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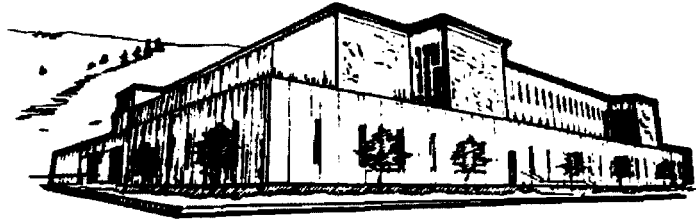
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University of
Montana

**THE PERCEPTION AND PRODUCTION OF ENGLISH
SPEECH CONTRASTS BY BILINGUAL CHILDREN FROM
SPANISH-DOMINANT BACKGROUNDS**

by

Karen M. Gideon

B.A., University of Montana, 1987

Presented in partial fulfillment of the requirements

for the degree of

Master of Arts


University of Montana

1989

Approved by:


Chairperson, Board of Examiners


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Gideon, Karen M. M.A., December 1989 Communication Sciences & Disorders

The Perception and Production of English Speech Contrasts by Bilingual Children from Spanish-Speaking Backgrounds (139 pages)

Director: Michael K. Wynne, Ph.D. 

The present study examined the relationship between speech perception and speech production in bilingual children from Hispanic families and described a hierarchy of difficulty of various English phonemes, as predicted from contrastive analysis between Spanish and English. Responses were recorded from eleven Spanish-dominant Mexican-American children aged 4;11 to 6;10 years. A task designed by Oller and Eilers (1983) was used to assess speech perception. Children were presented with pairs of real objects and nonsense objects, whose names were minimal pairs with contrasts in word-initial position. Children were expected to show evidence of discriminant responding by looking for a reinforcer under the object named by the experimenter. Speech production was assessed by recording childrens' imitation of sentences containing target words which were modeled by the examiner.

The results indicated that there was no significant correlation between speech perception and production, however, this may have been due to the small sample size and various methodological problems. Suggestions for methodological modifications and further research are discussed. In addition, the results suggested an interlanguage phonological system of the phonemes examined. Place of articulation errors were made the least frequently, voicing errors were made more frequently, and frication errors were made the most frequently. Childrens' performance on specific phonemes is discussed. Finally, the results indicated that age is significantly correlated with the production of the specific phonemes (/b, d, g, p, t/), but not with the perception of English contrasts. The discussion also relates the results to theories of second language acquisition and it suggests reasons for the individual variation observed.

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TABLE OF CONTENTS

| | |
|-----------------------|-----|
| Abstract..... | ii |
| Acknowledgements..... | iii |
| List of Figures..... | v |
| List of Tables..... | vi |

CHAPTER

| | | |
|---|-------------------|-----|
| 1 | Introduction..... | 1 |
| 2 | Methods..... | 53 |
| 3 | Results..... | 63 |
| 4 | Discussion..... | 77 |
| | References..... | 116 |

APPENDIX

| | | |
|---|---|-----|
| A | Definitions of Terms..... | 124 |
| B | Subject Selection Criteria and Procedures Checklist..... | 126 |
| C | Pretest Training for Perception Task..... | 127 |
| D | Parent Questionnaires..... | 128 |
| E | Recording Forms for Perception Task..... | 131 |
| F | Recording Forms for Production Task..... | 134 |
| G | Subject Characteristics and Summary of Performance..... | 136 |
| H | Consonant Sounds of English..... | 138 |
| J | Diacritic Symbols used in <u>Clinical Phonetics</u> | 139 |

LIST OF FIGURES

| Figure | Page |
|--|------|
| 3.1 Plot of correlation between perception and production: Total scores..... | 69 |
| 3.2 Correlation between speech perception and speech production: Type I contrast..... | 71 |
| 3.3 Correlation between speech perception and speech production: Type II contrast..... | 72 |
| 3.4 Correlation between speech perception and speech production: Type III contrast..... | 73 |
| 4.1 Correlation between age and total perception scores..... | 92 |
| 4.2 Correlation between age and total production scores..... | 93 |

LIST OF TABLES

| Table | Page |
|---|------|
| 1.1 English contrasts which must be learned by the native Spanish speaker | 21 |
| 1.2 Latin Spanish consonants..... | 23 |
| 2.1 Subject selection criteria..... | 54 |
| 2.2 Stimuli used in perception task..... | 57 |
| 3.1 Description of results of speech perception and speech production tasks..... | 64 |
| 3.2 Correlation between speech perception and speech production..... | 68 |
| 3.3 Residuals from Least Curve Fit analysis..... | 70 |
| 3.4 Inter-judge reliability coefficients for production scores..... | 75 |
| 4.1 Correlation coefficients between age and perception/production Type categories..... | 91 |
| 4.2 Gender with relation to total scores on perception and production tasks..... | 104 |
| 4.3 Location with relation to total scores on perception and production tasks..... | 106 |

CHAPTER 1: INTRODUCTION

The assessment of bilingual children's speech and language abilities raises many concerns for the speech-language pathologist. Glass (1979) stated:

Among these problems is finding some way to determine whether a bilingual child's difficulties in English are due to what may be the temporary competition between the two languages, or reflects some more basic language deficit that would be revealed in both languages (p. 512).

Inappropriate diagnostic and management decisions can be made after evaluating the speech and language abilities of a bilingual child if the effect of learning a second language is not considered. For example, it would be erroneous to test a child in his second language and label him as disordered when he is only beginning to learn the second language. Alternatively, it would be erroneous to overlook the child whose native speech and/or language is disordered or delayed, attributing his troubles to his incomplete knowledge of the second language. The investigation of the facilitation and interference of languages upon each other may help make speech-language assessment of the bilingual child more efficient and accurate.

Matluck and Mace (1973) stated that a child's knowledge of Spanish phonology interferes greatly with the learning of English phonology. They suggested that many of the phonological errors in bilingual children's speech production go unreported because of the insufficient training of the investigators. Furthermore, these errors are caused by an inaccurate perception of English phonemic contrasts. Matluck and Mace asserted that, in many cases, the Mexican-American child's problems in perceiving English speech are severe and, if untreated, will lead to lexical and grammatical failings as well as problems in other areas of learning. They stated:

Without lots of tender, loving help--but informed, scientifically accurate help--[the child] will go on missing his signals; he will go on developing linguistic and educational, and perhaps even racist, neuroses; and he will go on being robbed of his linguistic birthright, and in the process, of his legitimate goals in life (p. 378-379).

Matluck and Mace's statement illustrates the possible ramifications of poor speech perception abilities of the bilingual child learning a second language and the need for scientific research to be conducted. This study will determine the interference of Spanish on the learning of English phonology by examining the relationship between perception and production of English speech contrasts in bilingual children from Spanish-speaking migrant families.

Issues: Communicative Assessment of Bilingual Children

Demographic Information

According to the 1980 Census, 34.6 million or 15% of the U.S. population is composed of native speakers of various minority languages. The American Speech-Language-Hearing Association estimated that approximately 4.5 million of these speakers have speech, language, or hearing disorders that are unrelated to the use of a minority language (Committee on the Status of Racial Minorities, 1985). Projections by the Census bureau suggest that by the year 2000 one-third of the caseload of the school speech-language pathologist and audiologist will consist of black, Hispanic, Asian, and American Indian children (Cole, 1989).

The Role of the Speech-Language Pathologist

The traditional role of the speech-language pathologist has been to provide clinical services to the communicatively handicapped child or adult. The ASHA Committee on the Status of Racial Minorities (Committee on the

Status of Racial Minorities, 1983) stated that it is possible for dialect speakers to have linguistic disorders within the dialect. Therefore:

an essential step toward making accurate assessments of communicative disorders is to distinguish between those aspects of linguistic variation that represent the diversity of the English language from those that represent speech, language, and hearing disorders.... Once the difference/disorder distinctions have been made, it is the role of the speech-language pathologist to treat only those features or characteristics that are true errors and not attributable to the dialect (p. 24).

The committee stated that while the speech-language pathologist may be available to nonstandard English speakers who seek elective clinical services for acquiring competency with the standard English dialect, it remains his or her priority to serve the truly communicatively handicapped speaker and to be able to determine if a minority speaker's speech and language skills are the result of a communication disorder or if they are representative of the communicative characteristics of the minority population to which the client belongs.

Federal legislation has placed stringent demands on the assessment of bilingual children. The Education of the Handicapped Act Amendments of 1986 (Public Law 99-457) and its precursors (Public Laws 93-380 and 94-142) firmly establish the right of all handicapped children to a free, appropriate, public education, with the goal of providing full educational opportunities to all handicapped children. To receive the appropriate, individualized education which is mandated by these laws, handicapped children must first be identified, then evaluated, and finally receive recommendations for a specialized educational program. In order to

determine the appropriate placement, careful evaluations must be conducted by certified clinicians who are knowledgeable about normal speech and language acquisition, communication disorders, and assessment procedures. The assessment of bilingual children is particularly difficult as few clinicians are knowledgeable about minority and bilingual language acquisition, and they are not familiar with the assessment protocols to use with such children. Further, few valid assessment instruments are designed to accommodate those bilingual children who use two languages to varying degrees and who come from culturally and linguistically different backgrounds. As a result, many bilingual children have been misclassified as handicapped, which has led to litigation charging discrimination in the educational assessment procedures. Kayser (1989) found that of three Mexican-American children who were labeled as language disordered by certified speech-language pathologists, only one child was truly handicapped when appropriate assessment techniques other than the conventional standardized tests were used. The difficulties associated with the assessment and evaluation of bilingual children were recognized during the legislation of Public Laws 93-380 and 94-142, and thus each law (and the more recent Public Law 99-457) contains provisions stating that procedures must be adopted to assure that the testing and evaluation materials selected and administered to bilingual children are not racially or culturally discriminatory. Public Law 99-457 further specifies that no single assessment instrument may be used as the sole criterion for specialized placement and that all testing must be in the child's native language.

Various statistics have illustrated the need to provide services to minority groups (Committee on the Status of Racial Minorities, 1985; Cole, 1989). Furthermore, ASHA and federal legislation demand that professionals

be knowledgeable about the cultural and linguistic characteristics of minority groups. Unfortunately, researchers and clinicians are only beginning to develop an adequate knowledge base concerning methods of assessing the languages of bilingual children. According to Glass (1979), the task of evaluating the language skills of these children is "formidable". The literature has attributed the faulty evaluation of bilingual children's speech and language skills primarily to the problems inherent in the assessment procedures. These problems and possible solutions will be discussed further in this paper.

Problems and Possible Solutions

Bilingualism: Definitions. According to Glass (1979), the systematic investigation of bilingualism has been hindered by the lack of a commonly accepted definition of bilingualism. "Bilingualism" is a term which is often used loosely to describe the use of two languages by the same individual. Although many investigators have attempted to define bilingualism, there is little agreement on one uniform definition. Because the definition of bilingualism is crucial to any study which involves subjects who speak more than one language, it is important for examiners to define what they mean by "bilingual".

Past definitions have not, for the most part, taken into account the fact that bilingualism can be a range of proficiencies which differ depending on the language area used (e.g., understanding and expression of the languages in the various areas such as articulation, semantics, syntax, etc.) or the social situations in which the languages are used. For example, an individual may be proficient with two languages in informal situations (e.g., when speaking with a child) but his or her proficiency may be inadequate when in more formal situations (e.g., when speaking to a child's teacher).

Actual definitions of bilingualism vary along a continuum from strong to weak interpretations. A strong interpretation states that bilingualism is the ideal mastery of two languages and a weak interpretation states that bilingualism is simply monolingualism in which individuals use different varieties of the same language. Most definitions lie somewhere between the two ends of this continuum.

Many researchers have considered the "ideal mastery of two languages" to be unrealistic. Fishman (1966) stated, "to require that bilingualism be defined in terms of equal and advanced mastery is no more justifiable than to require that intelligence be defined as equivalent to genius" (p. 122). Alternatively, definitions which state that bilingualism is an ability to use two language or two varieties of a language to any degree are too general. For example, Weinreich (1953) defined bilingualism as the ability to use two languages alternately. His definition is so general that it would seem that anyone who occasionally made use of any foreign words or cliches would qualify as bilingual. Haugen (1969) provided a slightly more specific definition. He stated that a bilingual individual is one who can produce meaningful sentences in a second language. His definition does not however, specify how proficient one must be at producing meaningful sentences. MacNamara's (1967) definition of bilingualism is not much more useful. He defined bilingualism as the possession of at least one of the language skills (listening, speaking, reading, or writing) in a second language to even a minimal degree. While he specified the modalities in which bilingualism may occur, he, like Haugen, did not specify what the minimal degrees of language proficiency might be.

Fishman (1966) has provided a more useful definition. He defined bilingualism as an ability to engage in communication in more than one

language. Thus, Fishman viewed bilingualism as more than an ability to produce cliches or even meaningful sentences, as the ability to communicate requires effective production and understanding of language. Rather, he viewed bilingualism as the ability to communicate effectively in various social situations. He stated in a 1968 article that bilingualism should be examined in terms of performance with the simultaneous interaction of the areas of: (1) media (e.g., speaking, reading, and writing); (2) role (e.g., comprehension, production, and inner speech); (3) formality levels (e.g., intimate, casual, and formal levels); and (4) the domains of bilingual interaction (e.g., work, home, school, church, government and other settings).

The current thinking tends to agree with Fishman's definition of bilingualism. Many authors believe that an adequate description of bilingualism must take into account the sociological context in which bilingualism exists and the speech community's norms for language use in various language areas (Erickson and Omark, 1981). If examiners do not come to an agreement on the definition of bilingualism and if such considerations are ignored, the attempts at assessing bilingual proficiency must be questioned in terms of their meaning and applicability which will in turn affect the accurate assessment of speech and language disorders. To simplify matters for the purpose of this document, "bilingual" will refer to those individuals who are capable of effectively communicating in two languages in at least one social situation.

Standardized Versus Nonstandardized Measures. The assessment of bilingual children's language skills is, simply stated, difficult at best. Any test instrument must assess the use of both languages in various contexts and language areas, with a consideration of the child's dialect and his socioeconomic, familial, and cultural background. The accurate assessment

of bilingual childrens' language skills requires valid, reliable assessment tools (Vaughn-Cooke, 1983). Yet there is simply an absence of such tools. According to Taylor and Payne (1983), "Given the state of the art in speech and language tests, it can be concluded that there are few, if any, standardized measures that can provide a completely valid and nonbiased evaluation of handicapping conditions for linguistically and culturally diverse populations" (p. 9-10).

The shortage of adequate standardized tests available may be due to the requirement that they reflect the dialect a child speaks. There are many Spanish-American groups in the United States (e.g., Texas Mexican-Americans, New Mexico Chicanos, Florida Cuban-Americans, New York Puerto Ricans, etc.), each with different cultural, linguistic, and socioeconomic characteristics. The language characteristics as well as the contextual use of language of the different bilingual subgroups can obscure the focus of the assessment of these bilingual groups. For example, test translations do not insure that all items in the test will be suitable for all individuals who speak the language. A Mexican-American in the Southwest may use the word "papalote" for the English word "kite", while a Cuban-American would say "cometa", and a Puerto-Rican would say "chiringa" (Glass, 1979). To control for dialectical variation, the test content should be carefully designed and selected to reflect the language usage and cultural patterns of the child's regional dialect (Mowder, 1982). In addition, supporting materials, such as stimulus pictures, should consider the appropriateness of the media (e.g., line drawings, photographs) and the content (e.g., urban experiences, rural experiences) to the child's age, regional, and cultural background.

Several researchers (Damacio, Oller, and Storey, 1983; Erickson and Omark, 1981; Kayser, 1989; Mattes and Omark, 1984; Vaughn-Cooke, 1983;

and Wilen and Sweeting, 1986) have suggested alternative strategies for speech-language assessment of bilingual children. These strategies include: the adaptation of existing standardized tests, the use of language samples and other more naturalistic methods, and the use of questionnaires.

Vaughn-Cooke (1983) suggested modifications of existing tests to make them more appropriate for minority speakers. She illustrated the use of tests standardized on speakers of standard English with modified scoring systems that would not penalize the speakers if they produced responses that were characteristic of their minority dialect. She stated, however, that it is critical that examiners obtain a thorough knowledge of the dialect before initiating revisions. Further, she recommended refraining from using all standardized tests that have not been corrected for test bias when assessing the language of non-mainstream speakers.

Another alternative to using standardized tools in testing the speech-language skills of bilingual children is to use more naturalistic measures such as language samples. A language sample involves collecting a spontaneous speech sample from a child and conducting an analysis of his or her utterances. The content, structure, and function of the utterances provide some of the information needed to determine whether a child's language is developing normally. Furthermore, language samples can provide information about a child's communicative ability in a range of situations (e.g., interactions with different persons and in different situations such as the home and classroom). The use of criterion-referenced testing is another more naturalistic way to assess language abilities. It involves specifying the specific linguistic behaviors to be tested and establishing criteria for acceptable responses. These more naturalistic methods of language assessment depend on extensive research on the normal language acquisition

process of the population tested. In order to determine if a bilingual child's language is developing normally or whether it meets certain criteria for his age, it must be analyzed in a developmental framework. Such a framework would reveal the sequence of normal language behaviors for specific age levels. Therefore, unless developmental research with the population of the child being evaluated has been conducted and the information has been made available, the use of language samples and criterion-referenced tests is unacceptable.

The use of observational charting of social and/or language behaviors may also be incorporated into the assessment of the bilingual child's speech and language skills or proficiencies (Kayser, 1989). According to Kayser, the observed behaviors may include the frequency of child- or peer-initiated interactions, positive and negative responses to interactions, facial expressions, or responses of peers to the target student's communication, and the use of gestures instead of speech and language. These behaviors may provide a profile of a minority child's language use in various situations. Two observational techniques are used: the scan and focal techniques. The scan technique is used to observe several children during one period of time, and the focal technique concentrates on the behaviors of one child. The observer notes the behaviors of children during normal interactions among groups of children. Damacio, Oller, and Storey (1983) analyzed the pragmatic criteria in the observational and elicited language samples of bilingual children. They found that pragmatic criteria such as nonfluencies, revisions, delays, specificity of referential terms, abrupt topic shifts, inappropriate responses, and the need for multiple repetition of prompts were more effective than traditional surface-oriented criteria in identifying

academically consequential language disorders in the sample of bilingual children.

Finally, the use of questionnaires to determine the input and output characteristics of the language in the child's environments is helpful in the speech-language and proficiency testing of the bilingual child. In addition, any language differences due to the child's ethnic background, the level of his acculturation to the mainstream culture, the attitudes of the child, family, and community toward the two languages and cultures, and the child's family's socioeconomic status may be at least partially determined by questionnaires or interviews.

Examiner Competencies. The evaluation of a bilingual child's speech and language skills is simplified when the examiner is familiar with the specific dialects of the child's languages. A monolingual examiner would likely have considerable difficulties in distinguishing the dialectal differences from true communication disorders. Even a bilingual examiner would have difficulty if he or she is not familiar with the particular dialect a child speaks. Many aspects of the speech and language evaluation are complicated by the client's use of two languages. For example, the phonemic, allophonic, syntactic, morphological, semantic, lexical, and pragmatic characteristics of a child's native language cannot be adequately assessed without knowledge of the content, form, and use rules of that language. Voice qualities, such as breathiness, harshness, loudness, and pitch vary across languages as do prosodic and suprasegmental characteristics. These factors may make it difficult to rule out a disorder when the examiner is unfamiliar with the paralinguistic characteristics common to the native language. In addition, hesitations, false starts, and other dysfluent behaviors may be exhibited by a bilingual client due to his unfamiliarity with the

language or due to the speech flow patterns of the native language. Finally, differences between minority cultures and the general population in traditions, customs, values, beliefs, and practices may affect the service delivery models and programs (Committee on the Status of Racial Minorities, 1985). Therefore, if speech-language pathologists intend to provide their services to bilingual speakers, they must continually consider the influence of linguistic, paralinguistic, and cultural differences on the nature of their language assessment results.

The ASHA Committee on the Status of Racial Minorities (1985) recommended a set of clinician competencies for their assessment and remediation of communicative disorders in minority language speakers. According to the committee, if a bilingual child is proficient in English, it is not essential that the speech-language pathologist be proficient in the minority language to provide assessment or remediation services in English. However, the speech-language pathologist must be able to understand the minority language as a rule-governed system, have knowledge of the contrastive phonological, grammatical, semantic, and pragmatic features of the minority language, and have knowledge of nondiscriminatory testing procedures. If any assessment and remediation services will be provided in the minority language, however, the speech-language pathologist must have "native or near-native" proficiency in both the minority language and English. In addition, the bilingual speech-language pathologist should:

- possess (1) ability to describe the process of normal speech and language acquisition for both bilingual and monolingual individuals and how those processes are manifested in oral and written language;
- (2) ability to administer and interpret formal and informal assessment procedures to distinguish between communication differences and

communication disorders in oral and written language; (3) ability to apply intervention strategies for treatment of communicative disorders in the client's language; and (4) ability to recognize cultural factors which affect the delivery of speech-language services to the client's language community (Committee on the Status of Racial Minorities, 1989, p. 93).

Clearly, the assessment of the speech-language skills of the bilingual child is facilitated if the examiner is not only proficient with the minority language and knowledgeable about the culture, but if he or she is knowledgeable about the normal language acquisition of children using the language. A clinician who possesses a knowledge of normal minority and bilingual language acquisition would be more able to effectively use language samples to evaluate the speech and language skills of bilingual children and he or she would be able to adapt the existing tests and assessment protocols so that they would be appropriate for the bilingual child. According to Vaughn-Cooke (1983), one of the factors which contributes the most difficulty to any language assessment of bilingual children is the lack of information concerning the developmental process of the language acquisition in minority languages.

ASHA's 1989 bilingual clinician qualifications are very idealistic. While it would be logical and of sound clinical practice for a child to be evaluated by a clinician who possesses the required knowledge and skills listed above, very few clinicians would actually have such characteristics. It is likely that only those individuals who have had the opportunity to live within a cohort of minority language speakers or who are members of a minority themselves would possess the necessary language proficiency and the knowledge of the cultural characteristics to work clinically with the

specific population. Furthermore, these individuals would need to have received their training in university programs which included education in the normal acquisition of the monolingual minority language as well as in bilingual language acquisition. In addition, Cole (1983) stated that it was up to the professional in communicative disorders to seek increased knowledge of bilingual and minority language acquisition and in appropriate assessment techniques through continuing education activities and independent study. The American Speech-Language-Hearing Association has admirably made it their goal to disseminate current literature concerning the assessment of minority populations to practicing speech-language pathologists. A committee is currently working on a manual describing the management of communication disorders in multicultural populations (Cole and Deal, in press).

The ASHA Committee on the Status of Racial Minorities (1985) suggested various alternative strategies that might be utilized when speech-language pathologists cannot meet the ASHA requirements when working with bilingual individuals. Those clinics or school districts which serve minority populations but which have no bilingual clinicians may choose to employ bilingual speech-language pathologists who are consultants and/or itinerants and have the primary responsibility to serve a specific minority language population. Interdisciplinary teams may be established which would include a monolingual speech-language pathologist and a bilingual professional colleague (e.g., psychologist, special education teacher, etc.) who is knowledgeable of the assessment procedures and of the language development in the minority language. Networks could be established between clinics and universities which have programs in bilingual speech-

language pathology or audiology in order to develop and exchange information and materials.

When there are no trained professionals available who are proficient in the minority language of a particular client, interpreters or translators may be used during the clinical interactions. According to ASHA (Committee on the Status of Racial Minorities, 1985), the individuals who could serve as translators can include "(1) professional interpreters from language banks or professional interpreting services, (2) bilingual professional staff from a health or education discipline other than communicative disorders, or (3) a family member or friend of the client" (p. 31). However, if a translator is used, he or she must be trained and preferably evaluated on the purposes, procedures, and goals of the tests and therapy methods used with the minority language speaker in order to reduce the risk of invalid testing. Finally, the ASHA committee (1985) recommended that the speech-language pathologist and audiologist must state in their written evaluations that a translator was used and the validity of the results may be affected.

Examiner Ethnicity. Researchers have suggested that a child's responses to an Anglo examiner may not be representative of his abilities. Mycude (1968) found that language test scores of Mexican-American children were higher when the test was administered by a Mexican-American rather than Anglo-American examiner. Variables such as personality, dress, and rapport, however, prevented his results from being conclusive. According to Glass (1979), Allen S. Toronto conducted a pilot study in 1977 which was unpublished. Toronto found that the examiner's ethnicity and social class had a dramatic effect on children's responses. The Mexican-American preschool children whose primary language was Spanish would only respond

in English to the examiners who came from outside the barrio even though each of the examiners was a native Spanish speaker.

Additional systematic and comprehensive studies which use a large number of monolingual and bilingual examiners are needed to better determine the problems of examiner ethnicity. Until there is a better understanding of the effects of examiner ethnicity on children's responses, it would be safe to assume that a bilingual child from a minority language background who is evaluated by an Anglo examiner may exhibit responses that are not representative of his or her abilities. Still, a bilingual examiner from the same minority background should be used if possible.

Second Language Acquisition

Theories of second language acquisition have focused three distinct areas of study: (1) the role of the native language in the learning of a second language, (2) the adult's versus the child's learning of a second language, and (3) the effects of early bilingualism on further linguistic and cognitive functioning. The research relating to these theories of second language acquisition appears to have produced conflicting results.

The Role of the Native Language in Second Language Acquisition

It appears that having a knowledge of one language can both facilitate and hinder performance in a second language (Glass, 1979). For example, the knowledge of a first language has been found to facilitate learning of a second language in the area of categorical perception (Carrow, 1971). Carrow found upon comparing groups of English-speaking children to Spanish-speaking children, that their vocabulary comprehension skills were similar, which may suggest that comprehension depends on the referent for the linguistic structure and possibly on the frequency with which the particular item is used in the language. The knowledge of a first language may

interfere with the acquisition and use of the semantics, syntax, and phonology of a second language (Carrow, 1971; Cornejo, 1969; Fishman, 1968; Matluck and Mace, 1973). Carrow found that Mexican-American children have problems with pronouns, negatives, and tense markers, which provides evidence of a syntactic interference.

According to McLaughlin (1984), many theorists assume that "interference between first and second languages is an inevitable and ubiquitous part of second-language learning." In other words, errors in the second language can be predicted on the basis of comparison with the native language. Lado (1957) presented the Contrastive Analysis hypothesis which purports that the learner's first language serves as a filter through which the second language is learned. Errors which then reflect the native language are called transfer errors. Stockwell and Bowen (1965a; 1965b) presented contrastive analyses of the grammatical and phonological systems of English and Spanish. These analyses demonstrated a hierarchy of difficulty that predicts the nature of the the transfer errors for a native speaker of English learning Spanish, based on the similarities of the two languages. McLaughlin (1984), however, stated, "generally, no more than a third of the errors in a speech corpus can be identified as due to intrusion of first-language structures." He reviewed the literature and concluded that there was little evidence for any interference between languages, especially if the two languages are learned simultaneously.

Dulay and Burt (1974) found that the second language learner commits the same kinds of errors as does a native speaker during first language acquisition. This L1-L2 hypothesis holds that errors produced for each first and second language acquisition will be similar. According to McLaughlin (1984), the majority of errors that second-language learners

make are the result of generalizing and misapplying the rules of the second language before they are mastered, and oversimplifying morphology and syntax in the way that first-language learners oversimplify. In addition, they make "other errors also found in the developmental data for first-language learners of the target language." The errors made by a second language learner which reflect the pattern of acquisition of the same language by a native speaker are called overgeneralization errors.

The Interlanguage Hypothesis (Selinker, 1972) accounts for both the role of the native language and the developmental nature of second language acquisition. It holds that the learner's second language development consists of a progression of developmental states which are systematic and which demonstrate the influence from the learner's native language. In addition, this theory states that the difficulties in the second language itself lead to errors in overgeneralizing the rules of that language. The Interlanguage hypothesis attempts to account for ambiguous errors. For example, it may be difficult to determine if an error is due to language interference or to developmental features. If a child said "I no like it", the error might reflect either the influence of the Spanish language or a developmental stage through which native English speakers will pass. The Interlanguage hypothesis implies that while an interlanguage system cannot be predicted from contrastive analysis alone, the speakers of different languages will have different interlanguage systems when learning English due to at least some influence of the native language. The contrastive analysis hypothesis is not sufficient in itself to explain the errors made during second language acquisition since it is apparent that first-language influences do enter into various aspects of second-language performance. Still, it is important to know where and why transfer errors occur.

Interference of Spanish on the Acquisition of English Phonology. The area of phonology may be the one aspect of language which is the most affected by language interference, although more experimental research is needed (McLaughlin, 1984). The bilingual child's task is difficult because he or she must distinguish two sound systems from each other. This is especially difficult if the native language is dominant. McLaughlin stated that if two languages are in balance, there is little evidence of confusion. If one language predominates, however, the sound features of the dominant language may be substituted for those of the subordinate language. While developmental factors may be an etiology of phonological errors (e.g., when corresponding phonemes in the two languages are difficult to acquire regardless of the language spoken by an individual), the contrastive analysis of two languages is helpful in predicting some of the phonological errors made in learning the second language.

The contrastive analysis hypothesis (Lado, 1957) predicts that those sounds in the second language which have equivalent features in the native language will be the sounds learned first. Alternatively, those sounds which do not have equivalent features in the native language will be more difficult and thus acquired later. As discussed above, Stockwell and Bowen (1965) presented a contrastive analysis of the phonological systems of Spanish and English that included a comparison of the consonants, vowels, and suprasegmental systems of the two languages. They designed an eight-step hierarchy of difficulty that predicts the phonological problems a native speaker of American English would experience while learning Spanish. It is based on whether the sounds in the target language occur in the native language, and whether they occur as allophones or phonemes. According to Stockwell and Bowen, the easiest category of consonantal sounds are those

which have the same phoneme status in both languages (e.g., [m] occurs in both languages as a phoneme). They stated that these Spanish consonants present no real difficulty to the English learner of Spanish. It is logical to infer that this category would include the easiest sounds for the Spanish speakers learning English. The sounds whose mispronunciation by English speakers result in a heavy foreign accent consist of those sounds which are phonemes or allophones in English but which do not exist in Spanish (e.g., English has a flap [ɾ] between vowels while Spanish does not). The sounds which are the most problematic and which may result in a greater misunderstanding if pronounced with English influence are those sounds which are either phonemes or allophones in Spanish but which do not exist in English at all, or those sounds which are allophones in Spanish but are phonemes in English (e.g., the frictionalized [b] does not exist in English). Although Stockwell and Bowen's work can be utilized to predict interference between any native and target language, it was intended for the use of teaching Spanish pronunciation to English speakers and it has not been rigorously tested.

Matluck and Mace (1973) and Avery and Erlich (1987) have approached the contrastive analysis theory from a different point of view. They have examined the difficulties that native Spanish speakers learning English may have in perceiving English speech sounds. Matluck and Mace stated that if the Spanish-speaking child does not learn a new set of English phonemic contrasts, he or she will hear many pairs of words as identical words. The nine consonantal phonemic contrasts which the Spanish speaker must learn are presented in Table 1.1. In addition, of the 14 phonemes in the contrasts described in Table 1.1, four phonemes do not exist as sounds in American Spanish, and only three phonemes appear in word-final position in

Table 1.1

English contrasts which must be learned by the native Spanish speaker

-
1. /tʃ/: /ʃ/ as in chair/share
 2. /tʃ/: /dʒ/ as in rich/ridge
 3. /s/: /z/ as in sip/zip
 4. /n/: /ŋ/ as in run/rung
 5. /b/: /v/ as in base/vase
 6. /t/: /θ/ as in bat/bath
 7. /θ/: /s/ as in thin/sin
 8. /d/: /ð/ as in dare/there
 9. /j/: /dʒ/ as in yellow/jello.
-

American Spanish (/n/, /d/, and /s/). This suggests that Spanish speakers may not be able to contrast or perceive most of these phonemes when produced in the final position. Further, a word never ends with more than one consonant sound in Spanish while, in English, thousands of words end with two, three, and sometimes four consonant phonemes. Table 1.2 summarizes the phonologic system of standard Spanish. The reader should acknowledge that there are many dialectical variations of this system. For example, Lance (1979) found that dialectical forms which existed in the Spanish of South Texas residents included an [h] variant of /s/ and a [x] variant of /f/.

Matluck and Mace (1973) stated that vowels were also a problem for Spanish speakers learning English. The Spanish system consists of five vowels. The English learner must learn eleven additional vowels, which need to be distinguished only in stressed syllables, and he must learn that unstressed syllables are often reduced to a schwa /ə/. In addition, the suprasegmental system of Spanish is characterized by syllables of approximately equal length. This makes it difficult for the Spanish-speaking child to perceive the very short unstressed syllables in English.

As the native language of the learner is not now assumed to be a completely accurate predictor of second language errors and as there is no simple formula for predicting the second language learner's errors, further research in the area of second language phonology must be conducted. Information on the kinds of errors second language learners from various linguistic backgrounds produce in their interlanguage phonology can then be made available to investigators and clinicians who are concerned with communication disorders. One must be aware, however, that the variables

Table 1.2
Latin Spanish Consonants

The analysis of the Spanish consonant system presented here is a simplified version of that made by Harold V. King (1952), as presented in Sawyer (1975) in Hernandez-Chavez, Cohen, and Beltramo, eds.

| | |
|---------------------------------|--|
| /b/ with allophones: | <p>[b] occurring initially and medially before [r] and [l], initially before a vowel, and medially after [m].</p> <p>[b̥] frictionalized, occurring medially before vowels and voiced consonants.</p> <p>[b̥̥] occurring before voiceless consonants or pause, partially voiceless and frictionalized.</p> |
| /d/ with allophones: | <p>[d] occurring initially and medially before [r], initially before a vowel, and medially after [n].</p> <p>[d̥] occurring medially before vowels and voiced consonants.</p> <p>[d̥̥] partially voiceless and frictionalized, occurring before voiceless consonants or pause.</p> |
| /g/ with allophones: | <p>[g] occurring initially and medially before [r] and [l], initially before a vowel, medially before a stressed vowel in free variation with [g̊], and medially after [n].</p> <p>[g̊] frictionalized, occurring medially before vowels.</p> |
| /p/ with one allophone | [p] rarely occurs finally. |
| /t/ with one allophone | [t] rarely occurs finally. |
| /k/ with one allophone | [k] rarely occurs finally. |
| /t͡ʃ/ with one allophone | [t͡ʃ] rarely occurs finally. |
| /f/ with one allophone | [f] rarely occurs finally. |
| /h/ with one allophone | [h] rarely occurs finally. |
| /ʃ/ with one allophone | [ʃ] occurs finally after vowels in a small number of sequences. |
| /s/ with allophones | <p>[s] occurs in all positions and may be lax or [h].</p> <p>[z] occurs in free variation with [s] before [l], [m], and [n], and before voiced consonants.</p> |
| /m/ with one allophone | [m] occurs initially and medially before vowels, medially before [p] and [b], and before voiced consonants. |
| /n/ with allophones: | <p>[n] occurs before [t͡ʃ] and [s].</p> <p>[n̪] dentalized, occurs before vowels and consonants other than labials or velars and finally.</p> <p>[n̠] occurs before [g], [k], and [x].</p> |
| /ɲ/ with one allophone | [ɲ] occurs medially between vowels and rarely initially. |
| /l/ with one allophone | [l] occurs initially, medially, and finally. |
| /w/ with one allophone | [w] with varying amounts of voiced velar friction, occurs initially and medially before vowels. |
| /j/ with allophones: | <p>[j̥] with varying amounts of voiced palatal friction, occurs initially and medially before vowels.</p> <p>[j̥̥] with varying amounts of voiceless palatal friction, occurs before pause.</p> |
| /r/ with one allophone | [r] occurs only between vowels, a voiced alveolar flap. |
| /r̄/ with allophones: | <p>[r̄] apical trill, occurs initially, medially before vowels, medially before consonants, and in free variation with voiceless trill finally.</p> <p>[r̥̄] voiceless apical trill occurring before pause.</p> |

that influence second language acquisition and cause individual differences are also applicable at the phonological level. Childhood acquisition of the phonology of a second language depends on the amount and quality of the child's exposure to both the native and the second language, the child's motivation to learn the language, the child's family's social position, and the child's personality and other cognitive characteristics. Apparently, the child's age at the time of learning the second language is not important. Snow and Hoefnagel-Hohle (1978) demonstrated that there is no significant difference in the phonology of native Dutch speakers learning English between five different age groups ranging from age three to adult. Further, these researchers found that none of the advanced learners had achieved perfect, native-like pronunciation of the English phonemes. The findings on age differences, then, do not support a critical age hypothesis and children as well as adults will have difficulties in acquiring the phonology of a second language.

In assessing the phonological/articulation skills of the bilingual child, it is necessary to determine if errors in the second language are the result of any interference from the alternate language, or are the result of a developmental delay or disorder. Such a determination will influence the decision regarding whether a child will be placed in speech therapy. Currently, there are no reliable means to determine whether a child's articulation errors in the second language reflect the child's interlanguage phonology or whether they are evidence of a speech disorder (Anderson, 1981). Therefore, if the clinician suspects that a bilingual child has a speech impairment, the assessment should be conducted in the child's native language so that any aberrations in their speech development can be determined more accurately.

Second Language Learning in Childhood and Adulthood

It is a common assumption that "the young child acquires a language more quickly and easily than an adult because the child is biologically programmed to acquire languages, whereas the adult is not" (McLaughlin, 1984). McLaughlin questioned Lenneberg's (1967) idea of a critical period for language acquisition. The "critical period" proposition states that before puberty, the brain possesses the plasticity necessary to acquire languages effortlessly through the child's mere exposure to languages. Other researchers have shown that the cutoff point for lateralization of language function is complete by or earlier than four or five years of age (McLaughlin, 1984). McLaughlin stated that language learning is not effortless for any child as is evidenced by their number of false starts and "considerable frustration." Furthermore, there is no evidence that children acquire languages more quickly and easily than adults. According to McLaughlin, the experimental research addressing whether children differ from adults in their ability to acquire second languages has "consistently demonstrated the inferiority of young children under controlled conditions" (p. 217). McLaughlin (1984) speculated that children are placed in more situations where they are forced to speak the second language than are adults. Even when the method of teaching appears to favor learning in children, they perform more poorly than adults. MacNamara (1973) suggested that the traditional view that children are superior to adults in learning languages may reflect the psychological and social factors that favor the child. In this view, children are likely to have fewer inhibitions and they will be less embarrassed when they make errors. They will speak more and receive more feedback and they may have more motivation to speak. MacNamara stated that adults might prove superior to children if they are given the

same naturalistic learning environment in which children usually acquire second languages.

The misconception that children acquire languages more quickly and easily than adults leads to another common misconception: "the younger the individual, the more skilled in acquiring a second language" (McLaughlin, 1984). Again, the idea that younger children acquire languages more skillfully may stem from the influence of the quality of their language experiences and not necessarily from the neurological plasticity of their brains. McLaughlin suggested that older children may be more inhibited, more afraid of making mistakes, and may have less of a chance to interact with speakers of a second language in play situations. He speculated that given the same amount of exposure and quality of exposure, an older child (or an adult) will presumably do just as well or even better than a younger child. Therefore, it is impossible to suggest an optimal age for learning a second language, as it depends more upon the type of experiences to which children and adults have been exposed.

Early Bilingualism: The Threshold Hypothesis

One factor which may influence second language development is the level of a child's proficiency in his or her native language when a second language is introduced. Cummins (1979) proposed a threshold hypothesis to explain his theory that "a cognitively and academically beneficial form of bilingualism can be achieved only on the basis of adequately developed first language skills" (p. 222). That is, there may be a minimum or threshold level of language competence that bilingual children need to achieve "to avoid cognitive deficits and to allow the potentially beneficial aspects of becoming bilingual to influence their cognitive growth" (p. 229). For example, a Hispanic child who attends an American School with inadequately

developed native language skills will likely have great difficulties acquiring second language skills due to their lack of mastery of concepts in the native language. Therefore, teaching children through the second language when they have not reached an appropriate level of conceptual development in the native language may "foster alingualism or failure to develop fluency in either language" (Wilén and Sweeting, 1986, p. 62).

McLaughlin (1984) concluded from his review of the literature that broad, sweeping statements cannot be made regarding the effects of early bilingualism on language development, cognitive functioning, or intellectual development. He stated that some research has suggested that bilingualism may actually delay the lexical and syntactic development of the young child in comparison to monolingual speakers. In contrast, other research has suggested that the bilingual experience sensitizes children to the formal aspects of all languages. Further, it has been commonly assumed that the experience of early bilingualism negatively affects the child's cognitive functioning and/or intellectual development. It appears that, in these areas, the research findings are either contradictory or their validity can be questioned on methodological grounds. The only tentative statement that can be made with any validity is that the effects of bilingualism may be different for early and late bilinguals. That is, children who grow up learning two languages simultaneously may experience consequences from their bilingualism that are quite different from those experienced by children who learn a second language once their first language is firmly established. Clearly, additional research is needed regarding the specific interactions between the different types of bilingual experience and the different areas of language (e.g., phonology, morphology, syntax, semantics).

Individual Differences in Second Language Acquisition

Children differ in the rate and ease with which they learn a second language. While the study of factors leading to greater proficiency in second language learning is difficult due to the number of interacting variables and the lack of tools to measure some variables (e.g., personality), researchers have concluded that several factors may affect an individual's second language acquisition. These include: (1) the opportunity to learn a second language, (2) motivation, (3) social position, and (4) subject traits such as cognition and personality.

The number and quality of learning opportunities in the environment clearly affects second language learning. Williams (1979) studied the effects of age and experience on learning at the phonetic level during second language acquisition. He categorized groups of Puerto Rican children living in the United States based on their ages and their length of stay on the mainland and he described and compared each group's ability to perceive and produce the English voicing characteristics of stop consonants. He found that increased learning occurred with the increased length of stay in the United States. This result is logical given that many aspects of second language acquisition occur through natural learning mechanisms, which are activated when the learner is involved in a communicative activity (Littlewood, 1984). Thus, if a child is to learn a second language, it is important that he or she have access to situations where the language is used as a natural means of communication. It is not enough to simply reside in or visit another country. Language learning occurs through the individual's interaction with native speakers at a personal level. Littlewood (1984) also proposed that the emotional climate of learning situations and

the experience with any formal teaching of the language also influence second language acquisition.

Sociopsychological factors also influence the rate and ease of second language acquisition. Even if an individual has access to a community in which the second language is used, he or she must have the motivation to interact with that population and to learn its language. According to Cummins (1986), motivation to learn a second language and attitudes towards the speakers of the second language are related and may significantly affect second language learning. Children will be more likely to have high motivation to learn a second language when they have a positive attitude toward the cultural group that speaks the language and when they wish to identify with that group rather than if they have a negative attitude towards speakers of the second language and their learning of that language is viewed as a threat to their identity.

Gardner and Lambert (1972) described two types of motivation which they call 'integrative' and 'instrumental'. A learner with integrative motivation has a genuine interest in the second language community and he or she wants to learn their language in order to better communicate and to gain closer interaction with this community and its culture. A learner with instrumental motivation is more interested in how the second language can be a useful instrument towards furthering other goals, such as improving employment prospects.

Barker (1979) described how the language spoken by a minority individual varies according to his or her social experiences. According to Barker, the character of this experience depends on the position of the minority group in the general community, the relation of the individual to the minority group, and the relation of the individual to the general

community. Barker described four types of linguistic behavior patterns which emerged within his pool of subjects in Tucson, Arizona, based on this framework:

- (1) Individuals who speak Southern Arizona dialect of Spanish and sub-standard English. They favor English and avoid Spanish in conversations with Anglos. They seek mobility through Anglo contacts and are oriented toward Anglo culture in all aspects except that of intimate and familial relationships;
- (2) Individuals who speak standard Mexican Spanish and sub-standard English. They favor Spanish in conversation with Anglos and tend to be shy about their English. They seek mobility through the Mexican community and are oriented toward Mexican culture in familial relationships and informal and formal relations with other bilinguals;
- (3) Individuals who speak the Southern Arizona dialect of Spanish, Pachuco, and sub-standard English. They favor their own special language and reject both Mexican and Anglo groups, seeking to form a society of their own; and
- (4) Individuals who speak standard Spanish, Southern Arizona dialect, and standard English. They favor both standard English and standard Spanish. They are marginal to both Mexican and Anglo groups and try to maintain an even balance between Anglo and Mexican groups.

Based on these findings, it is apparent that acquisition of a second language is not only influenced by a person's motivation to learn a language, but also by his or her social position. This, in turn, is influenced by how his family and his language community view speakers of the second language.

The ability to learn is another factor which may account for the differences between learners of second languages. Given the same opportunity and motivation to learn, some individuals are simply better at learning than others. This can be due to both cognitive (intelligence, learning strategies, etc.), and personality factors. Strong (1982) examined the relationship between personality variables and second language acquisition in kindergarten children. He found three variables which showed significant relationships with communicative language skills: Talkativeness in the native language, responsiveness in the native language, and gregariousness in both languages. These personality variables might be related to intelligence or to learning strategies. In turn, these variables will affect an individual's motivation to learn a second language. If a child experiences several negative situations in using the new language, he or she will likely be less motivated to interact with speakers of the language. Thus, the variables influencing second language learning interact and, while it is useful to determine the effects of these variables in assessing the language of a bilingual child, it is difficult to isolate the effects of each one of these variables.

Characteristics of the Migrant Population

Apparently, there have been few studies which have described the linguistic and cultural characteristics of migrant populations in the United States. Approximately 3.5 million migrant and seasonal farmworkers and their dependants are hired in the United States each year (Wilk, 1986). Of these, approximately 85% are Hispanic and the remaining 15% are Anglo, Black, Native American, and Southeast Asian. In Montana, 65% of the migrant population list Texas as their home state. The rest are from

Washington, California, Oregon, Florida, Wisconsin, Mexico, and Central America (Montana Office of Public Instruction, 1987)

Low socioeconomic status is often considered to be the primary characteristic responsible for the migrant worker's social status. Migrant workers provide cheap, temporary, and unskilled labor to farmers needing help in the planting, care, and harvesting of fruits and vegetables in the United States. Many of these workers are unable to establish and maintain regular employment and, as a result, their annual incomes fall below the poverty level.

Poverty in itself manifests a distinct subculture for the migrant population. According to Weirather (Personal communication, 1989), the subculture creates boundaries between itself and the rest of society where integration and adaptation become difficult. This, in turn, affects the linguistic and cultural adaptation of the population. These boundaries prevent the migrant worker from having a natural, quality exposure to the native speakers of the English language. This exposure is critical for optimal second language learning (Littlewood, 1984). According to Sawyer (1979), the acquisition of a new language and culture has not been a necessity for Mexican immigrants in Texas. The influence of the Spanish language and Mexican-Spanish culture is ubiquitous in this region of the United States. The Mexican immigrant is surrounded by relatives and friends who share the same customs and speak the same language. In addition, Sawyer stated that the complete integration with the Anglo cultural community may never come for the Spanish-speaking population as a whole, since many of them do not seek it either for themselves or for their children. In fact, the children who adopt American cultural ways and master the English language are often called "agringados", a derogatory term. It is important to many

members of minority populations to preserve their language and culture. Yet, recent generations of Texas Spanish-speakers want equal opportunities to education and employment and they may now be more motivated to learn the English language and the American culture. Still, according to the data released by the U.S. Department of Education (1987), many, if not most, Hispanic workers have a minimal knowledge of the English language.

Speech Perception

Definitions

The term "perception" has been used broadly by a number of investigators. Historically, "speech perception" was conceived to be a passive process in which a percept was achieved by a simple frequency-over-time transformation of a signal (Kuhl, 1982). More recently, "speech perception" has been used to describe the categorization of speech sounds. "Categorical perception" refers to the perception of boundaries between categories and "perceptual constancy" refers to defining category centers (Kuhl, 1978). A subject's experience with language would therefore influence his percept. This suggests that while the ability to perceive speech appears to be innate (the neural pathways are organized in such a way that perception of speech is allowed), speech perception is actually shaped by the language one learns.

Infant Studies

Several investigators have utilized infant studies to demonstrate that speech perception abilities are innate (Eimas, Siqueland, Jusczyk, and Vigorito, 1971; Aslin, 1987). For example, English-learning infants between one and four months of age show far better discrimination along a synthetic voice onset time (VOT) continuum for two stimuli that straddle the adult /ba/-/pa/ phonetic boundary than they do for two equally acoustically distinct stimuli from within the same phonetic category (Eimas, et al., 1971).

Furthermore, cross-linguistic research has indicated that infants can discriminate native and nonnative VOT distinctions, but are less able to discriminate VOT contrasts that are not relevant in any language (Eimas, 1975; Lasky, Syrdal-Lasky, and Klein, 1975; Streeter, 1976). These results suggested that infants may have a biological predisposition to discriminate a universal set of phonetic contrasts.

Cross-Linguistic Studies

It has also been suggested that there is an apparent decline or reorganization in the universal phonetic sensitivity as a function of learning a particular language (Werker and Lalonde, 1988). Research has shown that adults and older children more easily perceive those phonetic contrasts that are phonemic, that is those phonetic contrasts that are used to differentiate meaning in their native language (Eilers, Gavin, and Oller, 1982; Oller and Eilers, 1983; Trehub, 1976; Werker and Lalonde, 1988). Werker and Lalonde (1988) demonstrated that the child's reorganization from phonetic to phonemic perception occurs sometime during the first year of life. Young English-speaking infants (six to eight months of age) were able to discriminate both Hindi and English contrasts, while older infants (11 to 13 months of age) were significantly less able to discriminate the Hindi contrasts. Thus, as children grow older and are increasingly exposed to one language, they filter out or ignore those contrasts which fail to signal a change in meaning in the language. Finally, additional research has demonstrated that adults still possess or can acquire an ability to discriminate nonnative contrasts if they are given sufficient training (Pisoni, Aslin, Perey, and Hennessy, 1982).

Speech Perception in Bilingual Children

Investigations of the speech perception abilities of bilingual children have been used to demonstrate that the perception of non-native contrasts is re-acquired as the child's exposure to a second language increases. That is, phonemic contrasts of the second language are either no longer ignored or they are re-learned. Williams (1977; 1979) and Caramazza, Yeni-Komshian, and Zurif (1974) demonstrated that learning at the phonemic level does indeed occur during second language acquisition. The results of their studies, however, cannot be extended to make any general conclusions about bilingual children's speech perception abilities. Both studies utilized synthetic speech to examine the perception of stop consonant voicing in syllables. More information is needed regarding bilingual children's abilities to perceive second language contrasts in meaningful speech situations (e.g. words, sentences, and conversation) in order to determine how knowledge of the phonemic system of a first language interferes with learning a second language. Furthermore, the abilities of bilingual children to perceive contrasts in a second language should be studied relative to their abilities to produce phonemes of the second language. This information would be useful for determining possible etiology for the reported difficulty which children as well as adults have in acquiring the phonology of a second language (Erickson and Omark, 1981).

The Relationship Between Speech Perception and Speech Production

The relationship between the bilingual child's perception and production of nonnative phonemes has not been sufficiently addressed in the literature. To understand the relationship between speech perception and production abilities of bilingual children, it is helpful to first examine the

relationship between speech perception and production in monolingual children, an area which has been extensively studied. Even in this, however, there are conflicting findings, perhaps largely due to differences in the assessment procedures.

Assessment of Speech Perception

The knowledge of how a child perceives speech sounds permits a more complete understanding of how the child's expressive phonological system develops. In the case of the bilingual child, that knowledge can help clarify whether a child's production errors in his second language are a result of not perceiving the sounds in that language or whether he or she does not produce those sounds for other reasons. To evaluate a child's speech perception skills clinically, the investigator needs guidelines for selecting or designing the assessment protocols.

The process of speech perception in itself cannot be directly observed by an examiner. He can only infer what a child perceives based on the nature of the child's responses to speech stimuli. The nature of the task required of a child can also greatly affect the obtained results. For example, a child might correctly perceive stimuli but fail to respond as if he or she did. The child must determine what types of analysis he or she is expected to perform and then decide whether the cues are sufficient in size or type to indicate a response. In addition, the child must understand and remember how he or she is required to respond. Locke (1980), Schwartz and Goldman (1974), and Barton (1976) have provided suggestions for criteria to use in selecting or designing perception tasks.

According to Locke (1980), the results of speech perception testing should be reflective of what a child actually produces. If perception testing is for a clinical purpose, that purpose is to decide if therapy is needed and

what direction the therapy should take. If a child produces /w/ for /r/, one would want to determine if he or she is able to discriminate between /w/ and /r/. Depending on the results of perception testing, one may or may not then decide to train that contrast. Stated more simply, if a clinician intends to relate a child's speech perception skills to his speech production skills, then she must ensure that the same phonemes are assessed in both the perception and production tasks. The administration of certain speech perception tests may result in scores which reflect a child's overall speech perception abilities, but the score may not reflect the child's ability to produce specific phonemes.

Locke also recommended that the child's production and perception be assessed in the same phonetic contexts, as articulation is context sensitive. For example, a child who mispronounces [k] in "cat" may not necessarily do so in another phonetic context such as "kick". Locke stated:

"If we cannot observe agreement between the production of a particular phoneme in one context with the production of that same phoneme in a different context, how could we possibly expect agreement between production and perception when they involve different environments?" (p. 434).

Therefore if we test a child's production of "cat" we must also test his or her perception of "cat".

Locke stated that assessment protocols must allow the child to display evidence of discriminant responding. To achieve this, the child should be trained on subtle contrasts to determine if he or she is ready for the task. Locke stated that perceptually dissimilar sounds (e.g., /t/-/r/) are not adequate to use in training. If a child responds correctly to the presentation of a dissimilar contrast, he may be responding correctly only to the greater

perceptual distance between the sounds. The child may not necessarily, then, be ready for a task which requires discrimination of more subtle differences. It might be ideal to use training with more than one contrast pair before testing is begun. The training with perceptually dissimilar sounds may determine whether the child understands the task in itself. Training with more perceptually similar sounds might then be used so that the child better understands how much attention is required in order to respond correctly.

According to Locke (1980), the discrimination task must be based on a comparison of an adult's surface form and the child's internal representation. That is, the examiner's intent should focus on the determination of whether a sound just heard differs in some way from the child's lexically-based storage of sounds and words. Matluck and Mace (1973) stated that, in the case of bilingual children, the phonemic system of a language acts as a filter through which the native speaker hears the sounds of other languages. This phonemic filter assigns the sounds of foreign languages to the nearest equivalent phoneme in the native language. The purpose of the clinical assessment is to determine if the perception of the sound stimulus is comparable to the phonetic forms that exist in the child's long-term memory.

In assessing the discrimination of contrasts, a child must be given repeated opportunities to reveal his or her perceptual decisions. Locke (1980) stated, "a task that has one instance of a particular item or contrast simply cannot permit any conclusions about the nature of the child's perceptual behavior nor any predictions as to whether it will change or should be treated" (p. 436). The nature of the same/different discrimination task allows a 50% chance that one will respond correctly when guessing. Repeated opportunities for each contrast will illustrate whether the child's

responses are due to chance or to actual discrimination of the contrasts. Furthermore, the examiner may prevent nonperceptual errors from interfering with overall results if he or she presents multiple trials for each item and does a qualitative analysis of the errors. If the child is distractible or if he becomes inattentive, these behaviors should be evident from his pattern of responding, as the errors may begin to occur on those items which were passed with accuracy in earlier trials. Thus, with the use of multiple trials and an error analysis, few of the child's behavioral (nonperceptual) errors would be interpreted as perceptual errors. In addition, it is important to keep distractions to a minimum in order to reduce the likelihood that behavioral errors will occur, as Schwartz and Goldman (1974) found that when background noise was present during stimulus presentation, performance was poorer.

Locke (1980) also suggested that the discrimination task should be fairly short in duration and that it should "require a response easily within a young child's conceptual capacities and repertoire of responses" (p. 437). If the task is too complex, too much time will be spent in pretraining. In addition, the test may be invalid due to the child's failure to understand the task. As many tests of discrimination require that the child make judgements of same/different, the child may not be able to make "same-different" decisions in the way the examiner intends, and even if he does, the child's definition of "same" may not necessarily mean that the paired items are not different, but rather that he does not regard the difference to be sufficiently large to mean "different".

An alternative to the "same/different" discrimination task is a picture identification task in which the child is shown two or more pictures with labels that contain minimal phonemic differences (e.g., "cat", "bat", "mat").

After the examiner says one of the words the child is required to point to the correct picture. It is assumed that the child judges each picture independently and searches for something that could be represented by the word produced. Unlike discrimination tests, the picture identification task requires little pretraining. The examiner should be aware, however, that word familiarity can affect results. Barton (1976) found that with children between 22 to 35 months of age, word familiarity affected the child's speech sound discrimination performance and thus should be considered as a confounding variable.

Schwartz and Goldman (1974) recommended that meaningful and familiar tasks should be used to test discrimination. They found that their subjects consistently made more errors when their target words were presented in paired-comparison context (e.g., "goat" versus "coat") than when their target words were included in carrier phrases and sentence contexts (e.g., "The man bought a coat"). These results provided some support for using the picture identification task as a more valid means of assessing speech perception.

Finally, the examiner must consider that discrimination may be a developmental skill. Walley, Smith, and Jusczyk (1986) stated that young children have more difficulties in attending to the phonemic segments of speech. In comparing the results between kindergarten and second grade children's abilities to classify nonsense words which were related by syllable and phoneme correspondences, they found that there was a developmental trend in the level of attention (increase) to individual phonemic segments. In addition, Weiner (1967) stated that auditory discrimination appears to be a developmental skill which reaches a ceiling at eight years of age.

In summary, there are many variables which influence the assessment of children's speech perception abilities. In order to obtain information which has the greatest clinical utility for each child, examiners must carefully evaluate existing discrimination tests or design ones that fit their own needs or the needs of the child and which fulfill the requirements discussed above. It appears that different test formats may provide different kinds of information which may be helpful in answering certain questions.

Assessment of Speech Production

Procedures for obtaining speech samples. One variable which greatly influences the results from the assessment of articulation/phonological skills is the way in which the data is gathered. Methods of data collection can be placed on a continuum with informal observational techniques placed at one end and formal, highly structured methods placed at the other. There are advantages and disadvantages to using any method of data collection.

During the use of the informal observational technique, vocal productions are allowed to occur as part of the natural interaction between the subject and another person. The primary advantage of this method is that the samples obtained are ecologically valid; they represent the individual's spontaneous speech productions in a natural setting. According to Stoel-Gammon and Dunn (1985) the major disadvantages of this technique are: (1) data collection and data analysis are often very time-consuming especially if the child is reluctant to engage in dialogue with an unfamiliar adult; (2) the samples may not include a sufficient number or variety of words or utterances to permit a thorough analysis of English phonemes and their various allophonic variations; (3) subject samples are often so different that it is difficult to make comparisons across subjects; and (4) if the child's

speech is highly unintelligible, it is difficult to determine which adult words were attempted.

In a slightly more structured method, the setting remains informal. Subjects are encouraged to talk, but no direct elicitations are used. Typically, the experimenter introduces stimulus items (e.g., pictures or toys), in an attempt to get the child to verbalize. The stimuli are selected so that the words produced contain target phonemes. This method is advantageous because it is less time-consuming than a completely informal method, it works well with children as young as 1;0 to 2;6 years of age (Stoel-Gammon and Dunn, 1985), and it provides the examiner with a set of word productions which contain target sounds, thereby facilitating intersubject comparisons. The disadvantages of this method are that not all children will produce all of the labels and should the child be reluctant to talk about the objects, it may require much time to collect data.

In the most structured method of data collection, the data is gathered in a formal setting in which the child is required to produce, either spontaneously or through imitation, a predetermined set of utterances, usually single words. This method is the least time-consuming and it readily allows a comparison of data between subjects, but it also provides the least ecologically valid sample of the child's productions. In addition, if the examiner obtains single-word productions, he must be aware that differences may frequently exist between those words produced in connected speech and the same words produced in isolation (Bernthal and Bankson, 1981). Therefore, the practice of using single words to make inferences about the subject's speech production performance during connected speech is questionable.

Elicitation Methods. When formal methods of data collection are used, the verbal productions can be elicited in a number of ways. In elicited naming, the child is asked to name the object or action shown in a picture. In elicited imitation, the child is asked to repeat what the examiner said. Imitation can be either immediate, in which there is no pause or interruption between the examiner's production and the child's production, or it can be deferred, in which there is some distraction between the two productions. The repetition of sentences containing a target word or insertion of a distractor such as the examiner saying "now you say it" after having produced the word would be examples of deferred imitation.

The examiner should place particular attention to the method of elicitation of utterances because this may influence the child's pronunciation of target words or sentences (Stoel-Gammon and Dunn, 1985). For spontaneous productions, the child must rely on his own underlying representation of a word or sentence, whereas in an imitation task the child must repeat a word or sentence modeled by the experimenter. Spontaneous or elicited naming is likely to produce responses that are more representative of the child's own underlying representation of the word and thus more similar to his productions in a natural, nontest setting. Spontaneous or elicited imitation, on the other hand, is likely to produce productions that are less representative of a child's pronunciation patterns in spontaneous speech.

Although it is often assumed that imitated words are more accurate than spontaneously produced words, studies regarding this issue have provided conflicting results. Therefore, no conclusive statements can be made regarding the effect of imitation on pronunciation. Stoel-Gammon and Dunn (1985) stated that there is a general agreement that the imitated

productions are often different from spontaneous ones, but the nature and extent of these differences have not been well documented. They suggested that, given the differences observed in the two types of speech, it is best to note whether an utterance was produced spontaneously or as an imitation and then to analyze the two sets of utterances independently.

Recording of the Speech Sample. Few studies have examined the effects that the variable of audio and/or audiovisual recording has on assessment results. In many diary studies and during the administration of articulation tests, the child's speech productions are often not tape-recorded but are recorded on-line with pencil and paper. According to Stoel-Gammon and Dunn (1985), on-line recording of productions is advantageous for the following reasons: (1) the transcriber can note oral and facial movements; (2) there is no need for a microphone or other recording equipment, which may be intimidating for a child; and (3) on-line transcription takes relatively little time. The major disadvantage of on-line recording is that there is no way to check the accuracy of the transcriptions.

Schriberg and Kent (1982) stated that videotaping seems to be the method of choice for recording speech samples. It allows the examiner to observe articulatory behaviors and it allows the accuracy of transcriptions to be checked. Still, video equipment is more expensive than audio equipment, it takes longer to set up, it may be more intimidating to a child, and the audio signal on most inexpensive videotape recorders is generally poorer than the signal on a medium-priced audiotape recorder. Schriberg and Kent (1982) reviewed the small amount of literature available on the accuracy of transcribing live, from audiotape, or from videotape and found equivocal results. Thus, the examiner should know the advantages and disadvantages

of each recording system and be able to select a system depending on her own clinical and research needs.

Scoring of the Speech Sample. As with the methods for collecting data, the methods for scoring data vary depending on the goals of the study or the characteristics of the individuals being evaluated. Typical scoring systems involve binary decisions, classification of errors into different types, and transcription.

The binary method of scoring a child's productions involves scoring responses as correct or incorrect. This method is adequate for screening and it may also be used to determine if treatment is needed, but it is not recommended for determining the nature or direction of treatment (Bernthal and Bankson, 1981). It simply does not allow the examiner to determine what types of errors are occurring, what their causes might be, and whether a child can correctly reproduce a target using various therapy techniques.

One alternative is to have the examiner score a child's productions by classifying them as either substitutions, omissions, or distortions. This scoring system provides slightly more information than a classification of "right" or "wrong" in that omissions, substitutions, and distortions represent a hierarchy of severity of sound errors. This system may be used to determine whether treatment is required and also to determine the severity of a disorder. It does not, however, allow the examiner to determine what therapy techniques might be used when therapy is indicated.

A transcription system is often necessary to fully describe speech sound productions. The amount of detail included in a phonetic transcription depends on the purpose of the study or the type of client being evaluated. If the goal is to determine which phonemes are produced correctly and which are not, the level of transcription can be broad. This might be the case for a

child who makes substitution errors, that is, he or she substitutes one phoneme for another. However, if the goal is to describe correct and incorrect productions in detail, the transcription should be narrow and include diacritical markings and segmental phones not found in the adult language. Narrow transcription is also useful for describing the speech of individuals who make articulatory errors that cannot be adequately described by a broad transcription system such as the errors produced by individuals who have cleft palates, hearing impairments, or neuromotor speech disorders.

Usually, General American English speech is used as the reference dialect for transcription (Schriberg and Kent, 1982). When transcribing the speech of an individual who speaks a regional dialect of English or an individual for whom English is a second language, the use of a narrow transcription system will help identify deviations from the reference dialect. Schriberg and Kent (1982) recommended that examiners learn the phonological rules of the dialects of the individuals they serve and the boundaries for acceptable production of each allophone. For example, if a child from a Spanish-speaking family said [bæn] for "van", should this production be recorded as an error or as an acceptable production due to the influence of the phonology of the Spanish language? Schriberg and Kent emphasized that dialectical differences between the speaker and transcriber must be considered and placed in proper perspective.

The International Phonetic Alphabet (IPA) is the most commonly used broad transcription system (Bernthal and Bankson, 1981). It involves a different written symbol for each phoneme. Narrow transcription systems are based on broad transcription systems, and additional information is recorded with the aid of diacritics, or markers, that add detail to the broad

phonetic symbols. Several systems of narrow markers have been published. The Shriberg and Kent (1982) system is popular and is easily applied for use with communication disorders. It is based on the IPA and includes diacritics for describing lip, tongue, and nasality characteristics as well as sound source, stop release, timing and juncture, and miscellaneous characteristics (see Appendices H and J).

Stoel-Gammon and Dunn (1985) recommended that researchers and clinicians be aware that the adopted transcription system will influence data which may, in turn, affect the results of their study. For example, if a broad system is used in transcribing the speech characteristics of bilingual Spanish-English speakers, the final results will not adequately reflect the influence of the native language on their speech characteristics, many of which will be subtle, or best described by diacritics. Further, if a child's speech is to be described narrowly, the recording equipment should be of very high quality and the sample should be obtained in a quiet setting, ideally a sound-treated room. A slight loss of audio quality can cause errors to be recorded as correct or correct productions to be recorded as errors. Ultimately, the resulting transcribed sample may not represent the speech characteristics of the individual.

Reliability of Scoring. In order to reduce examiner bias and error, the reliability of the examiner's judgements of sound productions should be established. That is, she should ensure that her judgements of articulatory productions agree with those of other professionals. Interjudge reliability involves comparing the judgements of one examiner with the judgements of another. Usually, a figure of 0.85 or above on an item-by-item comparison is considered an adequate level of reliability to ensure that one person's judgements of articulatory productions will be similar to another's (Bernthal

and Bankson, 1981). Comparison of judgements made when scoring the same data on two separate occasions is referred to as intrajudge reliability. Bernthal and Bankson (1981) recommend that a point-to-point reliability index of 0.90 or above be achieved on a correct-incorrect judgement basis.

Speech Perception and Speech Production in Monolingual Children

Research on the relationship between speech perception and speech production in monolingual children has focused on (1) the pattern of normal acquisition of perception versus production skills and (2) the relationship between articulation disorders and speech sound discrimination skills.

The relationship between children's perception of phonological contrasts and their production of those contrasts is not well understood. Stoel-Gammon, and Dunn (1985) presented several hypotheses regarding this relationship, ranging from Straight's (1980) claim that perception and production are distinct and independent components of the language acquisition process to Smith's contention (1973) that perception precedes production, and finally to Shvackin's belief (1973) that correct production can precede and facilitate perception of certain sounds. Given the evidence currently available, perception of speech-sound contrasts generally precedes their production. For example, Smith (1973) argued that children do not learn to speak until they have learned to perceive at least the majority of the contrasts present in the adult language. He based his conclusions on data from his son, Amahl. He noted that, prior to the onset of speech, Amahl was able to distinguish minimal word pairs. Later, through informal testing with picture cards, Smith was able to ascertain that his son could discriminate between word pairs such as "mouse-mouth" and "card-cart" even though they were produced as homophones.

According to the hypothesis that perceptual skills are still developing during the period of meaningful speech, production errors may be direct reflections of perceptual confusion. Several experimental studies (Locke, 1980; Menyuk, 1980) provide data to support this hypothesis by showing that, in some cases, the failure to produce a phonemic contrast is associated with the inability to perceive that contrast. For example, if a child fails to produce the [s-ʃ] contrast in "sip" and "ship", pronouncing them both [sɪp], it may be that the child is unable to perceive the distinction between [s] and [ʃ] in adult speech. Weiner (1967) reviewed the literature on the perception-production question and concluded that auditory discrimination appears to be a developmental skill, reaching a ceiling eight years of age, and that a positive relationship seems to exist between auditory discrimination problems and more severe articulation difficulties below nine years of age. Thus, it may be hypothesized that a failure of a bilingual child to produce a nonnative phoneme is possibly a result of not correctly perceiving that phoneme.

Speech Perception and Speech Production in Bilingual Children

The research described above supports the proposition that children as well as adults indeed have difficulties in acquiring the phonology of a second language. Fantini (1974) studied the speech of his son, who was 5 years, 8 months of age and from a Spanish-speaking background. Fantini indicated that even after several years of intensive exposure to English, his son still produced English which had a foreign quality. In addition, Erickson and Omark (1981) suggested that phonological proficiency is the most basic level of communication and may have both social and educational consequences.

Few studies have been conducted to examine the possible causes of poor phonological production skills in bilingual children. Terry and Cooper (1969) hypothesized that bilinguals' speech production skills are related to their speech perception skills. Specifically, that deviant speech production may be related to an inability to perceive nonnative speech contrasts. Terry and Cooper found, however, that Puerto Rican bilinguals' perception of phonological variation in Spanish and English was found to be unrelated to the relative frequency of their production of these variables. Methodological problems, however, prevented this study from providing strong support for this finding. The authors failed to report the subjects' length of exposure to English, which may be an important variable as the length of exposure to a second language may have influenced how well the subjects can perceive and/or produce nonnative phonemes (Williams, 1979). The authors also failed to report the ages of their subjects, which would fail to address the influence of a critical period or other developmental aspects of language learning in young children (Lenneberg, 1967). Finally, they did not describe their methods in sufficient detail to allow replication, and they presented only eight Spanish items and eight English items to each of 24 subjects, which was likely an inadequate number of data points. Locke (1980) recommended that the child be allowed repeated opportunities to reveal his perceptual decisions in order to reduce the influence of the level of chance (50%) in a discrimination task.

Lee Williams (1979) examined the modification of speech perception and production as children learned a second language. While he did not directly examine a relationship between perception and production abilities of bilingual children, he found that as children were increasingly exposed to English (and as they grew older), significant changes occurred in both the

children's perception and production of voicing of stops toward the English monolingual pattern. Thus, it appears that perception and production may be related, at least in bilingual children learning English patterns of stop consonant voicing. Clearly, more research is needed to describe the relationship between speech perception and speech production abilities of bilingual speakers. The purpose of the present study was to compare the production and perception of English speech contrasts by bilingual children from a Spanish-dominant background. It attempted to demonstrate that bilingual children's production of English speech contrasts is related to their perception of those contrasts. More specifically, it was hypothesized that:

If perception and production are related, then those children who perceive English contrasts will be able to produce the English contrasts while those who can't won't.

In addition, the results were also examined retrospectively to assess the following secondary issues:

1. Patterns will emerge from the data as follows:
 - a. Those English contrasts which are also contrastive in Spanish ([b-g] and [p-t]) and which differ in place of articulation will be perceived correctly most often.
 - b. Those English contrasts which are also contrastive in Spanish and which differ in voicing characteristics ([p-b] and [d-t]) will be perceived correctly less often. The English and Spanish voicing features differ phonetically between the two languages (e.g., the Spanish /p/ and /t/ have partially voiced allophones [p̚] and [t̚] while English does not, and the English /p/ and /t/ have aspirated allophones [p^h] and [t^h] while Spanish does not).

c. Those English contrasts which are not contrastive in Spanish ([b-v] and [d-ð]) will be perceived incorrectly most often.

These contrasts differ in manner of articulation.

2. Perception will be the least related to production for those phonemic contrasts which are produced with different phonetic characteristics in each language (/d-t/ and /p-b/), and most related to production for those English contrasts which either do or do not exist in Spanish (/b-g/, /p-t/, /b-v/, and /d-ð/).

CHAPTER 2: METHODS

Subjects

Eleven bilingual (Spanish-dominant) children participated in this study. Each child was enrolled in a public school program sponsored by the Montana Migrant and Seasonal Farmworker Council; five children attended school in Billings, Montana and six attended School in Hysham, Montana. The parents of the children were migrant and seasonal farmworkers employed in the Yellowstone Valley of Eastern Montana. The subjects included six male and five female students between the ages of 4;11 and 6;10 years. The mean subject age was 6;1 years with a standard deviation of 7.8 months. Table 2.1 presents the selection criteria for the subjects in this study.

Instrumentation

All training and testing took place in an empty classroom in the school in which the children were enrolled. The rooms were relatively free of visual and auditory distractions. During the speech/language screening and the training and testing of the perception and production tasks, the experimenter and child were seated at a small child-sized table with the experimenter situated at the corner of the table and at a 90-degree angle to the child.

Hearing Screening. The screening protocol consisted of otoscopy, pure-tone audiometry, and oto-immittance screening, although the children were required to pass only the pure-tone screening. A Welch-Allen otoscope with #3 specula was used during otoscopy. A Maico MA-20 portable audiometer calibrated to meet the American National Standards Institution's (ANSI) S3.6-1969 standards and TDH-39P (10 ohm) earphones and MX-41/AR cushions were used for pure-tone screening. A portable Earscan immittance bridge was used for tympanometric screening.

Table 2.1.**Subject selection criteria**

Each child met the following criteria:

- 1. The child was capable of conversing in both Spanish and English as reported by his/her classroom teacher.**
 - 2. The child's native language was Spanish (he/she began to learn Spanish before learning English).**
 - 3. The child did not begin to use English expressively to communicate prior to the age of 2 years.**
 - 4. The child had been using English to communicate in at least one situation for at least one year.**
 - 5. The child passed a pure-tone hearing screening.**
 - 6. The child passed a speech/language screening for reception and expression of Spanish to rule out a communication disorder in the native language.**
-

Parent Interview Questionnaire. In order to obtain information regarding each child's native language and the amount of his or her exposure to and use of English and Spanish in various situations such as at school, at home, and with friends, parents were asked to fill out questionnaires. Questions were based on Omark and Erickson's guidelines (1983) and are included in Appendix D. Questionnaires were sent home with each child and were completed and returned by the parents of seven of the eleven children.

Language screening test. The Compton Language Screening Test--Spanish version (Compton and Kline, 1983) was used to individually screen each child's receptive and expressive speech and language ability. The test includes screening measures to assess articulation, semantics, morphology, syntax, fluency, and voice. It is designed for children ages 3;0 through 6;11 years. Age guidelines are provided for each item which conservatively suggest when that item should be acquired by a Spanish-speaking child. The developers of the screening test did not specify particular Spanish dialects for which the test is considered to be appropriate. Compton and Klines' pass/fail criteria were not used, as this screening test did not appear to be culturally valid for these children. Instead, those children who made 13 or more errors on the screening test were excluded from the study.

Stimuli. The stimuli used in the perception task were presented via audio recording. Recordings were made previously by a native English speaker using a Sony TC-D5M tape recorder and a Sony F-V3T microphone. The recorder was demagnetized and cleaned prior to use. Stimuli were played back on the same Sony cassette recorder. The stimuli were English minimal-pairs, with the phonemic contrast existing on the word-initial phoneme. The word pairs consisted of a real word (referring to some easily representable, familiar object) paired with a made-up word (referring to an

unfamiliar object). Various types of contrasts were used in this study. Each type differed by only one phonological feature (either place of articulation, manner of articulation, or voicing). Type I contrasts consisted of English phonemes which also exist as phonemes in Spanish (/b-g, p-t/). Type II contrasts consisted of English phonemes, each of which are contrastive phonemically in Spanish, but which have different phonetic characteristics than in English, which might cause them to be more easily confused (/p-b, d-t/). Type III contrasts consisted of English phonemes which are not phonemically contrastive in Spanish but which exist as allophones (/b-v, d-ɾ/). Table 2.2 summarizes the three types of contrasts.

The vocabulary used was reviewed by an adult bilingual speaker from the same region as that in which the children were domiciled to ensure that stimuli were culturally unbiased and appropriate for five- and six-year old children who are learning English.

Procedures

Hearing Screening. Two graduate students and one licensed audiologist from the Department of Communication Sciences and Disorders at the University of Montana conducted the hearing screening. American Speech-Language-Hearing Association (ASHA) 1985 guidelines were followed for procedures and for pass/fail criteria.

Perception Task. A task designed by Eilers and Oller (1975; Oller and Eilers, 1983) was used to assess each child's ability to attach a discriminative label to an object. The stimuli were presented in a "shell game" format in which one real item was placed on top of an over-turned container, and its paired nonsense object was placed on top of another over-turned container. The child was then asked to look under one of the objects to find reinforcement. For example, the experimenter might say, "The bead is under

Table 2.2.**Stimuli used in Perception Task****Type I contrasts**

English contrasts which are also contrastive in Spanish. Pairs differ in place of articulation.

| | | |
|-------|----------------------------|----------------------------|
| b - g | bug - gug girl - birl | /bʌg - gʌg/ /gɜl - bɜl/ |
| p - t | teeth - peeth pen - ten | /tiθ - piθ/ /pɛn - tɛn/ |

Type II contrasts

English contrasts which are contrastive in Spanish but which are phonetically different between the languages. Pairs differ in voicing.

| | | |
|-------|------------------------------|----------------------------|
| p - b | pen - ben bug - pug | /pɛn - bɛn/ /bʌg - pʌg/ |
| d - t | duck - tuck teeth - deeth | /dʌk - tʌk/ /tiθ - diθ/ |

Type III contrasts

English contrasts which are not phonemically contrastive in Spanish. ([v] is an allophone of /b/ and [ɰ] is an allophone of /d/ in Spanish). Pairs differ in manner of articulation.

| | | |
|-------|----------------------------|----------------------------|
| b - v | bug - vug van - ban | /bʌg - vʌg/ /vɜn - bɜn/ |
| d - ɰ | duck - thuck dog - thog | /dʌk - ɰʌk/ /dag - ɰag/ |

the dog. Look under the dog." For success, this task requires that the child must be able to discriminate between stimuli. Eilers and Oller stated that children appear to notice, in each case, whether the experimenter pronounces the name of the real object; if not, he or she chooses the other object. A total of twelve contrastive pairs were presented (four each for Type I, II, and III contrasts), each of which was presented three times. Thus, a total of 36 items was presented to each child. The stimuli were counter-balanced for position so that the nonsense item was not always on the child's left and for the examiner's command so that the experimenter did not always tell the child to look under the nonsense item. The overall order of presentation was randomized for three different audio recordings to control for an order effect.

Before the testing procedure began, each child was required to demonstrate knowledge of the real words to be tested. He or she was asked to name in English each of the twelve objects used in testing and the one used in training. If the child was unable to name an object, he or she was asked to point to objects in an array of at least six choices, giving three consecutive correct responses for each object. Children who failed at this task were taught the names of unknown objects and testing did not begin until they were able to first identify those objects in the array of six choices on three consecutive trials and to subsequently name them three times.

Each child was also required to demonstrate an understanding of the task itself. This was accomplished by pre-training the child with non-test words, as described by Oller and Eilers (1983). Each child was trained on one word pair, "frog" and "mog". "Frog" referred to a toy frog and "mog" referred to a shapeless plastic object. The objects were clearly contrasted. For example, the experimenter said, "This is a frog, but this thing is not a

frog, is it? No, it isn't. This is a mog." The child was then provided with two additional illustrations of the contrast. Next the child was asked to correctly identify the objects three times in a row as the experimenter named each one of the objects. The child was given verbal reinforcement each time she or he correctly identified the named object. The child's errors were pointed out and corrected. The training words were then presented exactly in the same manner as the target items would be presented during the testing phase. The child was tangibly reinforced for correct answers during both the training and the testing phases. Each time the child responded correctly, he or she was allowed to take a bead (token) and at the end of the testing period, he or she traded in the beads for a small toy. The child was given five trials of "frog" versus "mog", and was required to score at least four out of five correct to meet the task criteria. If the child failed to achieve four out of five correct, the child was dropped from further participation in the study. For the current study, each child successfully met the criteria described above.

After the child met the selection criteria on the training task, testing began. If the child appeared to be fatigued or to have lost interest during testing, he was scheduled to return for additional testing the next day. This determination was made objectively by examining the child's pattern of responding. Stimuli were presented in three sets of twelve contrast pairs. If a child made three errors more on one set of twelve stimuli than he had on the previous set, testing was terminated for the day. At the time of additional testing, the child was re-introduced to the task through presentation of the training items and testing then resumed where it had been terminated.

Production Task. During the production task, each subject was required to talk about a set of objects utilizing English words containing target sounds in word-initial position and embedded in the carrier phrase, "This is a ...". There were seven target phonemes (/b, d, p, t, g, v/, and /θ/), each of which was assessed in two different phonetic contexts. The child was required to produce each word at least three times. Thus, each child was required to produce a total of 42 utterances utilizing target words. The child was required to directly imitate the model provided by the examiner. The child was shown 14 toys (seven of which were used in the perception task) and instructed as follows: "Let's talk about these toys. I want you to say what I say." Instructions were also given in Spanish for the purpose of clarification. Occasionally prompting such as "now you say it" or "say the whole sentence" was required.

Scoring and Analysis

In the perception task, the responses were recorded on-line using a binary scoring system. Correct responses were scored as "+" and incorrect responses were recorded as "-". A "+" indicated the target phoneme in a target word was produced with correct English characteristics and a "-" indicated the target phoneme was produced with characteristics which are not typical of English. The percentage of correct responses (number correct divided by the number possible) was calculated for each of the three contrasts types and for the total number of contrasts (see Appendix G). In addition, the production responses were audio-recorded on the Sony TC-D5M tape recorder using the Sony F-V3T microphone placed on a chain around the child's neck at a distance of approximately four inches from the child's mouth. The production of each target word was also recorded as a phonetic transcription of the child's utterance. The productions of target words were

scored on-line by the examiner, and later via the audio-recording by two graduate students trained in Schriberg and Kent's method of phonetics, as being produced with appropriate English features or as being produced with non-English or otherwise incorrect features. The target words were also transcribed from the tape using broad phonetic transcription with diacritics to describe allophones which might be aspirated, unaspirated, unreleased, dentalized, partially voiced, partially devoiced, or frictionalized. The Schriberg and Kent (1982) adaptation of the International Phonetic Alphabet (IPA) with modified conventions for diacritics was used for transcription (see Appendices H and J). The percentage of correct responses was computed for each of the judges and averaged before any data analysis was conducted. Because the average of the three judges' scores would represent a more stable measure of each child's articulation skills, by eliminating the biases of any one examiner, the three-judge average scores for the production task were used in further data analysis. The phonetic transcriptions made by the principle examiner were further analyzed to describe any patterns of error.

The relationship between perception and production of target phonemes was analyzed by using the Pearson product-moment linear correlation coefficient (r). The correlation between the number correct for perception of target contrasts and the average of the three judges' scores of number correct for production of target phonemes was calculated and data for each child was graphed, with perception (discrimination) represented on the X-axis and production represented on the Y-axis. The scores within each of the three contrast types were compared in the same manner. In addition, F-tests and Sign tests were used to determine whether there was a

significant difference between the scores in any one of the three Type categories for both the perception and the production tasks.

Reliability

The reliability of the method of scoring childrens' responses during the production task was determined through calculation of the correlation of the three judges' scores. Binary decisions made on-line by the experimenter were later compared to binary decisions made by the two graduate students who scored productions while listening to the audio recording. Reliability between the two students was also calculated, as was reliability between each judge and the average of the three judges' scores. In order that neither the experimenter nor the graduate students had knowledge of each subject's performance on the perception task when the production tasks were scored, subjects were identified by random number.

CHAPTER 3: RESULTS

The present study attempted to compare bilingual childrens' ability to perceive and produce English speech contrasts. Separate scores for speech perception and speech production were obtained and compared using the Pearson Product-moment correlation coefficient (r) and the Greatest Deviation correlation coefficient (r_{gran}) (Gideon and Hollister, 1987), a statistic which reduces the influence of outliers on the resulting correlation. The speech contrasts were categorized by type. Type I contrasts consisted of phoneme pairs which differed in place of articulation (/b-g/ and /p-t/). Type II contrasts consisted of pairs which differed in voicing (/b-p/ and /d-t/), and Type III contrasts were phoneme pairs which differed in manner of articulation (/b-v/ and /d- /). Scores for Type I, II, and III contrasts, as well as total scores were described and compared. F-tests and Sign tests were used to examine statistical differences between the three category types for both perception and production. Tables G.1 and G.2 in Appendix G provide overviews of the characteristics and performance of each subject who participated in the study.

Speech Perception and Speech Production: Description

In general, the subjects obtained lower scores on the speech perception task than on the speech production task (i.e., eight subjects out of eleven scored higher in speech production and one subject had approximately equal scores for both tasks). The mean total score for speech perception was 74.5% compared to 78.5% for speech production. In addition, the mean score for each Type subcategory was lower for speech perception than for speech production. Table 3.1 summarizes these results. Variability among the subjects appeared high in all areas except in production of Type I

Table 3.1

Description of results of Speech Perception and Speech Production Tasks

a. Speech Perception

| | Total Scores | Type I Scores* | Type II Scores** | Type III Scores*** |
|-------------|--------------|----------------|------------------|--------------------|
| Mean | 74.5% | 82.0% | 83.9% | 59.9% |
| Stand. Dev. | 10.7 | 11.4 | 13.4 | 15.6 |
| Range | 61-92% | 66-100% | 65-100% | 25-75% |

*- /b-g, p-t/ **- /p-b, d-t/ ***- /b-v, d-ð/

b. Speech Production

| | Total Scores | Type I Scores* | Type II Scores** | Type III Scores*** |
|-------------|--------------|----------------|------------------|--------------------|
| Mean | 78.5% | 88.7% | 92.5% | 71.2% |
| Stand. Dev. | 12.5 | 4.2 | 5.8 | 15.3 |
| Range | 57-98% | 71-100% | 84-100% | 53-96% |

*- /b, g, p, t/ **- /p, b, d, t/ ***- /b, v, d, ð /

and II phonemes. The total mean speech production score, as presented in Table 3.1, does not represent the average of the mean scores for each of the Type categories. As the phonemes in the speech production task existed in more than one Type category, it would have been erroneous to average the three Type mean scores, thus biasing the subjects' total score toward their performance on those phonemes which are produced in more than one category. The total mean score represents the subjects' mean performance equally on all seven targetted phonemes, each of which was produced six times during the speech production task. In summary, the subjects' speech production scores were generally higher than their speech perception scores.

F-tests revealed the difference between the Type subcategories was significant at a 0.01 confidence level for both perception and production. Sign tests revealed the difference was due to the lower scores obtained on Type III phonemes. Every subject except one scored lower on Type III phonemes than on either Type I or Type II phonemes for both the speech perception and production tasks. There was no significant difference between the subjects' performance on Type I and Type II phonemes for either speech perception or speech production. In summary, the subjects demonstrated significantly lower scores in their perception of the contrasts /b-v and /d-ð/ than in their perception of the contrasts /b-g/, /b-p/, /d-g/, and /d-t/. In addition, the subjects exhibited significantly lower scores in their production of the phonemes /v/, /ð/, /b/, and /d/ than in their production of the phonemes /b/, /p/, /d/, /t/, and /g/. As /b/ and /d/ are members of each of the Type categories, it appears that subjects had significantly more difficulty in appropriately producing the phonemes /v/ and /ð/.

Type I and II speech production errors consisted primarily of phonetic errors. Those phonetic errors were usually errors of frictionalization of voiced stops. For example, "boat" was often pronounced [b_xot]. Other Type I and II errors included voicing of voiceless stops. Some children partially voiced /t/ and /p/. For example, "teeth" was sometimes pronounced [tj_vθ]. Alternatively, many of the children exaggerated aspiration of the English allophones [t^h] and [p^h]. The phoneme /g/ was erroneously produced more often than any other Type I or Type II phoneme (/b, p, d, t/). As a result, the mean score for Type I phonemes was slightly lower than the mean score for Type II phonemes, as the phoneme /g/ is a member of the Type I category.

Type III production errors consisted primarily of stopping of the voiced fricatives /v/ and /ð/. For example, the subjects often produced "van" as [bæ_n] and "that" as [dæt]. In addition, a variety of other errors occurred for the phoneme /ð/ such as omission ([~~θ~~-læ~~θ~~-kæt-w[^]n]), and other substitutions (/g, ɹ /). There were indeed more errors on the subjects' articulation of the phonemes /v/ and /ð/ than on any other targeted phoneme. As a result, Type III speech production scores were significantly lower than Type I and Type II speech production scores.

Speech Perception and Speech Production: Correlations

Pearson product-moment correlation coefficients revealed little correlation between scores obtained for the speech perception task and those obtained for the speech production task. There were insignificant correlations between speech perception and speech production for the total scores as well as the Type category scores. In addition, the Greatest Deviation correlation coefficient (r_{gran}), which reduces the influence of any outliers, revealed more correlation than the Pearson coefficient for Type I

and III categories, however, the overall correlation remained insignificant. For the Type II comparison, the rgran statistic reduced the influence of subjects in which perception and production were more correlated. In summary, as these subjects' speech perception scores improved, their speech production scores did not necessarily improve as well. Table 3.2 summarizes the correlations for each Type category and for the total scores.

Figure 3.1 presents a scattergram of the total scores of each subject. It can be seen that subjects 4 and 8 had speech production scores that were notably lower than their speech perception scores and their data points are a greater distance from the line of least curve fit. Table 3.3 provides residual values for each subject, which indicates how far each data point is from the line of least curve fit. The data indicate that subjects 4, 7, and 8 obtained scores which influenced the overall relationship between total speech perception and total speech production toward a lower correlation.

It was predicted that perception and production would be the least correlated for Type II contrasts and the most correlated for Type I and III contrasts, however, the results demonstrated little difference in the amount of correlation between the Type categories. Type I contrasts were the least correlated ($r = 0.165$), Type III contrasts were slightly more correlated ($r = 0.252$), and Type II contrasts were the most correlated of the three categories ($r = 0.315$). Figures 3.2, 3.3, and 3.4 present scattergrams for the correlation between speech perception and speech production for each of the three Type categories.

By examining individual data points on the scattergrams for each Type category, it is evident that subject number 4 consistently obtained production scores which were notably lower than perception scores, causing

Table 3.2
Correlation between Speech Perception and Speech Production

| Statistic | Total Scores | Type I Scores | Type II Scores | Type III Scores |
|------------------|---------------------|----------------------|-----------------------|------------------------|
| r | 0.39 | 0.166 | 0.315 | 0.252 |
| Signif.* | >0.20 (NS) | > 0.20 (NS) | >0.20 (NS) | >0.20 (NS) |
| rgran | 0.40 | 0.40 | 0.0 | 0.40 |
| Signif. | >0.10 (NS) | >0.10 (NS) | >0.10 (NS) | >0.10 (NS) |

NS - Not significant

* n=11

Figure 3.1

Plot of correlation between perception and production:
Total Scores

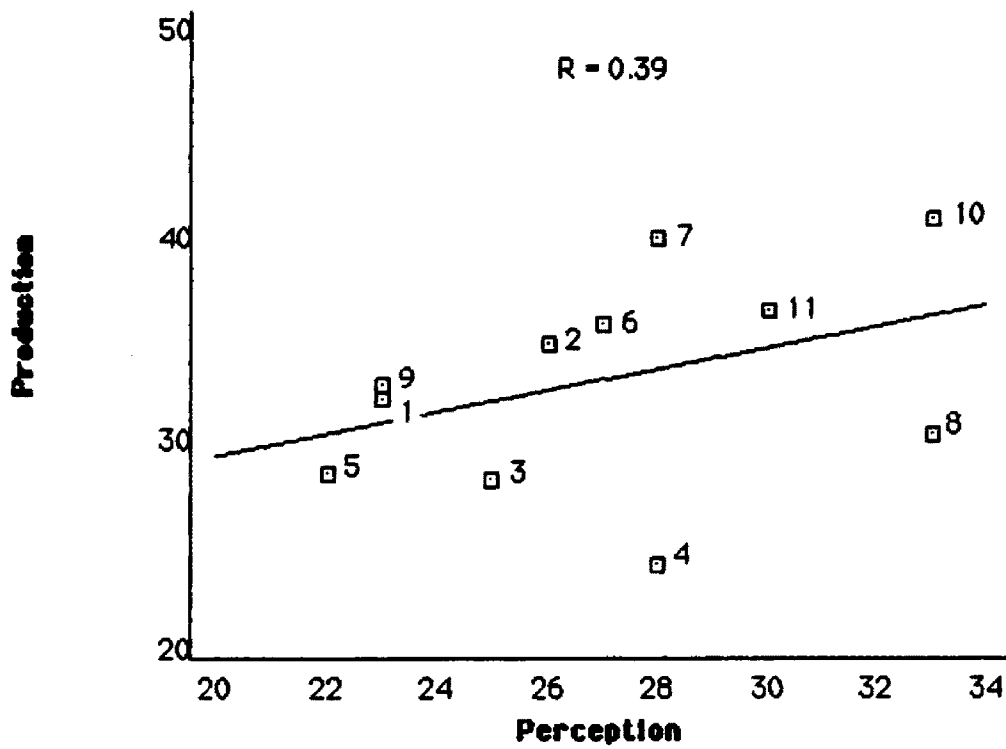


Table 3.3
Residuals from Least Curve Fit Analysis

| Subject No. | Residual Distance |
|--------------------|--------------------------|
| 1 | 1.17 |
| 2 | 2.25 |
| 3 | -3.89 |
| 4 | -9.48 |
| 5 | -1.96 |
| 6 | 2.71 |
| 7 | 6.51 |
| 8 | -5.80 |
| 9 | 1.84 |
| 10 | 4.86 |
| 11 | 1.78 |

Figure 3.2

**Correlation between speech perception and speech production:
Type I contrast**

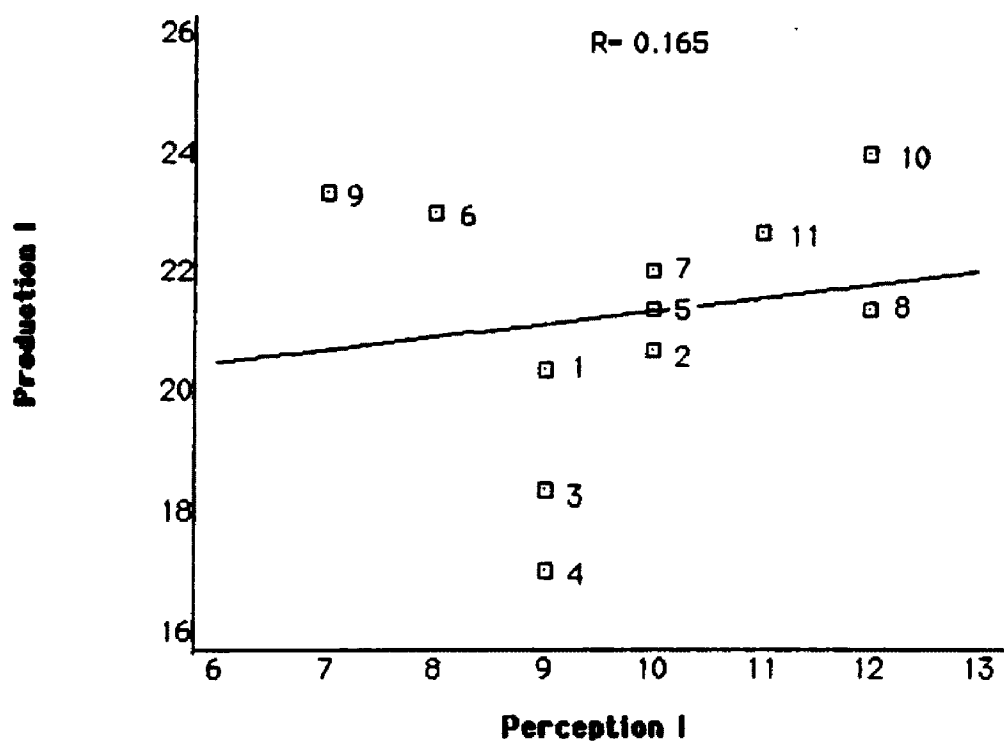


Figure 3.3

**Correlation between speech perception and speech production:
Type II contrast**

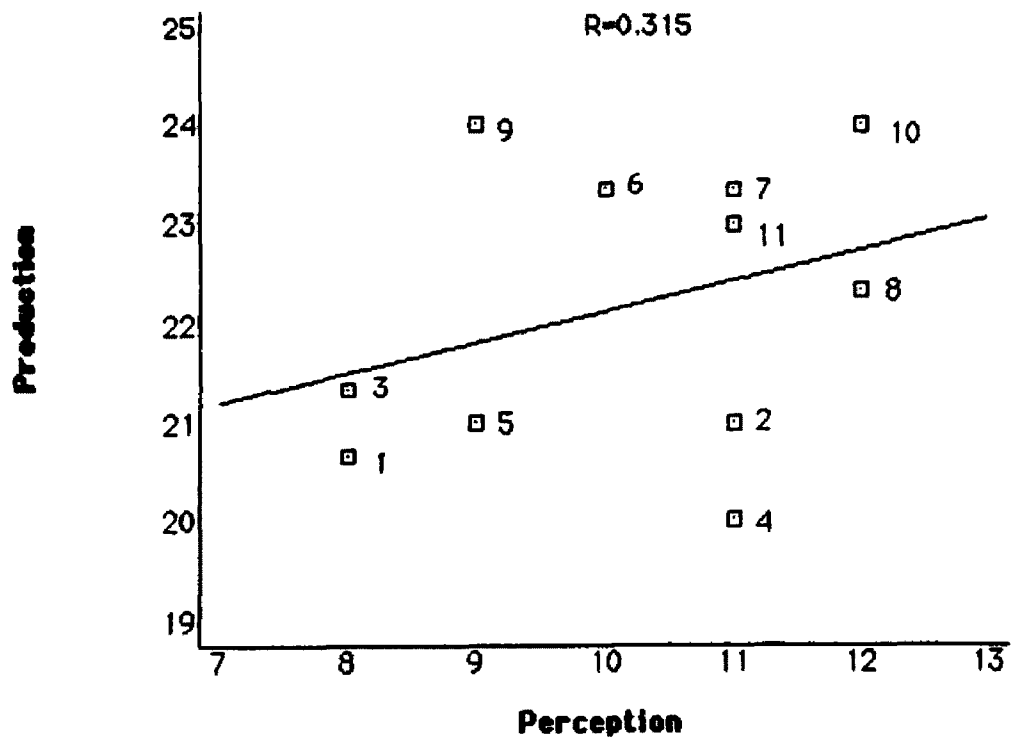
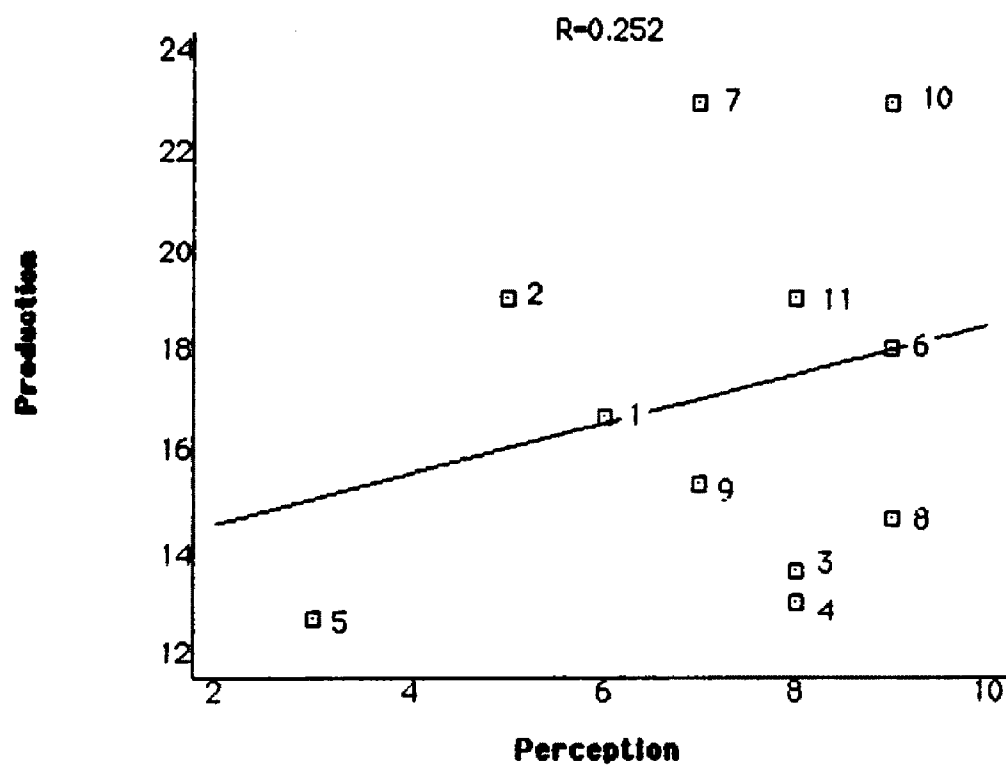


Figure 3.4

Correlation between speech perception and speech production:
Type III contrast



her to be located a larger distance from the line of least curve fit. Subject number 1 obtained perception and production scores which seemed fairly well-correlated, causing him to be located near the line of least curve fit in each Type category. All of the other subjects varied in their distance from the line across the different Type categories.

Reliability

The reliability of the scoring of the subjects' productions of target phonemes was determined using Pearson product-moment correlation coefficients. The r values indicated high inter-judge reliability between all judges and high reliability between each judge and the average of the three judges' scores. These results are summarized in Table 3.4. Because each judge's scores were highly correlated with the average of the three scores, it was determined that the average score for production was a stable measure which accurately represented subjects' performance on the production task. Thus, the averaged production scores were utilized during data analysis.

Table 3.4
Inter-judge reliability coefficients for production scores

| Judges compared | Correlation coefficient |
|-----------------|-------------------------|
| 1, 2 | r= 0.744 |
| 1, 3 | r= 0.778 |
| 2, 3 | r= 0.938 |
| 1, 3-judge avg. | r= 0.913 |
| 2, 3-judge avg. | r= 0.956 |
| 3, 3-judge avg. | r= 0.944 |

Summary

In summary, the perception and production of English phonemic contrasts by bilingual children from Spanish backgrounds were not significantly correlated, as measured by the paradigms used in this study. There was no significant correlation for the subjects' total scores or for their Type category scores. Thus, as these subjects' speech perception scores improved, their speech production scores may or may not have improved. In general, the subjects in this study performed more successfully on the production tasks than on the perception tasks. The correlations were in some cases influenced by one or two outliers whose data points were located a large distance from the line of least curve fit.

It was found that the contrasts /b-v/ and /d-ð/ (Type III contrasts) were significantly more difficult than the other contrasts for the children to perceive. In addition, the phonemes /v/ and /ð/ (Type III phonemes) were significantly more difficult for the children to produce correctly. The phonemes /v/ and /ð/ were often stopped (to [b] and [d], respectively). Production errors on Type I and II phonemes were usually phonetic. The phonemes /b/, /d/, and /g/ were often frictionalized and the phonemes /p/ and /t/ were occasionally partially voiced.

CHAPTER 4: DISCUSSION

The purpose of this study was to examine the relationship between the perception and production of English speech contrasts by bilingual children from Spanish language backgrounds. It was hypothesized that some children who speak English with a foreign accent do so not out of choice or habit, but because they cannot perceive some phonetic and phonemic distinctions in the second language. That is, these children's English speech production skills would be related to their English speech perception skills. In addition, a hierarchy of difficulty was predicted for these children's perception and production of specific phonemes, based on contrastive analysis between the Spanish and English languages. Phonemes were divided into three subcategories (Types I, II, and III) which consisted of different groups of phonemes. Distinct patterns of relationship between perception and production were predicted across the different categories. The findings regarding the hierarchies of difficulty as well as age and experience variables will be discussed and then related to theories of second language acquisition. Finally, these findings will be discussed in relation to individual variation.

Correlation between Speech Perception and Speech Production

The statistical analysis of the data did not reveal a significant correlation between perception and production of English speech contrasts by these bilingual children, either for their total scores or for their scores on the different Type subcategories of phonemes. Thus, the results did not support this study's hypothesis. Since perception and production were not significantly related, it cannot be determined whether children who perceive English contrasts can or cannot appropriately produce the English contrasts. In addition, it cannot be determined whether children who cannot perceive

English contrasts can or cannot produce the English contrasts. In summary, the subjects' speech production skills do not appear to be related to their speech perception skills, as measured by the paradigms used in this study.

The results of this study are not consistent with the findings of Williams (1979). Williams found a relationship between speech perception and production by examining the change of these skills as children learned a second language. He reported that as children grow older and are exposed to English for a longer period of time, both their perception and production of stop consonants change more toward a monolingual English pattern. He presented synthetic speech for the perception task and used a spectrogram to analyze voice onset time (VOT) characteristics of the childrens' productions.

This study attempted to utilize more naturalistic measures of speech perception and production. Oller and Eilers (1983) emphasized the importance of assessing speech discrimination in real speech contexts as the results will relate to how children use speech to communicate and, as a consequence, the results will be more "ecologically valid." Furthermore, the task of differentiating speech sounds in real speech is "more complex" than discrimination of syllables presented via a speech synthesizer.

The results of the current study are similar to the results of Terry and Cooper's (1969) study which used more naturalistic methods in comparing bilingual subjects' ability to perceive and produce English and Spanish phonetic contrasts. Terry and Cooper performed phonetic analyses of spontaneous language samples and assessed the subjects' abilities to perceive differences between alternate phonetic productions of the same word. The researchers found that "in general, perception and production were not particularly related." That is, their subjects' performance on the

perception test was not a good predictor of the phonological variation as observed in their speech. Terry and Cooper failed, however, to discuss any possible reasons for their results, and their results are questionable based on methodological grounds (they used few exemplars for data collection and provided inadequate descriptions of the population and the methods used).

Studies which have examined the relationship between perception and production in monolingual populations have produced conflicting results, as have those studies which have looked exclusively at speech perception or at speech production. This may be largely the result of the use of differing methodologies across the studies. Many researchers have therefore recommended specific methods for testing speech perception and production (Locke, 1980; Schwartz and Goldman, 1974; Stoel-Gammon and Dunn, 1985). Still, there is no single, uniform manner in which speech perception and production should be assessed. Rather, the assessment methods should be chosen based on the goals of the research or on the clinical need of the examiner.

Methodological considerations

It is possible that for the population examined in this study, speech perception and production were actually significantly correlated, but the methods utilized did not allow this relationship to appear. Methodological issues which may have affected the results involve several factors:

1. the size of the sample population was small;
2. the ethnicity of the examiner was not hispanic;
3. Eiler and Oller's method of testing speech perception may not have been a valid means to address the assessment of this population or the goals of this study;

4. the assessment of speech production or articulation may not have represented the spontaneous skills of the children in natural settings; and
5. the use of binary scoring reflected phonemic errors more than phonetic errors in scoring of the speech samples.

Sample size. A stronger relationship between speech perception and speech production may have occurred if a larger sample of subjects had been used. With only eleven data points, it would require a very strong relationship to show a high degree of correlation between any two variables. A large r sample might have demonstrated a significant correlation from a more subtle pattern of relationship. Thus, it is possible for a Type II error to have occurred in this study. A Type II error occurs when the null hypothesis has been accepted although it is truly false and could have been rejected had the sample size been larger.

Examiner ethnicity. The subjects' performances on the speech production task and on the language screening test may have been affected by the ethnicity of the examiner. The examiner was Anglo, although she was capable of conversing in Spanish. It is possible that the children, in the presence of an Anglo adult, were self-conscious about their Spanish linguistic influence and attempted to speak in an "English" manner rather than in a more typical manner. This tendency may have resulted in speech production scores that were higher than the corresponding speech perception scores. This, in turn, may have reduced the strength of the correlation between the scores on the two tasks. Although these children's speech perception skills were also assessed by the Anglo examiner, their speech perception scores may not have been as highly influenced by the

examiner's ethnicity. That is, the perception task was less culturally relevant than the speech production task.

In addition, examiner ethnicity may have caused lower scores on the screening of the subjects' Spanish language skills. Only one out of the 24 children screened actually met the criteria recommended by the developers of the screening test. In a study investigating the effects of examiner ethnicity and social class on language test results, Toronto (1977) found that Mexican-American preschool children whose primary language was Spanish would respond only in English to examiners who were not Hispanic. This finding is also consistent with teacher reports that many of the children who participated in the screening appeared to be quite fluent in Spanish when talking with their peers. These same children, however, were unable to name common objects in Spanish during the Spanish screening test administered by an Anglo examiner.

Assessment of Speech Perception. Eilers and Oller's (Eilers and Oller, 1975; Oller and Eilers, 1983) perception paradigm may not have been appropriate for use in this study for many reasons. While they initially found the task valid for use with monolingual two-year old children, they required the children to demonstrate their perceptual skills on a variety of contrasts that existed in English, the native language. Later, in 1983, Oller and Eilers found the paradigm to be valid for two-year-old bilingual children, however, those children were required to demonstrate their perceptual skills on contrasts that did not require phonetic differentiations (e.g. /j-w/ in English and /r-ř/ in Spanish are phonemes in their respective languages). The present study required the children to make both phonemic and phonetic distinctions on some contrasts which may have been more difficult, as predicted by the contrastive analysis between Spanish and

English. For example, [d-ð], and [b-v] are considered to be allophones of /d/ and /b/ in Spanish but not in English, and [d-t], and [b-p] are considered to be phonemic contrasts in both languages, but the phonemes have different allophonic variations in each language.

Two outcomes of the current study suggest that the ability to perceive such subtle contrasts may have presented more of a cognitive load to children than did the contrasts presented in other studies. First, it was found that the female subjects performed significantly better than the male subjects on the speech perception task, although an age factor may have interfered with the results. The literature has clearly documented that boys are slower to develop speech than girls since as early as 1952 when Templin reported sex differences in the development of articulatory skills. Later, Winitz and Lawrence (1961) found kindergarten girls were superior to boys of the same age in learning unfamiliar, non-English sounds. The fact that the gender differences appeared in the measure of speech perception during the present study provides support for the hypothesis that there is indeed a gender difference in learning speech, which is closely related to the subjects' cognitive, developmental skills. Second, age was more strongly correlated with the speech perception scores than with the speech production scores. This suggests that as children grow older and become more cognitively advanced, they are better able to understand the requirements of this speech perception assessment task. The age and gender results will be discussed in further detail in this chapter.

The speech perception task in the current study followed many of Locke's (1980) guidelines for assessing speech perception. First, the same phonemes were present in the same or at least similar phonetic contexts during both the perception and production testing. Second, the task was

short. Third, the children were tangibly and verbally reinforced, which should have increased their motivation to attend to the task. Finally, as was recommended by Schwartz and Goldman (1974), a meaningful task was used, that is, a picture identification task was used and target phonemes were embedded in sentences.

Locke (1980) also recommended that children should be given repeated opportunities to reveal their perceptual decisions. Although Locke stated that one instance of a particular contrast is not adequate, he did not suggest how many instances would be sufficient. The perception task in the current study presented six opportunities to discriminate each one of the six different contrasts. It is possible that results would have been more stable or conclusive had more instances of each contrast been presented.

Finally, Locke also recommended that training should be conducted prior to testing so that the child can show evidence of discriminant responding. The present study utilized the training of a dissimilar contrast ("frog" versus "mog") prior to testing the child's speech perception. This training paradigm was felt to be adequate for teaching the children the nature of the task and the mode of responding. Further training, however, could have been conducted with word pairs containing more subtle contrasts. The children may not have been ready for testing because they were not initially prepared to listen for subtle differences. This initial "unreadiness" would conceivably lead to a learning effect during testing, especially when children are reinforced for correct answers only. A learning effect did, in fact, occur across the repeated trials during the testing phase of the current study. The mean score on the first set of twelve presentations of speech contrasts was 70%. The mean score then increased to 80% on the second set of presentations and fell slightly to 76% on the third set. This suggests that,

after the first set of speech contrasts was presented, the children understood what degree of attention was needed in order for them to succeed. The children's lower scores on the first set of presentations lowered the overall speech perception scores. It should be recalled that perception scores were consistently lower than production scores. Had training on the more subtle contrasts been initially conducted, the subjects' speech perception scores may have been higher and, thus, better correlated with their speech production scores.

Eilers and Oller did not, in either their 1975 or 1983 articles, specify the nature of the reinforcement schedule used in their studies. The reinforcement schedule used in the current study may have been different from those used in the previous studies, which may have caused different results to have occurred. In the current study, children were tangibly rewarded only for their correct answers. In this case, this reinforcement schedule allowed more discriminant responding to occur. During the first trial run of the speech perception paradigm the subject was reinforced for every response she made, regardless of the correctness of her response. That is, a bead was placed under each of the two available choices. Consequently, the trial subject usually ignored the nonsense item and retrieved the bead from under the real item. Thus, the resulting score was near chance level (50%), since stimuli were balanced for presentation of nonsense and real items. The method used in the current study may or may not have been different from Oller and Eiler's method.

Assessment of articulation (production). The choice of the speech production task used in this study was made based on the task's efficiency. While samples of spontaneous speech provide the most naturalistic assessment in which the children's productions are the most representative

of their typical productions, the technique requires extensive periods of time to allow the children to become comfortable with the examiner and to speak freely. In addition, the children may not produce many of the target words without prompting from the examiner. It should be noted that the task used in the current study involved the imitation of target utterances and, although the reinforcement of the children's responses was not contingent upon correct productions, a learning effect may have occurred due to the modeling of correct productions. Thus, the children's reproductions of the models might not have been representative of their typical speech productions. That is, as the subjects' speech production task scores were consistently higher than their speech perception task scores, their productions may have been influenced by the presentation of a model. This possibility is supported by the Motor Theory of Speech Perception which argues that speech sound perception is mediated by reference to the articulatory patterns that produce them (Liberman, 1975). In addition, Shvakin (1973) stated that correct production can precede and facilitate perception of certain sounds.

Scoring of articulation (production). The method of scoring the articulation errors presented in the speech samples may have contributed to higher scores than might have been expected based on the children's performances on the perception task. The examiner chose to use binary scoring for the purpose of comparing the number correct on the production task to the number correct on the perception task. Each subject's scores were averaged for three different judges in order to decrease the chance of examiner bias and to provide a more stable measure of articulation skills.

The two assistant judges were instructed to "mark a production as correct if you think the target phoneme is produced with appropriate English

characteristics. Mark a production as incorrect if you think it is not made with appropriate English characteristics." These judges, who had no knowledge of Spanish, tended to score productions as incorrect only if they interfered with a child's intelligibility. For example, if a child produced a frictionalized [b_x], the two judges would score it correct because they understood it as /b/. They discounted the phonemic errors but usually not the phonetic errors. The principle examiner, however, scored the phonetic errors as incorrect. She deemed phonetic errors to be significant because the children were expected to make phonetic differentiations on the perception task. For example, the children were asked on at least one occasion to differentiate between [bæɲ] and [væɲ]. In Spanish, [b] and [b_x] are phonetic variations of /b/ whereas [v] does not exist. If a child produced the word "van" with a frictionalized [b_x], it was scored as incorrect by the principal examiner because the error may have been due to a failure to perceive the difference between [bæɲ] and [væɲ].

Averaging the principle examiner's scores with the scores of the two assistants resulted in a final score that was biased toward phonemic errors, which may not have compared well to the subjects' perception errors. The principle examiner's scoring of speech production was, in fact, more highly correlated with childrens' perception scores. While this correlation was not significant, it was a stronger correlation than the one reported in the results chapter. The correlation of speech production scores (from her scoring) with the speech perception scores was $r=0.46$. In contrast, the correlation for the second judge's scores was $r=0.36$ and the correlation for the third judge's scores was $r=0.26$. The third judge appeared to make the fewest phonetic distinctions in the articulation scoring, and this was reflected by the low correlation of her scores.

The scoring tendencies of the two assistant judges, however, should not be discounted. The fact that the judges considered many errors to be so subtle that they scored them as correct suggests that the children's speech was generally intelligible even when it contained phonetic errors. While a bilingual child's Spanish accent may not interfere a great deal with the listener's understanding of the child's speech, perception errors may be causing the bilingual child to have difficulties in other areas. It is not known, for example, whether the child's perceptual errors are causing him difficulties in his learning and understanding of the English language.

Heirarchies of difficulty

It was predicted, based on analysis of the Spanish and English sound systems, that English contrasts which differ in place of articulation, the Type I contrasts such as /b-g/ and /p-t/, would be the easiest to perceive as they share the same places of articulation in Spanish. Type II contrasts, which differ in voicing, such as /d-t/ and /b-p/, were predicted to be more difficult because Spanish voicing patterns are different from English voicing patterns. For example, in English, /p/ and /t/ have aspirated allophones while, in Spanish, /p/ and /t/ have partially voiced allophones. Finally, it was predicted that Type III contrasts, such as /d-θ/ and /b-v/, which differ in frication, would be the most difficult for the children to perceive because /θ/ and /v/ do not exist as phonemes in Spanish, as they do in English.

The results of this study supported the prediction that Type III contrasts would be the most difficult for the children to differentiate. There were no significant differences, however, between the subjects' perception of Type I and Type II contrasts. These findings provide support for Stockwell and Bowen's (1965b) observation that those phonemes which are phonetic variations of the same phoneme in the native language but which are

separate phonemes in the second language would be the most difficult phonemes for the second language learner to acquire. Stockwell and Bowen also observed that sounds which have the same phonemic status in both languages are the easiest to acquire. Type I and II contrasts are phonemic in both languages, but they have different allophonic distributions in each language. Apparently, the phonetic characteristics of the contrasts did not greatly influence the current speech perception results. The phonemic status of these contrasts may have been more salient, causing no differences to occur between the Type I and the Type II contrasts, and causing them to be easier to perceive than the Type III contrasts.

No predictions were made regarding a hierarchy of difficulty for the production of phonemes in this study. It was found, however, that, as in the speech perception results, the correct production of the Type III phonemes had occurred the least frequently among the three types of contrasts and there was no significant difference between the results for the correct production of the Type I and Type II phonemes. Thus, it appears that Stockwell and Bowen's (1965b) hypotheses are also applicable to these articulation findings. In addition, the lack of a significant difference between Type I and Type II phonemes in the production task may be due to the fact that the categories were not mutually exclusive and they differed by only one phoneme. The Type I phonemes included /g/ whereas the Type II phonemes included /d/.

The production of both Type I and Type II phonemes in an English manner required the children to attend to the place, manner, and voicing characteristics of each of the phonemes, regardless of their classification. As a result, similar errors were made on Type I and Type II phonemes. The phonemes /b/, /d/, and /g/ were often frictionalized and the phonemes /p/

and /t/ were sometimes partially voiced or unreleased. The Type III phonemes also were not mutually exclusive from the other Type categories. It was determined that the numerous articulation errors on /v/ and /ð/ contributed to the low Type III production scores. The subjects most frequently produced the fricatives /v/ and /ð/ with a "stop" manner, although some children changed the place of articulation or omitted the initial consonant altogether. Based on informal observation, the phonemes /p/ and /t/ were produced with the most accuracy, and /b/ and /d/ were incorrectly produced with only slightly more frequency. A number of errors occurred on the phoneme /g/. Finally, the phonemes /v/ and /ð/ were produced with the least accuracy.

It is interesting to examine articulation errors in terms of a hierarchy of difficulty based on place, manner, and voicing features. Errors of place of articulation (e.g., /b/--> /g/) occurred the least frequently, and frication errors (e.g., /ð/ --> [d]) occurred the most frequently. The frequency of voicing errors (e.g., /t/--> [t̚]) fell between these two extremes. Based on contrastive analysis, it is expected that Spanish-speaking children would partially voice voiceless stops when speaking English. Thus, it was surprising that many of the subjects in the current study overcorrected this tendency and actually exaggerated the English characteristic of aspiration (which is a longer than normal period of voicelessness) on the phonemes /p/ and /t/ in the target words.

Age and Language Experience

Although age and language experience variables were not addressed in the hypotheses of the current study, relevant findings were made retrospectively during data analysis.

Age

Pearson product-moment correlation coefficients were used to describe the relationship between subjects' age and their scores on perception and production tasks. The correlation coefficients for total scores and for scores obtained in each of the Type categories are presented in Table 4.1. Figure 4.1 presents the scattergram for the age-total perception correlation and Figure 4.2 presents the scattergram for the age-total production correlation. Age was not significantly correlated with the total perception scores nor with the total production scores, although the coefficients closely approached significance. The correlation was significant, however, between age and two of the Type subcategories. Age was significantly correlated with these children's production of Type I and II phonemes. Thus, as these bilingual children from similar backgrounds grow older, they become more skilled at producing the English phonemes /p/, /b/, /d/, /t/, and /g/, the phonemes classified to the Type I and II categories. Age was not significantly correlated with the children's ability to produce the English phonemes /v/, /d/, or /ʒ/, the Type III phonemes. Because the Type III category includes the phonemes /b/ and /d/ which are also included in Type I and II categories, it is likely that age was actually not significantly correlated with these children's ability to produce /v/ and /ʒ/.

The characteristics of each subject's perception and production of all presented contrasts may be determined by examination of their corresponding data points on the two scattergrams correlating age with perception and production. It appears that subjects number 8 and 10 obtained higher scores than might be expected for their ages on the perception task. Subjects number 5 and 9 obtained lower scores than might have been expected for their ages on the perception task. Subject number 4

Table 4.1

Correlation coefficients between age and perception/production Type categories.

| Age correlated with | r | Signif. |
|--------------------------|------|---------|
| Perception scores | | |
| Total | 0.56 | >0.05 |
| Type I | 0.28 | >0.20 |
| Type II | 0.55 | >0.05 |
| Type III | 0.47 | >0.10 |
| Production scores | | |
| Total | 0.47 | >0.10 |
| Type I | 0.67 | <0.05* |
| Type II | 0.82 | 0.002* |
| Type III | 0.36 | >0.20 |

*significant at 0.05 confidence level

Figure 4.1
Correlation between age and total perception scores

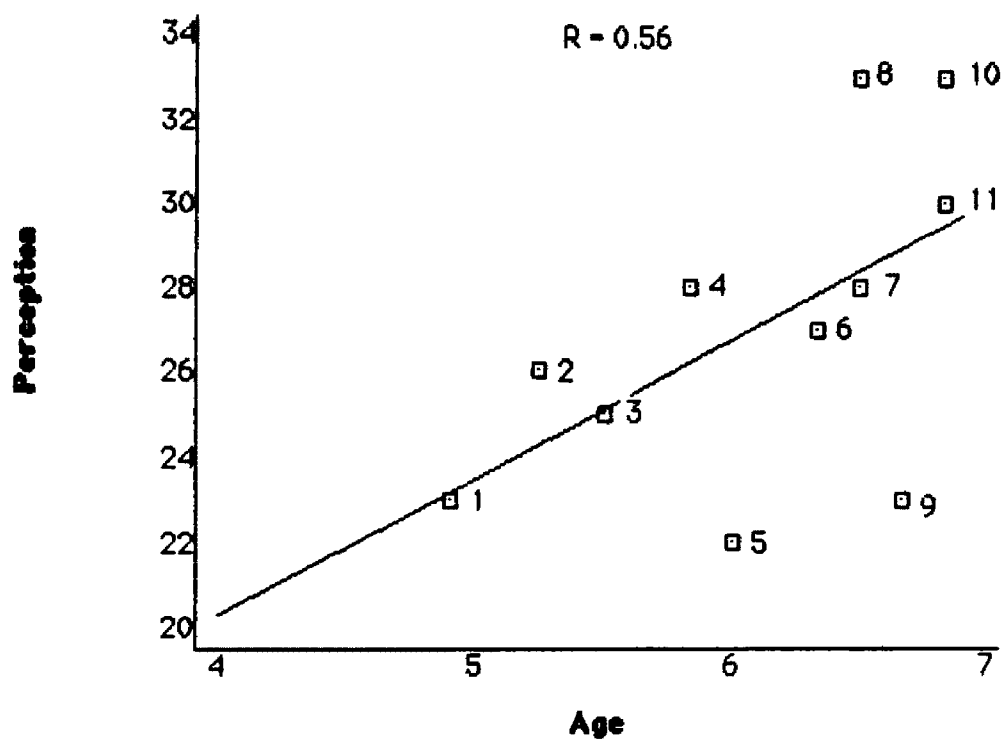


Figure 4.2

Correlation between age and total production scores



obtained notably lower scores for her age on the task of speech production. These subjects are considered outliers which may have caused an insignificant correlation coefficient to occur for the relationship between the children's age and their total scores for their perception and production of English speech contrasts.

In summary, age was not significantly correlated with total scores on either the speech perception task or the speech production task, however, the correlation closely approached significance. As the sample size was very small, the strength of the correlation could have been significant if the sample size had been larger. Thus, it might be speculated that the older the child, the better his or her score on the speech perception and production tasks. This hypothetical result would be logical given that the speech and language acquisition in monolingual children is a developmental process. According to Bernthal and Bankson (1981), articulation is a maturational skill which reaches a ceiling at eight years of age. Weiner (1967) reported that auditory discrimination is also a developmental skill which reaches maturation at eight years of age.

While there were strong but not significant correlations between age and total speech perception and production scores, age was not highly correlated with either the perception of the phonemes in the Type I category or the production of the phonemes in the Type III category. It is unclear why this result had occurred. Perhaps the perception of Type I contrasts is developmentally possible for all of the children as young as 4;11 years of age and those children who made errors on Type I contrasts did so for reasons not related to their chronological age. In addition, the production of the Type III phonemes was perhaps too difficult developmentally for all of the

subjects and age is therefore not related to their correct production, at least up to age 6;10 years.

Language Experience

Performance on Language Screening Test. A Spanish Language screening test (Compton and Kline, 1983) was given for the purpose of ruling out a communication disorder in Spanish for all subjects. Because only one subject passed the screening test out of an initial subject pool of 24 subjects (most of whom were reportedly fluent in Spanish), it was determined that Compton and Kline's test was not a valid measure of these children's communicative ability in Spanish. As a result, it was determined that the children's errors should be used in examining the results rather than as strictly an inclusion criterion. It was thought that those children who obtained the lowest scores on the measure might have a higher degree of English influence, causing them to perform worse on the Spanish screening test but better on the tasks of perceiving and producing English speech contrasts. Conversely, it was thought that those children who performed well on the screening measure might have a higher Spanish influence and they might thus obtain lower scores on the perception and production of English speech contrasts. Pearson product-moment correlation coefficients were used to examine the relationship between the number of errors on the language screening test and the number of correct answers on the speech perception and production tasks. There was no correlation between the children's performance on the language screening test and their performance on either the perception or the production tasks. The Pearson correlation coefficient of the relationship between the number of errors on the language screening test and the number of correct answers on the perception task was

$r = -0.07$. The correlation for the screening test and the production task was $r = -0.06$.

Language Background. The questionnaire which was used to determine if subjects were appropriate for inclusion in the study was also used in further data analysis. The questions relevant to the subjects' amount of exposure to English were assigned numerical values for the purpose of later determining how language background relates to performance on perception and production of English speech contrasts (see Appendix D).

Because questionnaires were not returned for four out of the eleven subjects, statistical analysis of the data was not performed. Some general conclusions, however, are possible. One subject exhibited a strong Spanish influence (score = 11) and one subject exhibited a strong English influence (score = 3.5). The rest of the children were more balanced in their language experience. The parents of these "balanced" children spoke mostly Spanish with their children but the children spoke both Spanish and English with their siblings and friends. The children varied in how long they had been using English to communicate in any one situation (1-3 years). These more balanced children obtained scores of either 7 or 9.

It is difficult to determine how language experience is related to scores obtained on the speech perception and production tasks. One might expect that the higher the degree of English experience, the higher the scores obtained on the tasks of perceiving and producing English phonemes might be. Alternatively, the higher the degree of Spanish influence, the lower the scores on the English perception and production tasks. Based on an informal visual examination of the data, this seems to be the case for the speech production scores. The child who had the highest degree of Spanish influence obtained the lowest score on the speech production task and the

subject who had the highest degree of English influence obtained one of the highest scores on the production task. All of the other subjects for whom questionnaires were returned obtained scores which varied between the two extremes.

There did not appear to be a relationship between language experience and speech perception scores. For example, the child who had the highest degree of English influence obtained a low score for perception of English contrasts. There did not seem to be any pattern between language background and perception scores for any of the other subjects. This lack of correlation may have been influenced by the small number of subjects who participated in the study.

Every parent who returned the questionnaire reported that he or she wanted his or her child to learn English. One parent stated that English "seems to be the language needed today to get ahead in life," and another stated that the "English language is very important for when [the child] grows up to better himself in a career or job here in the United States." Still another parent stated that her child was missing a lot by not being able to communicate with teachers who do not speak Spanish. Some parents stated that they also wanted their children to retain their ability to speak Spanish. There did not appear to be a pattern of performance on perception and production of English contrasts based on parental attitude as assessed by their answers to the question "do you want your child to learn to speak English." In addition, there did not appear to be any relationship between the childrens' performance on the tasks and whether or not the parents returned the questionnaires.

In summary, the child's language experience as measured by the parent questionnaire appeared to be related to the child's performance on

the speech production task. Too little data, however, was collected to reach any definitive conclusions. Language experience did not appear to be correlated with the child's performance on the speech perception task. One would expect that, with their increased exposure to English, these children would be better able to comprehend and produce the phonology, semantics, and syntax of the English language. Indeed, Williams (1979) found high levels of significance regarding the effect of exposure ($p < 0.001$). That is, the greater the amount of exposure to English, the more the children in his study perceived and produced speech with English characteristics. In addition, Williams found that age had a significant effect on language skills, particularly with speech production.

Methodological considerations for control of age and language experience

Perhaps the apparent differences between the results of the current study and the results of Williams' 1979 study can be attributed to the degree of control the experimenters had over the variables of age and language exposure. Williams had excellent control over those variables, as he chose six distinct experimental groups of subjects for the inclusion in his study. The subject selection was based on the person's length of stay in the United States after having moved from Puerto Rico where little English is spoken.

The present examiner studied a population which had a more variable language background and the exact extent of their exposure to English was difficult to determine. Furthermore, the nature of this study was descriptive and, therefore, separate experimental groups were not utilized. The examiner depended on teacher and parental report, which is neither totally valid nor reliable, to determine degree of the child's exposure to the English

language. In addition, the questions on the parental questionnaire may not have been sufficiently sensitive to define this attribute or the parents did not understand these questions. Many parents provided very general answers to specific questions. For example, when asked "How long has your child been using English to communicate in any situation?", one parent responded, "Since he began going to the migrant school." In some cases, the parents did not answer all of the questions. It is possible that many of the parents did not actually know the answers to such questions, since their children may have spoken only Spanish in the home and English when the parent was not present.

The children's performances on the Spanish language screening test was not correlated with their performances on the speech perception or production tasks. As discussed earlier, the test may not have been culturally valid for this population and examiner ethnicity may have affected its results. Furthermore, this measure of Spanish communicative ability should not be assumed to be related to English language experience. Performance on a Spanish language test does not allow any inferences regarding the length or quality of the child's exposure to English.

Theories of second language acquisition

The results of the current study can be related to the theories of second language acquisition, specifically, theories supporting the contrastive analysis hypothesis, the L1 - L2 hypothesis, and the interlanguage hypothesis. The results of this study do not provide clear support for any one hypothesis, however, the application of these hypotheses can be used to suggest reasons for the current results.

Contrastive Analysis Hypothesis

The contrastive analysis hypothesis (Lado, 1957) contends that errors made in the second language can be predicted based on differences between the native language and the second language. Clearly, some articulation errors in the second language can be predicted through contrastive analysis. For example, by examining the phonological systems of Spanish and English, one might expect Spanish-speaking children who are learning English to stop some English fricatives (e.g., /v/ and /ð/) as these phonemes do not exist as phonemes in Spanish. In addition, one might expect these children to partially voice the voiceless stops and to frictionalize the voiced stops due to the influence of the allophonic patterns of voiceless and voiced stops in Spanish. Indeed, the children in the current study produced these speech errors. In contrast, partial voicing of voiceless stops and the frictionalization of voiced stops are not typical speech errors produced by monolingual children acquiring English as their first language.

The contrastive analysis hypothesis may be used to account for the following statement: Experience with native language phonology influences how the phonology of the second language is learned. Subsequently, if experience with the second language is related to the acquisition of a second language, then as a child's experience with English increases and the more salient the characteristics of English become, the better the child performs on speech and language tasks in English. Theories of cross-linguistic speech perception have suggested that infants may have a biological predisposition to discriminate the universal set of phonetic contrasts, and there is an apparent decline or reorganization in this universal sensitivity as a function of learning a particular language (Werker and Lalonde, 1988). It is unclear if this decline is due to the inhibition of non-native contrasts or to the

increased attention to native contrasts. It remains unclear whether, during second language learning, the native phonemes and contrasts are inhibited or second language phonemes and contrasts are facilitated through experience.

L1 - L2 Hypothesis

The L1 - L2 hypothesis (Dulay and Burt, 1974) suggests that the native language of the child has little influence on the learning of the second language. It is assumed, instead, that the second language learner encounters many of the same problems that a native speaker does during the acquisition of his first language. Thus, the speech errors will be similar for the both the first and the second language.

The results of this study can be interpreted so as to provide support for this hypothesis. It could have been predicted, based on the L1 - L2 hypothesis, that the bilingual children in this study would have more difficulty in perceiving and producing Type III contrasts. Because 90% of the native, monolingual speakers of English do not acquire the phonemes /v/ and /ð/ across all contents until eight years of age (Sanders, 1972), and because it is presumed that errors for the first and second language will be similar, it follows that 90% of the Spanish-speaking children learning English would not acquire the phonemes /v/ and /ð/ prior to eight years of age. Thus, the errors made on /v/ and /ð/ may be developmental errors and not necessarily transfer errors. Indeed, some of the errors made on /ð/ in the current study were not characteristic of the errors which would be predicted based on contrastive analysis, as several children did not produce [d] in place of /ð/. Rather, some children omitted /ð/ altogether or they substituted various other phonemes such as /g/ or /l/.

The L1 - L2 hypothesis may also account for why children performed better on Type I and II contrasts. According to Prather (1975), the phoneme /p/ is acquired by 90% of monolingual English-speaking children by 28 months of age, /t/ is acquired by 32 months of age, and /b/, /g/, and /d/ are acquired by age 36 months of age. The children in the current study were above the age of 36 months. The L1 - L2 hypothesis does account for the findings in the current study that age is significantly correlated with the child's performance on some speech and language tasks in the second language, specifically, production of the phonemes /b/, /p/, /d/, /t/, and /g/.

Interlanguage Hypothesis

The L1 - L2 hypothesis does not account for why a number of errors did indeed occur on the Type I and II phonemes. If only the L1 - L2 hypothesis were accepted, one would have to predict that only 10% of the children would commit errors on the phonemes in the Type I and II categories as 90% of monolingual English-speaking children older than 35 months of age produce them correctly. This, however, was not the case. Of the children in the present study, 91% committed at least one error in the production of Type I and II phonemes. Therefore, an interaction between the contrastive analysis and L1 - L2 hypotheses may be needed for adequately explaining the results of this study. The interlanguage hypothesis (Selinker, 1972) addresses the influence of both languages during second language learning. It holds that the learner's second language development consists of a series of developmental periods which demonstrate the influence of factors from his native language as well as the influence of the developmental characteristics of the target language. For example, it is not clear whether the subjects of this study have not acquired the phonemes /v/ and /ʒ/ because of the influence of the Spanish language

(/v/ and /b/ do not exist as phonemes in Spanish) or because /v/ and /b/ are not acquired, even by 90% of monolingual English speakers, until 8 years of age. The interlanguage hypothesis would account for these ambiguous errors. Furthermore, it would account for why both the child's exposure to the second language and the child's age would influence their second language acquisition.

Individual Variation

The examination of scattergrams from the data obtained in this study make it clear that there was a large amount of individual variation among the scores of the subjects. It is likely that the small sample size did nothing to improve the observed variability. Additional variables which may have caused the individual differences observed may include: (1) the subjects' gender; (2) the subjects' location (which school they attended); (2) the subjects' attitude and motivation; (3) the subjects' opportunities to learn English; (4) the subjects' cognitive abilities; and (5) the subjects' personality characteristics.

Gender

The influence of subject gender was examined retrospectively in relation to the subjects' scores on perception and production tasks to determine if the results were influenced by gender. These findings are summarized in Table 4.2. Of the eleven subjects, six were male and five were female. The female subjects performed significantly better than male subjects on the perception task at a confidence level of 0.05 as was determined by a t-test. The mean score obtained by male subjects on the perception task was 70.0%, compared to a mean of 81.6% obtained by the female subjects. This result may have been complicated by an age factor, as the mean age of the male subjects was 6;0 years whereas the mean age of

Table 4.2

Gender with relation to total scores on perception and production tasks

| Measurement | Gender | | t (9 d.f.) | Confidence level |
|-------------------------------|---------|---------|------------|------------------|
| | Male | Female | | |
| Total Score Perception | | | | |
| Mean | 70.0% | 81.6% | 2.14 | 0.05 |
| Stan. Dev. | 3.06% | 8.75% | | |
| Total Score Production | | | | |
| Mean | 79.2% | 77.8% | -0.02 | >0.05 (N.S.) |
| Stan. Dev. | 7.0% | 17.8% | | |
| Age | | | | |
| Mean | 6:0 yrs | 6:3 yrs | | |

the female subjects was 6;3 years. If the age factor was accounted for statistically, the mean score of the male subjects would have been 72%. As a result, the significance of the difference would have decreased and the 0.05 level of confidence criteria would not have been met.

Location

A location effect on results was ruled out retrospectively using statistics to describe the total scores obtained in the perception and production tasks for subjects in the Billings school and subjects in the Hysham school. Means and standard deviations were determined for perception and production for both groups and t-tests were used to determine if any differences were statistically significant. These results are summarized in Table 4.3.

Of the eleven subjects, five attended the Billings school while six attended the Hysham school. The subjects in the Hysham school obtained total perception scores which were notably higher than those scores obtained by the Billings subjects. The mean total perception score of the children in the Hysham school was 79.6% and the mean total perception score of the children in the Billings school was 70.0%. This difference, however, was significant to only the 0.07 confidence level. Furthermore, the higher scores of the Hysham children were likely due to their higher mean age. The mean age of the Hysham children was 6;4 years compared to a mean of 5;10 years for the Billings children, a difference of approximately six months. As was demonstrated earlier, age is a significant factor in performance on Type I and II categories of the production task and it closely approaches significance for the total perception score.

The mean total production scores of the Billings and the Hysham children were similar. A t-test demonstrated no statistical difference.

Table 4.3

Location in relation to total scores on perception and production tasks

| Measurement | Location | | t (9 d.f.) | Confidence level |
|-------------------------------|----------|---------|------------|------------------|
| | Billings | Hysham | | |
| Total perception score | | | | |
| Mean | 70.0% | 79.6% | -1.62 | 0.07 (N.S.) |
| Stan. Dev. | 2.59% | 11.5% | | |
| Total production score | | | | |
| Mean | 81.3% | 76.3% | 0.64 | >0.05 (N.S.) |
| Stan. Dev. | 4.34% | 6.05% | | |
| Age | | | | |
| Mean | 5;10 yrs | 6;4 yrs | | |

**Attitude, motivation, learning opportunity,
cognition, and personality factors**

It was noted that, with very few exceptions, each subject obtained higher scores on the speech production task than on the speech perception task. Only two of the subjects did not behave in this manner. The scores of these two subjects were outliers on the scattergram for the total scores presented in Figure 3.1. Although they did not perform particularly well on the perception task, their production scores were even poorer when compared to their perception scores. This suggests that while these children were able to perceive English contrasts to a certain degree, they did not produce them to the same degree. Many reasons may account for this finding. Perhaps, these children had been more exposed to native speakers of English and thus they are able to perceive the contrasts in English. Their family members, however, may speak English with a strong Spanish accent. Thus, the children receive mixed input and, to resolve the differences between this input, they choose to speak in the manner to which they are most accustomed, that is, the manner in which their parents speak.

Or perhaps the children had negative attitudes toward the second language community and they did not wish to "sound like the Anglo." Cummins (1986) stated that the child's motivation to learn a second language and his attitudes towards speakers of the second language may significantly affect his second language learning. This attitude may be shaped by the child's own personal experience or by his family's or community's attitudes.

In addition, it is possible that the child's cognitive abilities determine how he will use the second language. Although these children were able to perceive the English contrasts, perhaps they did not produce them because

they were unable to perceive them in their own speech or they were unable to actualize what they had learned.

Finally, personality factors may have affected how these children use the English characteristics in their speech. It is possible that in this sample the children were simply shy. They may have paid attention in class and they may have developed a healthy attitude about Anglos, but, because they were shy, they may not have often taken the opportunity to practice using English or to experiment with its articulation.

While one could continue making conjectures regarding why individual variation did occur, it is clear that there are many variables which affect second language learning even at the phonetic level and they interact in numerous ways. It is difficult to isolate variables which may be affecting perception and production of English speech contrasts in this population, and further conjectures will not be discussed, either with regard to the two subjects who were outliers, or in regard to the subjects who varied from other subjects in different manners.

Implications of the Research Findings

The results of this investigation support the need for additional studies and the use of different experimental design for employing speech perception and speech production research in order to improve our understanding of the relationship between speech perception and speech production in bilingual children. In addition, these investigations could contribute to our knowledge of the interlanguage system by addressing the speech perception and production skills of Spanish-speaking children acquiring English as a second language.

Directions for Future Research

The implications for finding a specific relationship between the speech perception and production skills in bilingual children may significantly impact the study of the speech and language skills of these children. The demonstration of a specific relationship would particularly facilitate the identification of speech disorders in this population. A child who exhibits a foreign accent which interferes with his intelligibility but whose speech perception skills demonstrate an adequate perception of English phonemes and allophones does not necessarily have a speech disorder and would not require intervention. It is his choice to maintain his pronunciation. Alternatively, a child who has an accent which interferes with his intelligibility and who also demonstrates an inability to perceive English contrasts may need intervention in order to train his perception of the English contrasts. If the bilingual child learning English is placed in environments with English speakers and is to be formally educated through the English language, the training of his perception of the English contrasts may prevent a perceptual problem from interfering with other areas of learning.

In the face of such implications, and in the absence of any definitive findings in the area of speech perception and production in bilingual children, future research should be directed at resolving the methodological problems in order that a relationship, if it exists, may be demonstrated. Future researchers should continue to utilize speech production tasks which are familiar and meaningful to children and which are appropriate for their subjects' cognitive and attentional level. Researchers should also be extremely careful to assess the same phonemes in the same contexts in perception tasks as they assess in production tasks. A number of studies

involving a large number of subjects and numerous instances (at least ten) of one or two speech contrasts should be conducted. This would allow the childrens' true speech perception abilities to be demonstrated, as long as they were motivated to succeed and they were appropriately trained to the task. It is crucial that the researcher train children to the nature of the perception task by using dissimilar contrasts. Subsequently, the examiner should train the children to the degree of attention that will be required for successful responding by using subtle contrasts, if subtle contrasts are to be assessed in the task.

The childrens' articulation skills should be assessed in as naturalistic a setting as possible. The following setting would tap those productions which are the most representative of childrens' typical productions and would also be time-efficient. For example, the examiner could ensure that two children know the names of the items to be assessed. These two children could be seated at a table with a barrier between them. The examiner could show one of the children a picture of an object and instruct that child to tell the second child which toy out of a selection of toys in front of him to choose. Prizes could be awarded for completed tasks. This paradigm eliminates the need for a model to be provided, it can be accomplished in a short amount of time, and children would be motivated to play the game with their friends. It may also reduce the effect of examiner ethnicity on the results. However, using an examiner from the same linguistic and cultural background as the children would be a better control for this variable.

Finally, it is critical that examiners score production samples in the same manner as is required by the perception task. All judges should be instructed as to the amount of detail needed. Even if binary scoring is used,

it should reflect phonetic detail if the perception task requires subjects to make phonetic distinctions between contrasts.

Perhaps the downfall of the present study was that it attempted to prove too much. Had the examiner chosen two contrasts on which a number of exemplars could be assessed, the results may have been more conclusive regarding the relationship between speech perception and speech production. By conducting a number of studies using different contrasts but using the same methodologies, patterns may emerge which would demonstrate the relationship between perception and production, and provide evidence for a hierarchy of difficulty for various contrasts and phonemes.

Clinical and Theoretical Implications

Although this study failed to demonstrate a strong correlation between the speech perception and production skills in bilingual children where one may have existed, other findings did have theoretical and clinical implications. The results did provide some support for both the L1 - L2 and the contrastive analysis hypotheses of second language acquisition. That is, age plays a significant role in the acquisition of a second language. Second language learning, like first language learning, is a developmental skill and the errors made during the acquisition of the two languages will be similar. In addition, the errors made in the second language do reflect the influence of the first language. Those errors can be predicted to some degree by analyzing the differences between the two languages.

These findings are important clinically because they assist the clinician in understanding the nature of acquisition of English by bilingual children from Spanish-speaking backgrounds. Because the clinician knows that the phonological systems of different languages reflect a similar

developmental pattern, she can determine, by comparing a child's errors to the English norms (when norms for the native language are not available), if a particular sound should be acquired by a child of a certain age. If the clinician finds that a child's errors are not developmental, she can then determine if they are transfer errors which reflect the native language. By knowing the type of errors and their etiology, the decision regarding the child's need for treatment will be made easier. In addition, the focus of the treatment program may differ depending on etiology. If errors are due to the influence of the native language, the treatment may focus on the training of the perceptual and productive differences between the two languages. If errors are due to a developmental delay or a disorder, the treatment should focus on different methods of training (depending on the nature of the errors).

The findings of the present study contribute to a description of an interlanguage phonological system of bilingual children from Spanish-speaking backgrounds. The study also describes a hierarchy of difficulty for certain phonemes and allophones, as influenced by both the knowledge the children had of Spanish and by the developmental level required for the accurate perception and production of these phonemes and allophones. Although this was not a normative study, speech-language clinicians can utilize these findings to better understand the phonological systems of these children and to recognize how the child's age and experience with the two languages influence their phonological systems.

The results of this study suggest that many of the phonetic differences in bilingual children's English do not significantly affect their intelligibility. Many of the children's phonetic errors often go unnoticed, even by speech pathologists who are unknowledgeable about the rules of the Spanish

language. This suggests that these childrens' foreign accents, to a large degree, do not cause them to be misunderstood. The ASHA position paper on social dialects (Committee on the Status of Racial Minorities, 1983) holds that dialectical differences should be treated only at the client's request. Indeed, it may certainly be important for linguistically and culturally different populations to maintain their accent in order that they may retain some of their heritage or culture. This is important especially in the present era during which minority populations are losing their heritage due to the influence of the American culture and the belief that one must speak English in order to succeed in the United States. The present examiner retains her proposal, however, that bilingual children's perceptual abilities should be assessed to rule out an underlying problem which is causing them difficulty in learning the sounds, semantics, and syntax of English, if these children are expected to learn or to be educated through the English language.

There is not a current, comprehensive description of the interlanguage system of bilingual Spanish-English speakers. This is difficult to achieve because there are many variables which interact and influence second language learning, including the amount and quality of the child's exposure to both the native and the second language, the child's motivation to learn the language, the child's and family's social position, his or her personality, and other cognitive factors. Because a knowledge of the characteristics of interlanguage systems is important for determining whether articulation errors reflect a child's interlanguage phonology or whether they are evidence for a speech disorder, future research should attempt to control these variables and establish normative data for various minority populations. Currently, speech pathologists must assess children's phonological systems in their native language and in the second language in

order to detect any developmental delays or deviations. This is not entirely appropriate, however, because the bilingual children's phonological systems may not be characteristic of either the native language or the second language, but of an inter-language, in which characteristics of both languages are mixed.

Conclusions

This study examined the relationship between preception and production of English speech contrasts by bilingual Spanish/English-speaking children 4;11 to 6;10 years of age, as assessed by a speech perception paradigm designed by Eilers and Oller (1975) and by a delayed imitation production paradigm. In addition, it examined a heirarchy of difficulty for the perception and production of English phonemes and allophones, based on contrastive analysis.

The results from the speech perception and production tasks were not found to be significantly correlated, however, this may have been the result of a number of methodological problems. As the previous studies which examined the relationship between speech perception and production in bilingual children have been inconclusive (also due to methodological problems), the present results reinforce the need for additional research to resolve these procedural problems. Several suggestions for the methodological modifications were discussed above.

In addition, the results of the current study provide a tentative description of the interlanguage phonological system of these bilingual children. It was found that place of articulation errors are made the least frequently and frication errors are made the most frequently. The frequency of voicing errors fell between these two extremes. The perception and production of specific phonemes was discussed. The results also

indicated that while age was not significantly correlated with the child's speech perception and production skills, these correlations were strong and approached significance. It appears that experience with the second language may also be related to articulation of the second language, but further research is needed.

The current study demonstrates that the contrastive analysis and L1 - L2 hypotheses can be applied to the results, and that a variety of other variables cause wide individual variation. A number of variables should be carefully controlled in further studies and normative data should be gathered in the future so as to provide comprehensive descriptions of the interlanguage phonological systems of a variety of minority populations. The knowledge of the relationship between speech perception and speech production and of the interlanguage phonological systems of bilingual children can indeed assist the speech-language clinician in determining a child's need for treatment and the direction for this treatment.

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APPENDIX A

Definitions of Terms

Allophone: A variant of a phoneme. The allophones of a phoneme form a set of sounds that (1) do not change the meaning of a word; (2) are all very similar to each other; and (3) occur in phonetic contexts different from each other.

Articulation: The movements of the speech organs employed in producing a particular speech sound.

Aspiration: A fricative noise generated as air escapes through partly adducted vocal folds and into the upper cavities after the release of an articulation, usually a stop consonant.

Bilingualism: The ability to effectively communicate in two languages in at least one social situation.

Contrast: A difference in pronunciation which speakers use in distinguishing different utterances in a language.

Contrastive Analysis: The analysis of the phonological and grammatical systems of two languages which results in predictions of what errors will occur in the speech and language of a speaker of one language who is learning the other language.

Diacritic: A special symbol used to modify a phonetic symbol to indicate modification of sound production (e.g., the addition of ~ distinguishes a velarized from a nonvelarized sound, as in [ñ] as opposed to [n]).

Discrimination: The task of perceiving distinctions between or among stimuli.

Fricative: A manner of articulation in which a continuous noise is generated as air is channeled through a narrow articulatory constriction.

Frictionalize: The process of changing the distance between two articulators so that the airstream is partially obstructed and a turbulent airflow is produced.

Intelligible: Capable of being understood.

Interlanguage: The speech and language system of bilingual persons which is influenced by interference from the native language and by developmental features of the second language.

L1 - L2: A theory of second language acquisition which states that errors made in the second language are due to the developmental difficulty of the features being acquired. It holds that errors made in the first and second language will be the same.

Overgeneralization: The application of regular rules to exceptional forms in a language (e.g., "went"--> "goed").

Phoneme: A basic speech segment that has the linguistic function of distinguishing between morphemes (the minimal units of meaning in a language)

Phonemic Transcription: A notation system describing utterances by indicating sounds significant to the native speaker. A phonemic transcription is usually written between slanted lines / /.

Phonetic transcription: The notation system which describes speech sounds in an utterance. It can be of any desired degree of detail and is usually written between square brackets []. Broad phonetic transcription uses a simple set of symbols and does not show a great amount of detail. Narrow transcription shows phonetic details by using a wide variety of symbols and, in many cases, diacritics.

Phonology: The study of the structure and function of sounds in language.

Stop: A manner of articulation in which the vocal tract is completely closed for some interval, so that air flow ceases.

Transfer Error: An error made by a second language learner in which a rule of the native language is transferred and applied to the second language.

APPENDIX B

Subject Selection Criteria and Procedures Checklist

Subject Number: _____

D.O.B.: _____

Age: _____

Sex: _____

Location: _____

Criteria

_____ Teacher reports capable of conversing in both Spanish and English

_____ Pass hearing screening

_____ Spanish is the native language

_____ English was not spoken prior to the age of 2 years

_____ Has used English to communicate in any one type of situation for at least one year.

_____ Pass Spanish speech/language screening

Status on Procedures

_____ Vocabulary check done [training was needed: Y/N]

_____ Perception training task done

_____ Perception testing done

_____ Production task done

APPENDIX C

Pre-test Training for Perception Task

Subject No.: _____

Vocabulary Check

| <u>Phoneme</u> | <u>Word</u> | <u>Expressive</u> | <u>Receptive 3x consecutive</u> |
|----------------|-------------|-------------------|-------------------------------------|
| /p/ | pen | _____ | _____ |
| /b/ | bug | _____ | _____ |
| /t/ | teeth | _____ | _____ |
| /g/ | girl | _____ | _____ |
| /d/ | duck | _____ | _____ |
| /v/ | van | _____ | _____ |
| /θ/ | them | _____ | _____ |
| training | frog | _____ | _____ |

Perception Training Task

_____ "This is a "frog", but this is not a "frog", is it? No, it isn't. This is a "mog." Two more illustrations to contrast the items.

_____ Child identifies each object three times in a row as the experimenter names them. Verbal R+ given.

_____ Training words presented as in testing. General R+ given. Child scores 4 out of 5 correct (+/-).

1 _____

2 _____

3 _____

4 _____

5 _____

_____ Proceed to testing

_____ Needs more training

_____ Drop from study

APPENDIX D

Parent Interview About Child's Language Background--English

Subject No.: _____

1. What language(s) does _____ speak? _____
2. Which language did he/she learn first? _____
3. Did he/she learn to speak Spanish before learning English or did he/she learn both at the same time? _____
4. When did _____ begin to learn to speak English? _____
5. What language(s) do you (the parents) speak to each other? _____
Do you speak other languages? _____
6. What language(s) do you speak to ____? _____
7. Has the language spoken in the family changed in the last year? _____
8. What language(s) do the children speak to each other? _____
9. What language(s) does _____ use when speaking with friends? _____
10. Who does ____ spend time with after school? _____
What language(s) do they speak? _____
11. How long has ____ been using English to communicate in any situation? _____

12. Do you want _____ to speak English? _____ Why/why not? _____

13. Do you have a T.V.? _____ Have you ever? _____ What language(s) are the programs in? _____
14. Where are you from? _____
15. How long have you been working as migrant? _____

Pass criteria _____

Fail criteria _____

**Parent Interview About Child's
Language Background--Spanish**

Subject No: _____

1. ¿Qué lengua(s) habla _____?
2. ¿Qué lengua aprendió primero? _____
3. ¿Aprendió el/ella a hablar español antes de hablar inglés o aprendió las dos al mismo tiempo? _____
4. ¿Cuándo aprendió _____ a hablar inglés? _____
5. ¿Qué lengua hablan Uds. entre si (en casa)? _____
¿Hablan Uds. otras lenguas? _____
6. ¿Qué lengua hablan Uds. con _____?
7. ¿Pero hablaron Uds. en la familia inglés/español (más) antes el año pasado? _____
8. ¿Qué lengua hablan los niños entre si? _____
9. ¿Qué lengua habla con sus amigos? _____
10. ¿Con quién está después de terminar las clases cada día? _____
¿Qué lengua hablan entre si? _____
11. ¿Hace cuánto tiempo usa _____ el inglés para expresarse en cualquier situación?

12. ¿Quieren Uds. que _____ hable inglés? _____
13. ¿Tienen Uds. televisión? _____ ¿Y en su país? _____ ¿En qué lengua
están los programas? _____
14. ¿De dónde son Uds.? _____
15. ¿Cuánto tiempo hace que trabajan de migrates? _____

Pass criteria _____

Fail criteria _____

Key to Answers on Parent Questionnaires

Questions regarding criteria for children's inclusion in the study

| <u>Question No.</u> | <u>Required Answer</u> |
|---------------------|--|
| 1 | Child speaks both English and Spanish |
| 2 | Child learned Spanish first |
| 3 | Child did not speak English prior to the age of 2 years |
| 11 | Child has been using English to communicate in any situation for at least one year |

Questions regarding further language experience*

| <u>Question No.</u> | <u>Weightings of Answers</u> |
|---------------------|--|
| 4 | 0 = Child began to speak English before age 3 1 = Child began to speak English after age 3 |
| 5 | 0 = Parents speak only English with each other 1 = Parents speak both languages with each other 2 = Parents speak only Spanish with each other |
| 6 | 0 = Parents speak only English to child 1 = Parents speak both languages to child 2 = Parents speak only Spanish to child |
| 8 | 0 = Child speaks only English with siblings 1 = Child speaks both languages with siblings 2 = Child speaks only Spanish with siblings |
| 9 | 0 = Child speaks only English with friends 1 = Child speaks both languages with friends 2 = Child speaks only Spanish with friends |
| 10 | 0 = Child speaks only English with care provider 1 = Child speaks both languages with care provider 2 = Child speaks only Spanish with care provider |
| 11 | 0 = Child has been using English for more than 3 years 1 = Child has been using English for 1 to 3 years |

* Lower number indicates a greater amount of English experience
Higher number indicates a greater amount of Spanish experience

APPENDIX E

Recording form for Perception Task--1

Subject No. _____

Word list #1

Binary scoring (+/-)

Bold lettering = stimulus item

 r/l = nonsense item on right/left

1. teeth-**deeth** ____l
2. bug-**vug** ____r
3. **van-ban** ____r
4. duck-**tuck** ____r
5. **teeth-peeth** ____l
6. pen-**ben** ____r
7. **thog-dog** ____r
8. **bug-pug** ____r
9. pen-**ten** ____l
10. **duck-thuk** ____l
11. **bug-gug** ____r
12. **girl-birl** ____l

25. van-**ban** ____l
26. **bug-pug** ____l
27. **pen-ben** ____r
28. bug-**gug** ____r
29. bug-**vug** ____l
30. **teeth-deeth** ____l
31. **duck-tuk** ____l
32. duck-**thuk** ____r
33. pen-**ten** ____r
34. thog-**dog** ____l
35. girl-**birl** ____r
36. teeth-**peeth** ____l

13. teeth-**peeth** ____l
14. **pen-ben** ____r
15. duck-**thuk** ____r
16. teeth-**deeth** ____l
17. bug-**pug** ____r
18. **duck-tuck** ____r
19. bug-**vug** ____l
20. **girl-birl** ____l
21. bug-**gug** ____r
22. **van-ban** ____r
23. **pen-ten** ____r
24. thog-**dog** ____l

Type I

b-g ____/6- ____%

p-t ____/6- ____% ____/12- ____%

Type II

p-b ____/6- ____%

d-t ____/6- ____% ____/12- ____%

Type III

b-v ____/6- ____%

d-ð ____/6- ____% ____/12- ____%

Total ____/36- ____%

Recording Form for Perception Task--2

Subject No. _____

Word list #2

Binary scoring (+/-)

Bold lettering = stimulus item

r/l = nonsense item on right/left

- | | |
|------------------------------|------------------------------|
| 1. teeth-peeth ____l | 25. van-ban ____l |
| 2. pen-ben ____r | 26. bug-pug ____l |
| 3. duck-thuk ____r | 27. pen-ben ____r |
| 4. teeth-deeth ____l | 28. bug-gug ____r |
| 5. bug-pug ____r | 29. bug-vug ____l |
| 6. duck-tuck ____r | 30. teeth-deeth ____l |
| 7. bug-vug ____l | 31. duck-tuk ____l |
| 8. girl-birl ____l | 32. duck-thuk ____r |
| 9. bug-gug ____r | 33. pen-ten ____r |
| 10. van-ban ____r | 34. thog-dog ____l |
| 11. pen-ten ____r | 35. girl-birl ____r |
| 12. thog-dog ____l | 36. teeth-peeth ____l |
| | |
| 13. teeth-deeth ____l | |
| 14. bug-vug ____r | |
| 15. van-ban ____r | |
| 16. duck-tuck ____r | |
| 17. teeth-peeth ____l | |
| 18. pen-ben ____r | |
| 19. thog-dog ____r | |
| 20. bug-pug ____r | |
| 21. pen-ten ____l | |
| 22. duck-thuk ____l | |
| 23. bug-gug ____r | |
| 24. girl-birl ____l | |

Type I

b-g ____/6- ____%

p-t ____/6- ____% ____/12- ____%

Type II

p-b ____/6- ____%

d-t ____/6- ____% ____/12- ____%

Type III

b-v ____/6- ____%

d-ð ____/6- ____% ____/12- ____%

Total ____/36- ____%

Recording Form for Perception Task--3

Subject No. _____

Word list #3

Binary scoring (+/-)

Bold lettering = stimulus item

r/l = nonsense item on right/left

- | | |
|--------------------------------|--------------------------------|
| 1. van -ban _____ | 25. bug- pug _____ |
| 2. bug -pug _____ | 26. van- ban _____r |
| 3. pen -ben _____r | 27. duck- tuck _____r |
| 4. bug- gug _____r | 28. teeth -deeth _____l |
| 5. bug -vug _____l | 29. duck- thuk _____l |
| 6. teeth -deeth _____ | 30. pen -ten _____r |
| 7. duck -tuk _____l | 31. thog -dog _____r |
| 8. duck -thuk _____r | 32. bug -vug _____r |
| 9. pen -ten _____r | 33. teeth -peeth _____l |
| 10. thog- dog _____l | 34. girl- bird _____l |
| 11. girl- bird _____r | 35. pen -ben _____r |
| 12. teeth- peeth _____l | 36. bug- gug _____l |
| 13. teeth- deeth _____l | |
| 14. bug- vug _____r | |
| 15. van -ban _____r | |
| 16. duck- tuck _____r | |
| 17. teeth -peeth _____l | |
| 18. pen- ben _____r | |
| 19. thog -dog _____r | |
| 20. bug -pug _____r | |
| 21. pen- ten _____l | |
| 22. duck -thuk _____l | |
| 23. bug -gug _____r | |
| 24. girl- bird _____l | |

Type I

b-g _____/6- _____%

p-t _____/6- _____% _____/12- _____%

Type II

p-b _____/6- _____%

d-t _____/6- _____% _____/12- _____%

Type III

b-v _____/6- _____%

d-ð _____/6- _____% _____/12- _____%

Total _____/36- _____%

APPENDIX F

SCORING OF TARGET WORDS IN PRODUCTION TASK--Binary

Subject No: _____

(+/-) = Binary scoring

| | <u>Gloss</u> | <u>Production 1</u> | <u>Production 2</u> | <u>Production 3</u> |
|-----|--------------|---------------------|---------------------|---------------------|
| /p/ | pen | _____ | _____ | _____ |
| | pig | _____ | _____ | _____ |
| /b/ | bug | _____ | _____ | _____ |
| | boat | _____ | _____ | _____ |
| /t/ | teeth | _____ | _____ | _____ |
| | toe | _____ | _____ | _____ |
| /g/ | girl | _____ | _____ | _____ |
| | goat | _____ | _____ | _____ |
| /d/ | duck | _____ | _____ | _____ |
| | dog | _____ | _____ | _____ |
| /v/ | van | _____ | _____ | _____ |
| | vase | _____ | _____ | _____ |
| /θ/ | them | _____ | _____ | _____ |
| | that | _____ | _____ | _____ |

/p/ ____/6 = ____%
 /b/ ____/6 = ____%
 /t/ ____/6 = ____%
 /g/ ____/6 = ____%
 /d/ ____/6 = ____%
 /v/ ____/6 = ____%
 /θ/ ____/6 = ____%

Type I /b, g, p, t/:
 ____/24 = ____%
 Type II /p, b, d, t/:
 ____/24 = ____%
 Type III /b, v, d, θ/:
 ____/24 = ____%

Total: ____/42 = ____%

APPENDIX F

**SCORING OF TARGET WORDS
IN PRODUCTION TASK--Transcription**

Subject No: _____

| | <u>Gloss</u> | <u>Production 1</u> | <u>Production 2</u> | <u>Production 3</u> |
|-----|--------------|---------------------|---------------------|---------------------|
| /p/ | pen | _____ | _____ | _____ |
| | pig | _____ | _____ | _____ |
| /b/ | bug | _____ | _____ | _____ |
| | boat | _____ | _____ | _____ |
| /t/ | teeth | _____ | _____ | _____ |
| | toe | _____ | _____ | _____ |
| /g/ | girl | _____ | _____ | _____ |
| | goat | _____ | _____ | _____ |
| /d/ | duck | _____ | _____ | _____ |
| | dog | _____ | _____ | _____ |
| /v/ | van | _____ | _____ | _____ |
| | vase | _____ | _____ | _____ |
| /ð/ | them | _____ | _____ | _____ |
| | that | _____ | _____ | _____ |

APPENDIX G

Table G.1

Subject Characteristics

| Age(yrs) | Sex | Location | Lang. Screening [†] | Lang. Background ^{**} | Total Percept'n Score | Total Prod'n Score | |
|------------------------|---------|----------|---------------------------------|-----------------------------------|-----------------------------|--------------------------|-----|
| 1 | 4;11 | M | B | 7 | 7 | 64% | 76% |
| 2 | 5;3 | M | B | 13 | 7 | 72% | 82% |
| 3 | 5;6 | F | H | 7 | * | 69% | 66% |
| 4 | 5;10 | F | H | 4 | 11 | 77% | 57% |
| 5 | 6;0 | M | B | 7 | * | 61% | 67% |
| 6 | 6;4 | M | B | 9 | 7 | 75% | 85% |
| 7 | 6;6 | F | B | 9 | 3.5 | 69% | 95% |
| 8 | 6;6 | F | H | 11 | * | 92% | 72% |
| 9 | 6;8 | M | H | 6 | 9 | 65% | 78% |
| 10 | 6;10 | F | H | 5 | * | 92% | 98% |
| 11 | 6;10 | M | H | 1 | 9 | 83% | 87% |
| Range 4;11-6;10 | | | 1-13 | 3.5-11 | 61-92% | 57-98% | |
| Mean | 6;1 | | 7.2 | 7.6 | 74.4% | 78.5% | |
| S. D. | 7.8 mo. | | 3.3 | 2.35 | 10.7 | 12.5 | |

B = Billings school

H = Hysham school

* = Questionnaire not returned

† = number of errors made

** = higher numbers indicate stronger Spanish influence; lower numbers indicate stronger English influence

Table G.2

**Total Scores and Type subcategory scores for perception
and production across all subjects**

| Subject | Total | | Type I | | Type II | | Type III | |
|---------|--------|-------|--------|--------|---------|--------|----------|-------|
| | Percep | Prod | Percep | Prod | Percep | Prod | Percep | Prod |
| 1 | 64% | 76% | 75% | 85% | 66% | 86% | 50% | 69% |
| 2 | 72% | 82% | 83% | 86% | 91% | 88% | 42% | 79% |
| 3 | 69% | 66% | 75% | 76% | 67% | 89% | 67% | 57% |
| 4 | 77% | 57% | 75% | 71% | 92% | 84% | 66% | 54% |
| 5 | 61% | 67% | 83% | 89% | 75% | 88% | 25% | 53% |
| 6 | 75% | 85% | 66% | 96% | 83% | 97% | 75% | 75% |
| 7 | 69% | 95% | 83% | 92% | 92% | 97% | 58% | 96% |
| 8 | 92% | 72% | 100% | 89% | 100% | 93% | 75% | 61% |
| 9 | 65% | 78% | 70% | 97% | 65% | 100% | 60% | 64% |
| 10 | 92% | 98% | 100% | 100% | 100% | 100% | 75% | 96% |
| 11 | 83% | 87% | 92% | 95% | 92% | 96% | 66% | 79% |
| Range | 61-92 | 57-98 | 66-100 | 71-100 | 65-100 | 84-100 | 25-75 | 53-96 |
| Mean | 74.45 | 78.45 | 82.0 | 88.7 | 83.9 | 92.5 | 59.9 | 71.2 |
| S. D. | 10.7 | 12.5 | 11.4 | 4.2 | 13.4 | 5.8 | 15.6 | 15.3 |

APPENDIX H

Consonant Sounds of English

| | | Bilabial | Labiodental | Dental | Alveolar | Palatal | Velar | Glottal |
|----------------------------------|------------|----------|-------------|--------|----------|---------|-------|---------|
| Obstruents | Stops | vcd | b | | d | | g | ʔ |
| | | vcless | p | | t | | k | |
| | Fricatives | vcd | | v | ð | z | ʒ | |
| | | vcless | | f | θ | s | ʃ | h |
| Nonobstruents or sonorants | Affricates | vcd | | | | dʒ | | |
| | | vcless | | | | tʃ | | |
| | | nasal | m | | n | | ŋ | |
| | | lateral | | | l | | | |
| | rhotic | | | | r | | | |
| | glide | w* | | | | j | w* | |

*This sound has constrictions in both the bilabial and velar places, as does its voiceless cognate /w/.

(From Schriberg and Kent, 1982)

APPENDIX J

Diacritic Symbols used in Clinical Phonetics (Schriberg and Kent, 1982)

