

EFFECTS OF DIFFERING SIGN LANGUAGES AND COMMUNICATION MODES ON
THE COMPREHENSION OF STORIES BY DEAF STUDENTS

by

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B.Sc., Simon Fraser University, 1976
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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF EDUCATION

in

THE FACULTY OF GRADUATE STUDIES
Educational Psychology And Special Education

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

January 1985

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Abstract

The purpose of this study was to examine comprehension by deaf students of stories presented in Signed English (SE) and American Sign Language (ASL), under three modal conditions - manual-only, manual plus oral, and manual plus oral plus aural. It was predicted that: (1) an increase in comprehension would correspond to an increase in the number of modes used in presenting the stories; (2) ASL would be a more efficient method of communication than SE; (3) there would be an interaction effect between language and mode of presentation; and (4) in unbalanced bilinguals a translation to the dominant language would occur when a story was presented in the subordinate language.

Thirty-six deaf subjects from the British Columbia provincial School for the Deaf participated in the study; their mean age was 16 years 7 months, and their average hearing threshold level in the better ear was 99.8 decibels with a range of 83 decibels to 113 decibels. All subjects had a minimum of five years' experience as students in total communication programs using SE. Three ghost stories (mean readability level = Grade 2.7) were videotaped under all modal conditions for each of the languages. In the experimental task, subjects were shown a different story under each of the three modal conditions; but each subject was given stories in only one language. After each viewing the subject's retelling was videotaped.

Data analyses showed that: there was no significant treatment effect for mode of presentation; subjects reproduced

stories presented in ASL better than SE stories; there was an interaction between language and modes, where adding speechreading to the manual-only modality led to higher comprehension scores in the SE presentations; and a majority of subjects retold ASL and SE stories in ASL.

The results support ASL as being the more effective method of communication for signing deaf students who have extensive training in total communication and Signed English. It is suggested that total communication classes adopt an ASL-English bilingual program to enhance classroom communication and assist in the development of oral and aural skills, and that speech always accompany the use of SE. Suggestions were made for future research activities.

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Acknowledgement

In completing this dissertation I am indebted to several individuals who provided me with valuable input and moral support. I would like to give a very special thanks to the chairman of my committee Dr. Bryan R. Clarke for providing me with a boundless think tank that often helped me through difficult periods in writing this paper. I would like to thank the other members of my committee Dr. Anne Treisman, for helping me see my work from a different perspective, and Dr. Robert Conry, for guiding me through the statistics maze.

I would like to thank all the subjects of this study whose journey through the education system is providing me with the motivation to conduct research. In addition, thanks to the Principal of Jericho Hill School for the Deaf, Ms. Helen Adam and the Vice-principal, Ms. Nancy Miller for allowing me to conduct my study with their students.

Many thanks to my research assistants Aastrid Flanjak, Danny Lecours, Doug Lambert, Celia Corriveau, and Bill McKee for their work and spirit that made this study a pleasure. A very special thanks to Mrs. Betty Reid for her typing and moral support that helped me finish on schedule.

Finally, a big hug and kisses for my dear wife Elizabeth, for her ever present love, support, and understanding.

I. INTRODUCTION

Total communication programs in the education of the deaf currently endorse the position that the most effective means of communication will consist of a simultaneous combination of audition, speechreading, and signing. In nearly all programs the signing component has been one of several English based systems (Jordan, Gustason, & Rosen, 1979). However, some concerns have been raised over the use of a visually-based system to represent an auditorily-based language. Kretschmer and Kretschmer (1978) have suggested that if a visually-based system used to represent an auditorily-based system is symbolically organized in a different way, then the simultaneous comprehension of these divergent systems may not be feasible. They propose that a visual system should be presented first to ensure a child's communication proficiency and the next step should be to "piggyback standard English onto this symbol system either as spoken or read-written language" (Kretschmer & Kretschmer, 1978, p. 140). To implement this proposal would significantly change the manner in which present total communication programs are being conducted.

More recently, Clarke (1983) has reviewed traditional methods in teaching language to hearing impaired children in total communication and oral based programs. He found that language as taught in the school curriculum did not provide an adequate basis for the assimilation of grammatical structures. Clarke felt that too much emphasis was given to specific language teaching areas such as morphology and syntax, and too

little to communication. As a remedy, he proposed that the emphasis should be shifted to a conversational approach backed up by suitable activity-based situations to stimulate communication and authentic language transactions.

There is a clear need for a critical examination of the framework of total communication programs as they are presently defined. If one is to concede that language development is the primary concern of an effective total communication program then two questions in particular must be investigated. First, with regard to processing information, does the provision of a simultaneous communication method employing audition, speechreading, and signs facilitate language assimilation? Second, with respect to language, does the use of Signed English, the language of the classroom, more adequately facilitate authentic language transactions than American Sign Language, the language of the deaf community?

1. BACKGROUND OF THE PROBLEM

The basic assumption made by proponents of total communication is that in simultaneous communication, information is concurrently perceived (1) through the auditory and visual senses and (2) in the vision sense through signs and speechreading. Further, it is assumed that the more sources of information available to an individual the more information will be perceived. The advent of total communication over the past 15 years was stimulated by research based on these assumptions.

In simultaneous communication three distinct modes are utilized to convey information through two sensory channels. In

the auditory channel the aural mode is used for the perception of speech sounds. In the visual channel two modes are used to transfer messages: The oral mode accomplishes this through lip movements and facial expressions (i.e., speechreading) and the manual mode through hand movements and body language. Thus, in simultaneous communication, two channels are used for the perception of signals and three modes for conveying the signals. In other words, simultaneous communication implies a bisensory and a trimodal form of communication. Although this is the model that total communication has embraced, the feasibility of processing multi-modal sources of information has been questioned (Wilbur, 1979).

Several field studies have examined the processing of multi-modal presentations. Most of them have shown that an increase in information assimilation occurs when modes are added to create presentations which are similar to those of simultaneous communication (Klopping, 1972; Moores, Weiss, & Goodwin, 1973; White & Stevenson, 1975; Carson & Goetzinger, 1975; Brooks, Hudson, & Reisberg, 1981; Ouellette & Sendelbaugh, 1982; Pudlas, 1984). For example, Pudlas (1984) found that profoundly deaf subjects extracted more information from the use of oral and aural modes together than from either of the modes alone. And when the manual component was added, a significant ($p < .01$) increase was obtained in the comprehension of sentences.

On the other hand, Beckmeyer (1976) found that an individual's preference for a certain communication mode was the

primary determining factor of a mode's effectiveness. In his study, the oral mode was most efficient for those students with an oral preference and the manual mode for those who indicated a manual or an oral/manual preference. In addition, multimodal combinations did not increase the efficiency of students with a unimodal preference. The question is whether adding further modes to the best mode helps. Obviously, adding a better mode to a worse mode will help, even if only the better mode is perceived.

Examination of the literature seemed to warrant the conclusion that increasing the number of modes generally increases the amount of information assimilated. However, methodological considerations caution against generalizing these findings to the classroom. A major reason for this is the absence of adequate language items in the testing of receptive skills. The use of single vocabulary items (Klopping, 1972; Moores et al., 1973), nonsense syllables (Carson & Goetzinger, 1975; Beckmeyer, 1976), foreign words (Brooks et al., 1981), and single sentences (Pudlas, 1984) are not sufficient to represent language in discourse, although each can be used to investigate narrower aspects of communication. Furthermore, all previous studies used written responses or multiple-choice items in English as a means of testing the amount of information assimilated. In general, deaf children are very weak in their knowledge of written and spoken English, therefore the validity of such response methods has to be questioned seriously. The present study attempted to avoid these methodological problems

by utilizing stories as the independent variable and the subject's retelling of the stories in signs as the dependent measure.

The other area of pedagogical interest investigated here is the use of a particular signing method with deaf children. In total communication programs, one of several types of sign systems are used. Sign systems can be defined as methods of signing which visually represent a spoken language. In British Columbia, it is the Ministry of Education's policy that one kind of sign system, Signed English, be used in all total communication programs. However, the question whether Signed English is a more appropriate means of signed communication than other sign systems has not received much attention. Rather, since total communication programs began in the mid-sixties (Clarke, 1972) there have been general doubts cast about the validity of using sign systems for instructional purposes (Woodward, 1973a; Battison, 1974; Stokoe, 1975; Stevens, 1976; Kluwin, 1981a, 1981b). As noted earlier, a particular concern has been raised that a visual mode may not be appropriate to express an auditorily-based language. Further, the few experimental studies that have been done indicated that the teachers who use sign systems to represent English rarely approach a true one-to-one correspondence between signs and English word order (Marmor & Petitto, 1979; Kluwin, 1981a). If one of the major functions of a sign system (e.g., Signed English) is to represent visually the information being transmitted by speech, then the capacity to sign and speak

English accurately and simultaneously must be demonstrated.

Another important aspect of Signed English is the restricted environment in which it is used. Essentially, Signed English is a classroom based language that is rarely used out of school. Outside the classroom, American Sign Language, which is recognized as the language of the deaf community (Kannapell, 1982), is the preferred means of communication between deaf people (Stewart, 1982). Nevertheless, Signed English or some form of it may be used by the deaf in conversations with hearing people who are learning to sign (Padden, 1980). In fact, variations of Signed English that retain English word order but delete sign indicators for suffixes, plurals, articles, and determiners are more common than Signed English, both in and out of the classroom. These variations, known as pidgins (Woodward, 1973b) or registers (Cokely, 1983), are not languages per se and have not been the subject of adequate linguistic research. Indeed, their pedagogical value in communication with deaf children is not known and a functional use for Signed English outside of the classroom still remains to be demonstrated.

This lack of research and understanding of Signed English has prompted Stokoe (1978) to question its viability as a means of communication. He states that:

The teacher who learns signs and puts them in English phrases and sentences to teach Deaf pupils will fail to communicate, unless pupils already have mastered the sentence-forming and the word-forming systems of English - a most unlikely chance. Just seeing signs that someone thinks stand for English words is by no means the same as learning the word-systems of English (Stokoe, 1978, quoted in Cokely, 1980, p. 141).

If the goal is to teach the deaf to learn English through the medium of sign, then a solution must be found that does not bypass the purpose of communication. Appropriate signing results in comfortable and meaningful communication. Therefore, it seems unfortunate that the language of instruction in the school should differ from the language used by the Deaf community. This has caused an increasing number of educators and researchers to consider the possibility of incorporating American Sign Language into total communication programs, thus creating a bilingual situation with American Sign Language as the primary and English as the second language (Charrow & Wilbur, 1975; Cokely, 1978; Curry & Curry, 1978; Woodward, 1978; Stevens, 1980). The deaf community has also expressed an interest in bilingual education (Stewart, 1983a) and the same is true of teachers of the hearing impaired (Stewart, 1983b). Hence, a comparison of the communicative effectiveness of Signed English and American Sign Language is important.

In the area of bilingual education only a few studies have evaluated the use of Signed English and American Sign Language (Higgins, 1973; Murphy & Fleischer, 1977; Ouellette & Sendelbaugh, 1982). These studies were generally exploratory

and did not provide a close examination of the many factors that may determine effectiveness. To obtain some information about the possible outcome of a bilingual program in education of the deaf it may be useful to examine research in bilingualism; however, this usually involves two oral languages.

One aspect of bilingualism that is of interest here concerns the non-balanced bilingual individual. These individuals are described as having one fully developed language and lesser skills in a second language (Dornic, 1979) and form the largest segment of the bilingual population (Grosjean, 1982). In the administration of a bilingual education program the assignment of each of the languages to various instructional tasks is critical. How well students are able to process information in each of their languages will be a pertinent factor.

Information processing research with oral bilinguals has revealed that the dominant language is more efficient for certain tasks. Both Scherer and Wertheimer (1964) and Kolers (1966) found that bilinguals were able to comprehend materials presented in their dominant language better than in their subordinate language. Mcnamara (1967) found that faster responses were obtained in the dominant language when the task required the matching of words with pictures. Similarly, Preston and Lambert (1969) obtained faster times in the dominant language for a simple color-naming task. In a series of studies, Dornic (1979) showed that environmental noise, mental fatigue, emotionally loaded events, and other external factors

differentially influenced the performance in each language of non-balanced bilinguals. Grosjean (1981) summarized Dornic's findings by pointing out that the bilingual "slows down, is less effective, and is even tempted to switch to his or her dominant language" (p. 255) when the presentation is in the subordinate language.

Although research findings on oral bilinguals have been an influence, proponents of bilingual education for deaf children have provided little more than rhetorical support for their proposals. Most concur that American Sign Language should be recognized as the dominant language of deaf children and English should be taught as a second language (Cicourel & Boese, 1972; Fant, 1972; Stokoe, 1975; Woodward, 1978; Stevens, 1980). However, the effectiveness of either language relative to classroom instructions and English language development still awaits empirical evidence. Until such time as relevant data have been gathered, English will continue to be the only recognized language for instructional purposes.

2. RESEARCH PROBLEM

The research undertaken here attempted to evaluate the story comprehension skills of deaf individuals under three different modal conditions and two different signing methods. The manual, oral, and aural modes of communication (see Definitions next section) were used to present three stories in each one of the following modal conditions: Manual only, manual

plus oral, and manual plus oral plus aural. The stories were signed in both Signed English and American Sign Language in order to assess competence in each of these two languages. Finally, subjects were assigned to one of the language conditions then tested under each of the modal conditions. Thus, the study employed a 3 (modes) X 3 (stories) X 2 (language) repeated measure design.

There are several features of this study that distinguish it from previous work. First, the manual mode was assumed to be the subjects' strongest mode and was used in all modal conditions. Increase in comprehension was tested with the addition of the oral (second strongest mode) and then the aural mode. Secondly, signs were used in a story telling language situation and not as isolated lexical items. This provided the study with greater ecological validity that allows generalizations to be made regarding communication. Finally, only profoundly deaf subjects who use signs as their primary means of communication were tested. Implications for total communication programs will therefore be drawn from results with a group of people who are most dependent on signs and who rely more on visual rather than auditory skills.

In Chapter II, a review of the literature explores various aspects of sign communication and information processing. Initially, the characteristics of American Sign Language and sign systems are outlined with particular interest given to their articulation and utilization. This is followed by a report on relevant sign language research that attempts to

relate the acquisition, sociolinguistic, and psycholinguistic characteristics of sign language to those of oral languages. Past research on the advantages of simultaneous communication and the prediction of the effects of simultaneous communication based on theories of attention are then explored. The concept of bilingual education (English and American Sign Language) is reviewed to determine its pedagogical value; and research findings in education of the deaf and in bilingual studies with spoken languages are interpreted to allow an exploration of the functioning of English and American Sign Language with deaf students. Finally, related research on intersensory integration and selective attention are reviewed to provide the theoretical underpinnings for the possible outcomes of this study.

3. DEFINITIONS OF TERMS

- a. American Sign Language: a visual-gestural language used by deaf people in Canada and United States. It is also known as Ameslan and ASL.
- b. aural mode: speech sound signals as perceived by the ears.
- c. comprehension of stories: the amount of information reproduced from a signed story. This study involves both the reception and comprehension of stories. Since the recall of stories depends on both of these skills (Bransford, 1979), a retelling task suggested by Goodman and Burke (1972) was used as a measure of comprehension. Obviously, memory is an important component of the study. In some particular manner each language and modality may be advantageous to memory performance. However, due to the fact that there was no delay in retelling the stories it was reasoned that comprehension was probably vital to accurate story reproduction. (In this paper the terms retell, recall, and reproduction are used synonymously.)
- d. deaf community: a group of people sharing similar cultural values, sign language, and attitudes toward deafness. Although it is largely composed of deaf people, the community may also include hard-of-hearing individuals. In this situation these individuals must meet the following criteria as stated by Higgins

(1980), "(1) identification with the Deaf world, (2) shared experiences that comes of being hearing impaired, and (3) participation in the community's activities" (p.38).

- e. deaf person: from a cultural perspective, a deaf person is one who has a functionally significant degree of hearing loss and identifies with the language and beliefs of the deaf community. And from an education point of view a deaf person is "one whose hearing is disabled to an extent ... that precludes the understanding of speech through the ear alone, without or with the use of a hearing aid" (Moore, 1978, p.5).
- f. hard-of-hearing: describes "one whose hearing is disabled to an extent ... that makes difficult, but does not preclude, the understanding of speech through the ear alone, without or with a hearing aid" (Moore, 1978, p.5).
- g. hearing impaired: a generic term that encompasses both deaf and hard-of-hearing people. In other words, it is used to refer to individuals with any degree of hearing loss.
- h. manual mode: of or relating to the use of signs. This includes signs, fingerspelling, facial expression, and body language.
- i. oral mode: of or relating to the use of speech. In the present context, the oral mode is used to refer

exclusively to movements of the lips and other speech related facial expressions and not to the accompanying sounds.

- j. Signed English: is a means of representing English using the medium of signs and fingerspelling.
- k. sign language: is a method of manual communication that is the primary language of the deaf. Each sign language has its own lexicon and syntax that is generally quite different from the spoken language of the community at large.
- l. sign system: a method of signing that has been developed as a means of representing a spoken language. There are several different sign systems in use in total communication programs in Canada and the United States.
- m. simultaneous communication: the simultaneous use of signs and speech.
- n. total communication: in theory reflects a process embraced by teachers, parents, and children which uses any available means of communication to express a thought. In practice, it calls for teachers and parents to develop their various skills, and those of deaf individuals, to transmit and receive information. Within total communication programs, simultaneous use of speech and signs is strongly encouraged.

II. REVIEW OF THE LITERATURE

1. MANUAL FORMS OF COMMUNICATION

Sign language is a manual form of communication that does not rely upon audition and the speech mechanism. Briefly, it is a visual form of language that has been developed and used by the deaf for interpersonal communications (Stokoe, 1981). It involves movements of the hands, fingers, body, and facial features to transmit language. Symbols formed by the hands, are called signs and are analagous to the words or phrases of a spoken language. The constraints of visual reception and the articulatory dynamics of manual movements, have resulted in the development of a grammatical structure that is unique and distinct from spoken languages (Stokoe, 1981).

Reflecting the emphasis in contemporary literature, discussion in this paper will focus on American Sign Language (ASL) as representative of the native sign language used by deaf people in Canada and the United States. However, it should be noted that a project is presently underway to compile signs for a Canadian Sign Language dictionary. Coordinated by the Canadian Coordinating Council on Deafness, this project will represent the joint efforts of the Canadian Association of the Deaf, the Canadian Cultural Society of the Deaf, the Association of Visual Language Interpreters of Canada, Deaf communities across Canada, and other resource people.

Included in ASL is fingerspelling. Fingerspelling uses different handshapes to present letters of the alphabet.

Commonly referred to as the manual alphabet, each of the letters can be shown by a single handshape on one hand. This is in contrast to the two-handed manual alphabet of England, Australia, New Zealand, and other parts of the British Commonwealth. Fingerspelling alone in conjunction with speech has also been used as a method of communication. Known as the Rochester method its use was short lived and very few classes are now using it (Jordan, Gustason, & Rosen, 1976, 1979). However, it is mentioned here because of its capacity to represent English by spelling out all of the words. Research on the effectiveness of fingerspelling as a communication tool will be discussed at a later point in this paper.

In addition to sign languages, sign systems also represent a manual form of communication. The distinction between a sign language and a sign system is an important one. Sign systems, in North America, are a result of borrowing signs from ASL, creating new ones and using these signs in a grammatically correct English word order. Sign languages, on the other hand, are considered distinct languages. They consist of a grammar and lexicon unique in their visual emphasis and the constraints of a manual articulation system that act upon its expression and reception (Friedman, 1977; Wilbur, 1979; Klima & Bellugi, 1979; Stokoe, 1981). In contrast, a sign system conforms to the grammar of an auditorily-based language and is therefore not a separate language (Bornstein, 1973).

A further distinction can be made by examining the respective milieux in which the two kinds of signs are used.

Within the deaf community, ASL is culturally based and is used among fluent signers (Markowicz, 1972; Stewart, 1981). Because of their difficulty in conversing orally, many deaf people are drawn towards the deaf community for the derived benefits of signed communication which it offers (Jacobs, 1974a, 1974b). ASL allows its users to integrate into this community. Largely through signed communication these group members are able to assimilate the social characteristics of a community bound by deafness and the experiences it entails. ASL, deaf culture, and the deaf community are three social phenomena that are nurtured by deaf people's desire to fulfill the social aspects of their lives (Jacobs, 1974a, 1974b; Baker & Padden, 1978; Kannapell, 1982).

Sign systems on the other hand, are most commonly used in total communication classrooms. The creation of these systems was based not upon the communication strengths of people but rather upon the needs (and ideas of the people who devised them) of an educational methodology. The advent of total communication in education of the deaf in the late sixties resulted in a change in teaching methods which up to that time had been dominated by the oral method (Vernon, 1972, 1975). Whereas, the oral method focused on aspects of communication such as listening skills, speech, and speechreading, total communication combined the oral approach with other visual aspects such as signing and fingerspelling. A central issue in total communication, however, was the role of signs and the kind of signs to be used.

In adhering to the total communication approach, educators had to determine a method of signing as a standard for both students and teachers. Here, the choices were either to adopt the sign language used by the deaf or to utilize one of the various sign systems. Bearing heavily upon the decision not to use ASL was the fact that it has a grammatical structure vastly different from English (Stokoe, 1960) whereas sign systems follow the grammar of spoken language. Although sign systems are not regarded as languages per se (Bornstein, 1973; Wilbur, 1979), their proximity to spoken languages favoured them as the best means of signing in total communication programs.

As the term sign systems implies, there is more than one system that incorporates signing into English word order. Two common characteristics of all sign systems are that each has a one-to-one correspondence between signs and words or morphemes of spoken English; and each incorporates to a different extent, the use of ASL signs (Crystal & Craig, 1978). Another important aspect of these systems is their restricted environment. They are intended for use only within the confines of a classroom and in interactions between teacher and students. However, the extent of their use has not met the requirements of a total communication program. It has been shown that the degree to which teachers actually use sign systems to represent English varies according to the experience of the signer and rarely approaches a true one-to-one correspondence between signs and English word order (Marmor & Petitto, 1979; Kluwin, 1981a). This raises serious questions as to the feasibility of requiring

a person to accurately sign and speak English simultaneously, thus, casting doubt upon the capacity of sign systems to fulfill one of their major functions - that of providing a visual representation of the information concurrently transmitted by speech. This is one of the areas to be examined in this study.

The restricted environment of sign systems may in itself defeat the purpose of teaching English through a visual mode. Language is a means of communication and as such serves a critical function in the community. The members of the deaf community do not use sign systems to communicate amongst themselves (Stewart, 1982), and generally use a form of Pidgin Sign English when communicating with people who do not know ASL (Woodward, 1973b). This implies that perhaps a sign system is non-functional in that it yields good sentences for writing but poor ones for conversations (Stevens, 1976). However, due to the lack of research, any proposition on the usefulness of sign systems would be hypothetical.

As mentioned earlier there is more than one sign system. In North America a survey of programs will find any of the following in use; Seeing Essential English, Signing Exact English, Linguistic of Visual English, Manual English and Signed English (Jordan, Gustason, & Rosen, 1979). The present study focuses on Signed English (SE) as it is the policy of the Ministry of Education that SE will be used in all total communication programs within the province of British Columbia. For a description of the other sign systems the reader is referred to reviews by Anthony (1971), Bornstein (1973), Meadow

(1976), Crystal and Craig (1978), Reimer (1979), and Griffith (1980).

Signed English is the most recent sign system devised, and its course of development and evaluation is comparatively well documented (Bornstein, 1973, 1974, 1979, 1982; Bornstein, Hamilton, & Saulnier, 1975; Bornstein, Saulnier, & Hamilton, 1980; Bornstein & Saulnier, 1981). Originally intended for pre-school children it was extended to elementary school children and is presently advocated by Bornstein (1982) as suitable for adolescents and adults. SE is not as complex as other sign systems. ASL signs provide the basis for the vocabulary and fourteen sign markers are used to indicate word form changes with five of these markers being adopted from ASL. Only one sign marker may be added to a sign word and those words that cannot be represented by a sign(s) are fingerspelled.

The effectiveness of SE has not been clearly demonstrated but a study by Bornstein and Saulnier (1981) on children who have used SE for four years, showed a noteworthy rate of growth in vocabulary. In the first three years of using SE, this rate was determined to be 43 percent of the rate at which hearing children normally acquire spoken English words. However, in the final year of the study there was a decrease in this rate. The study also indicated the development of some competence in the English language. A parallel study with other methods of communication will be necessary before objective claims can be made for the value of using SE.

One of SE's originators, Bornstein (1982), is now

advocating that the complete SE system be used with children in their early childhood until they have obtained a mastery of certain elements of English in any modality. At this time deletions of sign words and sign markers should be allowed if English can be inferred or if it is possible to substitute a single sign for two or more words. This change in philosophy seems to be conceding that SE is not the most efficient mode for communication and that older children should be allowed to sign in a manner in which they are most at ease. The characteristics of this modified form await future investigation, but it may well be a variation of Pidgin Sign English.

Pidgin Sign English (PSE) is a third type of signing relevant to this study. Before discussing PSE the influence of English upon ASL will be examined. Invariably, some effects on a minority language can be expected when the minority group interacts with the majority group utilizing the majority-based language. The effect would be increased if neither group knew the other's language well and conversation was distorted (Nash & Nash, 1978). In such a situation the minority group alters its own language to make it easier for the majority group to understand. Eventually, the group begins to incorporate more of the majority group's lexicon and grammatical rules to facilitate communication. When the modes of communication are different, the situation becomes more complicated. Such is the case of the deaf community living within a large hearing society. In such an environment, deaf individuals must be able to communicate in many different situations. This may require them to use ASL,

spoken English, written English, and sign systems. To cope, a signer may resort to altering his own sign language to conform with different contexts (Stokoe, 1970).

One such variation is PSE which was described as being a mixture of English and ASL (Woodward, 1973b). PSE does not adhere to the structures of either ASL or English but puts signs in English word order along with the deletion and alteration of various grammatical features. Thus, on a continuum of sign language and sign systems, PSE would lie between ASL at one extreme and English at the other with variations in PSE according to the extent to which ASL or English features are incorporated (Bornstein, 1978). Because of the English word ordering, PSE has become the preferred system for most hearing adults who learn to sign (Bornstein, 1978; Reilly & McIntire, 1980).

It has been suggested that deaf people who use PSE are, to some extent, familiar with English (Reilly & McIntire, 1980). Furthermore, fluent signers are found to write the way they would sign in PSE (Jones, 1979). Further research is needed to determine the possible use of PSE in teaching English.

There is however, another side to PSE as suggested by Cokely's (1983) investigation into the definition and analysis of PSE. In establishing the groundwork for studying a pidgin, Cokely began with the necessary preconditions for its emergence and development as put forth by Ferguson and DeBose (1977).

In summary these are:

- a. Asymmetrical spread of the dominant language among

speakers of one or more subordinate language, without reciprocal spread of that language(s) among speakers of the dominant language.

- b. A close network of interaction, limited with respect to speakers and uses, which is conducive to relative stability.
- c. An attitude on the part of a significant number of users that the emergent variety is recognized as a separate entity; i.e., it is perceived as a "whole" by the communities (Cokely, 1983, p. 2).

In applying these preconditions to the ASL-English contact situation Cokely concluded that they were inadequately met. With respect to asymmetry it was felt that the recent increase in ASL classes at colleges and universities and its acceptance for studies in linguistics has served to balance the spread of ASL with that of English among the deaf. Secondly, it is almost impossible to expect a close network of interactions only between deaf individuals as the demands of society mandates that deaf individuals actively interact with members of the hearing community. These demands are evident in education (e.g., United States Public Law 94-142, Sections 503 & 504) and by the lack of parallel service agencies and institutions within the deaf community. Finally, the necessity of recognizing a pidgin as a separate entity from ASL and SE has been hindered by the fact that ASL is still in the process of attaining full recognition as a separate language.

If the intermediate ASL-English language varieties that

occur cannot be classified as pidgins then what are the alternatives? Cokely (1983) put forth a model that incorporated the varieties that occur in an ASL-English continuum. The cornerstone of his model is the assumption that registers can be used to account for variations. A register is a specific way of using two languages in a given situation (Hymes, 1971). "Baby talk" and "foreigner talk" are two examples of registers that are deemed to be appropriate ways of talking to babies and addressing foreigners (Cokely, 1983). The use of a register is controlled by factors determined by the community (Ferguson & DeBose, 1977). Thus, within a community one can expect a register such as foreigner talk to be consistent amongst the members.

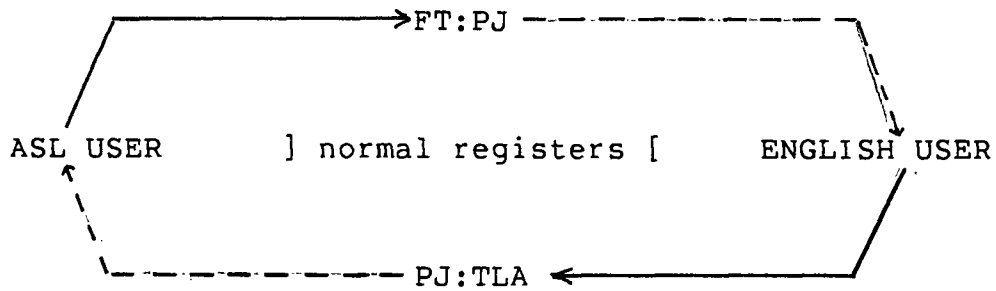
The model as depicted for the ASL-English continuum utilized the notion of foreigner talk (FT) (see Figure 1). The pertinent features of FT as identified by Ferguson and DeBose (1977) and reported by Cokely, (1983) are as follows:

- a. Short sentences.
- b. Analytic paraphrases of lexical items and certain constructions.
- c. Reduction of inflections.
- d. Lack of function words.
- e. Avoidance of slang or dialect form in favour of more standard forms.
- f. Use of full forms instead of contractions.
- g. Repetition of words.
- h. Slow, exaggerated enunciation (p. 10).

Thus, signing becomes more ASL-like or more English-like depending on the extent to which each of the above features is present. Thus, for example, a Deaf person whose native language is ASL, will tend to use signs that are more English-like when communicating with a person whose native language is English.

Further elaborations of the model took into account the sociolinguistic nature of the interaction between conversers. As an illustration, a hypothetical situation was established whereby a deaf person, fluent in ASL, is conversing with a hearing person who is in the process of learning ASL and is able to sign using ASL features. The deaf person makes an initial subjective assessment of the hearing person's signing skills in order to determine the amount of FT to utilize. Cokely, referred to this assessment as a proficiency judgment (PJ). Likewise, the hearing person depending upon his knowledge of ASL is able to incorporate a certain amount of ASL into his signing. As the nature of the interaction places the emphasis on ASL then the target language for both parties is ASL. Consequently, the hearing person makes accommodations in his own signing towards ASL. Cokely, called this a target language accommodation (TLA). Taken together, the interaction can be presented in the following way:

Figure 1 - Cokely target language accommodation model



In the above figure, foreigner talk (FT), judgement of proficiency (PJ), and target language accommodations (TLA) are three critical variables. Together they help account for the sign varieties that lie between the extremes of ASL and English. The notion of PSE as an intermediary step between ASL and English still holds. With further development this model might not only offer a more systematic method of analysing the sign varieties that lie along the ASL-English continuum but it may also prove to be an excellent English and ASL language assessment tool, thereby, giving educators a practical starting point for language instruction.

2. RESEARCH ON SIGN LANGUAGE AND SIGN SYSTEMS

Research on sign language is a relatively new field. It is only within the last twenty years that attempts have been made by linguists and sociologists to grant sign language a status on a par with spoken language. In a pioneer study, Stokoe (1960) was the first to investigate and describe ASL. He recognized the linguistic characteristics of ASL and its existence as a cultural entity:

...the cultural system which employs certain of the visible actions of the face and hands, combines them in recurrent sequences, and arranges these sequences into systematic distribution in relation to each other and in reference to other cultural systems. (p. 30)

Stokoe's work stimulated further investigations and analyses. Stokoe, Casterline, and Croneberg (1965) published their first comprehensive list of ASL signs in the "Dictionary of American Sign Language" additionally, Stokoe examined the phonology, morphology, semology, syntax, iconicity, and phonetic and phonemic notation of ASL structures (Stokoe, 1960, 1970, 1972, 1980, 1981). His description of sign language provides the following guideline for researchers ...

...sign language is quite like English or any other language. Its elements contrast with each other (visibly instead of audibly). They combine in certain ways, not in others. These combinations, signs, "have meaning" as words or morphemes do. Constructions combining signs, like constructions combining words, express meaning more completely and complexly than single signs or words can. These constructions or syntactic structures are systematic, rule-governed structures. But there is a unique set of rules for making sign language constructions just as there is for making standard English constructions, non-

standard English constructions, or the construction of any language. (1981, p. xv)

In other words sign language was no longer regarded as being pantomimic or iconic in nature, as many laymen had previously supposed (Bonvillian, Nelson, & Charrow, 1976).

2.1 Sign Language Acquisition

The acquisition of ASL by deaf children will differ according to whether the parents are deaf or hearing. The two environments provide different language models. Typically, deaf children of deaf parents are exposed to a language model akin to that of hearing children of hearing parents. Both, are receiving a language that can be readily acquired and used. On the other hand, deaf children of hearing parents are confronted with English that is not readily acquired in a visual mode. In both situations however, there are relatively few studies and the development of hearing children is used as a framework for comparison.

Evidence gathered from the literature indicated that the acquisition of ASL progresses along developmental stages that are similar to those of children learning a spoken language (Hoffmeister & Wilbur, 1980). However, the evidence is relatively scant. Much of it comes from master's theses, doctoral dissertations, unpublished manuscripts or from papers presented at conferences. The review presented here depends largely on an overview of the literature by Hoffmeister and

Wilbur (1980).

Collins-Ahlgren (1974, 1975) made several observations based on the acquisition of sign language by two preschoolers. Both children had hearing parents and were learning sign language in a total communication program. As with hearing children their acquisition of nouns, verbs, and adjectives showed the overextension phenomenon. That is, specific words were used to represent whole classes of words. It was also found that certain words developed multiple meanings over a period of time. Collins-Ahlgren concluded that deaf children advanced linguistically in a manner that could be predicted from research on normal hearing children.

McIntire (1974) reported the size of a deaf child's vocabulary. At age 10 months, the deaf child had a vocabulary of about 20 signs. In comparison, hearing children are usually just beginning to pronounce their first word at this age. In studies of hearing children of deaf parent(s) an earlier sign vocabulary was also observed (Prinz & Prinz, 1981). This phenomenon seems to be related to the fact that control of the hands is accomplished at an earlier stage than manipulation of the oral-articulatory system. Nevertheless, some caution in interpreting these results is needed, as the intelligibility of a child's first word (sign) may be obvious to the parents but not to other observers (Hoffmeister & Wilbur, 1980).

In the acquisition of phonology motor development played a vital role. Particularly, where handshapes were concerned, the stages of development incorporated mastery of increasingly

difficult motor movements. McIntire (1974, 1977) identified four stages of handshape development that reflected three distinctive characteristics, namely, opposition of thumb, extension of one or more fingers, and contact of a finger with the thumb. The first stage consists of handshapes where the thumb could be left in its natural position: S, L, A, G, C, baby 0, and 5. The motor requirement for these handshapes appeared to be much less than those, for example, in stage 3: I, Y, D, P, H, W, and 3.

Another behaviour characteristic of the language acquisition process of deaf children of deaf parent(s) was examined by Kantor (1982). This behaviour referred to those POINTing gestures that are affected by ASL rules. Kantor found that initially POINTing is used in a similar manner by deaf children acquiring signs and by hearing children acquiring speech. During the early stages of development both groups are learning the structure of indication and signification (symbolizing and naming). Eventually, in hearing children speech replaces POINTing, as a means of signalling and naming. On the other hand POINTing for deaf children continues to develop and incorporates adult syntax related to verbal modulation and indexing reference.

Livingstone (1983) reported on the acquisition of signs, either ASL or SE, by deaf children entering a total communication program. Six subjects were examined over a 15 month period. These students were congenitally deaf, had no additional impairments and had hearing parents who did not know

how to sign. The specific question asked was what language was acquired by students exposed to SE models. Results revealed the following:

- a. Greater grammatical facility in the use of ASL was obtained than with SE.
- b. ASL processes appeared earlier than similar processes in SE.
- c. Basic principles of language development were evident in both ASL and SE and these were similar to those guiding the acquisition of language by hearing children.

Thus, subjects became linguistically competent in a language for which they had no adult model. However, the importance of peer models must not be overlooked. As Falberg (1971) claimed, ASL is the only extant language that has been passed down from children to children. Livingstone (1983) remarked that perhaps:

...similar development principles are part of "a genetically determined human language facility" (Trotter, 1975, p. 33) that oversees the general design of language development while allowing leeway for both particular structural forms and for variation in exposure to linguistic models. (p. 282)

If the above statement is true the implications for language development and teaching methods for deaf children would be drastic. Focus would be shifted from the perspective of the society (teach a language) to that of the child (acquire a language).

Studies on the acquisition of syntax in sign language are seriously lacking. Within the few that have been done, word order, the most obvious characteristic of sentence structure, has been but briefly examined; and even amongst the few studies that have been undertaken there is little agreement.

Fischer (1975) suggested that ASL is basically a subject-verb-object (SVO) ordered language. She claimed that although ASL was to a larger extent SOV in the past it has now evolved to a SVO ordering because of the influence of English. Evidence by Liddel (1977) also supported this claim. Friedman (1976) however criticized Fischer's findings because they were based on prepared sentences presented to deaf subjects rather than live discourse. In her study Friedman (1976) used language samples based on conversations. From these samples Friedman suggested that ASL word ordering was relatively free with a basic underlying sentence pattern of SOV. Further, Wilbur (1979) noted that in both of the above studies "the point in space" as utilized in ASL signing was critical in determining word order. She described the point in space as a sign which functions as an index for a noun phrase or a pronoun and as an indication of a verb's inflection. She attempted to resolve the controversy of ASL word order by stipulating that inflected verbs themselves are a condition for free word ordering.

More recently, McIntire (1982) examined the locative constructions in elicited and narrative discourse of deaf signers and offered a different perspective on ASL word ordering. She noted that the capacity to encode simultaneously

a lot of information into a single sign reduces the significance of word ordering. Thus, the distinction between subject and object becomes less important in analyzing ASL sentences because of the wealth of other information incorporated into a single sign. As McIntire (1982) stated "a single sign may contain agent/experiencer, verb, and patient/goal; and that the signer's eyes, face, and body can at the same time be adding both semantic and syntactic information" (p. 381). She further observed that if linearity in spoken languages was imposed by a vocal-auditory modality, then it may be possible that a spatial-visual modality can convey information simultaneously.

Obviously more research is needed to identify clearly the processes involved in sign language acquisition. The knowledge gained will enhance the understanding of languages and thought in general and may enable the drawing up of parallel schemata for the development of auditory and visual languages. Subsequently, models may then be formulated which articulate the rationale and processes involved in acquiring an auditory-based language in a visual mode.

2.2 Sociolinguistics Of Sign Language

Sociolinguistic research has an important role to play in the understanding of ASL. As a language, ASL exhibits variations that are influenced, for example, by geographical factors (Woodward, Erting, & Oliver, 1976), racial factors (Woodward, 1976), and gender (DeSantis, 1977). It has already

been noted that the style of signing is influenced by environmental conditions (Cokely, 1982). The form and function of a language in society have implications for its use in the education system. Sociolinguistic research on ASL is still relatively meagre but an outline of some of the more relevant studies follows.

It has been reported that the present day form of ASL is related to the French Sign Language (FSL) that was brought to the United States by Thomas Gallaudet and Laurent Clerc in the early 19th century as a means of teaching deaf children (Stokoe, 1971; Friedman, 1977; Hoemann, 1978). Empirical research has substantiated this claim by showing that FSL and ASL cognates are undergoing similar historical changes (Woodward, 1976). In his study Woodward found that in 92.6% of the instances of historical change French signers used older forms more often than American Signers. This is not to say that ASL and FSL are identical languages. Rather, as Woodward (1976) has shown the differences between FSL and ASL are far too great to be attributed to divergences from a common language over a mere 160 year period. As an alternative explanation Woodward (1978, 1980) has suggested that the present variety of ASL represents a creolization of the FSL signs and the signs that were already in use in America before Gallaudet and Clerc began their work.

Within the United States and Canada there are also variations in the form of signing used. An attempt to explain these variations was first made by Stokoe (1970) who used the concept of diglossia as his framework. Diglossia in this

instance refers to a condition which utilizes different varieties of a language according to the needs of the situation (Ferguson, 1959). Typically, a literary variety is used in more formal situations and a colloquial variety in less formal situations (Woodward, 1980). Within the Deaf community, Stokoe (1970) identified English as being the literary variety and ASL as the colloquial. By identifying English as the literary variety, Stokoe appears to support the notion that English is viewed as superior to ASL. However, this notion has been challenged.

Hawking (1983) in his examination of Ferguson's (1959) characteristics of diglossia found reason to dispute some of the claims originally made by Stokoe (1970) concerning which language is denoted as the literary or the superior form. The characteristics examined were function, prestige, literary heritage, acquisition, standardization, stability, grammar, lexicon, and phonology. The language varieties compared were sign systems and ASL. By taking a different perspective of the environment in which the languages are used, Hawking was able to show that ASL in certain circumstances becomes the superior language. However, Hawking himself did not attempt to classify either of the languages. Instead, he insisted that the relationship between ASL and sign systems should be more properly examined against theories by relating them to bilingualism. He suggested also that observed variations of sign systems and ASL are simply foreigner talk, an idea that is shared by Cokely (1983). He criticized any attempt to elevate

the status of one of these languages because of the artificial barriers that it would create and suggested that ultimately, both forms of signing would have much to gain from each other and that a peaceful coexistence between the two would be optimal.

In addition to sociolinguistic differences between ASL and English (signed English) other differences are found in phonology, lexicon, and syntax. Much of the research in this area was done by Woodward and his colleagues and has been summarized by Woodward (1980).

2.2.1 Phonological Variation

Woodward, Erting, and Oliver (1976) noticed that there was a face-to-hand variation between signers from the Washington DC area and signers from more southerly regions of the United States. As an example the following signs are usually signed on the face by Washington DC signers, and on the hands by southeastern state signers: MOVIE, RABBIT, LEMON, COLOR, SILLY, PEACH, and PEANUT.

DeSantis (1977) documented an elbow to hand shift in certain ASL signs that was found to be different in males and females. The signs involved in this shift were formerly all signed near the elbow. Today, these signs are becoming more popularly signed near the hand. Furthermore, it was found that for some of these signs, DOOR, BEE, WARN, HELP, GUIDE, FLAG, POOR, and PUNISH, males tended to use the newer hand variation more often than females.

A transition from two-handed signs on the face to one-

handed signs has been found for the following signs: CAT, CHINESE, COW, DEVIL, HORSE, DONKEY, DEER, and FAMOUS (Woodward, 1976). Woodward also found an ethnic variation occurring with Black Southern signers who were more likely to use the older two-handed version than were White signers.

2.2.2 Lexical Variations

Over the past 15 years a common lexical variation has been introduced by the borrowing of initial letters from English words. For example, the sign for grandfather was formerly made with an open-five-handshape. Today, the G-handshape is usually utilized to sign grandfather. This type of borrowing from English is more likely to be used by educated signers (Woodward, 1980).

Further examples of lexical borrowing have been documented by Battison (1978). A common category includes those English words that may be quickly fingerspelled. Thus over time signs such as OR, ALL, BUT, WHAT, SURE, and SOON are being replaced in certain instances by a modified fingerspelled version.

2.2.3 Grammatical Variations

Woodward and DeSantis (1977) noted that there was a difference between Northeastern state signers and Northwestern state signers in their use of negative incorporation. Negative incorporation is a process whereby signs such as KNOW, WANT, LIKE, and GOOD were negated by a bound out-ward twisting movement of the active hand(s). It was found that the Northwestern signers used significantly more negative

incorporation than the Northeastern signers.

Social differences may also be reflected in grammar. Woodward (1973c) revealed social variations in ASL rules involving negative incorporation, agent-beneficiary, directionality, and verb reduplication. It was found that deaf people, people with deaf parents, and people who learned signs before the age of six were more likely to use these ASL rules than were hearing people, people with hearing parents, and people who learned signs after the age of six.

2.3 Psycholinguistics Of Sign Language

Psycholinguistics is the study of the way people generate and comprehend language (Morgan, King, & Robinson, 1979). One might guess that the study of sign language has much to offer in this area. However, the relative novelty of sign language research has meant that there is little knowledge on the subject. Consequently, linguists usually fall back upon oral language theories to generate hypotheses and give meaning to observed linguistic traits of sign language. A transition from oral language theories to a theory of sign language however, may not be so straightforward. As Grosjean (1980) stated, a model of linguistic performance must include "those aspects of encoding and decoding that are specific to the modality of communication, oral or visual" (p. 34) as well as those aspects common to all languages irrespective of modality.

It is a basic assumption amongst linguists that there are

commonalities shared by all languages. Nevertheless, language itself has yet to be defined (Fromkin, 1978). The characteristics of sign languages may be an important step towards a definition as linguists attempt to map auditory language universals onto visual languages. To this end an analysis of features related to the production and perception of sign language is critical. The following overview of the literature summarizes the research in this area.

2.3.1 Production Of Sign Language

In the few studies available, the variable most commonly observed has been rate of production. Generally the notion of language universals influences the line of research undertaken so that typically, in these studies, the rate of production and other traits of sign language were compared with those of spoken languages.

Bellugi and Fischer (1972) performed a number of experiments designed to compare the rate of production in English and ASL. (Grosjean (1980), cautioned that the signing, in this experiment, probably more closely resembled sign systems than ASL.) They found that the rate of articulation in signs (2.37 signs per second) was half that of speech (4.7 words per second). The slower rate for sign language is not unexpected as the movements of the articulatory muscles of the vocal mechanism are much smaller than those involved in the manual movements.

In another experiment, Bellugi and Fischer (1972) examined the rate of production for propositions. Results indicated that

both signs and spoken English produced proposition at a similar rate (1.47 signed proposition per second and 1.27 spoken propositions per second). The authors concluded that sign language made up for its slower rate of production for single signs by being heavily inflected. As noted earlier, McIntire (1982) expressed a similar view in her explanation of simultaneous encoding in sign language.

A further comparison of English and ASL rates of production was made by Grosjean (1977, 1978, 1979). Initially, Grosjean (1977) examined the change in perception of subject's signing and speaking rate when they were allowed to vary rate of production. Results showed that the ratio of actual change in rate of production to perceived change was nearly identical for signers and speakers. For both groups, it was found that when their rate of production was doubled they perceived it to be a sixfold increase in rate. It was suggested that a common underlying mechanism enabled speakers and signers to perceive similar sensations of their rate of production (Grosjean, 1978).

As a follow-up Grosjean (1979) investigated the factors involved in a change of rate. The relative duration of pause time and articulation time proved to be the major factor that distinguished signers from speakers. In lowering the rate of articulation signers slowed down the movements involved in making a sign. Speakers, on the other hand, increased the number of pauses in their discourse. The respiratory requirements of speech were used to explain this difference (Grosjean, 1980).

From the little research that has been done it seems that both spoken and signed language share some common production control mechanisms. Grosjean (1978) elaborated on this by indicating that in both languages production is influenced by the required rate of output, the semantic novelty of the message, the syntactic structure of the sentence, and the tendency for groups of words and signs to be produced with equal lengths. As these factors are further explored and new ones examined a deeper understanding of language will be reached.

2.3.2 Perception Of Sign Language

The perception of sign language can be described as the "processing of the visual signal from the moment it is detected by the retina to the moment the word or utterance is understood by the observers" (Grosjean, 1980, p. 16). There are few studies which have attempted to delineate the processes involved in perception. Prior to a review of this area, a description of the phonological characteristics of the formation of signs is appropriate.

In the first linguistic analysis of ASL, Stokoe (1960) identified three distinguishing phonological aspects of a sign as follows:

- a. tabula - the location of sign in relation to the body.
- b. designator - the configuration of the hand(s) involved in producing a sign.
- c. signation - the movement(s) of the hand(s).

By using these three aspects Stokoe claimed that any sign could

be described and distinguished from all others. Since this initial effort, linguists have come to recognize that a fourth aspect, orientation, is also necessary to describe a sign (Battison, 1978). Spatial orientation refers to the relation of the hands to each other as well as to the body. Reference to these four aspects provides the basis for describing various features inherent in the perception of sign language.

Francois Grosjean and associates provided the bulk of the literature available in this field. Research on sign recognition was undertaken by Grosjean, Teuber, and Lane (1979) and summarized by Grosjean (1980). To determine when a sign actually began Grosjean et al., (1979) repeatedly presented a sign that would stop short of completion at various durations ranging from 28 msec to 744 msec. Subjects involved in the task were to copy the sign as they had seen it, guess at what sign had been presented, and give an estimate of their confidence in that guess. Results showed that orientation, configuration, and location of the hands were correctly copied and guessed earlier than movement. This observation was explained by the fact that movement is distributed over time. Consequently, movement was the final aspect that triggers correct identification of a sign. From these observations the authors concluded that the "on-line processing of a sign does not consist of an all-or-none operation but rather that observers narrow in on the sign parameter by parameter" (Grosjean, 1980, p. 48).

Further analysis of the recognition of signs showed that on the average only the first half of a sign is critical when it is

signed out of context (Grosjean et al., 1979). Grosjean (1981) in a comparison of sign recognition with word recognition found that on the average 51% of a sign is needed for recognition whereas 83% is needed for spoken words. Grosjean (1981) also identified word length as a critical recognition variable for speech, and frequency of location for sign.

Another important issue in the perception of signs is coding. One of the studies that examined this issue was carried out by McIntire and Yamada (1976). As reported by Grosjean (1980), their study had deaf subjects shadowing in sign language stories signed in ASL by deaf signers. An initial latency period ranging from 200 msec to 800 msec was found. An analysis of errors gave evidence for parallel and interactive processing of linguistic information. First, ungrammatical ASL sentences were not found even where errors in shadowing were committed. Thus, semantic and syntactic processing were occurring during the shadowing task. Secondly, many examples of semantic substitution occurred indicating that during on-line processing decoding proceeded at all linguistic levels.

Reef, Lane, and Battison (1978) explored the linguistic encoding of signs. They hypothesized that subjects would react quicker to those signs that are codable. A sign was deemed codable if it incorporated phonological features used in the formation of ASL signs. To test this hypothesis a visual persistence test was designed utilizing ASL handshapes and handshapes not found in ASL. Results showed that shorter visual persistence time was found for the ASL signs. This was taken to

be indicative of the codability of the ASL signs (Grosjean, 1980).

The perception of sign language seems to be related to the articulatory dynamics of sign, which could explain the differences found between studies examining the recognition of signs and of words. Recognition times of each are probably influenced by modality characteristics that make meaningful comparisons difficult.

2.3.3 Memory For Sign Language

The last area of interest in psycholinguistic research is that of memory. For the most part, the findings here are similar to those found with hearing subjects (Bellugi, Klima, & Siple, 1975; Grosjean, 1980). The following review shows that most studies have focused on the relationship of memory and the formational and semantic properties of signs.

In one of the earliest studies on short term memory Odom, Blanton, and McIntyre (1970) tested deaf and hearing children's recall of lists of signable and non-signable words presented on videotape. It was expected and found that the deaf recalled the sign equivalent words better than the non-signable words and that hearing non-signers demonstrated no difference between lists. Results also showed the deaf to be superior to the hearing on both lists. The authors concluded that gestural signs, visual features, and visual images were important in a deaf child's symbolization of verbal material.

In relation to the findings by Odom et al., (1970), Wilbur

(1974) suggested that deaf people who know ASL utilize it for the coding and recall of written English, converting English to a sign representation. This would correspond with hearing people converting visually presented material to phonological representation for coding and storage.

Supportive evidence for this suggestion was found by Bellugi, Klima, and Siple (1975). They studied deaf and hearing subjects' performance on short term memory tasks to determine variables involved in encoding. For both groups a recency and a primacy effect were found and hearing subjects scored higher than deaf subjects on memory span (5.9 items to 4.9 items on a 7 item list). An interesting finding by the authors was the consistency amongst recall errors. Hearing children, as expected, made largely phonetic errors for example, as in replacing the word "vote" by "boat". However, deaf subjects tended to make errors based on the formational characteristics of the signs. For example, the sign "VOTE" would be replaced by the sign "TEA". The only difference between the two is in the movement of the hand. The other three distinguishing phonological aspects, handshape, orientation, and location are the same for both signs. Thus, where hearing subjects made acoustical errors the deaf subjects' errors were visually based and directly related to the formational properties of the signs.

On the other hand, Siple, Fischer, and Bellugi (1977) collected data that conflicted with these findings of Bellugi et al., (1975). The intent of their experiment was to see if retention of ASL signs would be interfered with by similar signs

when they were treated as single visual lexical items. They found that deaf subjects ($N=7$) did not mistakenly recognize signs on the basis of strong, visual, formational similarities. The authors suggested that items may be stored in a one-store memory system based on semantic and conceptual information.

In an effort to resolve the conflicting data thus far collected Poizner, Bellugi, and Tweney (1981) conducted three experiments to test for the effects of formational, semantic, and iconic information on the ordered recall of ASL signs. Their findings revealed that only formational similarity between signs decreased the ordered recall of a sequence of signs. Semantic similarity and iconicity had no significant effect. They concluded that deaf signers coded ASL signs in terms of linguistically significant formational parameters. Poizner et al., (1981) also put forth a model to explain how deaf signers process signed sentences:

Due to the rapid flow of signs in sentences, signs are temporarily held in a working store in phonological (formational) form rather than in semantic or iconic form. Incoming signs are processed in part by reference to the contents of this working store, as more and more sentential structure is revealed. Information from short-term working store is transferred into a more permanent, semantic presentation. (p. 1158)

Formational, semantic, and iconic information are three aspects that may influence recall. However, because both psycholinguistic research and research in sign language are

relatively new fields it may be too early at the present time to fit the findings of research on memory into existing models.

The various processes in the structuring of ASL sentences seem to be critical in determining the effectiveness of recall of either complete sentences or individual signs. Tweney and Heiman (1977) tested 60 deaf ASL signers and found that grammatical structure facilitates the recall of signed sequences. That is, a correctly signed ASL sentence gave a higher recall for embedded signs than did random strings of ASL signs.

Poizner, Newkirk, Bellugi, and Klima (1978) examined morphological effects on coding. By using ten basic ASL verbs and eight inflected forms the authors attempted to determine if inflected verbs were remembered as such or in terms of a base and an inflection. For example, the sign "ASK" can be inflected to mean - to ask me; to ask each other; to ask the two of them; to ask them; to ask each one; to continue asking over time; to ask over and over again; and to ask incessantly. It was found that the congenitally deaf subjects ($N=10$) tended to recall the items in terms of a base and an inflection. These data are particularly interesting in view of the fact that inflectional processes in ASL are coded as simultaneous changes as opposed to the sequential additions that occur in spoken languages. Poizner et al., (1978) concluded that inflections and basic verb signs were stored separately and that short term memory processes are guided by linguistically significant components that are either auditory or visual.

Siple, Caccamise, and Brewer (1982) hypothesized that if skilled signers based their processing on the visual linguistic structure of signs, then as their skills increased so should their use of this processing system. To test this hypothesis, 22 invented signs that did not violate phonological properties of ASL, were given to 341 deaf subjects and 73 hearing subjects in a test of sign language reception. The 22 signs were divided into pairs of formationally similar signs. The authors concluded that skilled signers encoded the invented signs in terms of linguistic structures whereas the unskilled signers used encoding processes based on visual-pictorial stimuli. That is, the unskilled signers depended more on the visual similarities of signs for coding. This was reflected in the high number of errors made on pairs of similar signs. On the other hand, the skilled signers made fewer errors on the similar sign pairs.

Finally, with respect to reading print two studies are worth mentioning for their emphasis on coding strategies used by the deaf. In a series of experiments Hung, Tzeng, and Warren (1981) looked at sentence processing in deaf children aged 14 - 18 years. It was found that deaf children used a linguistic coding strategy when sentences were signed in English, but not when sentences were presented in print. They suggested that the deaf subjects treated reading as a general problem solving activity and not a linguistic activity.

In another series of experiments, Treiman and Hirsh-Pasek (1983) used second generation deaf children to test for recoding

in reading. Using procedures analogous to those used to test phonological recoding in hearing populations the authors tested for the possibilities of their subjects recoding using articulation, fingerspelling, and ASL, or not recoding at all. Data collected illustrated that as a group the deaf recoded into signs. The authors also noted that second generation deaf children were among the most successful readers. They attributed recoding of English text into a native sign language as a possible reason for this success.

Although the evidence is sparse, it seems likely that memory for signs is enhanced by linguistic properties specific to sign language. The encoding of signs is influenced by phonological, morphological, and grammatical qualities. Whether these qualities hold for signs in general or for signs in the context of a visually-based language (e.g., ASL) still remains to be seen. Comparative studies on SE and ASL are certainly necessary to provide a deeper insight into these questions.

3. SIMULTANEOUS COMMUNICATION

Simultaneous communication implies a bisensory (visual and auditory) and trimodal (manual, oral, and aural) form of communication. Although this is the method that total communication has embraced, the feasibility of processing multi-modal sources of information is still being questioned (Wilbur, 1979). A few studies have been done in an attempt to resolve this issue. A summary of these studies followed by a discussion of their limitations is now given.

Klopping (1972) assessed the language comprehension of 30 deaf subjects between the ages 13 and 20 years in a state school for the Deaf. In administering vocabulary items, four modes of communication were utilized; speech, speechreading, fingerspelling, and signs. Klopping then compared speechreading with speech, fingerspelling with speech, and each of the modes with total communication. Demographic variables investigated included gender, residential versus day students, and average versus above average IQ. It was found that total communication scores were significantly higher than fingerspelling scores and both total communication and fingerspelling were higher than either speech or speechreading. No other significant differences were found. Klopping concluded that the simultaneous presentation displayed in total communication was most effective for the population sampled. However, a closer examination of the reason for the increase in scores when total communication was used would have resulted if Klopping's study had included a sign only mode. It may well be that only the

signs in a total communication presentation are being comprehended.

Moore, Weiss, and Goodwin (1973) developed a receptive communication test to assess the following modes: sound alone, the printed word, sound plus speechreading, sound plus speechreading plus fingerspelling, and sound plus speechreading plus signs. (The last condition most closely describes present day total communication programs.) Seventy-four subjects with an average age of 62.2 months and an average hearing loss of 96.45 dB were selected from seven programs. They were then administered vocabulary items that had been suggested by teachers in the programs. As modes were added scores improved from sound alone (34%), to printed words (38%), to sound plus speechreading (56%), to sound plus speechreading plus fingerspelling (61%), to sound plus speechreading plus signs (72%). Moore et al., concluded that the simultaneous use of audition, speechreading, and signs provided the most efficient means of communication with young deaf children. Again, this conclusion is weakened by the absence of a sign only presentation.

The comprehension of oral communication, manual communication, total communication, and reading was explored by White and Stevenson (1975). Using a random sample of deaf students aged 11.0 to 18.7 years and with IQ's ranging from 60 to 140, the authors found that reading, or the print mode, proved to be the most comprehensible. They also found no significant difference between manual and total communication.

Oral communication was the least efficient of all modes. Of interest here is the finding that signs plus speech resulted in better comprehension than speech alone but not signs alone. It might be postulated that the strength of the visual mode and the weakness of the auditory mode contributed to this finding. This proposal is discussed in more detail later in this paper.

In a study by Carson and Goetzinger (1975) 35 deaf, eight to ten year old subjects were tested on a nonsense syllable learning task. The subjects were divided into seven modal conditions: speechreading, signs, audition, speechreading plus audition, speechreading plus signs, signs plus audition, and signs plus speechreading plus audition. The speechreading plus audition condition obtained the highest score and was significantly higher than all of the others. The signs plus speechreading plus audition condition gave the next highest score, which indicated that the addition of signs impaired performance. This latter condition was in turn significantly greater than the score obtained with signs plus audition. On the basis of these results the authors doubted the effectiveness of the total communication approach in education of the deaf, Pudlas (1984), however, warned of the limitations of the study which included small sample size, lack of consideration given to other variables such as communication experience, and the use of nonsense syllables which have little pedagogical relevance.

The receptive abilities of deaf subjects in a total communication program were tested by Beckmeyer (1976). The test consisted of nonsense trigrams (consonant-vowel-consonant) to

which the subjects had been exposed in an initial training period. Trigrams were presented in the oral, fingerspelling, sign, oral plus sign, and oral plus fingerspelling modes. The 22 deaf subjects received all modal conditions but were categorized according to communication preference. Beckmeyer found no statistically significant effects although the scores obtained by both the oral and sign modes were superior to those obtained by fingerspelling. Observation of communication preference groups showed that the oral mode was most efficient for those with oral preference, manual mode for those with manual preference as well as for those with both oral and manual preference. Consequently it was proposed that in communication, efficiency depended to a large extent on the mode of communication preferred by the particular deaf individual. The results also suggested that bimodal presentations were not necessarily superior to unimodal presentation.

Various combinations of both unimodal and bimodal presentations were utilized to teach Spanish number words to 42 deaf subjects aged 12 - 15 years by Brooks, Hudson, and Reisberg (1981). Subjects were randomly assigned to one of seven modes of videotaped presentations: auditory, speechreading, fingerspelling, auditory plus speechreading, auditory plus fingerspelling, speechreading plus fingerspelling, and auditory plus speechreading plus fingerspelling. Initially a learning assignment was presented whereby Spanish numerals and their English counterparts were presented to the subjects. After this training period, subjects were asked to write the numeral that

corresponded to the presented Spanish numerals. The results showed auditory plus speechreading plus fingerspelling to be the most efficient modal combination. The other high scores all contained fingerspelling as one of the modal components. The authors also performed an analysis of covariance and found neither WISC scores nor age to be a significant covariate. With regard to learning, Brooks et al., concluded that bisensory communication was superior to unisensory. However, it should be noted that the bisensory conditions were not significantly higher than fingerspelling only. Thus, once more the strength of the manual mode in communication is revealed.

One of the first studies that attempted to test deaf students' reception of language was conducted by Pudlas (1984). In a carefully constructed design Pudlas presented single sentences to 106 deaf subjects with an average age of 14.6 years and a mean hearing threshold level of 97.7 dB. Each subject received sentences in one of the following modes: oral (speechreading), aural (audition), manual (signs), oral-aural (speechreading plus audition), and simultaneous (speechreading plus audition plus signs). Responses to the videotaped presentations were written and a maximum score of 57 was attainable. The simultaneous condition (\bar{M} = 33.2) and the manual (\bar{M} = 31.5) received the highest scores and were both significantly higher ($p<.01$) than the other conditions. At the lower end of the scale it was found that the oral-aural mode (\bar{M} =7.3) was significantly higher ($p<.05$) than the oral (\bar{M} =3.8) or the aural (\bar{M} =3.2) modes. Signed English was the sign method

used and analyses of personal and demographic variables indicated that the subjects' syntactic abilities, in all but the aural mode, accounted for a large proportion of the variance. The requirement that the responses be written may have contributed to this finding. Furthermore, although it could be said that in this study multimodal presentations facilitated language reception, the high results obtained by the manual-only mode must be examined. It should be noted that the addition of information through the weaker auditory channel to the stronger visual channel containing a manual component did not significantly enhance reception. Therefore, the multimodal condition proved to be more effective only when compared with the oral and aural modes. With the severe degree of hearing loss that was present in the subjects of this study, the weak effects of the aural and oral modes were to be expected. However, in his analyses, Pudlas did not find degree of hearing loss to be a significant predictive factor.

In this review most studies show an increase in information assimilation when modes are added. The condition for this result was that the multimodal presentation be compared with the weaker of the unimodal conditions. However, methodological considerations make generalizability to the classroom questionable. A major problem concerns the variety of receptive tasks used. Single lexical items, nonsense trigrams, nonsense words, and foreign vocabulary are examples of material with very little classroom validity except perhaps for spelling tests. If better communication is the goal in this realm of testing, then

language is critical in determining the effectiveness of various methods of communication. The use of sentences by Pudlas (1984) was a step in this direction. It should prove informative to test comprehension of stories and actual discourse.

The failure to fully examine demographic and personal variables also represented a shortcoming of many of these studies. Although, age, IQ, and hearing loss were taken into account by some researchers there are many other variables that could affect communication efficiency. Examples would be the age the subject learned to sign, the number of years of experience with signing, the hearing status of parents, the communication environment in the home, the method of signing utilized, hearing aid usage, etiology, and school setting. The hearing impaired population represents a wide range of individuals, and personal characteristics and background experience may determine different patterns of communication benefits.

Although, most of the findings indicated that multimodal communication is more effective than the weakest of the unimodal presentation, what is not clear is whether this finding holds across all forms of signing. Is an improvement noted when speechreading and audition are added to ASL signing as compared to SE signing? This would be a significant finding in relation to Kretschmer and Kretschmer's (1978) concerns about simultaneous presentation of a visually-based and an auditorily-based system. Most research has dealt instead with a visually represented auditorily-based system. The addition of

auditorily-based modes to SE may be expected to enhance comprehension because the language common to both modes is English. Conversely, ASL is a visually-based language with a different set of grammatical rules from English. Some insight into the information processing mechanisms could be gained from an experimental paradigm that investigated the comprehension of stories under various combinations of modes and languages.

Research that has compared different forms of signing is minimal and the same methodological weaknesses that characterized research in simultaneous communication also apply here. Examples of two studies are given to illustrate the nature of their experimental designs.

Higgins (1973) studied the comprehension of signed passages in 37 deaf undergraduate students from Gallaudet College. Eighteen students were assigned to a fingerspelling group and 19 students to a Siglish group. Twenty students from these two groups were then also assigned to the ASL group. Siglish was defined as the use of fingerspelling and signs in a close approximation to the English language and structure. Each group viewed two videotaped passages and were required to respond to multiple-choice questions. Results showed Siglish to be significantly superior ($p < .05$) to fingerspelling and ASL. As in other experiments a written response format might have been expected to favour an English presentation. However, in the experiment, the ASL group scored higher than the fingerspelling group. In a similar study by Murphy and Fleischer (1977) no differences were found in the comprehension scores between

Siglish and ASL presentations. Differences in experimental design and the bio-demographic characteristics of the subjects might help to explain the contradictions found in these two studies.

More recently, Ouellette and Sendelbaugh (1982) conducted a study into the effects of different forms of communication when presenting reading materials. A short-story and a multiple-choice comprehension test from level 5 of the Stanford Achievement Test was administered to three groups of 15 subjects aged 18 to 24 years. Age, sex, hearing loss, onset of deafness, reading level, and preferred mode of communication were all examined to obtain matched groupings. The passages were presented either in a print mode, in a manually-coded English mode, or in ASL. The highest score was obtained by the print mode followed by manually-coded English. A significant difference ($p > .05$) was found between print and ASL. As an explanation of the poor results with ASL, the authors suggested that socioeconomic factors may have contributed as well as lack of familiarity with ASL. The authors concluded by calling for further research in the area of communication modalities and the impact of modes on reading comprehension.

The present study attempts to overcome the methodological limitations of past research by measuring the effects of unimodal, bimodal, and trimodal presentations of material in both SE and ASL. Stories were used in place of single words and sentences in order to approach more closely the real situation of live discourse. In essence, what was tested was the ability

to assimilate meaning from a story. The subjects were required to retell the story utilizing any method of communication with which they felt comfortable.

4. BILINGUAL EDUCATION

A further aim of this study was to investigate the use of a particular signing method with deaf children. Signed English is used in most total communication programs despite the fact that ASL is the language of the deaf community (Stokoe, 1981; Kannapell, 1982). Furthermore, amongst deaf adults, ASL is the preferred method of signing (Stewart, 1982). This difference in the language used in the schools and in the community has caused an increasing number of educators and researchers to consider the possibility that ASL should be incorporated into total communication programs and thus create a bilingual situation using ASL and English (Charrow & Wilbur, 1975; Cokely, 1978; Curry & Curry, 1978; Woodward, 1978; Stevens, 1980). The deaf community has also expressed an interest in the concept of bilingual education (Stewart, 1983b) and the same is true of teachers of the hearing impaired (Stewart, 1983a). Therefore, a comparison of the effectiveness of SE and ASL with respect to communication is important.

Various definitions and uses of the term bilingualism can be found. Schlesinger (1978), suggested as a common definition "the coexistence of two languages which differ radically in most linguistic features with only minimal sharing of vocabulary items" (p. 63). Stokoe (1976), referred to bilingualism as "the constant use of two languages" (p. 22). Kannapell (1974) adopted a definition which has reference to people who are able to converse comfortably in two different languages. One who is comfortable speaking English and signing in ASL would be an

example of a bilingual person.

A distinction between ASL and sign systems, as they relate to bilingualism, is crucial in understanding their possible roles in bilingual education. Bilingualism implies the use of two languages. Spoken English and Signed English are not different languages although they use different communication modes. Bimodalism is the preferred descriptive term to describe the visual and auditory representation of one language utilizing two modalities (Schlesinger, 1978). Thus, bilingualism differs from bimodalism in that it refers to the use of two languages rather than the manipulation of two communication modes.

Further distinctions are needed to describe situations in which a language may be altered according to communication needs. Woodward (1973b) thought of sign language as a continuum ranging from ASL at one extreme to the exact visual representation of English through signs at the other. Variation is allowed to occur according to the signing skills of the individuals involved. Shared knowledge of ASL, between two speakers for example, would favour communication in signs representative of the ASL end of the continuum. The use of different variants of a language according to the needs of the situation is referred to as diglossia (Ferguson, 1959). Pidgin Sign English is a diglossic form of ASL. Both diglossia and bimodalism add to the complexities of integrating a bilingual philosophy with teaching strategies involving sign language.

Fundamental to the issue of bilingualism is the resolution of the language question: Which language is to be a deaf child's

first language, ASL or English? Literature dealing with the spoken languages of minority groups here reveal some important criteria. Fishman (1970) emphasized the importance of community attitudes towards different languages, particular situations calling for use of a specific language, and the stability of each language in the community. Richards (1970) related educational programs and bilingual policies by implying that a bilingual program will only be effective to the extent that it "recognizes and reinforces community aspirations and values" (p. 1). Walker (1979), in reviewing Mackey's (1972) concept of bilingual education, listed four relevant dimensions, the home behaviour of the bilingual, the school's curriculum, the surrounding community in the immediate area, and the status of each of the languages. It has also been noted that many of the difficulties which children from two cultures experience in school, arise from cultural rather than linguistic differences (Walker, 1979). To supplement the advantages brought about by using a child's first language, the state of Texas has included in its bilingual education programme the requirement of attending to the development in a child of a positive identity with his or her cultural heritage, as well as improving his or her self assurance and confidence (Walker, 1979). Thus, it is suggested that the accent in bilingual education should be on respect for the minority's language and the culture in which it is embedded.

Although the deaf population is widely dispersed within the larger hearing population its values and attitudes are very

important. The deaf community, like other minorities has its own language and culture and as Kannapell (1974) demanded ASL should be recognized as a deaf child's first language and used as a basis for developing English skills within the schools. Kannapell (1975) further argued that this recognition would lead to an improved self-concept and a greater willingness on the part of a deaf child to learn English as a foreign language.

It seems reasonable and obvious to expect deaf children to learn ASL as their first language when their parents are also deaf. On the other hand when the parents are hearing, the conditions necessary to acquire ASL are not as favourable. Many hearing parents may not want their deaf child to be acculturated into the deaf community. Advice given to parents over the years has emphasized that for deaf children to become talking members of the hearing society, they should avoid contacts with the deaf (Gannon, 1981). Moreover, for years, signing has been a stigmatized form of communication deemed inferior to speech (Van Uden, 1970). Thus, although bilingual education may be a desirable goal, the decision to use a particular language may ultimately reflect not the communication needs of the child but society's current attitude towards communication.

The idea of teaching English to the deaf as a foreign language has been supported by a number of educators (Cicourel & Boese, 1972; Fant, 1972; Moores, 1972; Stokoe, 1975; Woodward, 1978; Curry & Curry, 1978; Coye, Humphries, & Martin, 1978; Stevens, 1980). Teachers of the hearing impaired and the Deaf community also support the introduction of bilingual education

(Stewart, 1983a, 1983b). Despite their support, the process of implementing bilingual education is sure to face a strong challenge. Two of the major stumbling blocks are misconceptions about ASL and the attitude of people towards it (Vernon & Makowsky, 1969; Woodward, 1978).

Some common misconceptions about ASL have been described by Markowicz (1977). Included in his list are the following: ASL is universal, iconic, concrete, and ungrammatical. Markowicz goes on to refute each of these claims and to credit ASL with being a functional language as demonstrated in its use by deaf people. Over the past few years other linguists studying ASL have commented that the spread of negative attitudes and misunderstandings of ASL is found not only amongst the hearing population but also within deaf communities themselves (Woodward, 1978). As an example Woodward quoted the opinion of a deafened adult, George Johnston:

What Bellugi (sic) in California and other people are calling American Sign Language.... is actually Deaf English. DEAF ENGLISH is the typical errors (from improper or insufficient or unclear exposure) to English. It is a choice of words, a sub-culture style, ... (Johnston, 1977, p. 22).

Deaf students, too, are often unaware of what ASL is and are likely to form negative attitudes towards it (Berke, 1978; Curry & Curry, 1978). Thus, attitudinal barriers must be removed before an atmosphere conducive to bilingual education is created.

As more information becomes available about the lexicon and

structure of ASL, it seems likely that misunderstandings about ASL will be reduced. In addition, cultural, historical, and physical aspects of ASL should be studied and publicized to ensure its wider acceptance (Battison & Cogen, 1978). As with other languages, the emphasis should be on viewing ASL as a distinct language and not as a poor dialect of English. Coye, Humphries, and Martin (1978) suggested that the following five basic claims be affirmed to help overcome cultural biases between deaf and hearing people:

- a. All people have a functional language.
- b. ASL and English are distinct languages.
- c. English is not necessary to obtain an education, to be intelligent, or to attain success and value.
- d. The possession of English skills does not necessarily guarantee happiness, and
- e. Cooperation between two cultures can benefit both.

Thus, it is seen that research and a change in people's attitudes towards ASL are two possible pathways leading to a more promising bilingual atmosphere.

Until now written and verbal rhetoric have offered the only support for the feasibility of bilingual programs. Implementation and results still remain for future explorations. From the few studies that have been done, there is no indication that a bilingual approach would be detrimental to the development of English skills.

In a six week experiment with four elementary aged deaf children, Sallop (1973) taught English as a second language.

The students were instructed in different methods of sign communication depending upon their own language skills. That is, the child who only used gestures was taught ASL. Those children who were competent in ASL, were taught SE. Thus, English was only taught when a firm foundation in ASL had been established. Although, Sallop claimed success, the small number of subjects and the short duration of the study make his findings tentative.

The approach to English as a Second Language was also used at the English language program at the Tutorial Center of Gallaudet College (Goldberg & Bordman, 1975). Here, ASL was employed in all discourse and English was mainly practised in written form or whenever students wanted to express themselves in manual English. This notion of using ASL as a communication skill and English as a written skill may be a feasible compromise in a bilingual program for deaf children. This would be a content-specific approach where each language would be used only in certain courses (Cokely, 1978). In addition, Cokely specified two other approaches, namely the geographical and the temporal approach. The former implied that one of the languages would be used in some parts of the school and not others, while the latter implied that certain time periods would be dedicated to the use of a particular language. The effectiveness of Cokely's proposal is still to be tested.

The language competence of bilingual students was investigated by Hatfield, Caccamise, and Siple (1978). Two hundred and nineteen students from the National Technical

Institute for the Deaf (Rochester, New York) were classified according to sociolinguistic data into a high, medium, or a low group. The criteria for grouping were structured to place the most proficient ASL signers in the high group. Two videotaped stories in ASL and manual coded English (MCE) were presented to the subjects, followed by true-false questions signed in the language of the presentation. Results showed that there was no significant difference for the high group using either language (ASL or MCE). The authors concluded that possibly ASL skills are transferred to increase proficiency in receiving stories in English.

In recent years interest has been growing in the teaching of ASL as a second language to hearing people or to those with oral language fluency (Ingram, 1982; Woodford, 1982; Cogen & Philips, 1982). Ingram (1982) has criticized past sign communication courses for their emphasis on PSE and MCE. As an alternative he suggested criteria for designing a university level ASL curriculum that would be based on communication competence. Secondary objectives would include a linguistic understanding of ASL and deaf culture awareness. The notion of teaching ASL as a second language was earlier explained in a sign language book for beginners by Fant (1972). Recently, a more elaborate series of sign language books have been written by Baker and Cokely (1980). These constructive methods for teaching sign language may well improve the image of ASL and help to defuse negative attitudes towards it.

This review has shown that the concept of bilingual

education is relatively new in the education of deaf children. The concept itself is more theoretical than experimental, even though there is every indication that the time is ripe for researchers to explore this area of study. The thesis of this paper is a partial test of a bilingual education theory that until now has been hidden in academic journals. Until experimental evidence points otherwise total communication programs will continue to ply their trade of presenting English bimodally.

5. BILINGUAL RESEARCH

Research on speaking bilinguals will provide some insight into the expectations of a bilingual education for deaf students. Furthermore, on the basis of characteristics of bilinguals, predictions on the performance of subjects in the present study can be made.

In the area of bilingual research Dornic (1979) stated that "the study of the non-balanced bilingual's performance in information processing tasks in his two languages is of paramount importance for certain areas in applied psychology as well as in education" (p. 331). The deaf individual is an ideal subject for such a line of research. In general, a deaf student's grasp of English is low and SE is used primarily for communication within the classroom and mainly with teachers. For interpersonal communication with other deaf individuals ASL is used. On this basis, the assumption is made here that ASL is the dominant language and English the subordinate language of our non-balanced bilingual deaf subjects. This position is taken in order to facilitate analogies with other bilingual situations.

Information processing research on bilinguals has revealed that the dominant language is more efficient in certain tasks of processing. Research in general, has shown that comprehension speed or decoding efficiency is slower in the nondominant language than in the dominant (Dornic, 1980). Dornic (1979) attributed this slower decoding of words partially to the effects of the semantic content of words. It was reasoned that

the processes involved simply took longer to complete when presentations were in the nondominant language.

An early study by Lambert (1955) provided evidence in support of the hypothesis that nondominant language inputs were processed at a slower rate. In his study, Lambert recorded the time required for bilinguals to respond to instructions in one of their languages. Instructions were given which informed the subjects that they had to press a key which was identified by position and colour. Results showed that when instructions were in the nondominant language reaction times were slower. Lambert suggested that the speed of response was a reliable measure of language dominance.

A similar experiment was performed by Dornic (1977; 1979). Instructions were given that defined a series of items in terms of colour, shape, position, and value. The dependent variable in this design was the time it took subjects to check off the appropriate items. The bilingual groups used were as follows (dominant language stated first): Swedish-English, Swedish-German, German-Swedish, Slovak-German, Slovak-English, English-German, German-English, Polish-Swedish, Finnish-Swedish, Spanish-English, and French-English. Again, it was found that speed of response was slower when instructions were given in the nondominant language.

Macnamara and Kushnir (1971) examined processing at time of input by looking at a bilingual's capacity to interpret linguistically mixed passages. In four different tasks unilingual and bilingual sentences or paragraphs were presented

to French-English and English-French subjects. The purpose of all tasks was to investigate if the time required to switch languages in bilingual material added significantly to the time to process unilingual material. Recorded times showed that language switching tasks took longer. It was suggested that the reason for this stemmed from the existence of two distinct systems which were involved in the initial analysis of input before the input was further analyzed and attended to. It was also observed when unilingual presentations were in the native language of the subject, responses were faster.

Thus, for decoding, material presented in the dominant language appeared to be processed faster than material presented in the nondominant language. Research in this area has not been sufficient to allow one to generalize the effect of slower processing time on comprehension of materials presented in signs. However, there is other evidence that may be helpful in clarifying the direction of this generalization.

From the results of a series of experiments Dornic (1979, 1980) concluded that through different strategies and compensatory processes an imbalanced bilingual is able to conceal his slower functioning in his nondominant language. In addition, the individual will also compensate for his lower degree of automaticity as well as his inferior knowledge of the grammar and syntax of the weaker language. These weaknesses are usually revealed when the individual comes under pressure caused by information overload, environmental, emotional, social stresses, or fatigue. Such weaknesses, when exposed, become

good indicators of the covert imbalance between the dominant and non-dominant languages.

One of the procedures used to induce stress involved increasing information load. Dornic (1979) described a visual search task that was used to increase information load. The task required subjects to search for two-digit numbers, or words for two digit numbers, presented in the dominant or the nondominant language. Instructions, given in either of the languages, had subjects searching for one, two, or three of the targets at the same time. A pronounced increase in search time was found when the nondominant language was used. In explanation of this finding Dornic stated that a "more laborious and time-consuming process of rehearsal, ... left less capacity available for the search" (p. 336).

Other experiments by Dornic (1979, 1980) produced similar results: Stress tasks showed bilinguals function more slowly, less effectively, and occasionally switch to the dominant language under stressful conditions. Grosjean (1982) has commented that this is a common experience for bilinguals who have said they felt tired after conversing in the nondominant language for a long time, or have reported that in certain emotional situations they could not speak one of their languages. As Grosjean (1982) remarked, it is not unreasonable to expect bilinguals to revert, in times of stress, to their most comfortable language.

In the present study the testing condition can be viewed as being stress inducing. Subjects were required to retell a

story. Apprehension of forgetting parts of the story is a possible source of stress as is viewing the story in the weaker language (English or ASL). Anxiety might also be created by failure to understand signs, lip movements, or distinguish the auditory signals. The assumption was made that a language switch in the retelling of a story would indicate the dominant language. In this regard, it was assumed that the subjects would switch from their nondominant to their dominant language.

The tendency to translate to the dominant language has been demonstrated in a number of experiments. Goggin and Wickens (1971) administered a recall task of Spanish and English words to 384 university students. The subjects rated themselves on a scale with unilingualism in Spanish at one end and English at the other. The middle of the scale represented the strongest form of bilingualism. The bilinguals were divided into high and low groups, with the high group being the most comfortable in both languages. It was found that the high group recalled significantly more items than the low group. The authors postulated that this was due to the low bilinguals translating from the nondominant to the dominant language whereas the high bilinguals were able to encode items directly.

Macnamara and Kushnir's (1971) experimental findings led them to a similar conclusion to Goggin and Wickens. The authors reexamined the hypothesis of bilinguals translating to their stronger language. In their study it was found that French-English and English-French bilinguals responded more slowly to mixed-language sentences than to sentences given completely in

their weaker language. Because it was assumed that translation was taking place in the mixed presentations, the hypothesis had to be rejected. However, the bilinguals in the study were highly fluent in both languages. Macnamara and Kushnir concluded that translation from nondominant to dominant language does occur during the initial stages of becoming a bilingual. In addition, they felt that stressful conditions was the feature that induced the strategy of translating from the nondominant to the dominant language.

This review suggests that a translation from the language in which the stories are presented to the other language may identify the stronger language in unbalanced deaf bilingual subjects. Another prediction is that bilinguals will demonstrate greater comprehension of stories presented in their stronger language. Results from this study will be used to check the first of these two hypotheses. If the prediction is not upheld, new hypotheses specific to bilinguals dominated by their dependency on visual perception will be needed.

6. RELATED RESEARCH

The aim of the present study is to examine the comprehension of stories by deaf subjects under three modal and two language conditions. In a search of the literature no theory was found to serve as a framework for the present study. However, in the area of intersensory integration and selective attention there are several studies which provide different perspectives on the process involved in simultaneous communication. These studies will now be briefly reviewed.

6.1 Intersensory Integration

In simultaneous communication, information from three sources is presented to the senses. Voice is transmitted in the aural mode, signs in the manual mode, and speechreading in the oral mode. For simultaneous communication to be successful, information must be combined from each of the input modes, hence, the importance of intersensory integration. The efficiency of the total system is dependent upon the ability to integrate the messages as well as on the strength of the individual signals. Obviously, for a hearing impaired child the strength of the auditory input will be much weaker than that of the visual inputs. Individual signing and speechreading skills will determine the strength of manual and oral signals. Although, there are no models available that directly describe the information processes involved in simultaneous communication, there are several cross-modal investigations that do provide an insight into the possible relationship between the

sensory modalities.

Intersensory or cross-modal integration refers to the transfer of information received in one modality to another modality as well as the integration of similar information from two or more modalities. For example, a visually perceived triangular object may be subsequently recognized through touch when the eyes are closed. For this to occur, the visual information must in some way be matched to information perceived in the tactual modality.

In the present study several questions can be raised that relate to the field of intersensory integration. The most obvious question is whether or not any benefits can be expected when information is perceived in two or more modalities relative to that which is only received in the best single modality. One necessary condition for increased perception as suggested by Goodnow (1971) is redundancy of information between modalities. That is, when information is similar, input to one mode enhances the comprehension of the input to another mode. However, where the information from the modalities differs, an overloading of information may occur, leading to a disadvantage in understanding the incoming stimuli.

Walden, Prosek, and Worthington (1975) used transfer analysis of redundant information to describe the performance of hearing impaired adults ($N=98$) on consonant-recognition tasks. Results showed that transmission of duration, place-of-articulation, frication, and nasality information increased substantially with the provision of visual cues. Furthermore,

their data suggested that the improvement in audiovisual consonant-recognition ability resulting from visual cues is relatively constant across a broad range of hearing impairment. These findings are supported by studies which showed the addition of the oral mode to aural presentations increased the amount of information assimilated (Moore, et al., 1973; Pudlas, 1984). Thus, for hearing impaired adults perception of speech is enhanced when both auditory and visual cues are available.

Further evidence for the importance of visual cues in audiovisual speech tasks was provided by Erber (1979). Using optical distortion techniques to degrade the visual clarity of lip movements, Erber found that the greater the visual distortion the less accurate the perception of speech sounds. This finding is similar to studies which have shown that degrading acoustic signals decreases the level of speech perception by both hearing and hearing impaired subjects (Binnie, 1973; Binnie, Montgomery, & Jackson, 1974). Erber concluded that in speech perception the loss of information in one modality can be compensated by cues perceived in the other modality.

In a more elaborate experiment, Baggett and Ehrenfeucht (1981) investigated whether simultaneous presentation of visual and verbal information would lead to poorer encoding of information than when the visual and verbal information were presented sequentially. The instrument used was a 16 mm sound and colour film and the subjects were 459 university students. Upon presentation of the film the subjects were to answer 63

questions on the film topic. Findings showed that subjects could encode and retain visual and verbal information which occurred simultaneously in the movie better than the information that occurred sequentially. Evidence here suggested that in simultaneous communication encoding of information would not be hindered. In this study, visual images in the movie enhanced coding and retaining of information gathered in the auditory mode (narration). Encoding of information in the present study might also be enhanced by the visual images that can be stimulated by the types of signs used. In this respect, ASL, by its nature as a visually oriented language, may have an advantage over Signed English.

Another question that can be asked is whether different modalities are better suited for different kinds of information. O'Connor and Hermelin (1978, 1981) conducted a series of experiments on deaf, blind, subnormal, and autistic children in an investigation of modality-specific processing. They observed that particular modality specific memory stores were specialized for the appreciation of certain qualities of the input. For example, spatial qualities were more readily encoded in the visual modality, and stimuli in the successive temporal order favoured encoding in the auditory modality.

To further test this observation, O'Connor and Hermelin presented verbal items in the visual mode to see if the items would be encoded in the visual modality or in terms of a verbal sequence. The subjects tested were normal, congenitally deaf, autistic, and subnormal children. The task involved memorizing

three digits which were spatially displayed in the order, 1 4 7; but, were temporally displayed in the order, 4 7 1. That is, the digit, 4, was the first number presented and was in the second position of the first display. Results showed that for normal subjects and for subnormals with verbal IQs of 60 and above the visually presented items were recoded in an auditory-verbal form as recollection of the digits was temporal in nature (i.e., 4 7 1). For all others the coding was in the visual modality and recall was likewise visually oriented (i.e., 1 4 7). Thus as Miller (1981) had suggested, recall was dependent upon the subjects' own experiential background. Therefore, in simultaneous communication one might expect information from all inputs to be coded in the modality that has become specialized for it through the experiences of the observer.

Thus far, studies have shown that, when the content of the information is similar, simultaneous presentation to different modalities usually leads to more efficient perception than if either modality alone is presented. That is, a weakened acoustic signal is enhanced by visual cues and vice versa. However, what happens when the information to the eye and ear are in competition with each other?

O'Connor and Hermelin (1978) suggested that where there is a conflict of information being perceived by the senses the process of sensory dominance becomes operative. That is, the information picked up by the dominant sense will assume prominence over all inputs in the other modalities. Usually in a situation of conflict between modal input, the non-dominant

sensory system adapts to conform with the dominant one (O'Connor & Hermelin, 1978, 1981). Hence, "sound may appear to originate from an apparent source which is visually present, when in fact it is emitted from somewhere else" (O'Connor & Hermelin, 1981, p. 319). The authors suggested that this phenomenon of adaptation is critical because it indicates a certain degree of perceptual equivalence between two or more sensory inputs. In simultaneous communication the different senses available to perceive input signals raise the question as to whether the information from different sources is semantically similar. For example, can we assume that words perceived by the ears yield information that is similar to the messages resulting from English-based words that are represented in signs and perceived by the eyes? (Total communication programs have implied that this assumption is correct -- however, research evidence is still lacking.) If the information is not similar then sensory dominance may play a role in simultaneous communication.

In another study on non-redundant information McGurk and MacDonald (1976), and MacDonald and McGurk (1978) presented subjects with dubbed video-records in which there was a conflict of information between lip movements and sounds. They found that the conflict of information led subjects to report neither the sound they heard nor the lip movements they saw. For example, when exposed to the sound /pa/ dubbed onto the lip movements /ka/, the subjects perceived /ta/. The authors concluded that the subjects were looking for compatible information in both modalities. In the auditory field, /pa/,

/ka/, and /ta/ have voiceless consonants, and in the visual field, /ka/ and /ta/ have similar lip movements. Therefore, the subjects often responded with /ta/ as the best fit of the data perceived. They used information from both modalities to arrive at a solution that was compatible to both stimuli. Thus, it would seem that information from both the visual and auditory modalities, are being integrated in the perception of speech sounds.

It is apparent that modalities, in some instances, are specialized for the perception of certain kinds of information. Furthermore, the specialization is related to the experiences of the observer. Thus, as described earlier, for congenitally deaf subjects the visual modality would be expected to assume dominance over the auditory modality in the coding of visually presented verbal information which was coded in the auditory mode in hearing subjects (O'Connor & Hermelin, 1978).

When inputs are received in two modalities the question arises as to which modality is used for the final coding in long term memory. This review however does not attempt to examine the various theories that have been proposed to account for the way in which this coding may occur. Nevertheless, some theories that deal with the coding of information from different senses, will be reviewed.

One model that examined the coding of information was presented by Pick (1970). He suggested that "information obtained through a nonspecialized modality is recoded and represented in the form of the specialized modality" (Marcell &

Allen, 1978, p. 172). In other words, information is stored in whichever modality best processes this type of information. Pick (1970, 1974) presented subjects with conflicting sensory information on the location of an object. Visually perceived stimuli were found to exert the greatest influence on the subjects' sense of location. Pick's model would therefore imply that information on location received from any of the modalities should be stored in a visual form.

According to Pick's model, stimuli received through simultaneous communication would be most appropriately stored in a visual-linguistic form. Since the strength of deaf children lies in their visual rather than their auditory skills, one might expect storage to be more closely related to the visual modalities. Hence, a perceived sound would be translated to the visual modality. Furthermore, where the perception of signs is easier than the perception of comprehensible lip movements it may be assumed that the storage of linguistic information is more closely related to the language of signs, than it is to speech. Research in the psycholinguistics of signs reviewed earlier in this chapter, supports this idea (Odom, Blanton, & McIntyre, 1970; Reef, Lane, & Battison, 1978).

Jones and Connolly (1970) also attempted to draw up a model that best accounted for results obtained in experiments on intersensory integration (Freides, 1974). They suggested that "information from the input modality is recoded prior to its storage in the context of the modality of output" (Marcel & Allen, 1978, p. 172). In this model the transfer of

information occurs prior to its storage in short-term memory. This translation occurs through a system which utilizes a long-term memory store that has a quasidictionary list of equivalent modality entries. Hence, after transfer has occurred the information could be held in the context of the output modality.

Whereas, Jones and Connolly's model dealt with input through one modality which is subsequently transformed to a representation in another, simultaneous communication has input in two or more modalities. Typically, for the profoundly deaf, the manual mode is one of the input modalities and usually the output modality. However, for certain individuals there could also be oral and auditory inputs. Here, the auditory signals would be recoded in a manual mode permitting the perceived sounds to match the signs. Similarly, if one were trying to match sounds to lip movements, the auditory signals would be encoded in an oral modality.

Obviously, in simultaneous communication there could be a benefit in integrating information from the auditory and visual modalities. Research on intersensory integration provide some clues as to how the information is matched. Corcoran and Weening (1969), attempted to develop a model that would predict performance on an audio-visual task based on findings on audio only and visual only tasks. The auditory task was to distinguish noise emitted through earphones and the visual task was to distinguish specific noise patterns on an oscilloscope. Both the eye and the ear would make a judgement on a redundant input signal. This judgement along with a measure of certainty

would be passed on to a "decision system" where a final judgement on the information contained in the input signal is made. The most successful model was one which assumed that the auditory and visual systems act independently up to the level where the decisions are made.

To date, much of the literature provides supporting evidence for Corcoran and Weening's (1969) conclusion of auditory-visual independence (Ingersoll & DiVesta, 1972; Walden, Prosek, & Worthington, 1975; O'Connor & Hermelin, 1978; Baggett & Ehrenfeucht, 1981; Raney, Dancer & Bradley, 1984). For example, O'Connor and Hermelin (1978) in a series of experiments conducted on deaf, blind, autistic, and subnormal children, showed that when identical stimuli were presented in different modalities there was evidence for modality specific coding. Fewer studies have demonstrated support for correlation of, or an interdependency between, the auditory and visual systems (Lendau, Buschbaum, Coppola, & Sibvonen, 1974; McGurk & MacDonald, 1976; MacDonald & McGurk, 1978).

Another theory holds that cross-modal transfer is mediated by language, names, or verbal descriptions (Ettlinger, 1967). Millar (1981) cautioned against putting too much weight on language as the sole factor in mediating intersensory translation because of evidence demonstrating cross-modal transfer in apes, monkeys, and preverbal children. She stated that for visually impaired individuals, verbal information without related sensory experiences is insufficient to account for the variety of cross-modal evidence. She also suggested

that the critical variable determining the efficiency of a cross-modal task would be the status of an individual's available knowledge and how readily this information could supplement or complement inputs perceived in different modalities. Hence, where the verbal information necessary for a cross-modal translation is not available, the possibility of another process being used is not ruled out.

Research has also been conducted to determine if skills in different modalities are correlated across individuals. Raney, Dancer, and Bradley (1984) studied the relationship between auditory and visual systems in speech tasks. Using normal-hearing adults ($N = 30$), the Harris Revised Central Institute for the Deaf Everyday Sentence Lists were administered under a speech-in-noise (auditory only) condition and a speechreading (visual only) condition. Results showed no relationship between modalities in the ability to understand speech. That is, good ability in speechreading was not found to be related to good auditory skills. It was concluded that the auditory and visual systems are independent in processing unimodal speech signals.

From the experimental evidence reviewed on intersensory interaction it is reasonable to postulate that in simultaneous communication the addition of modalities contributing to the input signals will not impair performance. There are two requirements necessary for subjects to benefit from redundant information in two modalities. First, the information presented must be compatible in both modalities. Second, for enhancement to occur the auditory-visual and the visual-visual integration

mechanism must be functionally developed. Reasons for the first assumption have already been demonstrated by conflicting information studies (McGurk & MacDonald, 1976; MacDonald & McGurk, 1978). For the second assumption, some support may be drawn from research on the relationship of reading and intersensory integration. This discussion is presented here because of the possibility that the skills involved in reading print may be related to those skills used in perceiving SE -- both print and SE are visual representations of speech. In addition, it has been suggested that signing in one form or another may be used to facilitate the reading skills of deaf students (Vernon, Coley, & Ottinger, 1979).

Birch and Belmont (1964) investigated the relationship between reading and auditory-visual integration using non-verbal information. Initially, Birch (1962) hypothesized that a reading disorder was associated with difficulties in integrating information from different modalities (Vellutino, 1979). Birch and Belmont (1964) tested this theory on normal readers ($N= 50$) and poor readers ($N= 150$) and found that normal readers made significantly fewer errors on auditory and visual matching tests. The task, which required subjects to match auditory patterns with visual-spatial dot patterns was later administered to children ($N= 220$) from kindergarten to grade six (Birch & Belmont, 1965). This time the results were correlated with reading achievement. It was found that auditory-visual integration correlated with reading achievement in first and second grades, but, the correlation diminished in older students.

all of whom had well developed auditory-visual integration ability.

These initial findings by Birch and Belmont (1964, 1965) have been criticized for not controlling for intrasensory deficits (Vellutino, 1979). The suggestion was made that intersensory differences may have been due to differences in intrasensory abilities. Later efforts to verify Birch and Belmont's initial theory produced inconclusive evidence (Kavale, 1980).

Kavale (1980) attempted to summarize the data collected from 31 correlational studies on auditory-visual integration and reading achievement. Utilizing techniques of meta-analysis, coefficients from the correlational studies were analyzed. This statistical integration of the literature did show that auditory-visual integration was significantly related to reading achievement irrespective of testing methods.

It would seem that for integration to occur in simultaneous communication both auditory-visual (sound - speechreading and signs) and visual-visual (speechreading - signs) integration must be developed. Poor integration skills may prove to be a confounding factor in the present study, especially if the perception of SE requires skills similar to those used in reading print. However, in a review of the literature by Silverston and Deichmann (1975) auditory-visual transfer skills were found to increase with age up to approximately fifth grade. It is therefore assumed that the integration skills of the subjects in the present study (aged, 13 years and above) have

already been well developed.

6.2 Attention

During simultaneous communication a listener is exposed to auditory and visual signals. For a deaf individual the perceived auditory information is a function of the strength of the auditory signal and the perceptive abilities of the ears either with the assistance of hearing aid(s) or without. Given ideal environmental conditions, there are no additional sources of sounds competing for attention in the auditory channel.

On the other hand, in the visual channel signals from the two sources give rise to the perception of speech from lip movements and facial expression (the oral mode) and the perception of signs from hand and body movements and facial expressions (the manual mode). It is not known how the central nervous system processes information simultaneously presented in the oral and manual modes. Nevertheless, theories of selective attention do offer some insight into the feasibility of perceiving information from multi-modal sources.

In general, theories of selective attention imply that multimodal presentation of redundant information should not decrease the amount of information processed relative to the amount that would be processed unimodally and might increase it (Broadbent, 1957, 1958; Deutsch & Deutsch, 1963; Treisman, 1964; Neisser, 1967; Norman, 1968). How much additional information can be gleaned from the extra inputs depends upon the experimental conditions and the cognitive structures of the individual. All theories indicate that at least some if not all

of the initial sensory inputs will be processed and stored in a perceptual system. The information that is then pulled from this system is dependent upon the experiential knowledge of the receiver, the nature of the messages, and the rate of presentation. As an example, consider two subjects both fluent in signs, but A has poor auditory skills whereas B is much better able to distinguish some sounds. When a bimodal presentation of signs and auditory signals is given to both subjects, one would expect B to utilize his knowledge of sounds to process auditory information to a greater extent than A. On the other hand, A might simply bypass processing the auditory input. Thus, a simultaneous bimodal presentation, might not necessarily lead to a decrease for A in the amount of information processed.

There are three ways of deploying attention during messages. Attention may be on one modality, or it may be rapidly switched between two modalities, or it may be divided between the modalities, so that they are processed in parallel. In simultaneous communication parallel processing may take place as long as the capacity for processing has not been overextended. When this has occurred, then serial processing may be brought into play.

An important variable may be whether the signals in the different modalities are redundant or different. Many studies have used different stimuli. The evidence with simple non-verbal, non-redundant stimuli is conflicting. Shiffrin and Grantham (1974) provided some evidence of parallel processing.

Using three modalities, a faint light, a faint sound, and a gentle vibration on the skin, stimuli were applied to seven undergraduate subjects to determine if it was as easy to attend to all three modalities at once as it was to attend to just one modality. For both simultaneous and successive presentations, subjects were to respond to the presence of a stimulus using a button controlled response box. Results showed no reduction in performance with three modalities rather than one. This led Shiffrin and Grantham to suggest that an automatic mechanism abstracts relevant information from incoming signals and transfers it to short-term memory stores. They also suggested that selective attention does not function during perceptual processing but is utilized in short-term stores subsequent to perceptual processing

Colavita (1974), on the other hand, concluded that the central information processing mechanism (attention) could handle information from only one channel at a time. Auditory (sound) and visual (light) stimuli were presented simultaneously to subjects who were required to judge the magnitude of each. Initially, auditory and visual stimuli were matched for subjective magnitude by the subjects. Under conditions of simultaneous presentations it was found that the visual stimulus was perceived more readily than the auditory one. Furthermore, it was revealed that on some light-tone presentations subjects were unaware of the auditory tone. Thus, parallel processing appeared to be very difficult with bimodal presentations.

Using more complex non-redundant linguistic stimuli,

Spelke, Hirst, and Neisser (1976) attempted to determine if extensive practice would assist parallel processing when subject's resources were initially overloaded. They utilized different information in a reading and dictation task. Working on two subjects they were able to show that after six weeks of training, both subjects could read and take dictation just as well together as they could separately. Spelke et al., then modified the task and had the subjects write the categorical names of a given word (e.g., furniture for chair). Again, after practice similar results were obtained. This would seem to indicate that in simultaneous communication prolonged practice might make it possible to glean information from all modes. The necessary precondition for this to occur would be that the individual had adequate communication skills in each mode, and extensive practice in attending to both at once.

Another investigation of parallel and serial processing with non-redundant verbal messages was made by Treisman and Davies (1973). Earlier, Treisman (1969) had suggested that parallel processing might be possible between two different analysing mechanisms such as those for the ear and eye. Serial processing would be necessary when the same mechanism is used for two inputs being received through one channel. To test this, Treisman and Davies had dual phonological targets (words containing the letters "END" or the sound "end") and semantic targets (animal names) presented to subjects visually or auditorily, in the same or different modalities. Results showed that subjects were better able to divide their attention between

two inputs when both inputs were in different modalities. This finding gave support to Treisman's (1969) reasoning on parallel processing.

A variation of Treisman's suggestion is carried out in the present study with a change in modal presentations. The visual mode is to consist of an oral and a manual component. An important distinction is between the concept of channels and modes. Within the auditory channel the one mode presented will be audition, whereas, in the visual channel an oral and manual mode will be presented together to determine the capacity of attention to be divided between linguistic sources as well as physical sources (visual and auditory).

One of the few studies that has used redundant signals was carried out by Miller (1982) using non-verbal stimuli. He examined two models for response selection in experiments on divided attention. In the separate-activation model responding is controlled by the detection of a signal through either one of the two channels. Conversely, the coactivation model postulates that when redundant signals are bimodally presented then both signal components will affect the response. To test these models, Miller administered a timed bimodal detection task employing auditory (bell tone) and visual (asterisk on video screen) signals and a letter search task. He found that responses to the redundant signals were too fast to be explained as the result of a response to the faster of the two individual signals. He concluded that redundant signals stemming from different input modes both contributed to the process of

eliciting a response. He interpreted these results as support for the coactivation model for redundant stimuli.

In simultaneous communication the coactivation model would predict an increase in performance over a unimodal presentation of, for example, the word "car". Because the sign for "CAR", the lip movements for the word "CAR", and the sound for "CAR" all have the same lexical meaning, comprehension should be faster with simultaneous presentation in all three modes.

Another important variable affecting processing may be the intensity of the messages. Norman and Bobrow (1975) suggested that the effectiveness of simultaneous presentation could be reduced by lowering the intensity of one or some of the stimuli. Parallel processing is possible only when the strength of both sets of stimuli is sufficient. Therefore, in simultaneous communication an individual's response to various stimuli could depend on the intensity of the stimuli that he is receiving. For example, subjects with severe hearing loss would be expected to gain little when auditory signals are added to manual and/or oral presentations.

The present study is not designed directly to test any theories of attention. The design will not allow us to distinguish between parallel processing and rapid switching of attention from one mode to another. Both would result in benefits from redundant presentation of the same story through more than one mode. Serial processing would lead to a decrement only if switching were slow and the information rate exceeded the subjects' capacity. The studies discussed in this section

show that when inputs converge on a common representation, coactivation may occur, if Miller's (1982) conclusions can be generalized to linguistic stimuli. If different analyzing systems are involved in information processing then parallel processing may be possible (Treisman & Davies, 1973). If each of the receptive skills (e.g., manual, oral, and aural) are practised, then attention limits may disappear (Spelke et al., 1976). Finally, if stimuli conflict, then the visual signals may dominate (Colavita, 1974), especially if they are more intense than the other input signals (Norman & Bobrow, 1975) and more practised (e.g., signing in ASL or signing in SE.)

This brief review suggests that some gain from simultaneous communication should not be ruled out by attention limits when similar information is presented. This suggestion is also supported by evidence from results of experiments on intersensory integration reviewed earlier. The focus of interest in this study lies in the communication methods used in the classroom. It is designed to test whether simultaneous communication will increase efficiency in comprehending the full message expressed in an oral plus aural plus manual presentation. It will also explore the interaction effects between language and mode. Specifically, will there be a difference when a visually-based language (ASL) is used in place of an auditorily-based language (English), that is visually represented by SE, for the manual component of simultaneous communication.

Kretschmer and Kretschmer (1978) have stated:

If visually-based systems are organized symbolically in a different way from auditorily-based systems, the simultaneous presentation of divergent systems does not seem reasonable. (p.140)

The present study investigated this claim by testing subjects' comprehension of stories in ASL and SE under various modal conditions of presentation.

III. METHODOLOGY

1. OVERVIEW

The purpose of this study was to investigate deaf students' comprehension of stories presented in Signed English and American Sign Language under unimodal, bimodal, and trimodal conditions. The modes utilized were aural (audition), oral (speechreading), and manual (signing). It was realized that memory is also an important component of the study. It may well be that what is examined here is how each language and modality is advantageous to both memory performance and comprehension of stories. The present study did not separate these two components. Nevertheless, due to the fact that there was no delay in retelling the stories it was felt that comprehension was probably essential for accurate retelling.

As indicated in the review of the literature, one can expect comprehension to be enhanced as the number of modes are increased. However, the increase in comprehension is dependent upon the strength of the initial mode presented. If all of the information can be easily perceived through one mode then the addition of others will not increase the amount of data processed. Due to the visual strengths of deaf people the manual mode is likely to be understood best, followed by the oral, and then the aural modes. Thus, the present study arranged the manual mode as the unimodal condition, the manual plus oral as the bimodal condition, and the manual plus oral plus aural as the trimodal condition.

The inclusion in the experiment of two languages, English

(SE) and ASL, was made in response to the bilingual environment in which signing deaf children interact. So far, there has been very little research that seriously examines the differences between the two languages. Research on other bilinguals suggests that students will perform better in their dominant language. Another question considered was the capacity of a visually based sign system (Signed English) to represent an auditorily-based language. Finally, it was of interest to see whether some modes combined more effectively with one language than the other. Signed English more directly matches the oral and aural modes and might therefore benefit more from multimodal presentations.

2. METHODOLOGY

2.1 Design

The experimental design employed a 2 (language) X 3 (mode) X 3 (story) repeated measure approach to evaluate the comprehension skills of deaf individuals. As illustrated in Figure 1, the between subjects factors were language (ASL & SE), gender, and combination. A Greco-Latin square design was used to determine the combination of story and mode, where each story was presented in one of the three modal conditions: manual only, manual plus oral, and manual plus oral plus aural. In each of the modal conditions stories were signed in either SE or ASL to allow investigation of the differences in comprehension between the two languages. The within subjects factors were story, mode, and order of presentation.

Counterbalancing of both stories and modes of presentation

was necessary. To enhance generalizability (and to generate degrees of freedom), each subject was tested under each of the modal conditions. This required that three stories be utilized. Secondly, the possibility existed that the subjects would improve from one presentation to the next while going through the sequence of these stories. Therefore, it was also necessary to have, across all subjects, each modal condition shown an equal number of times at the start, middle, and final position of the sequence. To accomplish both of these ends, Greco-Latin square design was used to counterbalance simultaneously the repeated (within subjects) factors of stories, modes, and order of presentation.

Figure 2 - Greco-Latin square sequence for the assignment of subjects

			<u>MODE</u> (a)		
<u>Language</u>	<u>Gender</u>	<u>Combination</u>	M	MO	MOA
Signed English	female	1	A1(b)	B3	C2
		2	B2	C1	A3
		3	C3	A2	B1
	male	1	A1	B3	C2
		2	B2	C1	A3
		3	C3	A2	B1

American Sign Language	female	1	A1	B3	C2
		2	B2	C1	A3
		3	C3	A2	B1
	male	1	A1	B3	C2
		2	B2	C1	A3
		3	C3	A2	B1

(a) M = Manual; MO = Manual+Oral; MOA = Manual+Oral+Aural.

(b) Story type - indicated by the letters A, B, & C.

Order of presentation - indicated by the numbers 1, 2, & 3.

N=3 for each combination.

Each subject was assigned to one of the Greco-Latin sequences and to one of the languages. Thus, for this design the number of subjects used had to be a multiple of twelve and a minimum of 36.

The independent variables, and their levels were:

- a. language: Signed English and American Sign Language
- b. mode: manual; manual plus oral; manual plus oral plus aural
- c. story: three stories with themes dealing with supernatural events.

The dependent measure for the experiment was an aggregate score based on a scoring system proposed by Goodman and Burke (1972) (see Appendix A). The aggregate score was an average of the scores obtained from three ASL-English bilingual deaf judges.

In addition to the above experimental variables, biodemographic information was collected to determine the extent to which such factors affect performance. All information was obtained from current school records. These variables were:

- a. age
- b. gender
- c. age at onset of hearing loss
- d. etiology of hearing loss
- e. age at which subject learned to sign
- f. signing skills - as rated by four teachers
- g. hearing threshold level (HTL) i.e., the pure tone average of the better ear at 500, 1000, and 2000 Hertz (ANSI)

- h. history of educational settings
- i. history of communication methods used
- j. hearing status of parents
- k. hearing status of siblings.

The critical questions of this study were:

- a. Is there a difference in the amount of information reproduced when stories are presented in the manual, manual plus oral, and manual plus oral plus aural modes?
- b. Is there a difference in the amount of information reproduced when stories are signed in ASL and SE?
- c. Is there an interaction effect between modes and language in the amount of information reproduced under various modal conditions and in ASL and SE?
- d. In addition to these questions, it is of secondary interest to know if subjects will retell their stories in their dominant language.

Based on these questions the following hypotheses were formulated:

Hypothesis 1: Comprehension will be at a maximum for mode in the manual plus oral plus aural mode followed by the manual plus oral mode and then the manual-only mode.

Past research indicated that as the number of modes of input increased there was a corresponding increase in the amount of information comprehended. Typically, this occurred when the oral and then the manual modes were added to the aural mode. However, in the present study the assumption is made that the

subjects would comprehend the most information in the manual mode, as compared to the oral and aural modes. Therefore, this study reexamined the benefit of multimodal presentations by using the manual mode to attain a unimodal comparison score.

Hypothesis 2: Comprehension will be greater for stories told in ASL than for stories told in SE.

American Sign Language, as a community-based language, should be more readily understood than SE, which is a method of signing developed to be used mainly in the classroom. Furthermore, the language structure of ASL evolved solely for the purpose of visual channel reception. Conversely, SE is based on the language structure of auditorily-based English. Thus, ASL, with an evolution that emphasized communication, would be comprehended better than SE, which was recently developed for instructional purposes.

Hypothesis 3: The addition of the oral and aural modes to the manual-only presentation will result in greater increases in comprehension scores when SE is the language of presentation than when ASL is presented.

It was assumed that the similarity between spoken English and Signed English would lead to subjects being more receptive to the information being presented in the oral and aural modes. That is, since all three modes would be relaying the same information (e.g., the word "tree" would appear in signs, on the lips, and in audition), it was expected that the oral and aural modes would be more likely to add to the information that would be comprehended in a manual-only, SE presentation. American Sign Language did not develop to complement information in the oral and aural modes; therefore, the benefits of adding these

two modes to a manual-only ASL presentation was not expected to be as great as when SE was used.

In addition to these three major hypotheses, this study examined the effects of a dominant language on unbalanced bilingual subjects. It was predicted that subjects would tend to retell stories in their strongest language. Because there are no available tests of dominance in signing, the criterion for dominance was teachers' ratings. Along with students' opinions this method is recommended by Macnamara (1967) as the most accurate measure of language dominance in oral bilinguals.

Correlational analyses of the biodemographic variables previously listed and subjects' scores under the various signing conditions were also carried out. Each subject was shown a videotaped story that was approximately five minutes long. After viewing the videotape, the subject was required to retell immediately as much of the story as possible. Upon completion of the subject's first story, the second and the third story was then shown.

2.2 Subjects And Sampling

To facilitate data collection and to ensure that the signs used in the experimental task had a high probability of being known by all subjects, the sample ($N = 36$) selected was largely drawn from the British Columbia Provincial School for the Deaf. (Known as the Jericho Hill School for the Deaf, this school is much like other provincial schools for the deaf in Canada. It has both residential and day students and uses total communication with all students.) Within this population the

following selection criteria were used:

- a. profoundly deaf (HTL of 90 dB or greater in the better ear)
- b. 13 to 19 years of age
- c. vision was sufficient to enable the subject to see the signs on the television monitor clearly
- d. no known additional physical disability
- e. past five years of education in a total communication program.

As reported earlier a total of 36 students were required by the design of this study. The sample comprised 65 percent of the available school population in the designated age interval.

3. PILOT STUDY

Prior to the main study, four important tasks had to be performed. They were:

- a. developing three stories equated for syntax, reading level, and interest level;
- b. recording each story in all three modal conditions;
- c. selecting the time limit to be allowed for each subject to reproduce the story; and
- d. developing a procedure for reliable scoring of videotaped retellings of stories.

3.1 Stories

The task of writing and equating three stories was undertaken by Clarke (1984). To ensure a high level of interest three ghost stories (see Appendix B) were selected and subsequently revised to match on readability, syntactic complexity, and the degree of signing difficulty as measured by

the number of words and number of sentences. Using the Spache test of readability and the syntactic complexity formula suggested by Botel, Dawkins, and Granowsky (1973), the following scores were obtained:

	Story A	Story B	Story C
Syntactic complexity	127	127	127
Number of words	390	399	393
Number of sentences	37	37	37
Average sentence length	10.5	10.8	10.6
Spache Grade level	2.8	2.4	2.8

The readability level was deemed to be appropriate for the population of interest. This was based on findings that showed the average deaf individual to have a reading level of Grade 3.7 upon leaving school (Conrad, 1979). The scores obtained in the analysis of syntax ensured that the level of comprehension was similar across stories.

Furthermore, English was used as the language on which the stories were equated. Initially, it may seem to be appropriate to have also used ASL complexity as a criteria. However, analysis of ASL has not yet progressed to a stage that would allow one to equate ASL passages.

3.2 Signed Presentations

Initially, the three ghost stories were transcribed to ASL by the author (see Appendix C). Each of the stories, in SE and ASL, were then put on one half inch black and white videotape using the facilities and personnel of the Audio-visual Services, Department of the Faculty of Education at the University of British Columbia. A deaf male, competent in signing ASL and SE, signed all of the stories. The signer (also the author) has previously been a teacher at the Provincial School for the Deaf. (This was a potential source of bias, however ratings by deaf adults were obtained to minimize this effect.)

The signer was in a standing position ten feet from the camera. The camera centered the signer from the waist to three inches above his head to enclose what is called the "signing space" of an individual. An off-white wall served as the background and the signer wore a short sleeved navy blue shirt to enhance clarity of the signs. Taping proceeded under lighting conditions normally found in classrooms.

The spoken part of the SE presentations followed the stories as they appear in Appendix B. The words were spoken at a rate that synchronized each word with the proper signs. However, in the ASL presentations not all words were spoken. As shown in Appendix C, all signs that are not underlined were spoken. Due to the nature of ASL it is awkward to say a word for each of the signs produced. For example, in ASL it is possible to communicate simultaneously two or more thoughts. When this occurs it is inappropriate to say a string of words

that match these thoughts. Another example is when the facial expressions accompanying the signs make it difficult to also say a word. In these instances the facial expression is usually deemed to be important for conveying the appropriate messages.

A panel of three profoundly deaf adults, competent in signing SE and ASL, were used to judge the readability of the signs in the videotaped stories. Videotapes were revised as required; final copies were viewed separately by each of the judges. They were asked to attend to speed of signing, clarity of lip movements, and the comprehension of individual signs as well as to report any irregularities (e.g., unusual facial expressions or body movements) that might have affected the message being conveyed by the signer. Upon completion of each viewing the judges were given the story to read. This allowed for a check of their own comprehension of the story. Following this, each of the judges was then interviewed by the author. The results of this procedure showed a general agreement among judges, that the videotapes were clearly presented and no changes were necessary.

Finally, two hearing adults were used to determine the clarity of the voice on the videotape. Again, clarity of presentations was evidenced.

3.3 Time Limit

It was also necessary to determine an optimal amount of time in which the subject would reproduce the story. No lower time limit was established and for upper limits it was decided that subjects would be asked to indicate when they had finished

reproducing the stories.

3.4 Scoring Instrument

A scoring system for comprehension was used that was based on Goodman and Burke's (1972) Miscue Analysis Procedure for Retelling Stories (see Appendix A). Results of the pilot study showed that prompting would be necessary to elicit appropriate responses. Prompts were administered by a deaf female with signing competence in ASL and SE. Training of the administrator consisted of her viewing the tapes of the three pilot subjects and indicating to the author when it was considered necessary to prompt and how she would then prompt the subject. The prompts used were those suggested by Goodman and Burke and adhered to three general guidelines as recommended in their manual:

- a. The questions should make use of no specific information not already introduced by the subject. (e.g., If in the course of retelling Story C the subject mentioned the word "coin" without any reference to a particular situation, then the test administrator later prompted by asking the subject, "Can you tell me more about the coin?")
- b. The questions should be general in nature so that their formulation would not lead the subject to insights or views which did not grow from his or her own reading. (e.g., All prompts used were of the "Tell me more about Bob" or "What about the poison" variety, given that the subject had already mentioned Bob or the poison in their initial retelling of the

story.)

- c. Any name changes which the subject has instituted should be retained by the test administrator. (e.g., A subject lost four points under the scoring subscale, Character Analysis, if he or she substituted the name Paul for Bob in Story B. No further points were taken off for this error in the other scoring subscales.)

The test administrator reported that no more than two prompts per story were given. The number of prompts given was recorded and was consistent across both languages.

A total score of 100 points per story was possible based on four subscales; Character Analysis - 30 points, Theme - 20 points, Plot - 20 points, and Events - 30 points. Another subscale was called Additional Information. Here, the scorers recorded anything that they thought would not fit under the other subscales. A maximum of two marks was allowed here and under no circumstances were points deducted. The method of scoring used in the present study was to utilize the total scores where inter-judge reliabilities were high. As is discussed later, this was the case for all stories.

3.5 Pilot Subjects

Three profoundly deaf subjects from the provincial School for the Deaf were selected for the pilot study. Although it would have been desirable to have used more subjects, the availability of subjects was such that if any more were used in

the pilot there would have been insufficient numbers for the experiment.

4. DEVELOPMENT OF TESTING MATERIALS

4.1 Instrument

Twelve videotapes were used to present the stories to the 36 experimental subjects. Six of the videotapes were in SE and six of them were in ASL. In each language group each story was recorded once in the manual mode only and once with manual, oral, and aural modes simultaneously. The second set was used for both the manual plus oral mode and the manual plus oral plus aural mode. The only difference between the latter two modal conditions was that the sound was turned on for the manual plus oral plus aural mode. The volume control was set so that the output was at about the average loudness level for speech (i.e., in the range 60 - 65 decibels).

All subjects' responses were taped on one-half inch videotape for scoring. The subjects were taped in a sitting position ten feet from the camera. Again, the camera was centered on the individual's signing space defined as the space between the waist and three inches above the head.

4.2 Administrative Procedures

Administration of the task was carried out by two deaf signers, one male and the other female. Both were competent in signing and comprehending SE and ASL. All duties related to the videotape machine were handled by the male technician. All instructions were given in Pidgin Sign English by the female administrator. Where difficulty in understanding instructions was encountered, the administrator switched to either SE or ASL and repeated the directions. Instructions stated clearly that

the subject was required to watch the story carefully and then retell as much of the story as possible in any mode he or she wished. When each subject felt that he had retold the story to the best of his ability he or she was required to inform the administrator. At this time either prompting was given (in SE, ASL, or PSE if the test administrator wanted further clarification) or taping of the individual was stopped.

Initially subjects were ranked by age, numbered from 1 to 36, then each odd-numbered subject was to assigned to the ASL group and each even-numbered subject to the SE group, and finally each was randomly placed in one of three Greco-Latin sequences (see Figure 2). After presentation of the first story and taping of the subject's response, instructions similar to the first story were given and then the second story was shown. Similar administrative procedures were used for the third story. All stories were administered in the same sitting and each subject took approximately 40 minutes to complete the tasks.

4.3 Scoring

Three profoundly deaf persons competent in both ASL and SE scored the taped responses. For each subject three separate scoring sheets corresponding to the three stories were used (see Appendix A). The judges individually viewed the videotapes and scored each subject's responses. During scoring the judges were not aware of the condition of presentations. Scoring was completed two weeks after the last subject had been tested.

The scoring of the subjects' reproductions of the story was based on Goodman and Burke's (1972) Miscue Analysis Procedure

for Retelling Stories. Upon completion of all scoring, inter-judge reliability coefficients were found using Pearson's correlation. On Story A, the reliability coefficient for Judge 1 and Judge 2 was .82, for Judge 1 and Judge 3, .88, and for Judge 2 and Judge 3, .81. Likewise, for Story B the coefficients were .80, .78, and .87. Story C resulted in the highest correlations of .93, .92, and .93. All reliabilities were significant ($p < .001$), thus permitting the scores for each subject to be averaged across judges.

The scorers also noted the language in which the subject responded. This was accomplished by recording the signing most often used by the subject on a scale of one to seven. A "one" indicated that ASL was the language used and a "seven", Signed English. Numbers between one and seven referred to the continuum of signing found between SE and ASL (see Chapter II). An inter-judge reliability coefficient was found using Pearson's correlation. For story one, the reliability coefficient for Judge 1 and Judge 2 was .59, for Judge 1 and Judge 3, .68, and for Judge 2 and Judge 3, .60. Respectively, for story two, the coefficients were .52, .59, and .60. For story 3, the coefficients were .44, .58, and .58. These ratings were also averaged across judges.

4.4 Data Analyses

Correlational analyses were conducted using the Statistical Package for the Social Sciences: Version 8:00 (Nie, et al., 1975) and Version X (SPSS, 1983). The subprograms used were PEARSON CORRELATION and PARTIAL CORRELATION. All analyses of

variance (ANOVAs) were conducted using the BMDP Statistical Software (Dixon, 1981). The computer was an AMDAHL 470 V/8, maintained by the University of British Columbia Computing Center.

Multiple analyses using a three-factor ANOVA model with repeated measures on two factors were pooled to yield the results summarized in Table I. The statistical significance (probability of type I error) was determined for each independent variable and for each estimable interaction. The Bonferroni *t* statistic (cf. Kirk, 1978) was then employed as a post hoc analysis to determine the loci of significant differences found in main and interaction effects.

IV. RESULTS

The purpose of this study was to examine deaf students' comprehension of stories presented under two language conditions (English and American Sign Language) and three modal conditions (manual, manual plus oral, manual plus oral plus aural). Based on a review of the literature, three hypotheses were formulated stating expected main effects and interactions of language and mode. Summaries of Demographic characteristics of subjects can be found in Appendix D. The results of inferential statistical tests of the hypotheses are presented below.

1. STATISTICAL ANALYSES

Hypothesis 1: Comprehension will be at a maximum for mode in the manual plus oral plus aural mode followed by the manual plus oral mode and then the manual-only mode.

ANOVA results revealed that mode was not significant (see Table I). The first hypothesis was not supported.

Hypothesis 2: Comprehension will be greater for stories told in ASL than for stories told in SE.

The main effect for language approached statistical significance ($p = .0576$; see Table I), with the ASL mean exceeding that for SE under all experimental conditions (see Table II).

Table I - Summary of Repeated Measures Analysis of Variance of Comprehension Scores

Source of Variation	df	Mean Square	F	Probability (a)
<hr/>				
Between Subjects				
Language	1	29073.9	3.98	.0576
Gender	1	7268.5	0.99	
Combination	2	3099.9	0.42	
Lang X Gend	1	1281.3	0.18	
Lang X Comb	2	13354.0	1.83	
Gend X Comb	2	1814.6	0.25	
Lang X Gend X Comb	2	8712.3	1.19	
Persons (within Lang, Gend, and Combination)	24	7311.0	-	
Within Subjects				
Mode	2	2823.4	1.65	.0010
Order	2	13675.8	8.01	
Story	2	3860.8	2.26	
Lang X Mode	2	5707.2	3.34	
Lang X Story	2	5409.0	3.17	
Lang X Order	2	555.3	0.33	
Gend X Mode	2	2866.8	1.68	
Gend X Story	2	2189.1	1.28	
Gend X Order	2	743.4	0.44	
Lang X Mode X Gend	2	854.8	0.50	
Lang X Ord X Gend	2	3888.8	2.28	
Lang X Sto X Gend	2	776.2	0.45	
Ord X Person (within Lang, Gend, and Combination)	48	1706.3	-	

(a) Probabilities are given for all effects where $p < .10$.

Table II - Comprehension Means for ASL and SE, by Levels of Five Independent Variables

<u>Factor</u>	<u>Level</u>	<u>Language</u>	
		ASL	SE
Modes	Manual	- 68.2	47.6
	Manual+Oral	- 65.8	59.8
	Manual+Oral+Aural	- 66.3	60.1
Gender	Female	- 70.6	57.4
	Male	- 62.9	54.2
Story	A	- 59.8	55.0
	B	- 72.6	52.4
	C	- 67.9	60.1
Order	First	- 60.6	48.0
	Second	- 71.3	63.4
	Third	- 68.4	55.7
Combination	1	- 68.7	49.3
	2	- 73.4	56.2
	3	- 58.1	61.9

Table III - Comprehension Means for Levels of Six
Independent Variables

<u>Factor</u>	<u>Level</u>	<u>Comprehension Means</u>
Language	American Sign Language	- 66.8
	Signed English	- 55.8
Mode	Manual	- 57.9
	Manual+Oral	- 62.8
	Manual+Oral+Aural	- 63.2
Gender	Female	- 64.0
	Male	- 58.6
Story	A	- 57.4
	B	- 62.5
	C	- 64.0
Order	First	- 54.4
	Second	- 67.4
	Third	- 62.1
Combination (see Figure 2)	1	- 59.0
	2	- 64.8
	3	- 60.0

Given this pattern, and the alpha level of $p < .0576$, the language effect warrants discussion. The language factor level means were: ASL, 66.8; SE, 55.8 (see Table III).

There was a significant main effect found for order (see Table I). As shown in Figure 3 (and confirmed by the post hoc analysis) there was a significant increase in scores from the first to the second presentation (see Table IV). Means from first and third, and from the second and third presentations were not found to differ significantly. The difference between the means of the first and second presentations likely resulted from practise and task familiarization. The slight decrease in scores from the second to the third presentation may have resulted from fatigue.

Hypothesis 3: The addition of the oral and aural modes to the manual-only presentation will result in greater increases in comprehension scores when SE is the language of presentation than when ASL is presented.

Table I shows that there was a significant interaction effect between mode and language. Figure 4 illustrates the interaction found. The most obvious reason appears to be that stories in the manual-only mode were more easily reproduced when they were presented in ASL rather than in SE. Using the Bonferonni t statistic the difference between these scores was found to be significant (see Table V).

The difference in scores between the manual mode and the manual plus oral mode was also examined. A significant

Figure 3 - Mean Comprehension Scores by Order of Presentation

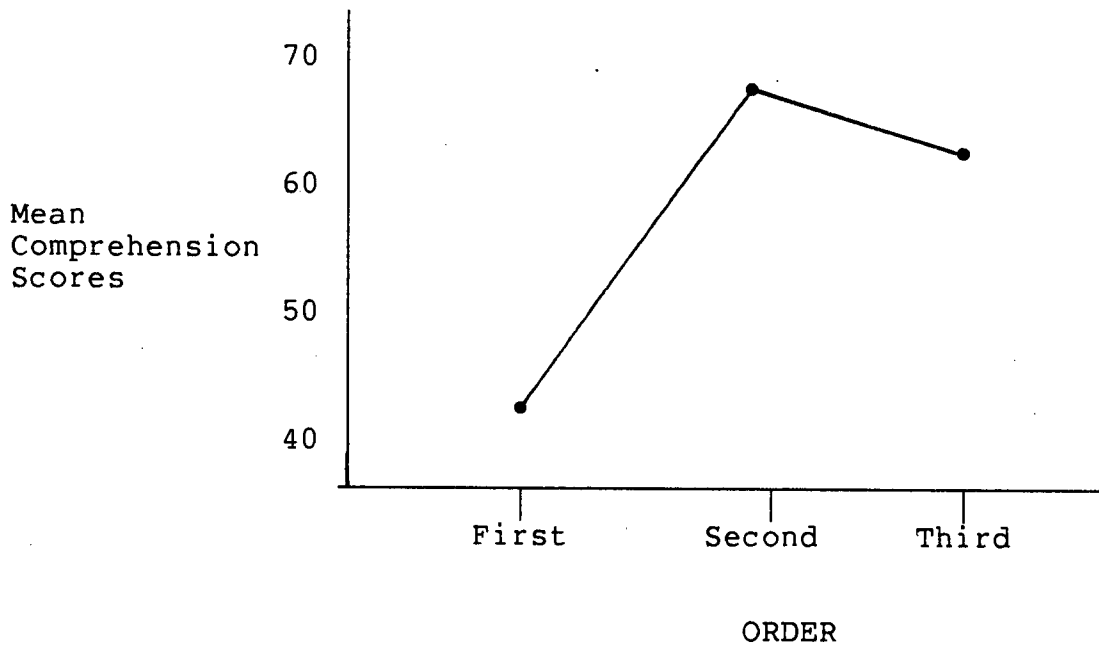


Table IV - Bonferonni t statistic: Significance of
Differences Between Orders

		<u>Differences between comprehension scores</u>		
		1	3	2
<u>Order</u>	<u>Score (a)</u>			
1	= 163.3	-	22.9	38.8 *
3	= 186.2		-	15.9
2	= 202.1			-

(a) Mean scores are reported as the sum over three judges.

* $p < .05$

Figure 4 - ASL and SE Mean Comprehension Scores by Mode

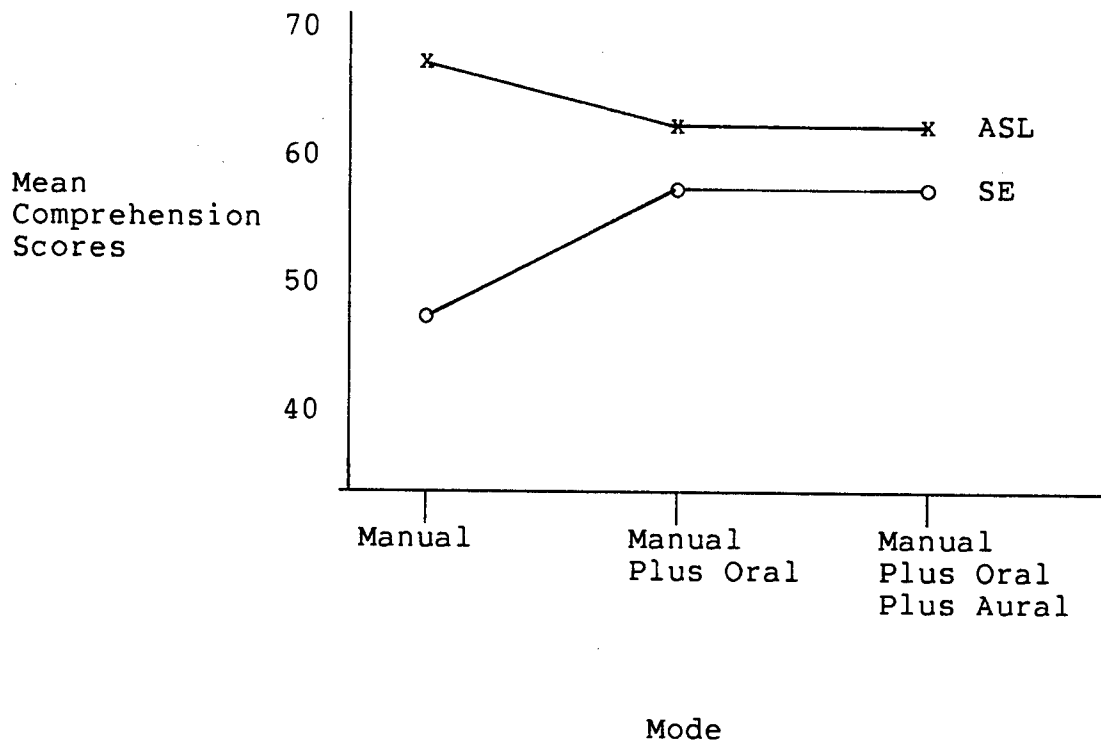


Table V - Bonferonni t statistic: Significance of Language Differences by Mode

		<u>Differences between comprehension scores</u>					
		4	5	6	2	3	1
<u>Combination</u>	<u>Score (a)</u>						
4. (SE,M)	142.7	-	36.7*	37.5*	54.6*	56.2*	61.9*
5. (SE,MO)	179.4		-	0.8	17.9	19.5	25.2
6. (SE,MOA)	180.2			-	17.1	18.7	24.4
2. (ASL,MO)	197.3				-	1.6	7.3
3. (ASL,MOA)	198.9					-	5.7
1. (ASL,M)	204.6						-

Levels are: ASL -- American Sign Language

SE -- Signed English

M -- Manual

MO -- Manual plus Oral

MOA -- Manual plus Oral plus Aural

(a) Mean scores are reported as the sum over three judges.

* - $p < .05$

Figure 5 - ASL and SE Comprehension Scores by Story

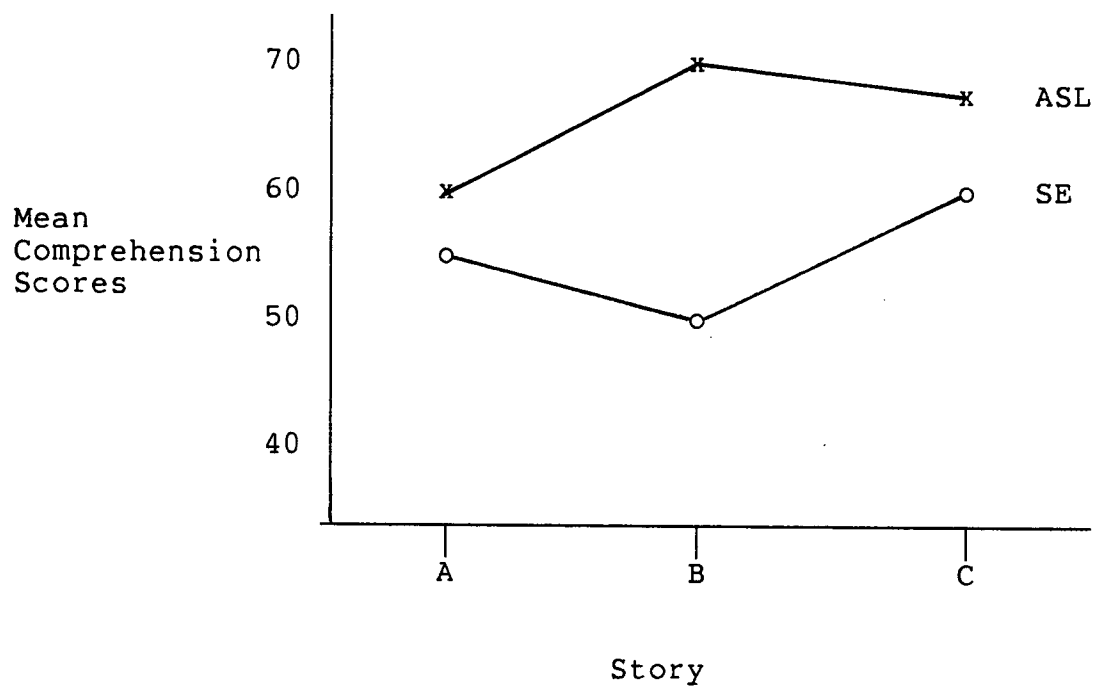


Table VI - Bonferonni t statistic: Significance of Language Differences by Story

		<u>Differences between comprehension scores</u>					
		5	4	1	6	3	2
<u>Combination</u>	<u>Score (a)</u>						
5. (SE,B)	157.2	-	7.9	22.1	33.0	46.5*	60.6*
4. (SE,A)	165.1		-	14.2	25.1	38.6*	52.7*
1. (ASL,A)	179.3			-	10.9	24.4	38.5*
6. (SE,C)	190.2				-	13.5	27.6
3. (ASL,C)	203.7					-	14.1
2. (ASL,B)	217.8						-

Levels are: ASL -- American Sign Language
 SE -- Signed English
 A -- Story A
 B -- Story B
 C -- Story C

(a) Mean scores are reported as the sum over three judges.

* $-p < .05$

difference was found when the language of presentation was SE and not ASL (see Table V). That is, when speechreading was added to signs the subjects were able to reproduce more of the SE stories, but scores did not change when speechreading was added to stories presented in ASL. The decrease in ASL scores from the manual-only mode to the manual plus oral mode was not significant. Therefore, the hypothesis for a language by mode interaction was accepted.

A significant interaction effect was also found between language and story. From Figure 5, it appears that Story B was more difficult to recall when presented in SE and easier to recall in ASL, than the other two stories. The results of the Bonferonni *t* statistic confirmed this (see Table VI). Furthermore, when the language of presentation was ASL, scores for Story B were higher than those for Story A ($p < .05$). It seems that equating the stories on the basis of written English criteria is an inadequate procedure when stories are to be signed in ASL or SE.

2. ANALYSES OF LANGUAGE OF REPRODUCTION

In addition to the major hypothesis of this study the effects of the dominant language on unbalanced bilingual subjects were examined. It was predicted that subjects would tend to reproduce the stories in their strongest language.

Initially, subjects were classified on the basis of ratings

by four judges of signing skills in SE and ASL. The higher rating of the two languages was then used as the basis for assigning dominant language status. Results of this first step showed 27 subjects to be ASL dominant bilinguals, seven subjects as English dominant bilinguals and two subjects as balanced bilinguals (see Table VII). Next, ratings on the subjects' signing of stories were collected. A seven point rating scale was used by the judges and the subjects were divided as follows:- A score of 3.5 or less was seen to be indicative of signing in ASL and a score greater than 3.5 was indicative of signing in SE. (Note: Due to the lack of definitive research that clearly defines the boundaries of ASL, SE, and Pidgin Sign English, a third category for PSE was omitted.)

With information available on subjects' dominant language and their language of recall, it was now possible to determine the relationship between the two (see Table VII). Of the 27 subjects who were classified as ASL dominant bilinguals, 24 reproduced stories using ASL signing. The three ASL dominant bilinguals who reproduced stories in SE had all received the stories in SE. Twelve (80.0%) of the ASL-dominant bilinguals to whom the stories were presented in SE, reproduced the stories in their dominant language, ASL.

Of the seven SE dominant bilinguals, five (71.4%) reproduced the stories in ASL and two (28.6%) reproduced them in SE. Of the five subjects who reproduced the stories in ASL two of them had watched stories which were presented in SE. Finally, of the two who reproduced stories in SE one had watched

an ASL presentation and the other an SE presentation.

The two bilingual subjects had been presented with stories in ASL and both subsequently reproduced the stories in ASL.

On the basis of these results two statements can be made. First, ASL dominant bilinguals generally preferred to reproduce stories in their dominant language. Second, SE dominant bilinguals also generally preferred to use ASL as their language of communication when reproducing stories. The prediction that subjects will tend to reproduce stories in their strongest language holds true for ASL dominant bilingual subjects but not for SE dominant bilinguals. Thus, for signing deaf students ASL was the preferred language for reproducing stories.

One further statistic on the language of reproduction is presented at this time. The type of translation that occurred is important because it allows comparison with previous bilingual research. Table VII illustrates the language of story presentation and the respective language of reproduction. Of the 18 subjects who viewed stories presented in ASL, only one (5.5%) subject translated the stories to SE. Further inspection revealed that this one subject was a SE dominant bilingual. Of the 18 stories presented in SE, 14 (77.7%) were translated to ASL. Twelve of these translations were effected by ASL dominant bilinguals.

Table VII - Language characteristics of subjects

Signed English (SE) stories					
Subjects	Teacher Ratings		Language Dominance(a)	Judges Ratings on Reproduction	Language of Reproduction(a)
	SE	ASL			
1	3.75	2.25	+	1.56	+
2	3.75	2.75	+	3.56	-
3	3.00	1.75	+	2.11	+
4	4.50	2.55	+	2.33	+
5	2.75	2.50	+	4.56	-
6	2.75	1.50	+	2.11	+
7	4.00	2.00	+	1.56	+
8	2.25	1.25	+	1.67	+
9	3.00	1.25	+	1.56	+
10	3.00	2.00	+	3.22	+
11	4.00	2.25	+	3.67	-
12	1.00	4.00	-	5.89	-
13	4.25	3.00	+	2.89	+
14	4.25	2.75	+	2.33	+
15	2.00	3.00	-	2.78	+
16	2.00	3.00	-	3.22	+
17	4.00	2.00	+	1.67	+
18	5.00	1.00	+	1.78	+
American Sign Language (ASL) stories					
19	3.25	1.50	+	1.44	+
20	1.75	3.75	-	1.89	+
21	3.00	2.00	+	1.89	+
22	3.00	1.50	+	1.67	+
23	1.75	1.25	+	1.56	+
24	4.00	2.00	+	1.78	+
25	4.00	3.00	+	1.44	+
26	2.00	2.25	-	3.56	-
27	1.00	1.00	*	1.67	+
28	2.00	1.50	+	1.33	+
29	3.00	2.75	+	2.44	+
30	2.00	1.00	+	1.44	+
31	3.00	2.00	+	2.33	+
32	2.00	2.00	*	2.11	+
33	3.25	2.25	+	2.56	+
34	2.00	3.00	-	1.67	+
35	2.00	3.00	-	2.89	+
36	2.75	1.25	+	1.78	+

(a) + = ASL; - = SE; * = Balanced

3. INDIVIDUAL DIFFERENCES

In the third part of this chapter, correlational techniques are used to relate biodemographical data to subjects' scores on the experimental tasks. The Pearson correlation procedure was used to correlate each of the variables with the subjects' average score on three stories. The intent of this analysis was to determine which of the biodemographic factors affected the subjects' scores. Only one of the variables, SE Signing skills, was found to be significantly related to comprehension scores.

Appendix D lists the biodemographic data that were examined. The average age of the subjects was 16 years 9 months, the average age for the onset of deafness was 3.2 months, the average age subjects learned to sign was 81.0 months, and the average hearing threshold level in the better ear at 500, 1000, and 2000 Hertz (ANSI) was 99.8 decibels with a range of 83 decibels to 113 decibels. Other biodemographic variables investigated were etiology, history of educational settings, history of communication methods used, age at which hearing aid use began, present use of hearing aids at home and at school, and hearing status of parents and siblings.

The variable signing skill was based on the average ratings of four teachers who knew the subject well. The five point subjective scale had teachers choosing from a score of "one" for excellent signing skills to a "five" for poor signing skills. The average signing skill across all subjects in ASL was 2.1 and in SE, 2.9. A significant positive correlation was found between SE signing skills and comprehension scores regardless of

whether SE or ASL stories had been presented ($r=.5946$; $p<.001$). This was the only variable examined that had a significant relationship with subjects' comprehension of stories.

4. SUMMARY OF FINDINGS

In the present chapter, the results of subjects' comprehension of stories under three modal conditions and two languages were analysed. Analysis of variance showed order to be the only significant main effect, with the lowest score being attained on the first presentation. Effects for language, mode, gender, and story were not found although the language effect came close to significance. There was an interaction effect between mode and language with the manual plus oral mode leading to an increase in comprehension over the manual-only mode when the stories were presented in SE. There was also a language by story interaction with Story B obtaining higher comprehension scores when signed in ASL compared with the same story signed in SE.

The prediction that the dominant language would be used in story reproduction was borne out for ASL dominant bilinguals. It must also be noted that Signed English dominant bilinguals ($N=7$) preferred to reproduce stories in ASL, and this was also the case with the two balanced bilinguals.

Age, age at onset of deafness, hearing loss, age learned to sign, signing skills in ASL and SE, etiology, history of educational settings, history of communication methods used, age at which hearing aid use began, present use of hearing aids at home and at school, and hearing status of parents and siblings

were examined as possible biodemographic factors which could influence deaf students' comprehension of signing. It was found that SE signing skill was the only variable significantly correlated with subjects' total scores on the experimental tasks. The following chapter presents a discussion of these findings.

V. DISCUSSION OF RESULTS

Over the last fifteen years in education of the deaf, total communication programs rapidly have become a dominant force in teaching methodology. The foundation of total communication rests on the utilization of a simultaneous combination of audition, speechreading, and signing to facilitate greater comprehension in communication (Vernon, 1972). In adhering to the language of the majority, sign systems with English-based syntax have been preferred. In British Columbia, for example, the sign system utilized is Signed English, which borrows signs found in American Sign Language -- the language used in deaf communities across Canada and the United States.

In the review of the literature, questions were raised concerning the methodological techniques used in previous studies which purport to demonstrate the effectiveness of multi-modal over uni-modal presentations. The literature also revealed a recent trend amongst educators and researchers to question the practicality of omitting ASL from the curriculum of total communication programs. For these reasons it seemed timely to explore the effects of various modal and language conditions on deaf students' comprehension of stories.

1. MODAL CONDITIONS AND THE COMPREHENSION OF STORIES

Recall scores under manual-only, manual plus oral, and manual plus oral plus aural modal conditions showed no overall improvement as modes were added. This differs from other researchers who utilized different methodological procedures and

found multimodal presentations to be superior to unimodal ones in comprehension and learning tasks (Klopping, 1972; Moores, Weiss, & Goodwin, 1973; White & Stevenson, 1975; Carson & Goetzinger, 1975; Brooks, Hudson, & Reisberg, 1981; Pudlas, 1984). Here, it was found that when language was not taken into consideration, there was no significant increase with the addition of modes. However, as will be discussed later, there was a language by mode interaction, with the use of speechreading and signs leading to improved scores over the sign only presentation in SE.

Using a different experimental design and task, Beckmeyer (1976) came to a similar conclusion. He found that bimodal presentations were not necessarily superior to unimodal presentations and he suggested that the efficiency of a particular communication method is dependent upon the preference of the individual. The present study is also consistent with an earlier finding by White and Stevenson (1975). They found that although the signs plus speech mode resulted in higher scores than the speech only mode, there was no significant difference when bimodal results were compared with the sign only mode.

Historically, ASL has not been regarded as a language. It has been defined as a manual form of broken English with the implication that ASL could not compete with oral languages as a means of communication (Markowicz, 1977). Over the past twenty years however, these criticisms have been systematically refuted by researchers investigating the linguistics of ASL (Stokoe, 1960, 1981; Friedman, 1977; Wilbur, 1979; Klima & Bellugi,

1979). Largely on the basis of their work, ASL has been established as a language per se. There is no reason for expecting communication in ASL to be less effective than communication in spoken English. The only source of differences might be the fluency of users in either language.

There are two possible reasons why adding modes did not help under ASL presentations. First, it may be that the obtained comprehension scores represent the best that could have been expected given the conditions of the experiment. That is comprehension and memory in the manual-only mode was sufficient to the point where additional modes did not help. All information that could be retained from the story was already picked up in the manual-only mode, and the oral and aural modes only served to reinforce this information. Secondly, it is possible that signs in ASL syntax do not match speech signals as well as signs presented in English syntax. That is, it may not be as simple to match auditorily-based signals (speech) with visually-based ones (ASL signs) especially when both signals were developed for different languages.

Signed English is a visual representation of an auditorily-based language. The signals produced by hand movements convey messages that have auditory counterparts. The addition of inputs in the oral and aural modes might be expected to enhance the matched information which is being processed manually. For example, these modes might provide the observer with a clue as to the correct meaning of a sign which was not perceived clearly enough or which seemed to be out of context. This would be

conditional on the intersensory integration mechanism being both applicable and functional in the context of the present experiment. Although no overall effect for mode was observed, future research should formulate similar hypotheses taking into consideration the language of the signs being used.

Finally, it must be noted that the aural mode might have presented signals too weak for detection by the subjects. The average hearing threshold level of the subjects was 99.8 decibels. In the study, the volume for speech was set at conversational level which is usually between 60 and 65 decibels. The rationale for this procedure was that it allowed a close simulation of a total communication environment. Although an examination of the subjects' use of hearing aids and auditory skills might have clarified this study's findings, its omission does not detract from the importance of the results: In a total communication setting the additional use of speech and audition does not appear to yield greater comprehension than that obtained in a signing only situation when ASL is the language of presentation.

2. LANGUAGE AND THE COMPREHENSION OF STORIES

A greater amount of content was reproduced when stories were signed in ASL than when they had been signed in SE. This result was significant when signs were the only mode used, but not when oral information was added. However, the overall difference between language approaches statistical significance at $p = .0576$. The fact that under all experimental conditions ASL scores were higher than SE scores warrants a discussion of

the possible reasons for the obtained differences in language.

There is very little research available with which to compare this finding. In a short story comprehension task, Hatfield, Caccamise, and Siple (1978) and Ouellette and Sendelbaugh (1982) found no difference in scores between manually-coded English and ASL. In another comprehension task, scores on Siglish signed passages were significantly higher than those on ASL signed passages (Higgins, 1973). However, a later study by Murphy and Fleischer (1977) found that there was no difference in comprehension scores obtained through Siglish and ASL presentations. The present experimental results provided evidence that ASL stories are more easily reproduced than SE stories even when the students have experienced a large part of their education in a total communication setting which utilized SE.

The power of the experimental design highlights the advantage of ASL for deaf students who have had at least five years' experience with total communication. Higher scores for ASL presentations were obtained under all conditions of gender, modes, stories, and order of presentations. These scores were not affected by demographic factors. Regardless of age, etiology, onset of deafness, hearing threshold levels, age at which sign was learned, signing skills in ASL and SE, age hearing aid use began, history of educational settings, history of communication methods used, present use of hearing aids at home and at school, and hearing status of parents and siblings, deaf students comprehended ASL presentations better than SE

presentations.

An interesting supplementary finding is that subjects' skill in SE was positively correlated ($r = 0.5946$; $p < .001$) with comprehension scores for both ASL and SE presentations. On a descending five point rating scale for signing skills the overall average for ASL was 2.12, with a range from 1.00 to 3.75, and for SE the average was 2.92 and ranged from 1.00 to 5.00. The higher rating and smaller range in ASL are indicative of the homogeneity of the group with respect to that language. This is not unusual when one considers that ASL is the language of the deaf community (Kannapell, 1982; Stewart, 1982). Similarly, one might expect hearing adolescents to have highly developed speech skills with little variation between good and poor speakers. There may have been little correlation of skill in ASL with comprehension scores due to the higher development of ASL across subjects. Thus, the correlation between SE signing skills and comprehension may have been obtained because of greater individual differences between the subjects' development of Signed English. As differences in SE skills approach zero a similar reduction in the correlation with comprehension would likely occur.

Perhaps ASL stories were better reproduced simply because ASL syntax has its basis in a visual-spatial medium. Research by Tweney and Heiman (1977) showed that ASL grammatical structure facilitated better recall than a random string of ASL signs. Perhaps ASL permits better results because it has evolved to match the articulatory dynamics of a visual-spatial

mode, whereas SE utilizes a visual-spatial medium in an attempt to represent the temporal auditory components of the English language. As suggested by Kretschmer and Kretschmer (1978) the simultaneous reception of symbolically different auditorily-based and visually-based systems may not be advantageous.

Finally, consideration must be given to the language characteristic of the sample. The teachers' ratings of the signing skills of the subjects and the subjects' use of language in reproducing the stories both showed that the sample was composed mainly of ASL dominant bilinguals. This fact may have accounted for some of the subjects doing well on ASL stories. However, the low reading level of the stories cautions against using language dominance as the sole reason. When one considers that SE has been the official sign system for total communication programs in the province for the past six years, the higher scores obtained in ASL presentations urges one to question current teaching methods. Perhaps deaf students have become ASL dominant bilinguals because the language itself is more conducive to comfortable communication. Being conceptually based it may allow for an easier internalization of the world around them. This would lead not only to its use amongst ASL signers but also to more relaxed behaviour in stressful situations such as the classroom and the experimental conditions of this study.

3. MODES OF COMMUNICATION AND LANGUAGE

A significant interaction was observed between modes of communication and language. To date, there are no known studies with which this result can be compared. It had been hypothesized that an interaction would be evidenced with increased comprehension of SE correlating with the addition of the oral and aural modes. Briefly, it is argued that because ASL develops independently of the speech and hearing systems then, for fluent signers, benefits from the aural and oral modes should not be expected. However, with SE, an advantage for multi-modal over unimodal presentations was expected due to the identical grammatical natures of SE and spoken English.

It does seem that when a language is used which has complementary signals in both the manual-only mode and the oral and aural modes then integration of information from different modes is possible. Theories of selective attention predict that some if not all of the initial sensory inputs will be processed and stored in a perceptual system (Broadbent, 1957, 1958; Deutsch & Deutsch, 1963; Treisman, 1964; Neisser, 1967; Norman, 1968). What information is drawn from this system depends upon the experiential knowledge of the receiver, the nature of the message, and the rate of presentation. The design of the present study does not allow one to make an assumption about the amount of information gathered in the oral and aural modes. However, this study did show that when SE was used input from the oral mode was processed and utilized by the observer to increase comprehension of stories. Thus, there was an advantage

of redundant and/or complementary information being presented in two modes and in English, relative to a presentation in the best single modality (Walden, Prosek, & Worthington, 1975; Erber, 1979; Baggett & Ehrenfeucht, 1981). However, the results here should not be taken as direct support for findings in intersensory interactions because the benefits of multi-modal presentations were found only with inputs in the visual channel.

The increase in SE comprehension noted in the manual plus oral mode might have been the result of the speech signals adding meaning to some of the signs that were not understood or were overlooked when presented alone. That is, it may be that lip movements helped because they matched SE better than ASL. In this instance, not only is redundant information an asset for comprehension in a manual plus oral presentation but a complementary language system must also be used in the two modes. Thus speech, being a component of an auditory language system, does not provide the same benefit when the modes of communication are used with a visually based language (e.g., ASL). Alternatively, it may also be that in the present study the scores in SE were simply low to begin with and any additional input served to increase comprehension.

Finally, there are three possible explanations for the lack of mode effect when ASL was used. First, there may have been a limit on the proportion of the story that can be reproduced with the score obtained on the manual-only mode representing this limit. A second possibility is that the subjects found it more difficult to match lip movements with ASL because speech is not

a complementary component of ASL. And lastly, the subjects had sufficient proficiency in ASL that they were able to comprehend the stories using information received in the manual-only mode alone. Possibly, some of the subjects received information in the oral and aural modes but it served to reinforce and not add to the information that was obtained in the manual-only mode. The typical manner of observing a signer includes watching the face of the signer (who may or may not also be speaking). The oral and aural inputs may have reinforced the manual only input and made reception in the manual plus oral plus aural mode easier to observe without increasing comprehension. Perhaps in a multimodal situation, attention is allowed to switch between different modes thereby relieving the strain of focusing on just one mode. Further research is necessary to explore these possibilities and to distinguish the contributions of each mode in a multimodal presentation.

4. DOMINANT LANGUAGE EFFECTS

It was predicted that unbalanced bilingual subjects would reproduce stories in their dominant language. This was confirmed for ASL dominant bilinguals. For SE dominant bilinguals however, ASL was also their preferred language of recall.

It is only the results ASL dominant bilinguals which support previous findings that indicated stressful situations often induce subjects to translate from the nondominant to the dominant language (Goggin & Wickens, 1971; Macnamara & Kushnir, 1971; Dornic, 1979, 1980). The present experiment involved

conditions which likely contributed to stress. During the testing period the subject was in the company of two adults, aware that he or she was being videotaped, and was under instructions to reproduce as much as possible. Reproducing the stories in ASL may well have made a stressful situation more bearable.

The ease of conversing in ASL could be attributed to its nature. Although, SE uses ASL signs, the syntax of English has the signs utilized in a different order and a different form than that of ASL. This may be a critical point as syntax may be pertinent in establishing the intended meaning of a particular sign. Translation from SE to ASL would occur if a subject felt that this was a more appropriate and comfortable medium in which to base one's conception of the story. Furthermore, given that the SE stories were understood, a translation would be favoured if it allowed greater flexibility for the signer in the retelling.

Memory limits might also have had an effect on translation. In Chapter II it was suggested that memory for signs is enhanced by linguistic properties specific to sign language and that the encoding of signs was influenced by these phonological, morphological, and grammatical qualities. For example, Tweney and Heiman (1977) found that ASL grammatical structures facilitated the recall of signed sequences over random strings of ASL signs. The sequencing of SE however, cannot be compared with random strings of ASL signs; but the possibility remains that the reproduction of ASL signs in English word ordering

could be more difficult than is the case with ASL. Hence, translation to ASL might be used as a strategy to facilitate memory.

Finally, the method used to determine language dominance for the sample's unbalanced bilinguals is not a standardized procedure although it was recommended by Macnamara (1967) as being an accurate measure of language dominance in oral bilinguals. At present, all that can be said is that future research is required to explore the evaluation of language dominance in signing bilinguals.

VI. SUMMARY, CONCLUSIONS, IMPLICATIONS, LIMITATIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH

1. SUMMARY

This study examined deaf students' comprehension of stories under two language conditions and three modal conditions. One of the languages, English, was represented by Signed English, which is the sign system recommended for use in all total communication programs in the province of British Columbia. The other, American Sign Language, is recognized as the language of the Deaf community. The three modal conditions were: manual-only, manual plus oral, and manual plus oral plus aural. The strength of vision relative to audition in deaf individuals, and the signing behavior of the sample population indicated that the manual mode should be present in all three conditions. This decision stemmed from past research which showed multimodal presentations to be comprehended better than unimodal ones. Typically, the evidence was based on experiments showing an increase in the amount of information comprehended when the two visual modes, oral and manual, were added to the aural mode. By using the manual-only mode as the unimodal condition it was possible to re-examine multimodal presentations for the benefits of using weaker modes to supplement stronger ones. In other words the question was asked if signing by itself, was a sufficient means of communication.

Two assumptions guided this study; from sociolinguistics came the proposition that the language of the deaf community is

more efficient for comprehension than a sign system developed for the classroom; from research in simultaneous communication came the suggestion that the more inputs available to the receiver the more information that is understood. In considering the nature of the two languages, one auditorily-based (SE) and the other visually-based (ASL), it was predicted that there would be an interaction effect between SE and the modes of presentation. In addition, it was felt that the dominant language of the unbalanced bilinguals in the study would influence the subjects' choice of language in retelling the stories.

The experiment presented three stories on videotapes under six different conditions. Reproduction of the stories was videotaped and three profoundly deaf, bilingual judges scored them. High reliabilities allowed the scores to be averaged across judges. To test the hypotheses, analysis of variance was then used to determine main and interaction effects for language, treatment, gender, story, and order.

The sample consisted of 18 females and 18 males with 26 taken from the provincial School for the Deaf on-campus classes and 10 from off-campus classes. The mean age was 16 years 7 months, and the average hearing threshold level in the better ear was 99.8 decibels. Eighteen had learned to sign by the time they were five years of age, ten by seven years of age and seven after the age of seven. All had been both enrolled in total communication programs and exposed to SE for the last five years.

Data analyses revealed no significant overall mode effect: The manual plus oral and the manual plus oral plus aural modes did not result in more information being reproduced than the manual-only mode alone. The difference between ASL and SE recall scores approached significance ($p=.0576$), with ASL being higher than SE under all experimental conditions. An interaction effect between language and mode occurred with the addition of speechreading resulting in improved comprehension scores when the stories were presented in SE. Subjects who were better signers in SE also scored higher on all the retelling tasks, irrespective of whether the stories were presented in SE or ASL. An order effect was found with subjects scoring significantly higher on the second presentation than on the first one. As well there was a language by story interaction with Story B being easier to reproduce when presented in ASL than in SE. Both ASL dominant bilinguals and SE dominant bilinguals tended to recall stories in ASL.

Lastly, because there were no main effects for stories, an average score for stories was computed for each subject. These scores were then correlated with all of the demographic variables. Results indicated only one significant positive relationship. This was between SE signing skills and comprehension of stories score.

2. CONCLUSIONS

In the present study it was found that, overall, the addition of an oral mode, and then an oral plus aural mode to the manual-only mode neither increased nor decreased comprehension of short stories. However, when language was taken into account the addition of speechreading to the SE presentation did improve scores. Two conclusions can be drawn from this result. First, ASL is a language that relies on signals transmitted in the manual-only mode in order to convey messages. This is an obvious conclusion in view of the fact that ASL evolved with constraints imposed upon it by vision and the articulatory dynamics of the body. This is not to say that ASL is always signed without speech. In the study, many of the students commented that it was easier to follow a presentation (ASL or SE) that had lip movements along with signs. Miller's (1982) theory of coactivation would predict that responses to redundant messages presented simultaneously in different modes would be faster than in just one of the modes alone. Possibly, multimodal presentations, by allowing for inputs to be perceived through different modes, puts less stress on the observer. Consequently, a more comfortable level of communication is attained. Nevertheless, for the population in the present study, ASL is comprehended equally well manually as it is when speechreading and sounds are added to the manual presentation.

The second conclusion is that by itself, SE was not an efficient means for communication for the subjects of this study. Signing in SE and speech (with or without sound) must be

used together in order to attain maximum benefit. With the profoundly deaf subjects of this experiment one of the effects of at least five years exposure to SE in a total communication setting seem to have been the coordination of these two complementary communication systems. When sign systems were in their initial stage of being created the enhancement of speech signals was one of their goals. In this respect, SE seems to have been successful.

This conclusion complements findings in intersensory research which for the present experiment predicted that the amount of information processed in a multimodal presentation of redundant information would increase relative to the amount that would be processed unimodally. Although, the manual and oral modes represent an intrasensory interaction the notion is still valid that two communication modes can be simultaneously integrated given that the information they provide is complementary.

American Sign Language for the deaf students tested in this study appeared to be a more effective means of communication than Signed English in both the receptive and expressive modalities. Although this finding was only significant in the manual mode, the overall result for scores in ASL to be higher than their counterparts in SE tends to support this conclusion. The usefulness of ASL in the adult deaf community is thus extended to deaf students in total communication programs. It is of interest to note that a survey of deaf adults showed support for the incorporation of ASL into educational programs

for signing deaf students because of the ease of communication it brings (Stewart, 1982). In conjunction with this study's results it is not unreasonable to expect that the use of ASL in the classroom could facilitate more effective communication between teachers and students providing teachers have fluency in ASL.

However, the results of this study need further investigation with respect to the efficiency of language. The higher scores of ASL need careful interpretation not only because of the interaction between language and mode but also because SE is meant to be signed in conjunction with speech. It would be of interest to know if higher ASL scores could be expected across all levels of story difficulties. Given this information a curriculum for language usage in the schools might be laid out which would take account of communication level of the students.

Research on normally hearing bilinguals indicated that a translation from the nondominant to the dominant language will occur under conditions of stress (Dornic, 1979, 1980). In the present study deaf bilingual students tended to express themselves in ASL. ASL dominant bilinguals demonstrated a marked trend to translate SE stories to ASL; yet SE dominant bilinguals did not demonstrate a trend to translate ASL stories to SE. It is possible that some of the subjects may have erroneously been classified as SE dominant bilinguals. However, the implication of the present study is that all subjects tended to recall in ASL rather than SE, regardless of language

dominance.

The value of simultaneous communication in improving English communication skills of deaf individuals was demonstrated by this study. By itself, SE does not seem to be the most efficient means for conveying information. However, when grammatical complexity in English is low (e.g., the present study's reading level is Grade 2.7) SE along with speech can be comprehended at a level that is not significantly lower than comprehension of a counterpart ASL presentation.

3. IMPLICATIONS

In this study deaf students reproduced more when stories were presented only in ASL than when they were signed in SE. In ASL, students performed as well in unimodal presentations as in multimodal ones; however, in SE, the addition of speech improved the comprehension of stories. It was suggested that when knowledge of ASL was sufficient there was little to be gained in comprehension through the additional cues derived from speechreading and audition in simultaneous communication. In general, the preferred language of recall was ASL. On the basis of these experimental findings, the following implications for total communication programs are proposed:

(1) Implementation strategies for the inclusion of ASL in total communication programs should be considered. In the province of British Columbia, teachers of the hearing impaired (Stewart, 1983a) and members of the adult deaf community (Stewart, 1983b) have expressed their support for a bilingual education for students in total communication programs. If deaf

students' skills in ASL are shown to be at a higher level than their skills in SE, a program which recognizes English as a second language would seem appropriate.

An important decision in this implementation would be the establishment of the first language (i.e., the language that an individual will use for interpersonal interactions) in a bilingual program. If ASL is chosen as the first language, a conflict will be created with the signing environment of the home. Ninety percent of deaf children have parents who are hearing and whose common method of communication in the home is speech. For the few parents who do learn to sign, SE or PSE are the usual methods of communication. Therefore, at the present time one can expect little reinforcement of ASL in the home. This situation is unlike that of oral bilinguals, whose first language usually is the one spoken in the home. One could argue that in this respect, ASL is not the first language of deaf children and that English, or even a pidgin English, has a stronger claim. However, ASL does seem for whatever reason to be the language in which most deaf children are proficient, irrespective of the language used in the home. Hence, it is proposed that for signing deaf children, potential proficiency in a language be used as the criterion for first language status.

(2) Results of this study suggest that simultaneous communication may indeed help the development of aural and oral skills in deaf children. In oral communication hearing impaired youngsters are often faced with the task of understanding and

repeating messages that make little sense. A command of good signing skills could permit the youngster to comprehend the content of a signed and spoken conversation, which in turn would provide a firmer base for speech and auditory training. It has been said that signs will take away from oral skills because the deaf signer will rely too heavily upon the signs for conversing (Van Uden, 1970; Reeves, 1977). This seems unreasonable when one considers that in signed communication the eyes are focused on the lips and face of the signer. As demonstrated in research on intersensory integration, there can be a transfer of information from one mode to another. It is likely that information obtained through signs, could assist in clarifying the probable weaker signals picked up in the oral and aural modes.

(3) Deaf students' reliance upon signing for comprehension requires that teachers become good role models in the two languages. Fluency in English should be reflected in their ability to sign accurately in SE. Currently, very few teachers are able to do so. It has been suggested that most teachers' signing can be described as a Pidgin Sign English (Woodward, 1973c) or as a register of English (Cokely, 1983). It is not surprising that deaf students' writing has also been likened to the way they sign in PSE (Charrow, 1975; Jones, 1979).

From this perspective one might suggest that PSE be recognized as a third component of the signing environment in total communication programs. Perhaps, PSE could be utilized as an intermediary step between ASL and SE in deaf children's

language development. However, it is important that the target language of the hearing community, English, and of the deaf community, ASL, assume key roles in guiding the language curriculum. Possibly, the present use of PSE is a result of inconsistency in the training of teachers of the deaf. It could be that the dominance of PSE in the signing behavior of teachers results from inadequacies in the teaching of SE or ASL in training programs, and from the schools themselves not enforcing the proper use of SE. Thus, teachers use a form of signing that best approximates PSE because they have not been taught to sign, ASL or SE. The present study hints at the benefits that could result if teachers were fluent signers in the dominant language of their students.

(4) Speech must be used with SE in order to guarantee that a higher level of comprehension will be obtained. By itself, SE is relatively poorer form of communication than either ASL only or SE with speech. It would seem that for pre-school and elementary aged deaf children ASL would be a more appropriate means of communication because both the English and speech level of the children may be too low to facilitate effective communication. Certainly if efficient communication, irrespective of language usage, is the goal (Clarke, 1983), then ASL could be used as the primary language with English assuming a second/foreign language role.

4. LIMITATIONS

(1) The findings of this study are generalizable only to profoundly deaf students, 13 to 19 years of age, who have spent at least five years in a total communication program.

(2) The stories were equated on measures pertaining to English but not ASL. An interaction effect between stories and languages was found, and techniques for measuring equivalences of stories presented in ASL are required.

(3) No tests were made of speechreading ability, aural skills, or of memory capacity.

(4) A main effect for order of presentation was found. A pre-test practise story could have been useful in eliminating this effect.

5. RECOMMENDATIONS FOR FUTURE RESEARCH

(1) Replication of this study in other total communication programs should be undertaken. Wherever possible, information should be gathered on students' academic achievement levels to determine pertinent relationships. This may be of assistance in remediation programs. Students' preference for a particular modal condition should also be considered. In addition, hearing subjects should be tested for comprehension of the same stories. This might assist in determining if there are memory limitations acting on the recall of the stories.

(2) Research is needed to design implementation strategies for bilingual programs and to evaluate the effectiveness of such programs in a total communication framework.

(3) Measurement techniques evaluating signing skills in SE and ASL should be developed in both the expressive and receptive areas. This could be of benefit in the assessment of teachers' as well as students' skills.

(4) To date, many studies have focused on maximizing the information acquired in multi-modal presentations. Much of the research is geared to identify the benefits obtaining to the development of English, speechreading, and aural skills through the use of simultaneous communication. The relationship of these skills to ASL must also be determined if we wish to create optimal learning environments for signing deaf students.

(5) It would be of interest to look at other ways of examining the protocols in order to investigate time to retell, sequencing of story, and other variables.

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APPENDIX A - SCORING INSTRUMENT*

Subject:.....
 Date Scored:.....
 Score:.....

Story A: The Man Who Cleared His Name

A. Character Analysis (30)

Recall	Development
Jim (5)	Worked, killed (5)
Bill (5)	Owner, dream (5)
Police (3)	Investigate Jim's death (3)
Bill's wife (2)	Police phoned her (2)

B. Theme (20)

A person who has died may come back, (as a ghost)
 to clear any misunderstandings. (10)

Sometimes we must trust what our dreams tell us. (10)

C. Plot (20)

When Jim got his job back, why did he disappear? (6)

Was that a real ghost in Bill's dream explaining
 that Jim did not kill himself? (7)

Will they find out how Jim died? (7)

D. Events (30)

A year after Jim quits his job Bill spots him on the
 street dressed in poverty. (4)

Bill gives Jim his old job back and Jim goes to a
 big party for the people who work at Bill's store. (4)

Bill does not go to the party, but has a dream in
 which Jim says people blame him for something he
 did not do. (6)

Jim never shows up for work so Bill ask police to
 investigate. Police tell Bill's wife that Jim
 committed suicide. (5)

Bill doubts the policy story and asks for further

investigation. Police find out Jim drank poison from a bottle he brought home from the party. The poison killed Jim. (7)

So it was the ghost in Bill's dream that informed Bill that Jim did not kill himself. (4)

E. Additional Information:

F. Rating of subject's signing

1	2	3	4	5	6	7
ASL			SE			

A. Character Analysis

B. Theme.....

C. Plot.....

D. Events.....

E. Additional Information.....

Total Points.....

* (#) - numbers in brackets indicate the points allotted for the part.

Subject.....
 Date Scored:.....
 Scorer:.....

Story B: The Ghost Who Outsmarted his Relatives

A. Character Analysis (30)

Recall	Development
Bob (4)	Loves Sue, dies (4)
Sue (4)	Does not get money (4)
Relatives, families (2)	Do not like Sue (2)
Woman (2)	Message from Bob (2)
Banker (1)	Gets Box (1)
Mechanic (1)	Gets Car (1)
Lawyer (1)	Should receive letter (1)

B. Theme (20)

Ghost will return to help when it has
 unfinished work left. (10)

Cannot stop two people's love for each other. (10)

C. Plot (20)

When Bob and Sue get married will the relatives approve? (10)

How will Bob inform Sue about the valuable things he
 has left for her? (10)

D. Events (30)

Relatives do not want Bob and Sue to marry and will take
 everything away if they do. (4)

Bob and Sue marry and go to France to visit
 relatives who are not nice to Sue. (5)

Bob has heart attack and dies. (2)

Relatives give nothing to Sue and tell her to leave
 the country. (3)

Woman passes message from dead husband to Sue. (3)

Sue follows message by going to the bank and garage. (2)

Sue gets money, diamonds, car, and letter. (4)

Letter should go to Lawyer but Bob dies before that could be done. (2)

Bob explains in letter that he knows about his relatives plan to keep all the money so he has hidden valuable things for Sue. (4)

E. Additional Information:

F. Rating of subject's signing

1	2	3	4	5	6	7
ASL					SE	

- A. Character Analysis.....
- B. Theme.....
- C. Plot.....
- D. Events.....
- E. Additional Information.....

Total points.....

Subject:.....
 Date Scored:.....
 Scorer:.....

Story C: The House That Was Not There

A. Character Analysis (30)

Recall	Development
Bill (4)	Invites John & Ken, doubts story (4)
John (4)	Visits Bill; stays in car (4)
Ken (4)	Visits Bill; asks for direction (4)
Man (3)	Gives directions to Ken (3)

B. Theme (20)

Ghost will help people in times of trouble. (10)

Although you might not believe someone
 you should check it out. (10)

C. Plot (20)

Bill invites John and Ken who become lost in the
 snow on their way to Bills. (7)

Who gives directions to Ken on finding Bill's
 house? (6)

Does Bill believe their story and how do they
 check this out? (7)

C. Events (30)

Bill invites John and Ken for a visit. On their
 way to Bill's they become lost in the snow. (5)

Ken spots a lighted house on top of a hill.
 They drive up, open a metal gate, then Ken asks
 the man at the house for directions to Bill. (7)

Ken gives the man a coin then Ken and John
 drive to Bill's place late at night. (4)

Bill does not believe John and Ken's story about
 the house because it burned down 20 years ago. (4)

The next morning, the three of them drive to

the house and find that it was burned down.
 The metal gate has not been open for a long time.
 But they see the car tracks and footprints. (7)

They find the coin in the snow. (3)

E. Additional Information

F. Rating of subject's signing

1	2	3	4	5	6	7
ASL					SE	

- A. Character Analysis.....
- B. Theme.....
- C. Plot.....
- D. Events.....
- E. Additional Information.....

Total Points.....

APPENDIX B - STORIES IN ENGLISHSTORY A: THE MAN WHO CLEARED HIS NAME

Jim worked at Bill's store for three years. Then one day Jim decided to quit his job at the store. About a year later, Bill was walking down a street when he saw a young man. The man seemed depressed and sick. He was very thin and his clothes were old. He looked like he might be broke. Suddenly, Bill realized that the young man was Jim. Bill offered Jim his old job back because Jim had been a good worker. Jim was very thankful and accepted the job.

Every year Bill had a party for the people who worked in Bill's store. Bill was too busy to attend but Jim went to the big party. The same night as the party, Bill had a strange dream. He dreamed that Jim was talking to him about something very important. Jim said that people blamed him for something, but that he did not do it. Jim did not want Bill to think that he was guilty of it. Jim said that he was innocent.

After the party, Jim did not go to work for several days. He never phoned Bill to explain why he wasn't coming to work. Finally, Bill began to worry about Jim. He tried to contact Jim but was not successful. He phoned the police. He asked the police to find out what had happened to Jim.

When Bill arrived home from work, his wife informed him that something terrible had happened. The police said that Jim had killed himself. It happened right after the party. Bill thought about the dream that he had the night of the party. Bill told his wife that the police were wrong about Jim's death. Bill did not believe that Jim had killed himself. Bill told the police to investigate Jim's death more.

The police later found out that they had made a mistake. Jim's death had been an accident. Jim left the party with a bottle and went home. He thought that it was a bottle of alcohol, but it was really poison. Jim had a drink from the bottle and the poison killed him. When the police found his body, they thought that he had killed himself. So the night of Jim's death, his ghost came back in Bill's dream. Jim's ghost told Bill that Jim did not kill himself.

STORY B: THE GHOST WHO OUTSMARTED HIS RELATIVES

Bob loved Sue very much but his family did not want him to marry her. His relatives would take away all of his money if he married her. Bob and Sue married anyway. After the wedding, they went to visit Bob's relatives in France. They wanted his

family to meet Sue, but his family was not nice to Sue. His relatives thought that Sue did not really love Bob. They said that she only wanted his money.

Then one day a terrible thing happened. Bob had a heart attack and died. His family ordered Sue to leave the country. Sue kept the jewelry and clothes that she was wearing. Bob's family permitted Sue to keep nothing else. Sue decided to go to England and a lucky thing happened to her there. One day she was talking to a woman when the woman suddenly sat up straight and became very stiff. The woman told Sue that she had a message for her. The message was from her dead husband. The woman began writing very fast on a piece of paper.

The woman wrote the address of a bank, a man's name, and a number on the paper. Sue went to the bank and she asked for the man. She showed the man the number. He gave her a special box that matched the number. She found money, diamonds, car keys, and the address of a garage inside the box. She went to the garage and gave the car keys to a mechanic. The mechanic went to get the car that matched the keys. She found another box inside the car. There were more money, diamonds, and a letter inside this box.

Sue's husband had written the letter before he died. The letter explained that Bob knew that his relatives would cheat Sue. They would keep his money and diamonds and give Sue nothing. But Bob wanted Sue to have his money and valuable diamonds. Bob had an idea. He decided to hide his money and diamonds from his relatives. He would tell Sue where he had hidden his money and diamonds. This way Sue would be able to have his money and diamonds. But Bob died before he gave the letter to his lawyer. So Bob's ghost returned from the dead. His ghost told Sue where she would find the money, the valuable diamonds and the letter.

STORY C: THE HOUSE THAT WAS NOT THERE

Bill invited his friends, John and Ken, to visit him. While John and Ken were driving to Bill's, it began to snow. John and Ken became lost in the deep snow. Ken noticed a light a few miles away, so they drove toward it. They soon came to a large metal gate. A huge house was behind the metal gate, at the top of the hill. Some lights were on in the house.

They opened the gate and drove up to the house. Ken went to ask for directions and John stayed in the car. Ken went to the front door and rang the doorbell. A man answered the door. When Ken finished talking to the man, he gave the man something. Then Ken went back to the car. The man had explained how they could get to Bill's house. John asked Ken what he had given the

man. Ken told John that he had given the man a coin for his help.

The two men followed the man's directions. They arrived at Bill's house late that night. They explained to Bill what had happened. They told Bill about getting lost, the house, the man, and the coin. Bill listened to all of their story. When they had finished, Bill told them that he did not believe a word of it. Bill said that they couldn't have visited that house because it burned to the ground 20 years ago.

So the next morning, the three of them drove to the house to see if it was there. When they reached the gate, it was locked. It looked like it had not been opened for years. The men looked up the driveway but did not see a house at the top of the hill. They only saw the house that had burned down. Then they noticed car tire tracks that continued up the driveway. The gate was locked, but the tracks did go up to the house. The tracks, also, went back down to the gate. The tracks proved that a car had been there.

The three men ran to the top of the hill. They found clear footprints that went to the house and away from it. They found the most surprising thing of all at the door of the burned house. Something was brightly shining in the snow. It was the coin that Ken had given the man.

APPENDIX C - STORIES IN AMERICAN SIGN LANGUAGE

KEY TO AMERICAN SIGN LANGUAGE TRANSCRIPTIONS **

Symbol	Explanation	Example	Translation
+	repeated once	KNOW+	I know
++	repeated two or more times	KNOW++	I know about that
(2)	signed with both hands	BROKE(2)	broken; damaged
LH; RH	signed with only the left or right hand	he=GIVE (RH)=her	he gives to her
R; L	signed on the right or left side	INFORM-L	inform, informed
F	signed in the front area of the signer's space	ASK-F	Ask
S	signed in the side area of the signer's space	(see 'RS')	
B	signed in the back area of the signer's space	HIS-LB	his
LF	signed to the left and forward	GO-LF	go there
RS	signed to the right and on the side	STAY-RS	stay there
LB	signed to the left and back	HE-LB	he, him
<u>TO</u>	underlining indicates that the word was not spoken when speech was used.	<u>TO</u>	sign, but do not say the word "to"

Symbol	Explanation	Example	Translation
-	used where two or more words are necessary to represent a single ASL unit of meaning	READY-TO-WRITE	in position to begin writing
> ; <	movement to the right or left	ASIDE>	move or put out of the way
B-O-B	dashes between letters indicate that the word is fingerspelled	B-O-B	Bob
BSR	body shift to the right	FAMILY-BSR	family
BSL	body shift to the left	NICE-BSL	nice
#	name sign	SUE#	Sue
=	used to join the parts of a complex sign where the sign itself has more than one part and each part has a meaning. Each part is labeled with a word. The principal part of each sign is capitalized and the other parts that modify in some way are printed in lower case.	HELP=me near=PAST	help me or lend a hand recent past or very recently
lower case letters	indicate signs made with the nondominant hand (the hand used less frequently).	she=GIVE=you yes	she gives to you yes
"..."	indicates a mimed or a signed-mimed expression	"SO-THAT'S -IT"	so that's what it is about

**Most of the symbols in this key were derived from the styles of Fant (1977) and Madsen (1982).

STORY A: THE MAN WHO CLEARED HIS NAME

B-I-L-L STORE/ J-I-M WORK THERE-RF THREE YEAR

HAPPEN ONE-DAY JIM QUIT

AROUND YEAR LATER B-I-L-L WALK++ NOTICE-R MAN YOUNG DEPRESSED
SICK SEEM THIN CLOTHES OLD BROKE(2)

SUDDENLY! MIND POP-UP THAT-L J-I-M

B-I-L-L OFFER-L JOB B-A-C-K OFFER-L / REASON before=AGO J-I-M
WORK GOOD

J-I-M ACCEPT-BSR THANK-YOU-BSR

every=NEXT-YEAR+++ B-I-L-L PARTY HAVE FOR+?

PEOPLE WORK FOR HIM-RF GATHER

ONCE PARTY BIG J-I-M GO-LF / B-I-L-L HOME STAY-RS

HAPPEN PARTY SAME NIGHT B-I-L-L DREAM STRANGE

HE-RS DREAM J-I-M INFORM-RS++ IMPORTANT SOMETHING

J-I-M EXPLAIN-RS PEOPLE BLAME++ / WRONG SELF-LF NOT-YET(2)+

B-I-L-L FEEL J-I-M GUILTY / J-I-M don't-WANT-BSR / SELF-LF
INNOCENT

PARTY FINISH / SEVERAL DAY J-I-M SHOW-UP WORK NOT-YET(2)++

SELF-LF PHONE-RS B-I-L-L / WORK MISS WHY? NOT-YET(2)++ he-RF

FINALLY B-I-L-L WORRY

B-I-L-L CONTACT J-I-M TRY / SUCCEED NOT

HE-RS PHONE-F POLICE ASK-F / J-I-M HAPPEN INVESTIGATE

"WELL" WORK FINISH B-I-L-L GO-LS HOME

ARRIVE-LS WIFE HIS-LS INFORM-LS / HAPPEN SOMETHING TERRIBLE

POLICE TELL-HER-LS J-I-M DEAD / WHY? / SELF-RF KILL

HAPPEN WHEN? / PARTY FINISH KILL

B-I-L-L before=AGO PARTY SAME NIGHT DREAM BACK=look-in-past

B-I-L-L TELL-LB WIFE / POLICE WRONG J-I-M SELF-RF KILL / DOUBT

"SHAKE HEAD-NO"

AGAIN POLICE PHONE-F / INVESTIGATE!

LATER=after-awhile POLICE MISTAKE ADMIT

JIM DEAD / HAPPEN "HOW EXPRESSION"

before=AGO PARTY FINISH / J-I-M LEFT BOTTLE GO-R HOME

ARRIVE-R / HE-RF THOUGHT BOTTLE SELF-R LIQUOR / WRONG

INSIDE POISON

"SO-THAT'S-IT" / HE-RF DRINK / KILL POISON / THAT-RF

POLICE BODY FIND / THOUGHT SELF-RF KILL "SHAKE HEAD-NO"

before=AGO NIGHT J-I-M DIE / B-I-L-L DREAM "DREAM CLOUD"

J-I-M GHOST SHOW-UP / GHOST INFORM J-I-M SELF-RF KILL NOT

STORY B: THE GHOST WHO OUTSMARTED HIS RELATIVES

B-O-B , BOB# / POINT-LB

S-U-E , SUE# / POINT-LS

HE-LB LOVE HER-LS TRUE

TWO-OF-THEM MARRY / HIS-LB FAMILY-BSR don't=WANT

SUPPOSE++ TWO-OF-THEM MARRY / RELATIVE-BSR MONEY-BSL

TAKE-AWAY-BSL WILL THEY-L

ANYWAY TWO-OF-THEM PROCEED MARRY

WEDDING FINISH(2) TWO-OF-THEM GO-RF FRANCE BOB# RELATIVE-BSR

VISIT-BSR

SUE# SHE-LS / FAMILY-RS / MEET WANT TWO-OF-THEM-L

"WELL" FAMILY-BSR NICE-BSL NOT THEY-L

RELATIVE-R OPINION-BSL SHE-LS LOVE HE-LB NOT

SHE-LS HIS-LB MONEY WANT SHE-LS / YES

ONE-DAY HAPPEN TERRIBLE / BOB# HEART-ATTACK DIE

HIS-LB FAMILY ORDER-LS GET-OUT(1) COUNTRY

RING WRISTWATCH NECKLACE (Note: say jewelry) CLOTHES HAVE SHE-LS

KEEP-LS OTHER THING they=GIVE=she NOTHING

#DO(2)++ / DECIDE GO-TO ENGLAND-RF DECIDE SELF-LS

HAPPEN LUCKY THERE-RF / ONE-DAY SHE-LS WOMAN SHE-RF CHAT

SUDDENLY / WOMAN SAT-UP S-T-I-F-F "READY-TO-WRITE" WOMAN

TELL=her MESSAGE-LF HAVE(1) her-RF

MESSAGE-LF FROM WHO / HER-LS HUSBAND DEAD THAT

WOMAN WRITE FAST WRITE ADDRESS B-A-N-K FIRST / MAN NAME SECOND /

THIRD NUMBER WRITE / she=GIVE(RH)=her

SUE# GO-TO-RF B-A-N-K / ASK MAN WHERE / MAN "come to her"

he=MEET=her

SHOW-R NUMBER / MAN "GO AWAY COME BACK"

SPECIAL BOX MATCH NUMBER? / "NOD" he=GIVE(RH)=her

OPEN-BOX / INSIDE MONEY DIAMOND CAR KEY ADDRESS GARAGE INSIDE

HAVE

"OKAY-WELL" she=GO-TO=LF GARAGE-LF / CAR KEY she=GIVE=him-RS

MECHANIC

MECHANIC "GO AWAY" SEARCH CAR / KEY MATCH VEHICLE

"CAR BROUGHT TO HER"

SUE# "OPEN TRUNK" "SURPRISE"! BOX ANOTHER FIND /

INSIDE MORE MONEY MORE DIAMOND PLUS LETTER

UNDERSTAND++ / before=AGO SUE# HER-LS HUSBAND LETTER WRITE

BEFORE DIE

THIS LETTER / BOB# EXPLAIN HIS-LB RELATIVE CHEAT HER-LS WILL
RELATIVE MONEY DIAMOND KEEP WILL THEY-R

they=GIVE(RH)=her NOTHING=zero / MONEY DIAMOND FOR HER-LS

WANT HIM-LB HOW?

IDEA HE-LB MONEY DIAMOND HIDE / RELATIVE SEARCH FIND

CAN'T they-R / HE-LB EXPLAIN-LS SUE#

MONEY DIAMOND HIDE WHERE / INFORM=her

MONEY DIAMOND S-U-E HAVE WILL SHE-LS

"WELL" WRONG HAPPEN before=AGO LETTER he=GIVE> LAWYER

BOB# DIE THAT

HIS-LB GHOST / GHOST INFORM=her MONEY DIAMOND LETTER FIND WHERE
INFORM=her / GHOST THAT

STORY C: THE HOUSE THAT WAS NOT THERE

B-I-L-L / POINT-RS

J-O-H-N / JOHN# POINT-LS

K-E-N / KEN# POINT-LF

TWO-OF-THEM-BSL FRIEND HIS-RS

HE-RS INVITE-BSL they=GO=RS-BSR VISIT-BSR

"ALL-RIGHT" TWO-OF-THEM "DRIVE" SNOW! BEGIN SNOW

"DRIVE" "VEHICLE-WEAVING-THROUGH-THE-SNOW" SNOW "PILING-UP"

"VEHICLE-WEAVING-THROUGH-THE-SNOW" (Note: say deep) LOST

"HEAD-LOOKS-TO-LEFT" FEW M-I-L-E-S "THERE"-LS LIGHT-BSL /
LIGHTS-SHINING-THERE-BSL / SPOT-BSL KEN# SPOT-BSL

"WHAT-IS-IT" TWO-OF-THEM "DRIVE-LS" SOON-BSL ARRIVE-BSL METAL
GATE-BSL

"UP-BEHIND-THE-GATE"-BSL UP-THERE-BSL HOUSE-LS LARGE-LS there-LS

"WHAT-IS-IT" HOUSE-BSL INSIDE-BSL LIGHT-BSL "LIGHTS SHINING
THERE"-BSL

TWO-OF-THEM GATE-OPEN / "VEHICLE DRIVE-THROUGH-UP-HILL"-BSL

KEN#-BSL GET-OUT WALK-UP / ASK-LS HOW B-I-L-L / JOHN# CAR-RS
STAY-RS

KEN# WALK-UP DOOR RING-BELL DOOR-LS OPEN-LS MAN stand-LS

KEN#, MAN TALK+ / FINISH KEN# SOMETHING he=GIVE(RH)=man

KEN# WALK-DOWN GET-IN

B-I-L-L HOUSE-BSR FIND-BSR HOW-BSR? / MAN EXPLAIN-RS

FINISH-RS BEFORE

JOHN# ASK-RS KEN# / R=GIVE(RH)=MAN WHAT-BSR?

INFORM-L COIN R=GIVE(RH)=LF COIN

B-I-L-L HOUSE-RS FIND-RS HOW-BSR? / MAN EXPLAIN LIST-OF-THINGS
FOLLOW "DRIVE"

NIGHT-LATE B-I-L-L HOUSE ARRIVE FINALLY

TWO-OF-THEM-L EXPLAIN-R B-I-L-L EXPLAIN-R HAPPEN-R TWO-OF-THEM-L
LOST HOUSE MAN COIN

B-I-L-L LISTEN-BSL "HEAD-SHAKES-IN-DISAGREEMENT" / STORY FINISH
LISTEN-BSL DOUBT he-R

he=INFORM=them 20 YEARS BEFORE HOUSE THAT-LS FIRE-LS COLLAPSE-LS

"puzzled" NEXT MORNING THREE-OF-THEM LET'S-SEE

"DRIVE" ARRIVE GATE LOCK!

"WHAT IS IT?" SEEM YEAR++ GATE OPEN NOT-YET+

GATE-SHUT "WHAT-IS-IT" LOOK-UP-LS(2)

EMPTY "EMPTY-AROUND-THERE" ;

HOUSE-LS NONE "WHAT-IS-IT?"

BURNT-LS COLLAPSE-LS HAVE there-LS

THREE-OF-THEM NOTICE-D CAR TRACK / PUZZLED

"TRACK UP HILL TRACK DOWN HILL" "THAT'S STRANGE"

PROVE / BEFORE CAR THERE

THREE-OF-THEM RAN-UP-HILL-L LOOK-AROUND-BSL / FOOT-PRINT

"FOOT-PRINTS-UP-HILL FOOT-PRINTS-DOWN-HILL"

"THAT'S STRANGE"

SPOT DOOR-BSL / FIRE-BSL HOUSE-BSL COLLAPSE-BSL

DOOR-BSL THERE-L SNOW SHINE-BSL

SURPRISE / COIN KEN# R=GIVE(RH)=L MAN / THAT-BSL COIN-BSL

APPENDIX D - DEMOGRAPHIC DATA

1. Age: average - 16 years, 9 months

	Frequency	Percentage
13 years	2	5.6
14 years	2	5.6
15 years	11	30.6
16 years	4	11.1
17 years	8	22.2
18 years	5	14.0
19 years	4	11.1

2. Hearing Status:
average HTL (ANSI) - 99.8 dB

3. Etiology:

genetic	12	33.3
meningitis	2	5.6
rubella	5	14.0
Rh blood factor	1	2.8
other/unknown	16	44.4

4. Age at onset of deafness:
average - 3.2 months (for those with acquired deafness)

	Frequency	Percentage
0 - 2 years	30	83.3
2 years and up	2	5.6
unknown	3	8.3
missing data	1	2.8

5. Age learned to sign:
average - 81 months

	Frequency	Percentage
0 - 2 years	7	19.4
3 - 5 years	11	30.6
6 - 7 years	10	27.8
7 years and up	7	19.4
missing data	1	2.8

6. Age hearing aid use begun:

	Frequency	Percentage
0 - 2 years	4	11.1
3 - 5 years	19	52.8
6 - 7 years	4	11.1
7 years and up	6	16.7
missing data	3	8.3

7. Current use of hearing aids:

	Frequency	Percentage
At home -		
often	8	22.2
sometimes	11	30.6
never	16	44.4
missing data	1	2.8
At school -		
often	24	66.7
sometimes	4	11.1
never	7	19.4
missing data	1	2.8

8. History of educational settings:

	Frequency	Percentage
1979 - 1984		
on campus	26	72.3
off campus	10	27.7
prior to 1979		
on campus	17	47.2
off campus	15	41.7
other	4	11.1

9. History of communication methods:

	Frequency	Percentage
1979 - 1984		
total		
communication	36	100.0
prior to 1979		
total		
communication	26	72.2
oral/aural	8	22.2
other	2	5.6

10. Hearing status of parents:

	Frequency	Percentage
Mother		
hearing impaired	7	19.4
hearing	28	77.8
missing data	1	2.8
Father		
hearing impaired	5	14.0
hearing	30	83.3
missing data	1	2.8

11. Presence of deaf siblings:

	Frequency	Percentage
yes	9	25.0
no	26	72.2
missing data	1	2.8