*. /r/ was slightly less well perceived: twice as /l/, once as /w/; in a cluster, there appeared to be no problem, cf. *strife*, *breathe.* In fact the main problem was /v/: two of the three subjects misperceived it, mainly for /b/, on both occasions, the items *vague* and *vest.*

Of the clusters, one subject failed to recognize /j/ in *pure,* and two failed with /sf/ in *sphere*.

Only one consonantal misperception was recorded in intervocalic position,but the data is unfortunately very slight.

The major problem was the final position. All six English plosives produced problems; but of the nasals, only /ŋ/, and even that might have been the result of lexical re-interpretation, cf. *turn* for *tongue,* on account of a misperception of the vowel; but the fricatives were very poorly perceived, except when they combined with a plosive in a final cluster. The most serious problems were with /θ,ð,s/; as noted above, the Korean /s/ does not occur in final position.

The evidence points unmistakably to obstruents in final position as the greatest problem for Koreans listening to English, and to a lesser extent to the liquids and /v/ in initial position.

II.3. Re-interpretation within an interlanguage lexicon

As described above, a non-native listener receives a phonological signal through a mother tongue filter and if the filtered perception does not immediately match an item in the current interlanguage lexicon, a second attempt at interpretation follows. Evidence of this appeared in this data. For example, the /æ/ of item 2, *mass*, is perceived as /ʌ/; there is no /mʌs/ in the lexicon, and so an alternative is sought. Final /s/ is particularly vulnerable to misperception, as we have seen, and so the indeterminate nature of its perception allows the listener a degree of freedom for re-interpretations. The result for one subject is a re-interpretation to *must*, and for another subject a re-interpretation that is even wider from the target, *nuts*. Presumably, in the similar case of *met* for *mad,* /æ/ is misperceived as /ɛ/; there is no /mɛd/ in the lexicon, and so the final /d/ is re-interpreted as /t/; in universal terms, this /d/ is doubly marked (being both final, and voiced) and is thus vulnerable to re-interpretation.

This process seems to explain *turn* for *tongue*, *clip* for *clear* —there is no /klɪ/ in the lexicon, and so a final consonant was invented— and, more interestingly, both *roof* and *loop* for *rope*. The evidence suggests first a misperception of the vowel, leading to a first attempt at interpretation as /ru:p/ which fails, and then a second attempt; for one subject, the vulnerable initial liquid allowed an interpretation to /l/; but for the other, the vulnerable final obstruent allowed an interpretation to /f/, clearly a case of over-correction. Perhaps the prominent aspiration of English /p/ contributed, as quite possibly the prominent aspiration of /t, k/ lead also to interpretations of *spot* as *sports*, and *duck* as *duct*.

The actual order of this re-interpretation process is not always clear. In item 29, *hiss*, did the /ɪ/ as /i:/ trigger the process, or the / -s/ as / -θ/? It is difficult to say as there is neither a /hi:s/ or a /hɪθ/ in the lexicon. Indeterminancy between /θ/ and /s/ is evident also in the invented **Ruther* for *looser* (is that, perhaps, a Korean pronunciation of *Luther*?) and in the interpretation of *faith* as *face.*

Bulb, item 16, proved interesting too. The highly vulnerable /ʌ/ was perceived by one subject as /əʊ/; there is no /bəʊlb/ (or even /bəʊlv/) in the lexicon, so *bold* is chosen. The perception of /ʌ/ as /ɔː/ led another subject to search for a non-existent /bɔːlb/ and finally settle for *board*. The vulnerability of doublely marked final voiced plosives (in universal terms, viz /d/ above) is confirmed also by an interpretation of *vague* which ignores the final /g/ altogether.

II.4. judgement-refusals

Subject 3 offered no interpretation of the items *kilt, perch, badge* and *tongue,* and the final three items *claps, sphere* and *let's*. There is unfortunately no opportunity for consultation with him, and thus one is left to one's own speculations. Maybe *kilt* was simply unknown to him. Maybe he lost concentration for a run of items (19 to 21) or even lost heart (the final three items)! But it is noticeable that six of the seven items contain vowels that a CA predicts as difficult, five contain clusters, which Korean does not in any case allow, and two contain affricates in a position, i.e. final, not permitted in Korean.

III. EVIDENCE OF MISPERCEPTIONS IN A SECOND EXPERIMENT

The author conducted a similar experiment but with a much more comprehensive word list and a larger sample, 13 subjects, who matched the age and academic background of the subjects in Ahn's experiment. However, in this experiment, the word list was not recorded, but read out aloud in their presence; it was, however, the same speaker in both experiments, with an accent close to British RP. The speaker stood behind the subjects so that they could not see lip movement and thus gain a visual clue on labial and rounded articulations; in that way the subjects were compelled to rely solely on their auditory impressions. One clue of a grammatical nature was offered in the case of the item *looser*; it was glossed as "That is, more loose".

There was, however, as noted above, a much more comprehensive list of words, extending the list to 63 items, in order to include every British RP vowel and every consonant in a variety of environments: initial, intervocalic, final, and in initial and final clusters. The experiment was conducted in two sessions; this reduced the strain on the subjects. (Regrettably, three subjects went missing in the second session, items 39 to 63; their absence is duly taken into account in the statistical analysis).

The author took the precaution of obtaining a control on the intelligibility of the speaker's accent by having a native speaker but with a different accent (educated Welsh English accent) as an additional 14th subject. That subject's written responses tallied entirely with the speaker's word list. They are, obviously, excluded from the following analysis.

The results of the experiment are given in summary form in the table below.

Table 2: Korean perceptions of an oral English word-list (second experiment)			
	Word	**Correct Perceptions**	**Misperceptions (with numbers of subjects)**
1	hit	9/13	Heat (2), hats (2)
2	mass	3	Math (8), maps, must
3	spot	10	Sport (3)
4	bought	2	Boat (8), boat/bought (2), board
5	pull	5	Pool (6), full, fool
6	hut	1	Heart (4), hot (3), hat (3), hurt (2)
7	contain	13	
8	coin	13	
9	waste	12	Raised
10	bite	11	Bites, *vite
11	found	12	pound
12	clear	13	
13	rope	10	loaf (2), roof
14	kilt	5	guilt (3), cult (2), kelt, killed, keep
15	duck	6	dark (5), dock (2)
16	bulb	4	verb (3), *volve (4), valve, *Bauber
17	mad	10	*med, man, *muz
18	vague	12	*bage
19	perch	9	purg, *furch, *furture, punch
20	badge	11	buzz (2)
21	tongue	12	turn
22	tail	13	
23	reed	13	
24	pure	12	- (1)
25	strife	10	stripe (2), *stright/*strift
26	vest	7	vast (4), vat, best
27	faith	10	face (3)
28	breathe	5	Breed (4), bleed, breeze, grieve, *brive
29	hiss	3	heath (6), his (2), *hith, *het
30	buzz	9	Bus, *burse, verse, *vuzz
31	looser	5	Luther (5), *Ruther, *Rusa, loose
32	sheet	12	shit
33	leisure	12	*reiser
34	claps	4	collapse (2), clubs (4), *clabs, clasp, *crapse
35	sphere	3	spear (9), spin
36	let's	13	
37	flute	11	fruit (2)
38	frame	9	flame (4)
39	goal	6/10	girl (2), gold, gull
40	thick	7	sick (2), seek
41	share	10	
42	zeal	9	Zero
43	those	9	Though
44	seep	0	Sip (3), ship (3), thief (3), seek
45	nought	1	Note (7), knot (2)
46	chart	10	
47	jug	4	Jog (3), John, jar, *zeck
48	robe	5	Rove (2), road, rude, rogue
49	dove	6	duff, *durf, dub, dull
50	mesh	0	Mash (10)
51	beige	0.5	*bage(2),badge(2),*bedge,*veidge,*baze,*basy,*bazy(0.5),vain

52 yeast	0.5	East (9.5)
53 defend	5	Depend (5)
54 ladder	1	Rather (6), lather, leather, latter
55 anger	10	
56 stable	9	Steven
57 useful	9	Usual
58 rival	9	Live
59 breezy	2	Breeze (4), *bleeze, *breage, bridge, *reasing
60 bury	3	Very (3.5), vary (0.5), *barry (2), *bary
61 pilot	9	Tired
62 youthful	1	Useful (8), -(1)
63 composure	1.5	Composer (8.5)
* invented, non-English words, beyond recognition		

III.1. Vowels

The vowel /i:/ was represented in seven items: *reed, breathe, shete, zeal, seep, yeast, breezy.* Thus the perception of it was tested 79 times, i.e. 13 subjects heard each of the first three words and 10 each of the remaining four words. On only 7 occasions was the vowel misperceived, and so the accuracy of perception was 72/79 (91.1%).

The vowel /ʌ/ figured in five items: *hut, duck, bulb, tongue, buzz,* by 13 subjects, and *jug* and *dove* by 10; hence in 85 instances. Only 44 judgments were accurate; there were 9 judgments of it as /ɑ:/, 9 as /ɒ/, 8 as /ɜ:/, 4 as /æ/ and 1 as /ɔ:/. In this case, accuracy of perception was measured at 44/85 (51.8%).

The vowel /ʊ/ figured in only one item. This might be construed as a regrettably low level of selection planning, but since the original intention of Ahn's research had been to test production, not perception, a single token was considered sufficient for that purpose. Thus there were only 13 perceptions available for the one item *pull.* It is significant, however, that only 6 subjects perceived it accurately (46.2%).

Despite the unevenness of the distribution of the vowels in the word list, it is of great interest to note the variation in the degree of perceptual accuracy, as in Table 3.

Table 3: Perceptions and misperceptions of the English vowels

Vowel	Total no. of judgments	No. of correct judgments	Percentage Correct	Main Misperceptions (%)
i:	79	72	91.1	ɪ (8.9)
ɪ	49	33	67.3	i: (24.5), ɛ (4.1), æ (4.1)
ɛ	69	50	73.2	æ (26.8)
æ	72	62	86.1	ʌ(11.1), ɛ (2.7)
ɑ:	10	10	100	
ɒ	13	10	76.9	ɔ: (23.1)
ɔ:	23	5	21.7	əʊ (69.6), ɒ (8.7)
ʊ	13	6	46.2	u: (53.8)
u:	46	45	97.8	1 refusal

ʌ	85	47	55.3	ɒ (15.2), ɑ:(11.8), ɜ: (10.6), æ (4.7)
ɜ:	13	12	92.3	ʌ (7.7)
ə	56	56	100	
eɪ	98	94	95.9	æ (2.1)
əʊ	53	48	90.1	u: (3.8), ɜ: (3.8)
aɪ	46	46	100	
aʊ	13	13	100	
ɔɪ	13	13	100	
ɪə	26	25	96.2	ɪ (3.8)
ɛə	10	10	100	
ʊə	13	12	92.3	1 refusal

The following table identifies those English vowels that Korean listeners of English had most difficulty in perceiving accurately from an educated British speaker.

Table 4

Vowel	Misperception (%)
1. ɔ:	78.3
2. ʊ	53.8
3. ʌ	44.7
4. ɪ	32.7
5. ɛ	26.8
6. ɒ	23.1
7. æ	13.9

The evidence largely bears out the result of the pilot experiment in that it is the short vowels (but not the weak vowel /ə/) that are the trickiest in perception terms. However, one unexpected difference was the degree of troublesomeness of the vowel /ɔ:/. Only 2 of the subjects interpreted /bɔ:t / correctly as *bought*; 2 were undecided between *bought* and *boat* (i.e. 2 x .5 correct judgments); 1 interpreted the signal as *board*, but at least perceived the vowel correctly; and 8 perceived the vowel as /əʊ/ *(boat).* Only 1 succeeded in interpreting / nɔ:t / correctly; 7 perceived the vowel as /əʊ/ (*note*) and 2 as /ɒ/ (*knot*).

The vowels /u:, eɪ, ɜ:, əʊ, ʊə, ɪə, i:/ were very well perceived, there being only occasional isolated cases of misperception for each. All-correct judgments were recorded for /ɑ:, ə, aɪ, aʊ, ɔɪ /.

The evidence from the two experiments suggests that the major discrimination problems for Korean learners of British English are as follows, and that pronunciation pedagogical strategies need to be concentrated on:

1 /ɔ:/ in contrast with /əʊ/
2 /ʊ/ in contrast with /u:/

3 /ʌ/ in contrast with /ɒ, ɑ:, ɜ:, æ/

4. /ɪ/ in contrast with /i:, ɛ/

5 /ɛ/ in contrast with /æ/

6 /ɒ/ in contrast with /ɔ:/

7 /æ/ in contrast with /ɛ, ʌ/

(The difference in British and American accents no doubt accounts for 5 and 7 above, and may, possibly, contribute to 6 as well.)

It should also be noted, however, that the fact that the long vowels (except /ɔ:/), the diphthongs and /ə/ posed no real problems in **perception** is no guarantee that they pose no problem in **production**.

III.2. Consonants

The CA set up certain expectations, since

i) no equivalents of /f, v, θ , ð, z, ʒ/ are found in Korean,
ii) [l] and [r], and [s] and [ʃ], are allophonic variations of a single phoneme respectively,
iii) Korean [l/r] does not occur initially,
iv) English /b, d, g, dʒ, s, r/ do not have identical articulatory characteristics with their nearest equivalents in Korean;
v) Korean final obstruents are limited to unaspirated/unreleased varieties of /p, t, k/ and
vi) Korean does not allow consonant clustering in final position, and only limited clustering with [j] and [w] in initial position.

The data is still not quite as comprehensive as we might wish, since evidence is lacking /k, ð, tʃ, dʒ/ in medial position. However, /k/ does not seem to present much of a problem in either initial or final position, nor the other voiceless plosives in medial position. The affricates do not appear to present much of a problem in either initial or final position, and interestingly, do not appear to be much confused with each other. /ð/ is, perhaps surprisingly, not a problem in initial position, although it is easily confused with /d/ in final position; however, it replaced /d/ in intervocalic position in 80% of cases, and so it could possibly be argued that /ð/ itself would not constitute a problem in that position. /h, j, w/ are not treated separately in medial position, since when they do occur there, they usually act as onsets to stressed syllables. A comprehensive review of the perceptions of single consonants appears in Table 5.

Table 5: Percentage of correct perceptions of single consonants in all experiments			
	Initial	Medial	final
p	87.2	100	69.2
b	81	90	50
t	100	100	97.1
d	100	10	90.6
k	100	n/a	96.1
g	100	100	80.8
f	96.9	50	75
v	81.3	100	60
q	70	10	68.75
ð	100	n/a	37.5
s (s + i)	40	.69.2	21.9
z	100	80	80.8
ʃ	100	n/a	100
ʒ	-	63.5	25
tʃ	100	n/a	87.5
dʒ	90	n/a	93.75
h	100	-	-
m	100	100	100
n	100	100	100
ŋ	-	100	87.5
l	91.75	90	94.2
r	86.5	100	-
j (j + i:)	5	-	-
(j + u:)	95	-	-
w	93.75	-	-

Clusters, it must be conceded, have not been handled as systematically as single consonants. Table 6 reviews the evidence from both experiments, but not all combinations have been tested, and fewer final consonants than initial. Nevertheless, some generalizations are included in the discussion below.

Table 6: Percentage of correct perceptions of clusters in all experiments	
initial	Final
st 100	st 97.6
sp 100	ps 62.5
sf 23.1	ts 100
br 84.6	lt 87.5
kl 90.6	lb 31.25
fr 69.2	nd 100
fl 84.6	
pj 87.5	

One major pedagogical implication is the need to concentrate discrimination exercises on consonantal contrasts in final position. Table 7 clarifies.

Table 7: Percentage of correct perceptions of all single consonants in all experiments		
initial	Medial	final
87.75	78.91	71.28

Detailed discussion now follows

a) *plosives*: the voice distinction in English plosives is well perceived despite the very different plosive system in Korean; the only troubles appear in final clusters: /p/ is occasionally mistaken for /b/ in /ps/, and /t/ for /d/ in /lt/. The major problem is the susceptibility of /p, b/ suffering from an over-correction tendency of some learners with /f, v/. Also, some learners have difficulty in hearing the presence of final /g/, and others over-react to the release of /p, t, k/ in final position, which sounds unduly prominent to Korean ears, yielding /ts/ for final /t/, for instance, in a word like *hit* (see Table 2).

b) *affricates*: again, the voice distinction in English affricates is well perceived. Some learners show indeterminacy between /dʒ/ and /z/ in initial and final positions. Again, some learners over-react to affricate release in final position, but in this case imagine an extra unstressed syllable.

c) *fricatives*: generally speaking, the voice distinctions in English fricatives cause no problems. /f, v/ are not confused with each other but with /p, b/ initially, medially, finally and in clusters. Similarly, /θ, ð/ are not confused with each other, but /θ/ with /s/ (not /t/), in all positions, and /ð/ with /d/ (not /z/) in medial and final positions; note the asymmetry. /s/ is confused with /θ/ (not /z/) in all positions, but also with /ʃ/ in initial position before front close vowels. /z/ is perceived well in initial position, but in final position, some learners either do not hear it or confuse it with /s/; final unstressed /-zi/ causes considerable problems: for many the /i/ is treated simply as the completion of a /z/ or /dʒ/ articulation.
/h/ causes no problem.

d) *nasals*: There are no major perception problems with English nasals.

e) *liquids*: /l/ and /r/ are generally distinguished very well by adults with some exposure to English. This, however, might be the result of intensive practice at school. In initial position, they are heard quite distinctly, with only occasional evidence of indeterminacy. In medial position —where Korean [r] occurs— English /r/ is no problem at all, and /l/ only occasionally. In final position —where Korean [l] occurs— English /l/ is no problem, although it may sometimes not be heard. The more significant problems in perceiving the distinction between /l/ and /r/ lie in their membership of initial clusters; the percentages for correct perception of /br, fr, fl, kl/ are noticeably lower than when they appear as single consonants. (British /r/ does not occur finally, either singly or in clusters; this eliminates a problem that might occur in the perception of North American final /l/ and /r/ ; however, Borden, Gerber & Milsark (1983, 1985) confine their attention to initial position only, even in a North American context.)

f) *semivowels*: the English semivowels /j, w/ are generally well perceived, although there may be occasional confusion between /w/ and /r/. However, there is a major problem when /j/ is followed by a front close vowel; it appears simply not to be heard at all.

III.3. Re-interpretation within an interlanguage lexicon

The subjects in the second experiment also used the strategy of lexical re-interpretation as a result of segmental misperception: it is often the case that a single phonological misperception leads to a lexical re-interpretation that is a further remove from the original signal. Thus, as in the trial experiment, the perception of /æ/ as /ʌ/ led one subject to imagine a closing /t/: *mass* heard as *must*; it led two to interpret *badge* as *buzz*, and another *mad* as the invented **muz*. /æ/ was also perceived by one subject as /ɛ/: *mad* heard as **med*. The /ʌ/ was, again, perceived by one subject as /ɜ:/ yielding *turn* for *tongue*. /ɪə/ also, once again, was perceived by one subject as /ɪ/: *sphere*, with the additional problem of /sf- / highlighted above, was heard as *spin*, with an imagined /n/. *Hiss* produced again the same varieties as in the trial experiment. *Rope* was interpreted as *roof* and *loaf*; in the trial experiment, as *roof* and *loop*.

There were also additional instances of re-interpretations. One subject perceived the final /-st/ in *waste* as / -zd /; since there is no /weɪzd/ in the lexicon, it was re-interpreted by switching the initial /w/ to /r/; such a substitution had occurred in the trial experiment, viz *reed* as *weed*. The /ɪ/ of *kilt* was perceived by one subject as /i:/; but since there is no /ki:lt/ or /ki:t/ in the lexicon, the vulnerable final plosive was re-interpreted as /p/ to yield *keep*.

The case of *grieve* for *breathe* is interesting. It appears that one subject interpreted the final [ð] as [v]; however, /bri:v/ does not match anything in their (interlanguage) lexicon, and as they puzzle over the wrongly perceived signal, they match it with *grieve*. No doubt the initial /b/ was originally perceived correctly, but yields to /g/ under the pressure of seeking a matching lexical item. Another subject, however, interpreted *breathe* as *bleed*; this might have come about as a first attempt at /bli:ð/, which does not match anything in their lexicon, and was then re-interpreted as *bleed*, since a good deal of indeterminacy exists over /bl/ and /br/ as initial clusters.

The case of initial /b/ in *bulb* and *buzz* is interesting. Apart from the case of *grieve*, the only alternative perception to /b/ in any of the items (*bought, bite, badge, breathe* as well as *bulb* and *buzz*) is /v/. However, no /v/ is perceived in *bought* or *badge,* presumably because there is no **vought/voard* or **vadge/vudge* possibility in the lexicon; in the case of *bite*, there is no **vite* either, although one subject invented it, presumably as a back formation from *vital* or *invite.* The /v/ alternative only emerges with *bulb,* where it does very strongly in initial position (8/13) and final position (5/13), and with *buzz* (2/13). The problem seems to derive from the vowel /ʌ/ in both cases; if /ʌ/ is perceived as /ɒ/, a lexical search for **bolb* fails; a second search leads to a re-interpretation which yields **volve*, presumably a back formation from *involve* etc.. The conjectured processes are displayed in the following table.

Table 7

Perception of /ʌ/ as	Failed first lexical search	Re-interpretation	Number of cases
/ɒ/	*bolb	*volve	4
/ɜ:/	*berlb	Verb	3
/æ/	*balb	Valve	1
/ɜ:/	*berz/se	Burse/verse	2
/ʌ/	buzz	*vuzz	1

One can only speculate that in the last case in the above table, that either the one subject did not know the English (onomatopoeic) lexical item or had always interpeted the onomatopoeia as **vuzz.*

Seep was interpreted by three subjects as *thief,* by one as *seek*; *ladder* by 6 as *rather* and by one as *leather*; *stable* by one as *Steven*; *breezy* by one as *bridge*; and *pilot* by one as *tired.* There is of course no **thiep, *theek, *stavle, *breedge* or **pired* in English, and presumably no *lather* or *larder* in the restricted lexicon. Nevertheless, a number of other items were invented, which are useful evidence in interlanguage phonology.

III.4. Judgement refusal

In the second experiment there were only two refusals to commit to a judgement. One was against the item *pure*. This appears surprising as all the other subjects interpreted the word correctly, and it was not one of the items avoided by Subject 3 in the trial experiment —although he did misinterpret it as *pour*. An initial consonant+/j/+vowel is a common sequence in Korean; one can only guess that the vowel /ʊə/ misled the subject, who might possibly have expected an American final /r/ to guide him to the right interpretation.

The second case was against the item *youthful.* Having correctly interpreted *useful* in item 19, one subject was reluctant to commit himself to any interpretation of the signal *youthful* in item 24, presumably because, although he might have heard it as *useful*, he considered it most unlikely that that item would be repeated.

CONCLUSIONS

The overall rate of success by these 13 adult Korean students in interpreting the British RP accent was 62%. This figure naturally includes the cases where there was 100% success, eg in interpreting /kɔɪn/ as *coin*, and where there was little success, eg in interpreting *bought* and *nought*. The figure also includes the occasional refusals, but more importantly, the cases of interpretations of lexical items where one phonological problem led to a further re-interpretation of another phonological item.

The detailed discussion of pedagogical implications shows the value of conducting educational research into learners' perceptions of the pronunciation system of a target language. Perception tests are not only valuable tools in the classroom for diagnostic purposes (see, for example, Bowen & Marks, 1992, Dalton & Seidlhofer 1994, Celce-Murcia et al, 1996) but also as a research tool for establishing a current state of interlanguage phonology, with implications for the design of teaching materials. A teacher cannot really expect good production of sounds without good perception of them: "faulty perception leads to faulty articulation" (Tench, 1981: 46).

The design of a perception test —whether for research or classroom exercises — is based on a thorough contrastive statement of the phonologies of the two languages concerned and on (even casual) observation of learners' attempts in the target language. The value of the latter, a kind of error analysis, is in supplementing the evidence from a contrastive analysis. Learners' strategies in target language pronunciation might involve issues that a phonological contrastive statement might miss, e.g. reference to orthography, choice of substitutions —some learners of English substitute /θ/ with /t/, others with /s/, for instance — use of either reduction or epenthesis in coping with unfamiliar clusters, and of paragoge in coping with unfamiliar codas.

What emerges from the contrastive study and the observation of errors is a list of problematical segments together with their most likely alternatives. It must be borne in mind, that some segments are not problematic in certain environments, but are so in others, e.g. English /j/ for Korean learners, but only before front close vowels. A list of minimal pairs is drawn up, matching the problematic segment with their alternatives; a list of items is thus drawn up which contains the problematic segments. Depending on the scale of the testing event, a number of parallel lists might be advisable, as Tench (1996) and Ahn (1997) have done. Furthermore the items must be carefully selected to avoid the risk of learners finding a semantic link between the items, and the risk of confusing spellings; for instance, if you choose *bow* /baʊ/, you have no way of knowing from the testee's written response whether /au/ or /əʊ/ was perceived. Also, the items selected must be reckoned to belong to the (interlanguage) lexicon of the learners. This reduces the risk of multiple re-interpretations which inevitably distort the evidence of the real phonological competence; for instance, *seat* would certainly have provided more satisfactory evidence in Experiment 2 than *seep* did, being a more familiar word which still has the potential for confusion with /ʃ/ + /i:/.

The perception test can be administered as described above; each item is given twice, from a point where lip action cannot be detected, with a control subject present. The analysis is most revealing! As is often the case in the classroom, what the teacher presents is not always what the subjects perceive —and this is true in phonology too! In the data presented above, the author was quite unprepared for the revelation that most people mistook *mass* for *math.* Allowing for cases of re-interpretation within the interlanguage lexicon, the results are a clear indication of the current state of receptive phonological competence, which thus provides the basis of the design of necessary remedial discrimination procedures.

It should be noted, too, that this evidence of phonological interlanguage is both general and individual. The above pedagogical discussion could lead to a review of the design of classroom materials, but for an individual very specific practice can be organized. Subject 1 in the pilot experiment needs practice in medial and final /s/, to distinguish it from /θ/, and in the distinction of the vowel /ʌ/ from /ɒ/; Subject 2 needs much more.

Naturally, the larger the sample, the more reliable the evidence, which might lead to the publication of discrimination exercises for specific groups of speakers: in the case reported in this study, adult Korean learners at an upper intermediate/lower advanced level in a professional setting. Such evidence, along with the kind of intelligibility evidence reported in Ahn (1997), would also inform the design of articulation exercises. The two kinds of material —perceptual and productive— would thus carry a strong guarantee of effective development of the phonological competence of those that are trained by it.

REFERENCES

Ahn, M.K. (1997) *The Phonological Interlanguage of Korean Learners of English.* Unpublished PhD thesis, University of Wales, Cardiff.

Borden, G., Gerber, A. & Milsark, G. (1983) Production and Perception of the /r/ - /l/ Contrast in Korean Adults Learning English. *Language Learning 33*, 499-526.

Borden, G., Gerber, A. & Milsark, G. (1985) Improvement in the Production of the /r/ - /l/ Contrast is Accompanied by Improvement in the Ability to Judge One's Own Speech. *Language Learning, 35*, 115-118.

Bowen, T. & Marks, J. (1992) *The Pronunciation Book.* London: Longman.

Celce-Murcia,M., Brinton,D.M. & Goodwin, J..M. (1996) *Teaching Pronunciation.* Cambridge: Cambridge University Press.

Dalton, C. & Seidlhofer, B. (1994) *Pronunciation.* Oxford: Oxford University Press.

Dodson, C.J. (1967) *Language Teaching and the Bilingual Method.* London: Pitman.

James, C. (1998) *Errors in Language Learning and Use.* London: Longman.

Jenkins, J. (1995) *Variation in phonological error in interlanguage talk.* Unpublished PhD thesis, Institute of Education, University of London.

Jenkins, J. (1996) Changing Priorities. In Vaughan-Rees, M. (editor) *Changes in Pronunciation, Speak Out! 18,*33-40.

Jenkins, J. (2000) *The Phonology of English as a nInternational Language.* Oxford: Oxford University Press.

Kenworthy, J. (1987) *Teaching English Pronunciation.* London: Longman.

Rivers, W.M. (1964) *The Psychologist and the Foreign-Language Teacher.* Chicago: University of Chicago Press.

Roach, P. & Hartman, J. (1997) Introduction. In Jones, D., *English Pronouncing Dictionary.* 15th edition. Cambridge: Cambridge University Press.

Tench, P. (1981) *Pronunciation Skills.* London: Macmillan.

Tench, P. (1996) Methodology in Phonological Interlanguage. *IRAL, XXXIV/4,* 241-260.

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REVIEW ARTICLE

Learning the Phonology of a Language: An Optimality Theory Approach

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Tesar, Bruce & Smolensky, Paul (2000) *Learnability in Optimality Theory*. Cambridge, Mass: MIT Press. 140 pp. (ISBN 0-262-20126-7 hardback).

I. OPTIMALITY THEORY AND GENERATIVE GRAMMAR

Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993; OT henceforth) has experimented a spectacular development in the last decade, exerting an influence on both phonology and syntax. The first introductory texts have already appeared (Archangeli & Langendoen 1997, Dekkers et al 2000, Kager 1999, McCarthy forthcoming) as well as the first serious attacks against the theory (McMahon 2000). Both things could well be seen as indicators of OT's successful development over a relatively short period of time. OT could well be seen as a development of traditional generative grammar. There is not a complete break between the two, but rather a set of noticeable differences in the approach to the basic oppositions universal *vs* language-specific and constraints *vs* rules. Both OT and generative linguistics accept the concept of Universal Grammar (UG) but they diverge from each other, among other things, in the interpretation of cross-linguistic variation. The Principles and Parameters Theory is the standard

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account of language-specific differences within the generative framework: "language knowledge consists of principles universal to all languages and parameters that vary from one language to another" (Cook & Newson 1996: 2). Chomsky summarises the relationship between language-specific grammars and Universal Grammar as follows:

> The grammar of a language can be regarded as a particular set of values for the parameters, while the overall system of rules, principles and parameters, is UG which we may take to be one element of human biological endowment, namely the "language faculty".
>
> *Chomsky (1982: 7)*

OT assumes the existence of a Universal Grammar understood as a set of universal constraints which are *violable*. Language-specific differences arise from different hierarchies of constraints: some languages will regard some particular constraints as more important than others, so that whenever it is necessary to incur the violation of some constraint, the one which is lower ranked will be chosen.

Learnability questions have always been inherent to generative grammar. In fact, data from L1 acquisition is on the basis of many of its assumptions, to the extent that the very existence of a 'language faculty' and a 'universal grammar' are directly linked to facts about first language acquisition. OT also had to offer an answer to the question of how we learn a grammar and Tesar and Smolensky's book is a coherent account of the learning process within the optimality framework. The importance of their endeavour can only be measured if we consider that no grammatical model can be plausible if it is not reasonable to assume that the logic of its machinery can be mastered by a six-year-old child. The credibility of OT as a grammatical model will depend on the theorists' ability to show how a language can be acquired easily, efficiently and even in non-optimal environments.

II. READING *LEARNABILITY IN OPTIMALITY THEORY*: SOME REMARKS

The general tone of the book is highly technical and those with no previous background in OT might find it not accessible. However, the basic idea (the so called RIP/CD learning algorithm) is presented quite straightforwardly. The refinements to this basic idea are more problematic: sometimes the notation (which in some cases resembles mathematical formulae) becomes an obstacle, rather than a means of explanation. This notational complexity is further reinforced by the fact that the influence of computational linguistics is present throughout the book (Smolensky was originally a computer scientist). Perhaps that is why some of the concepts in the book seem to have been phrased in order to make them understandable for the computers where the CD algorithm was going to be tested. The problem is that this involves a degree of abstraction and specific notation which may be difficult to follow.

The structure of the book is not completely clear, insofar as it sometimes returns to previously discussed issues and develops different bits of the same theoretical aspects in different parts of it. This is precisely the reason why we might get the impression that it is actually a collection of papers on learnability rather than a coherent whole.

It is also essential to make clear that most of the principles about learnability presented in the book are purely theoretical: they do not emerge from empirical work on phonological acquisition. Demonstrations (where provided) are computer-based: they just show that the proposed algorithms work quite well in computers (although depending on the initial constraint hierarchy, failure to achieve the target ranking can reach 39.5%, see page 69). It is doubtful that the assumption "if it works in computer simulations, it must be at work in the human mind" can actually be defended. Finally, all explanations deal with first language acquisition, no reference is made to second language acquisition processes.

III. THE MAIN TENETS

In this section we shall proceed to discuss the main tenets of *Learnability in Optimality Theory* before we move on to discuss the different topics included in each chapter.

III.1. The problem of learning underlying forms

The discussion about learnability starts from the very nature of OT as an input-output device. We know that learners have access to overt forms which are presented to them as a string of sounds: overt forms can be pronounced and heard. However, OT´s production of candidates relies on an input which is not necessarily equivalent to an overt form; the theory assumes that there are *underlying forms* (for instance, /tapóns/ for [tapónes] in Spanish or /kætz/ for [kæts] in English). Thus, OT distinguishes between the overt part of grammatical forms (which the learner can actually hear) and full structural descriptions (which include overt and hidden forms). It is not obvious how the learner can get to these underlying forms and this poses an important problem for learnability.

In order to learn a grammar, we need to have access to both overt and underlying forms (i.e. to *full structural descriptions*). The problem is that the procedure to establish the nature of underlying forms (**Robust Interpretive Parsing**) requires a grammar. At this point we seem to have arrived at an insurmountable difficulty, a circular situation which we have represented in figure 1.

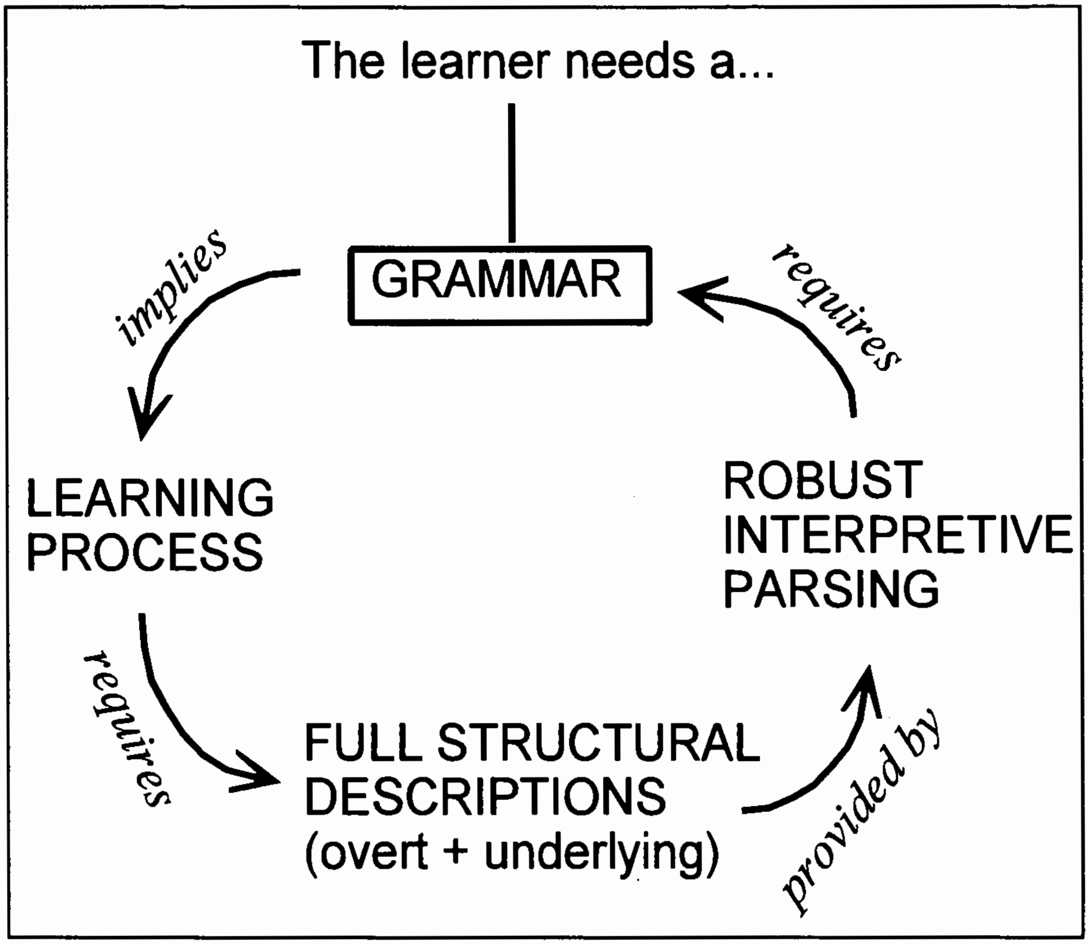

Figure 1. *The problem of learning underlying forms in an Optimality Theory approach to grammar*

Tesar & Smolensky suggest an *iterative* approach to the problem based on solutions devised for speech recognition programmes. These programmes were able to recognise a given sound and, at the same time, improve the recognition criteria with the new data provided by each occurrence of the sound. Thus they could both perform the task and improve accuracy of performance in each operation, until convergence with optimal feature specifications occurred. Applying this logic to grammar learning, we assume that the learner starts from a provisional constraint hierarchy (grammar) which is used to analyse overt forms and get full structural descriptions. The information provided by this analysis is then used to modify the existing hierarchy and subsequently robust interpretive parsing starts again. The process is repeated until the target hierarchy is finally found. We shall now focus on how constraint rankings are modified.

III.2. Constraint Demotion

In considering the process whereby constraints are ranked, we shall assume that learners start without a fixed initial order in their innate set of constraints, although we shall also discuss the proposal of some researchers in the direction of assuming that *markedness* constraints are ranked higher than *faithfulness* constraints in the initial hierarchy. Thus, we start with all constraints placed in a single *stratum*:

$$\{\mathbb{C}_1, \mathbb{C}_2, \mathbb{C}_3 \ldots\ldots\ldots\ldots\ldots\ldots \mathbb{C}_n\}$$

The learner perceives the learning data and, by applying robust interpretive parsing, assigns hidden structure to the overt forms (φ). By doing this, the learner does not only get positive evidence about the nature of optimal candidates, but also negative evidence about what cannot be an optimal candidate. Learnability in Optimality Theory is based on these two sources of evidence. The learner forms *mark data pairs,* that is to say, comparisons between the optimal candidate (and the constraints which it violates) and a suboptimal candidate and its list of violations. The relationship between them is expressed in the format *loser* $\prec$ *winner* (1)

(1)

loser $\prec$ *winner*	*marks (loser)*	*marks (winner)*
a $\prec$ b	$\mathbb{C}_1, \mathbb{C}_2$	$\mathbb{C}_2, \mathbb{C}_3$

The next step to take is to disregard those violations of constraints which both winner and loser have in common. This process is called *mark cancellation.* Those marks which are cancelled are crossed off the list (2):

(2)

Loser $\prec$ *winner*	*marks (loser)*	*marks (winner)*
a $\prec$ b	$\mathbb{C}_1, \cancel{\mathbb{C}_2}$	$\cancel{\mathbb{C}_2}, \mathbb{C}_3$

Then, the learner checks that the winner mark (violation of constraint $\mathbb{C}_3$) is dominated by the constraint violated by the loser ($\mathbb{C}_1$) in his provisional constraint ranking. In other words, once we have deleted the violations of constraints shared by loser and winner (i.e. those which assess them as equally 'bad'), the remaining constraint(s) will have to favour the winner, that is to say, the violations of the loser have to be more important than those incurred by the winner. If this is not the case in the current ranking, it will have to be changed to match the learning data.

Let us come back to the data in (2). Each candidate violates one constraint, but in spite of this *b* is the winner. The only possible interpretation is that violating $\mathbb{C}_1$ is worse than violating $\mathbb{C}_3$. Let us now imagine that our learner has the following constraint ranking:

$$\{\mathbb{C}_1, \mathbb{C}_2, \mathbb{C}_3\}$$

When she realises that in her grammar $\mathbb{C}_1$ and $\mathbb{C}_3$ are equally ranked, she applies *constraint demotion*: she proceeds to demote the winner mark minimally, placing it in the next stratum (creating it if necessary). Thus, the new ranking, given the first mark-data pair, is the following:

$$\{\mathbb{C}_1, \mathbb{C}_2\} \gg \{\mathbb{C}_3\}$$

This is how we change the initial ranking, moving towards the target one. However, we may find cases where taking demotion decisions is not so simple:

(a) It may happen that the winner marks are already dominated by those of the loser. In this case we have been presented with a *non-informative pair* and the ranking will not be changed.
(b) We realise that after mark cancellation, more than one winner marks are not dominated by the loser marks. In that case one single mark data pair may produce more than one constraint demotion. If all the loser marks are placed in the same stratum, we may start considering any of them; otherwise we have to start with the highest-ranked one. Let us assume a grammar with the following constraint ranking and a mark-data pair like the one in (3):

$$\{\mathbb{C}_3, \mathbb{C}_5\} \gg \{\mathbb{C}_1\} \gg \{\mathbb{C}_{2,} \mathbb{C}_4\}$$

(3)

loser $\prec$ *winner*	*marks (loser)*	*marks (winner)*
a $\prec$ b	$\mathbb{C}_1, \mathbb{C}_{2,} \cancel{\mathbb{C}_4}$	$\mathbb{C}_3, \cancel{\mathbb{C}_4}, \mathbb{C}_5$

First, we check which is the highest-ranked loser mark; in our ranking it is $\mathbb{C}_1$. Next, we check if the winner marks are dominated by $\mathbb{C}_1$. After realising that this is not the case, we demote these constraints to the stratum immediately below $\mathbb{C}_1$:

First demotion: $\{\mathbb{C}_1\} \gg \{\mathbb{C}_3, \mathbb{C}_5, \mathbb{C}_{2,} \mathbb{C}_4\}$

Subsequently we check if the remaining loser mark ($\mathbb{C}_2$) dominates the winner marks. As $\mathbb{C}_2$ is in the same stratum as $\mathbb{C}_3$ and $\mathbb{C}_5$, we have to apply constraint demotion again, leaving this ranking:

$$\text{Second demotion: } \{\mathbb{C}_1\} \gg \{\mathbb{C}_2, \mathbb{C}_4\} \gg \{\mathbb{C}_3, \mathbb{C}_5\}$$

III.3. Error Driven Constraint Demotion (EDCD)

Originally presented in Tesar (1998), *Error Driven Constraint Demotion*, (EDCD henceforth) is a refinement on the previous Constraint Demotion algorithm (CD). The aim is to alter the procedure of search of new mark data pairs so that these are always informative. We already know that CD analyses overt forms, completing them with hidden structure and considering that these are the optimal candidates (winners). Subsequently, CD generates a suboptimal candidate (a loser), chosen at random among the endless list submitted by *Gen*. The problem of chosing *any* suboptimal candidate is that it may not be informative, that is to say, that it may not provide information which can be used in the learning process. The solution provided by Tesar & Smolensky resorts to the following mechanisms:

- **Interpretive parsing:** It takes an overt form (φ) which has been perceived by the learner and provides a full structural description including hidden structure.
- **Production-directed parsing:** The evaluation of the different candidates which aims at selecting one of them (the optimal candidate).
- **Provisional ranking:** It is needed by the learner in order to approach the target constraint hierarchy.

The procedure performed by the algorithm is quite simple. The learner perceives an overt form (φ) and analyses it using interpretive parsing, thus achieving a full structural description including underlying / hidden structure. This is positive evidence: we know that φ, the form we have perceived, is the optimal output candidate. But is this evidence consistent with our ranking?. In order to check on this, the algorithm takes the underlying form of φ, which serves as the basis for production-directed parsing. The question is quite simple: given this input and my current grammar, which overt form is optimal? Is it the same as the one I have perceived?. If the answer is "yes", the ranking does not undergo any change, because it is consistent with the learning data we have. What we have perceived is the same as what we would have produced. However, if the answer is "no", there is something wrong with our constraint ranking. We have to make changes so that our grammar correctly selects as the optimal output the candidate which we know is optimal. Here is where 'traditional' Constraint Demotion starts. We take the optimal output which has been perceived and the candidate which our grammar (erroneously) regards as optimal, and by contrasting them we get a mark data pair which is going to be informative. This first pair causes the demotion of one or more constraints. If this is not enough, i.e. if the candidate provided by interpretive parsing and that of production-directed parsing are not the same one yet, the whole EDCD algorithm starts again. We have summarised the process in figure 2.

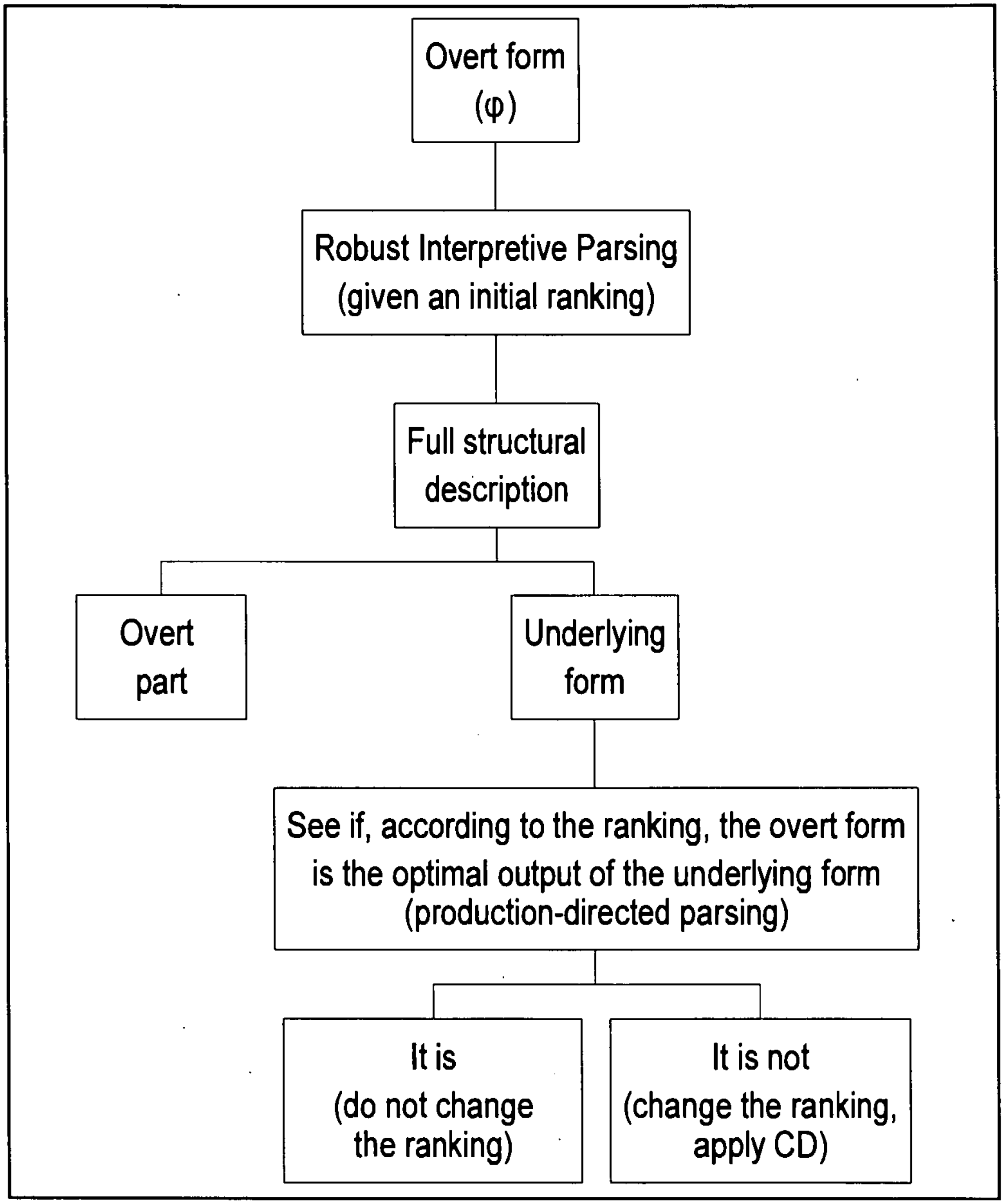

Figure 2. *Simplified representation of the EDCD algorithm as explained in Tesar and Smolensky (pp. 60-62)*

Let us take the example of the process of learning Spanish plurals. It is a well-known fact that they are formed by adding the suffix *-s* to the stem. Thus, the plural of the word *casa* is *casas*. However, when the final segment of the stem is a consonant, epenthesis takes place to avoid violation of a basic phonotactic principle of Spanish which militates against word-final coda clusters: *tapón* ~ *tapones*, not **tapóns* (but see Alarcos (1994: 63-64) for exceptions in words such as *bíceps* or *tórax*).

We shall put forward two constraints, WF-CLUSTER (which demands that no more than one consonant can appear in word-final position) and DEP, which militates against insertions. Let us assume that the learner has not yet ranked them, so that both constraints are placed in the same stratum:

{WF-CLUSTER, DEP}

Our learner can make do with that ranking provided that she only finds singular and plural forms of the type *casa* ~ *casas* and *fuerte* ~ *fuertes*. As we show in (4), the constraint ranking with no hierarchical implications for W-F CLUSTER and DEP does the job and chooses the optimal candidate:

(4)

/kása+s/	DEP	W-F CLUSTER
[kásaes]	*!	
☞ [kásas]		

The conflict arises when we face an input of the type /salóns/. In this case, we find that there is a tie between the two different candidates under consideration (5):

(5)

/salón+s/	DEP	W-F CLUSTER
? [salónes]	*	
? [salóns]		*

Let us now suppose that the learner actually perceives that the people around him actually pronounce [salónes], rather than [salóns]. After applying robust interpretive parsing to the overt phonetic form (φ = [salónes]), she gets a full structural description including the underlying form /salóns/. Subsequently, the learner submits that underlying form (input) to production-directed parsing, getting the result which we have presented in (5). This is how she realises that there is a mismatch between perceived form ([salónes]) and the grammar's lack of arguments to choose between [salónes] and [salóns], which would probably lead to alternations between both forms. As a result of this error, the learner gets a mark data pair (6) which, as opposed to the random procedure of selection of suboptimal candidates in CD, will always be informative, because it originates in a conflict between the grammar and phonetic (perceived) 'reality'.

(6)

Loser ≺ winner		*marks (loser)*	*marks (winner)*
b ≺ a	salóns ≺ salón	WF-CLUSTER	DEP

In (6) there is a winner mark (DEP) which is not dominated by the loser mark (W-F CLUSTER), so that the learner proceeds to apply constraint demotion, thus leaving the following hierarchy:

WF-CLUSTER » DEP

This ranking already selects the forms [kásas] y [salónes] as the optimal outputs for the inputs /kásas/ and /salóns/, respectively (7, 8).

(7)

Input: /kása+s/	WF-CLUSTER	DEP
☞ [kásas]		
[kásaes]		*!

(8)

Input: /salón+s/	WF-CLUSTER	DEP
☞ [salones]		*
[salóns]	*!	

To sum up, EDCD is a useful instrument to guide the search of informative mark data pairs which can help the learner to get to the target ranking with the minimal computational effort.

IV. *LEARNABILITY IN OPTIMALITY THEORY*, CHAPTER BY CHAPTER

Chapter 1 is an introduction to the contents of the book. It offers a first approach to the comparison between Principles & Parameters acquisition theory and OT. Tesar & Smolensky argue that Principles & Parameters provide either too general or too specific accounts of the learning process, whereas optimality approaches can offer theories which are both general and linguistically informed. Chapter 1 also introduces some of the basic terminology of OT and formulates the basic learning problem of acquiring hidden structures.

Chapter 2 provides a short introduction to OT. Some basic concepts are defined:

- **Constraint ranking**, which is the ranking of the universal constraints in a...
- **Dominance hierarchy,** in the sense that any constraint *dominates* all those placed below it in the ranking (in other words, it is more important than *all* the others below it).
- **Richness of the base**, whereby possible inputs are the same for all the languages in the world, so that differences between languages arise after applying a constraint ranking; in other words: "no constraints hold at the level of underlying forms" (Kager 1999: 19).
- **Harmonic ordering** of structural descriptions, implying that the one which incurs the least serious violations of constraints is the most harmonic.

Chapter 3 develops the concept of constraint demotion. It provides an example of a possible application to syllabic theory. Furthermore, it introduces other basic concepts:

- **Mark cancellation:** If two candidates violate the same constraint (ℂ), the mark of this violation will be cancelled when comparing them to decide which one is the optimal output.
- **Stratified hierarchies:** During the learning process it is possible to find that two or more constraints have the same importance in the ranking: they are said to belong to the same *stratum*. When the hierarchy develops so that there is just one constraint per stratum we say that it is *totally ranked*. Tesar & Smolensky argue that adult grammars are totally ranked, although the reader may think that rather than a statement about the structure of adult grammars what we are getting is a necessary condition for the successful application of Optimality Theory to the learning process. In other words, we know that OT's accounts of learnability seem to be problematic if we assume a target hierarchy which is not totally ranked, but does this necessarily mean that all adult grammars share this property?.

This chapter also includes some interesting considerations about data complexity in constraint demotion, which is of great importance if efficient and feasible learning is supposed to derive from it.

Chapter 4 presents us with the results of the application of the RIP/CD algorithm to metrical stress grammars. It is shown that the learner's initial hierarchy has an influence on the success of the algorithm and two different solutions are proposed: either we assume that the learner tries different initial hierarchies until she finds one which makes the algorithm work or we constrain robust interpretive parsing limiting its possibilities to provide suboptimal candidates. Some possibilities for future work are also evaluated. In addition, this chapter develops the concepts of interpretive parsing and production-directed parsing and their relation to constraint demotion.

Chapter 5 is short but particularly dense. Two main issues are dealt with: i) the nature of the learner's input and his initial constraint hierarchy and ii) the learning of the underlying forms of morphemes. As far as the first question is concerned, Tesar & Smolensky insist on the concept of richness of the base: all languages share a set of possible inputs, constraints account for language-specific differences. With regard to constraint hierarchies, they make some general comments about faithfulness constraints (those which make sure that meaning differences are preserved) and structural constraints (those which disallow the presence of marked forms). It is suggested that, in the absence of any further evidence, learners assume that structural (markedness) constraints dominate faithfulness constraints so that only if marked overt forms are found markedness will be demoted below faithfulness. Thus, learners start assuming a simple system and only include marked elements as the result of overt learning data.

As far as the learning of the underlying forms of morphemes is concerned, the basic proposal is **Paradigmatic Lexicon Optimization** (PLO). Lexicon optimization is a process for the selection of the underlying form of morphemes: "the underlying form of a morpheme is the one, among all those that give the correct surface forms, that yields the maximum-Harmony paradigm" (Tesar & Smolensky: 80). In practical terms, this usually means that we minimize as far as possible the divergence between output and input forms: "Wherever the learner has no evidence (from surface forms) to postulate a specific diverging lexical form, (s)he will assume that the input is identical to the surface form" (Kager 1999: 33). Tesar & Smolensky add that lexicon optimization has to be applied to *complete paradigms*, not just isolated elements, in order to account for lexical alternations. Useful examples from the devoicing of word final stops in German are provided. The concept of *lexicon optimization* is essential because an extreme interpretation of the richness of the base principle could lead us to infinite possible inputs, which is not feasible for learning and computational purposes.

Chapter 6 is basically a comparison of Principles & Parameters theory and OT. It is suggested that in the former there is no consideration of the interaction between different parameters. Furthermore, parameters have to have restricted effects, which is convenient for learning purposes but problematic for explanatory purposes. On the other hand, OT is in fact based on the *interaction* between constraints and Tesar & Smolensky argue that it is useful both for learning and descriptive purposes.

Chapter 7 could be seen as a schematic summary of the basic principles put forward in the book in the form of theorems and proofs, lemmas and definitions. Chapter 8 discusses a possible solution for computational problems in production-directed parsing (what Tesar & Smolensky call *dynamic programming*), although the authors claim that it is also applicable to interpretive parsing.

V. SOME RECENT ALTERNATIVES TO (ED)CD

In this section we have a look at some of the recent alternative proposals to the model presented in Tesar & Smolensky. We shall focus our attention on Prince & Tesar's *Biased Constraint Demotion* (1999) and Boersma & Hayes *Gradual Learning Algorithm* (2001).

V.1. Biased Constraint Demotion (BCD)

The BCD model, proposed by Prince & Tesar (1999) does not only place all markedness constraints in a privileged position, but also keeps their status *actively*. This is why it has to be regarded as an algorithm by itself, independent of the (ED)CD proposal. We shall not discuss the details of how the algorithm works, but rather focus our attention on some of its most important features.

Perhaps one of the most remarkable aspects of BCD is that, in practical terms, it implies the absence of an initial hierarchy. Although Prince & Tesar (1999) do not emphasise this particularly unorthodox aspect of their approach, they argue that their algorithm "places" constraints in the hierarchy and it even *promotes* some of the constraints, specially markedness ones (as opposed to the exclusively demoting technique advocated in Tesar & Smolensky). As Prince & Tesar (1999: 13) remark "Under BCD, the initial state is not arbitrary, nor does it require special stipulation". The algorithm is based on two basic principles: *faithfulness delay* and *avoid the inactive*.

> (a) **Faithfulness delay:** On each pass, among those constraints suitable for membership in the next stratum, if possible place only *markedness constraints*. Only place faithfulness constraints if no markedness constraints are available to be placed in the hierarchy (Prince & Tesar 1999: 10).
> (b) **Avoid the inactive:** When placing faithfulness constraints into the hierarchy, if possible only place those that prefer *some winner*. If the only available faithfulness constraints *prefer no remaining winners*, then place all of them into the hierarchy.
>
> *Prince & Tesar (1999: 11)*

Prince & Tesar suggest that faithfulness constraints should be dominated by as many markedness constraints as possible. In order to measure the degree of compliance with this principle, they propose what they call the *r measure* of a hierarchy: "The r-measure for a constraint hierarchy is determined by adding, for each faithfulness constraint in the hierarchy, the number of markedness constraints that dominate that faithfulness constraint" (Prince & Tesar 1999: 6).

V.2. The Gradual Learning Algorithm

The Gradual Learning Algorithm (Boersma & Hayes 2001) is based on an alternative account of the nature of constraints and a previous model of learnability within the model of Functional Phonology (Boersma 1997, 1998).

Hayes (2000) published a paper called «*Gradient well-formedness*» where he deals with the problem of coping with those areas of language where there is variation. He assumes that strict domination and selection of candidates is not always at work and acknowledges the need to incorporate the concept of 'preference' to any realistic grammatical model. Hayes makes reference to the traditional idea of free ranking, which implies that two constraints have exactly the same value and consequently neither of them is dominant. This is traditionally represented in Optimality Theory by a dotted line in a tableau; in the case of a tie between two constraints, each one is chosen 50% of the times (9)

(9)

Candidates	CONSTRAINT 1	CONSTRAINT 2
☞ (50%) cand1	*	
☞ (50%) cand2		*

Unfortunately, this idealised view does not seem to fit in with linguistic reality. Very often we find that choices are not strict, but in spite of this they reflect very clear patterns of preference of the type shown in (10).

(10)

Candidates	CONSTRAINT 1	CONSTRAINT 2
☞ (85%) cand1	*	
☞ (15%) cand2		*

In order to account for this fact, Hayes suggests that constraints should be understood as *strictness bands* where we can find some potential *selection points*. When two strictness bands overlap, variation appears: depending on the selection point chosen by the speaker in each strictness band, domination relations may change. The probability that one candidate is preferred to the other(s) will depend on the constraints′position on the domination continuum:

> It will be useful in what follows to consider rankings not as simple arrangements of constraint pairs but rather as the result of the constraints′each taking on a range of values on an abstract continuum [...] We can speak of each constraint possessing a *strictness band* [...]. Within each band, I have given a *selection point*, which is defined as the particular value of strictness taken on by a constraint on a given speaking occasion.
>
> *Hayes (2000: 89-90)*

Thus, constraints cannot be understood as discrete entities in a perfect domination relation, but rather as a group of domination values which can overlap with those of other constraints. In each constraint evaluation, the learner will assign an exact value to each constraint (the selection point) and this possibility of moving within a band helps us to explain probability distributions in the selection of optimal forms.

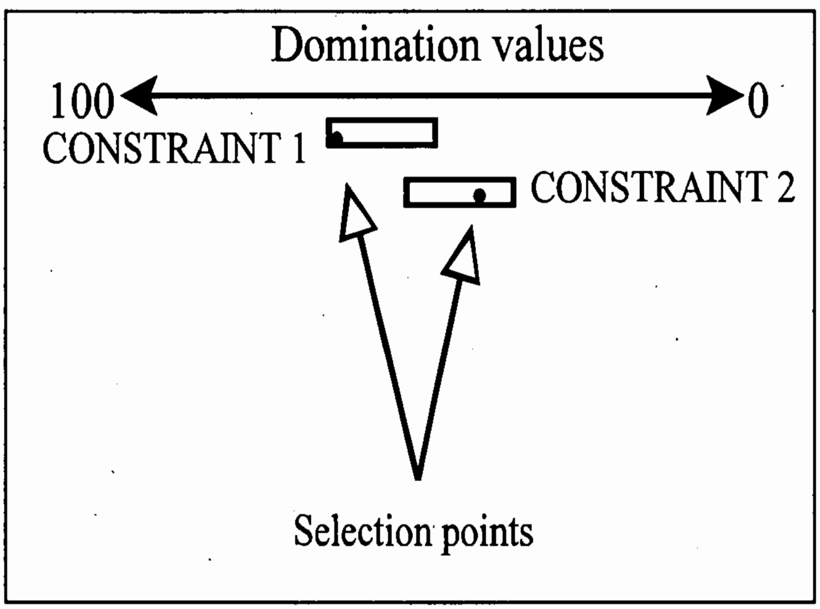

Figure 3. Constraint ranking represented as strictness bands. Given the selection points within each band, constraint 1 dominates constraint 2.

In figures 3 and 4 we show how the concept of strictness bands can account for probability distributions. Given the fact that most of the area of constraint 1 has higher domination values than constraint 2, we should expect that most of the times constraint 1 will dominate constraint 2 (figure 3). However, it is also true that both constraints overlap and consequently we may also find some cases (a minority) where constraint 2 dominates constraint 1 (figure 4).

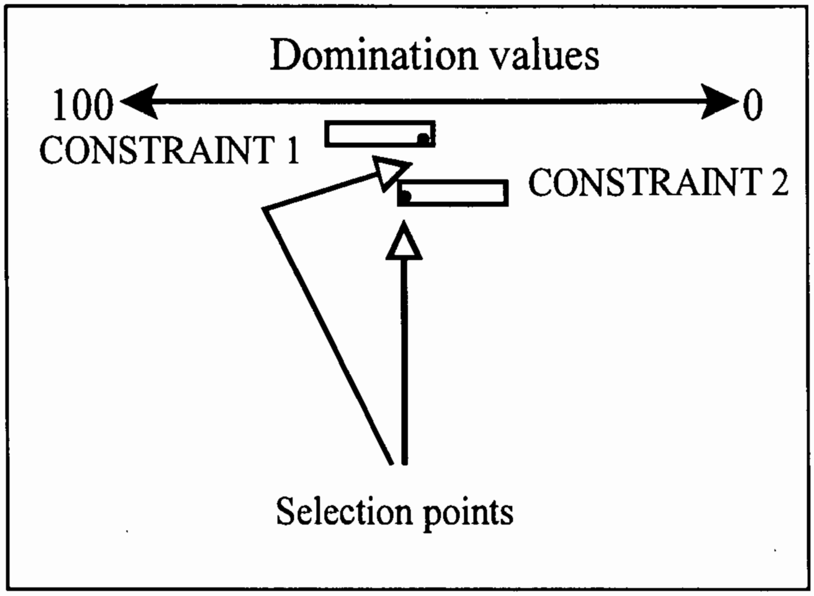

Figure 4. Constraint ranking represented as strictness bands. Given these selection points, constraint 2 dominates constraint 1 (variation).

This new approach to constraint interaction also implies a different learning algorithm. There are two slightly different versions: firstly, the Maximal Gradual Learning Algorithm (MGLA) proposed by Boersma (2000), which is a serious departure from traditional OT learning theory based on the principles of functional phonology; secondly, the Gradual Learning algorithm by Boersma & Hayes (2001), which favours some compromise with traditional views of learnability. We shall focus our attention on the latter.

The algorithm´s initial state places all constraints at the top of the scale with a domination value of 100. Like Tesar & Smolensky, Boersma & Hayes assume that learners have access to underlying forms. The basic mechanism is very similar to EDCD: the conflict between learning data and the learner´s provisional grammar prompts changes in the ranking of constraints. The difference is that conflicts between learning data and grammar do not lead to immediate constraint demotion, but rather to a slight movement in the position of strictness bands so that the result of these changes is not as dramatic as in Tesar & Smolensky´s model. Furthermore, the strictness bands violated by the winner will be *demoted*, but the ones violated by the loser will not remain unchanged, they will be *promoted*. These are the two greatest differences between EDCD and GLA: changes in constraint rankings are gradual and they involve both demotion and promotion.

The possibility of moving a strictness band depends on the degree of *plasticity* of a constraint ranking. The higher its plasticity, the more radical changes affecting the ranking will be and consequently the whole process will take place in a shorter period of time. On the other hand, a low level of plasticity helps reduce the possibility of learning being affected by erroneous data. Boersma & Hayes proposal is that the learner will start with a high level of plasticity in her ranking and this plasticity will gradually decrease as the learning process progresses. Thus, as the learner grows older it will be more difficult to introduce drastic changes in her constraint ranking, which fits in quite well with what we know about second language acquisition.

The algorithm has been applied to different situations where EDCD seems to have problems and the results obtained have been satisfactory. Firstly, GLA is able to cope with cases of *free variation*. It changes the ranking minimally, thus managing to reflect different distributions where variation exists. Secondly, the algorithm is robust when it faces erroneous data. Both Constraint Demotion and its error driven version carry out drastic changes in constraint rankings, so that one single slip of the tongue taken as a learning datum by the child affects her grammar dramatically. As constraint promotion is not allowed in these approaches, we cannot simply 'undo' the harm done by erroneous data: the whole constraint demotion process must start again to restore the initial state (probably after many operations and much trouble). In the case of the Gradual Learning Algorithm such a problem does not exist: changes are minimal and imply both promotion and demotion. An isolated erroneous learning datum could only produce a small change in the constraint's domination value, a change which can easily be corrected when data which are consistent with the correct grammar are found. In (11) we have contrasted the drastic effects of applying EDCD to erroneous data with the minimal variation performed by GLA affecting domination values (in brackets). In spite of the changes in these values, one single erroneous datum does not alter the hierarchy:

(11)

EDCD: $C_1 \gg C_2 \Rightarrow$ Erroneous data $\Rightarrow C_2 \gg C_1$

GLA: $C_{1(77)} \gg C_{2(44)} \Rightarrow$ Erroneous data $\Rightarrow C_{1(72)} \gg C_{2(49)}$

The Gradual Learning Algorithm has also been successful in coping with questions regarding *frequency of selection* of different alternative candidates and *gradient well-formedness*, that is to say, those cases where one form is not seen as completely wrong but rather inappropriate given one's own linguistic behaviour (Hayes (2000) applies this concept to the study of the alternation between dark and light 'l' in English).

Research in gradual learning is of the utmost importance. It is an attempt to adapt linguistic theory to the actual learning process and linguistic behaviour, which imply variability and gradation. It is also a call of attention to linguists, who resort to idealised data too often. As Hayes remarks, "there is little point in analysing overidealized data [...] if you possess a theory that permits you to analyze accurate data. [...] There is good evidence that at present linguistics is not difficult enough" (Hayes 2000: 117-118). Finally, the concept of *plasticity* can account for the consolidation of the adult's grammar, for fossilisation processes in second language acquisition and for the observed interaction between age and successful L2 acquisition.

VI. THE APPLICATION TO SECOND LANGUAGE ACQUISITION RESEARCH

Second language researchers have focused their attention on the possibilities of applying OT principles to traditional problems (such as the acquisition of syllable structure or prosody), although little attention has been paid to the implications of second language acquisition studies for the formulation of learning algorithms.

Hancin-Bhatt & Bhatt (1997) focus their attention on the acquisition of English syllabic structure by native speakers of Spanish and Japanese. In their paper they relate certain key issues in Optimality Theory to Major's *Ontogeny Model* (1987): the high level of transfer at the beginning of the learning process may be related to the use of the constraint ranking of the learner's mother tongue in the new L2 situation; the eventual decrease of transfer may be seen as the result of reranking.

Broselow, Chen & Wang (1998) also look at syllable structure in the interlanguage of some learners of English as a second language, resorting to the familiar OT concept of *the emergence of the unmarked*. According to their findings, the selection of different 'repair' strategies for syllable configurations which are not allowed in the learner's L1 depends on a group of markedness constraints. These constraints are low ranked in the learner's initial hierarchy, but as the result of the need to cope with foreign forms and unfamiliar syllable structures they become active, thus conditioning the shape of unfaithful candidates. Assuming that a violation of faithfulness has to take place (otherwise L2 syllable structure would already have been acquired), these markedness constraints make sure that at least unfaithfulness does not result in unnecessarily increased markedness.

The application of learning algorithms to second language acquisition research is specially interesting, although we can only point out some possible directions for future work. The Gradual Learning Algorithm offers interesting insights for researchers interested in the age variable. An investigation of the concept of 'plasticity' is needed: is it a developmental universal or an individual characteristic? Can it be consciously altered? How could we measure it?.

A second question to be considered is how lexicon formation takes place in second language acquisition. Can we really assume that the learner has access to underlying forms? To what extent can we argue that, in spite of having learnt a first language, her interpretive parsing is equally robust?. If this is not the case, are all errors grammatical or are they more closely related to issues such as erroneous lexical entries based on misperceptions?.

Finally, second language acquisition poses some problems for the concepts of *demotion* and *promotion*. When we apply CD / EDCD, alterations to the L1 ranking may have very drastic effects, which are sometimes unattested in any interlanguage. For instance, the demotion of sonority sequencing constraints would involve acquiring, all of a sudden, different groups of clusters which, in principle, are not even related. In these cases it may be more reasonable to assume that some constraints can be modified, rather than demoted or promoted, thus minimising the effects of learning operations. Second language research should be a valuable source of information about how theoretical generalisations about learnability fit in with actual data.

VII. CONCLUSION

Tesar & Smolensky's book is a valuable reference for traditional approaches to learnability within an Optimality Theory framework. It summarises the reflections of two of the 'founder members' of the discipline. However, other researchers have developed alternative algorithms based on the previous work presented in Tesar & Smolensky which, in our opinion, are more *realistic* insofar as they can cope with variation and developmental instability (Boersma & Hayes 2001).

Another interesting question, which affects all computational approaches to learnability, is whether such theories are really grounded or not. Now we know that computers can actually work out the constraint ranking of a language starting from *some* (but not all) initial hierarchies, provided that they are given sufficient overt information. Does that really mean that this is the way the human mind works?. We cannot be satisfied with a simple statement of the type 'if the human mind performed these operations, it would acquire a language'. The only possible answer is that further research on phonological acquisition must be carried out in order to test whether RIP/CD and EDCD are indeed at work in phonological acquisition by human beings.

Tesar & Smolensky's *Learnability in Optimality Theory* is possibly a must for phonologists. But insofar as the development of OT seems to have wider implications to the extent of having become a revolution in linguistic theory, it is also recommended for linguists in general and specially for applied linguists with some interest in phonological acquisition.

REFERENCES

Alarcos Llorach, E. (1994). *Gramática de la lengua española*. Real Academia Española de la Lengua, Colección Nebrija y Bello. Madrid: Espasa Calpe.

Archangeli, D. & Langendoen, D.T. (Eds.)(1997). *Optimality Theory: An introduction*. Oxford: Blackwell.

Boersma, P. (1997). How we learn variation, optionality and probability. Rutgers Center for Cognitive Sciences and Rutgers University, New Brunswick. [http:// ruccs.rutgers.edu/roa.html], ROA-221.

Boersma, P. (1998). *Functional phonology: formalizing the interactions between articulatory and perceptual drives*. LOT dissertations 11. The Hague: Holland Academic Graphics.

Boersma, P. (2000). Learning a grammar in functional phonology. In: J. Dekkers, F. van der Leeuw and J. van de Weijer (eds).

Boersma, P. & Hayes, B.P. (2001). Empirical tests of the gradual learning algorithm. *Linguistic Inquiry* 32(1): 45-86.

Broselow, E., Chen, S-I. & Wang, C. (1998). The emergence of the unmarked in second language phonology. *Studies in Second Language Acquisition*, 20: 261-280.

Chomsky, N. (1982). *Some concepts and consequences of the Theory of Government and Binding*. Cambridge, Mass.: MIT Press.

Cook, V.J. & Newson, M. (1996). *Chomsky's Universal Grammar. An introduction*. Oxford: Blackwell.

Dekkers, J., Leeuw, F. & Weijer, J. (2000). *Optimality theory: phonology, syntax and acquisition*. Oxford: OUP.

Hancin-Bhatt, B. & Bhatt, R. (1997). Optimal L2 syllables. Interactions of transfer and developmental factors. *Studies in Second Language Acquisition,* 19: 331-378

Hayes, B.P. (2000). Gradient well-formedness in Optimality Theory. In: J. Dekkers, F. van der Leeuw and J. van de Weijer.

Kager, R. (1999). *Optimality theory*. Cambridge: CUP.

Major, R.C. (1987). A model for interlanguage phonology. In: G. Ioup and S. Weinberger (eds)

Interlanguage phonology: the acquisition of a second language sound system (pp. 101-124). New York: Newbury House.

McCarthy, J. (forthcoming). *Optimality theory: A thematic guide*. (Manuscript).

McCarthy, J. & Prince, A. (1993) *Prosodic morphology I: constraint interaction and satisfaction*. Ms., University of Massachussetts, Amherst and Rutgers University.

McMahon, A. (2000) *Change, chance and optimality*. Oxford: OUP.

Prince, A. & Smolensky, P. (1993) *Optimality Theory: constraint interaction in generative grammar*. Ms., Rutgers University, New Brunswick and University of Colorado, Boulder.

Prince, A. & Tesar, B. (1999). Learning phonotactic distributions. ROA-353.

Tesar, B. (1998). Error-driven learning in Optimality Theory via the efficient computation of optimal forms. In P. Barbosa, D. Fox, P. Hagstrom, M. McGinnis & D. Pesetsky (eds) *Is the best good enough? Optimality and competition in syntax* (pp. 421-435). Cambridge, Mass: MIT Press and *MIT Working Papers in Linguistics*.

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Journal Article:

Sánchez, A. (1992). Política de difusión del español. *International Journal of the Sociology of Language*, 95, 51-69.

Scheu-Lottgen, U.D. & Hernández-Campoy, J.M. (1998). An analysis of sociocultural miscommunication: English, Spanish and German. *International Journal of Intercultural Relations* (IJIR), vol. 22:4, 375-394.

Hilferty, J. Valenzuela-Manzanares, J. & Villarroya, O. (1998). Paradox Lost. *Cognitive Linguistics*, 9:2, 175-188.

Book:

Monroy, R. (1998). *Sistemas de transcripción fonética del inglés. Teoría y textos*. Granada: Grupo Editorial Universitario.

Calvo, C. & J.J. Weber (1998). *The literature workbook*. London: Routledge.

Sánchez, A., Sarmiento, R. Cantos, P. & Simón, J. (1995). *CUMBRE. Corpus lingüístico del español contemporáneo: fundamentos, metodología y análisis*. Madrid: SGEL.

Edited book:

Barcelona, A. (Ed.) (2000). *Metaphor and metonymy at the crossroads: A cognitive perspective*. Berlin, New York: Mouton de Gruyter.

Pujante, A.L. & Gregor. K. (Eds.)(1996). *Teatro clásico en traducción: Texto, representación, recepción*. Murcia. Universidad de Murcia.

Book chapter:

Gregor, K. (1996). Unhappy Families: Ideology and English Domestic Life. In R. González (Ed.), *Culture and power: institutions* (pp. 69-78). Barcelona: Promociones y Publicaciones Universitarias.

Proceedings:

Conde-Silvestre, J.C. (2000). Variación estilística e isotopía textual en el poema anglosajón *The Ruin*. In *Selected papers in Language, Literature and Culture. Proceedings of the 17th International Conference of AEDEAN*, 321-25.

Martínez-Lorente, J. & Pujante, A.L. (2000). Mundos diatópicos y narrativa utópica: modelo social y conflicto humano en *We, Brave New World* y *1984*. In *Selected papers in language, literature and culture. Proceedings of the 17th International Conference of AEDEAN*, 383-87.

Doctoral Dissertation:

Walton, D. (1997). *Mail bondage. Sentencing Wilde between the sheets: An epestemology of the epistolary (an architectonic rhapsody)*. Unpublished Doctoral Dissertation, University of Murcia, Spain.

Cantos-Gomez, P. (1995). *Lexical disambiguation based on standard dictionary definitions and corpus-extracted knowledge*. Unpublished Master Dissertation. University of Essex, Colchester, United Kingdom.

Book Review:

Hernández-Campoy, J.M. (2000). Review of C. Silva-Corvalán (Ed.) (1995) *Spanish in four continents: Studies in language contact and bilingualism*. Washington, DC: Georgetown University Press. In *International Journal of Applied Linguistics* (IJAL), vol. 10.1, 141-145.

Technical Report:

Edwards, V. K., Trudgill, P. J. & Weltens, B. (1984). *The grammar of English dialects. A survey of research*. A Report to the ESRC Education and Human Development Committee. London: Economic and Social Research Council.

Conference paper:

Gregor, K. (2000). *The torch and the marriage bed, or getting a grip on Cuchulain: The politics of Yeats's* On Baile's Strand. Paper given at *ESSE 5*, University of Helsinki, Finland, August.

Conde-Silvestre, J.C. & Hernández-Campoy, J.M. (1997). *The 'Acceptance' of the Chancery Standard in Late Medieval England: Sociolinguistic and Geolinguistic Tenets*. Paper given at the XXI International Conference of the Spanish Association of Anglo-American Studies (AEDEAN), University of Seville, Spain, December.

Manchón, R. M., Roca de Larios, J. & Murphy, L. (1997). *Lexical problems in L1 and L2 writing: Comparing beginner and intermediate foreign language learners*. Paper given at the XV Conference of the Spanish Association of Applied Linguistics (AESLA), Zaragoza, April.

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Contents

IJES. Volume 1, Number 1, 2001

Foreword vii

RAFAEL MONROY & FRANCISCO GUTIÉRREZ
«Introduction: Perspectives on Interlanguage Phonetics and Phonology» ix

Articles:

ROBERT S. CARLISLE
«Syllable Structure Universals and Second Language Acquisition» 1

FRED R. ECKMAN, ABDULLAH ELREYES & GREGORY K. IVERSON
«Allophonic Splits in L2 Phonology: The Question of Learnability» 21

Mª LUISA GARCÍA LECUMBERRI
«Native Language Influence in Learners' Assessment of English Focus» 53

WIKTOR GONET
«Obstruent Voicing in English and Polish. A Pedagogical Perspective» 73

FRANCISCO GUTIÉRREZ
«The Acquisition of English Syllable Timing by Native Spanish Speakers Learners of English. An Empirical Study» 93

J. A. MOMPEÁN-GONZÁLEZ
«A Comparison between English and Spanish Subjects' Typicality Ratings in Phoneme Categories: A First Report» 115

RAFAEL MONROY
«Profiling the Phonological Processes Shaping the Frozen IL of Adult Learners of English as a Foreign Language. Some Theoretical Implications» 157

CHARLES REISS
«L2 Evidence for the Structure of the L1 Lexicon» 219

KARI SAJAVAARA & HANNELE DUFVA
«Finnish-English Phonetics and Phonology» 241

PAUL TENCH
«An Applied Interlanguage Experiment into Phonological Misperceptions of Adult Learners» 259

Review article:

J. A. CUTILLAS ESPINOSA
«Learning the Phonology of a Language: An Optimality Theory Approach» 279

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