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Communication for the non verbal [sic] severely physically handicapped: traditional augmentative devices and computer technology

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The University of Montana

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COMMUNICATION FOR THE NON VERBAL SEVERELY
PHYSICALLY HANDICAPPED: TRADITIONAL AUGMENTATIVE DEVICES
AND COMPUTER TECHNOLOGY

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Chapter 1

INTRODUCTION

In December, 1983, a Franklin Ace 1000 was purchased as a communication aide for an amyotrophic lateral sclerosis (ALS) patient. This was the writer's introduction to augmentative communication, devices and techniques. The original purpose of this paper was to assess the success of computer-assisted communication therapy for the nonvocal severely physically handicapped (NVSPH) population. Bibliographic searches failed to yield actual clinical or research support for the use of computers. (The search, however, did reveal a great deal of testimonial material on the advantages of computers.)

Since little clinical evidence was available to verify or refute computer use for the NVSPH, this writer decided to do a case study of a NVSPH ALS patient who had been provided with a computer to augment his communication. The computer was purchased for the patient in December, 1983. The case study was to follow the course of his computer-assisted communication therapy for three and a half months from
January, 1984, through mid-April, 1984. Almost immediately, technical difficulties began. The primary source of frustration was the incompatibility between the computer and the adaptive firmware card designed to provide patient access to the computer. By the time it was discovered that a chip had been improperly installed at the factory, there was insufficient time to carry out the original design of this paper.

As a result of these difficulties, a new direction was needed. Rather than limit the scope of the paper to the computer as a communication device, it was expanded to include non-computer, augmentative communication strategies for the NVSPH. The intended case study gave way to interviews focusing on communication strategies used by the NVSPH patients.

The paper in its final form, in the opinion of the writer, resembles the "state of the art" in computer-assisted communication. It addresses a need, summarizes existing strategies for dealing with the need, offers the computer as an alternative strategy, outlines the advantages of a computer, but cannot verify that the computer is actually better than other systems of augmentative communication. It "seems" obvious that the computer should have numerous advantages for the NVSPH as a communication device. There is a gap, however, between what
"should" work and what "does" work. Computers were not designed for severely physically handicapped people. They have to be adapted for this population. Adaptation, at the present time, is variable and unpredictable.

There are 500,000 NVSPH individuals in the United States. (Baker, 1982). The communication skills of this group are restricted by a lack of physical ability to produce speech or to form readable signs. Its members do not necessarily suffer from reduced cognitive or linguistic capabilities. The majority of the NVSPH population suffer from the effects of cerebral palsy, strokes, or severe head trauma (Baker, 1982). (This is not meant to imply that all victims of the above mentioned disabilities are in the NVSPH category.) Until recently, augmentative devices such as language boards, typewriters, and flip-charts were the primary kinds of communication prostheses available for this population. These devices paved the way for computer technology by providing access techniques and by highlighting many of the interactive difficulties faced by this population. The non-computerized augmentative prostheses demonstrated the NVSPH were able to use augmentative communication if it were made available to them.

The computer, by nature of being smaller, lighter, and more portable, has many advantages over more traditional
augmentative communication devices. As a communication prosthesis available to the NVSPH, it can offer them access to a variety of other materials as well, (e.g., educational, recreational, and vocational). In addition to possibly replacing many of the more traditional augmentative communication devices, the computer may be able to alter or enhance the communication strategies and interactive skills of NVSPH adults. It may also allow the NVSPH child to learn these skills in a more normal fashion than is currently possible. This paper will discuss communication strategies of the NVSPH, traditional augmentative communication devices, and will explore the effectiveness of a computer as a communication aid.
Chapter 2

Traditional Augmentative Communication

Various forms of augmentative communication strategies have been developed to benefit the NVSPH population. The most common augmentative communication device is the language or communication board (Vanderheiden and Grilley, 1977; Vanderheiden, 1979; Vicker, 1974). This device usually consists of a large board made of wood, plastic, or tag board. Pictures, letters, numbers, words, drawings, or symbols are mounted on the board. Communication is performed by selecting items on the board. The selection can be one word or picture at a time or in various sequential combinations. The choices on the board can range in complexity from five to ten pictures depicting survival needs (e.g., toilet, eat, drink, sleep, help, or hurt) to a large, printed vocabulary divided into syntactic categories. The primary limitation of this device is the user's ability to indicate a choice. There are three direct selection techniques used with augmentative communication: direct selection, scanning, and encoding. The choice of selection technique depends primarily on the physical
abilities of the NVSPH user. The three approaches will be briefly described.

2.1 Selection Techniques

2.1.1 Direct Selection

Direct selection is "any technique or aid in which the desired choice is directly indicated by the user" (Vanderheiden and Grilley, 1977, p.22). There is a key or switch for every possible choice. Typing or pointing to specific words or pictures are examples of direct selection. This technique is undeniably the most efficient but it also requires the greatest amount of physical dexterity and control. The user must be able to accurately indicate specific items. Direct selection can be performed by a variety of pointing styles, such as using a head pointer or eye gaze (i.e., looking directly at specific items which have been strategically placed to allow the user to indicate his choice by looking or gazing).

2.1.2 Scanning

Scanning is any technique in which a series of choices are presented and the user signals the appropriate
one. For example, a series of foods might be presented to the NVSPH individual. The user indicates in some way, such as a head nod or an eye blink, when his choice appears. Vanderheiden and Grilley (1977) argue that this is an "extremely powerful technique" (p.22) because it can be used effectively by persons with minimal physical control.

2.1.3 Encoding

Encoding is any "technique or aid in which the desired choice is indicated by a pattern or code of input signals" (Vanderheiden and Grilley, 1977, p.22). A matrix or Morse code are examples of encoding. Encoding is generally faster than scanning, especially as the number of choices increases. However, successful encoding depends on the user having "some form of quick motion" (Vanderheiden and Grilley, 1977, p.24). For the user who is unable to use a quick motion, and who has to rely on one switch, or has erratic movements, encoding may be slower than scanning.

Users of communication devices may employ a combination of selection techniques, depending upon individual needs and the situation.
2.2 Barriers to Communication

2.2.1 Communication Protocol

Providing a communication prosthesis to a NVSPH person only partially solves the communication dilemma. However, with many NVSPH people the interactive aspect of communication must also be addressed. Most normal communicative interactions follow the protocol outlined below (Harris, 1982).

1. An individual has a comment to make. Heformulates it and transmits it to a listener(s).

2. The listener(s) receives the message, reacts, responds, or in some way acknowledges it.

3. The listener(s) and the speaker exchange roles in a series of turn-taking episodes.

4. This pattern continues as long as the participants are willing to comment and listen to each other.

A conversation of this nature relies on a response in less than three seconds. Waiting for even ten seconds to receive a reply can cause anxiety on the part of the listener. If a person has to wait for five minutes or more, communication
breaks down and conversation is impossible (Baker, 1982). A "normal" conversational protocol is rapid and "almost reflexive" (Harris, 1982, p. 22). This "reflexive" pattern is disrupted with most communication devices. The user cannot respond "reflexively" and must tediously point, type or somehow indicate his responses.

Harris (1982) also argues that formulation as well as transmission of a message is more difficult for a NVSPH person than for his verbal counterpart because he must "keep the whole message in mind while assembling it and insuring an accurate expression of its parts" (p. 25). The NVSPH user of a prosthesis may have to deal with his listener attempting to guess his message. For example, if the message is figured out by the listener before it is fully composed, the NVSPH can either ignore the listener and continue, acknowledge that the listener is indeed correct, or proceed to the next step (which typically is the listener beginning to talk). While the NVSPH person is putting together a message and contending with the above mentioned possibilities, the listener may switch topics of conversation. A possible means of dealing with these problems is for the NVSPH person and his listener to decide before hand on the acceptability of guessing and the listener's role in maintaining and switching topics. Obviously, these kinds of intrustions can occur.

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during a verbal exchange, but the verbal person can more quickly and easily counter them. He is not bound to laborious and tedious communication techniques.

Traditional speaker/listener roles become "blurred" (Harris, 1982, p.25) because the listener has to take an active role in message formulation. For example, in some scanning situations the listener may have to present the choices to the "speaker." Other barriers to the interactive aspect of communication for the users of an augmentative system are described below.

2.2.2 Type of prosthesis

Traditional communication board

Listener must frequently become active in message formulation.

Electronic prosthesis with a printout

A device of this type may also reduce the social aspect of communication. The listener does not have to be present while the message is being formulated. He may leave the room, read a book, or engage in another conversation. Harris (1982) feels that if the speaker is left without a listener for much of the conversation, "motivation
to use electronic protheses may decline if their use means that listeners will disappear and return at their leisure" (p.26).

2.2.3 Speed

Communication performed by NVSPH individuals cannot approximate normal conversational speed, as a result, the tendency to second guess the "speaker" is prevalent, the user of a communication device may learn to either ignore his listener and continue with his intended message, or withdraw as an active participant.

2.2.4 Energy

Message formulation for the NVSPH is time consuming, tedious, and laborious. The inordinate amount of energy required to transmit a series of messages affects both the quality and the quantity of the communication output.

2.2.5 Vocabulary

For the NVSPH population who cannot use spelling as a viable means of communication, the vocabulary available is limited by the physical capacity of the particular device.
2.2.6 Repertoire

The user may not be able to choose an appropriate mode of expression (i.e., using a print-out with a non-reader).

Listeners, according to Harris (1982), tend to view communication devices as a way of allowing the user to respond, but not as a means of communicative interaction. Possibly due to the many and varied barriers to normal or expected conversational protocol, many NVSPH persons adapt a passive role. Communication is generally initiated and controlled by the verbal individual.

2.3 Communication difficulties for the NVSPH Child

Communication difficulties facing the NVSPH child and adult are similar. The primary difference is the degree of communication skills already established at the onset of the handicapping condition. For the previously verbal adult, non-verbal communication is an extremely frustrating experience. In general, however, his interactive skills have been established. He must learn to modify and adapt his skills, rather than develop them.
Most children learn communication skills and language through manipulating their environment, interacting with children and adults, trial and error learning, and positive feedback (Piaget, 1964; Bowerman, 1975; Woods, 1975; Bruner, 1975; Snow, 1972; McLean and McLean, 1978). The opportunity to explore and manipulate is frequently not possible for the NVSPH child. The primary reason for this is the obvious physical and motoric limitations. Frequently the caretaker-adult may not (or cannot) provide alternate means of exploration. This may lead to an understandable tendency to provide everything for the handicapped child instead of finding out what he can do completely or partially for himself (Seligmann, 1975). In addition, the child often has to have an adult-caretaker with him most of the time. There is little that happens to the child that the adult does not know or anticipate. As a result, there is little need to communicate. The child has no new information to provide, nor any unique requests to make. Since there is little need to communicate, and limited opportunity to explore and manipulate, the NVSPH child begins to learn passive, response-only communication at an early age. Interactive skills become truncated and limited.

Harris and Vanderheiden (1980) have initiated a communication program for the NVSPH child. The primary goal
of their program is "developing and enhancing interaction in the NVSPH child" (p. 239). They have based their program on normal developmental sequences and have adapted them to the needs and abilities of the NVSPH child. The developmental problems (i.e., language, social, cognitive) of NVSPH children are grave and must be considered when exploring augmentative communication prostheses for children. Appropriate follow-through and training must accompany a child who is provided with an augmentative communication system.

In spite of the fact the NVSPH population has a variety of augmentative communication techniques available to them, there has been a tendency to develop passive communication strategies.
Chapter 3

The Computer as an Augmentative Communication Device

The microcomputer is currently being used in a multitude of activities from science to recreation. Its ability to perform functions quickly, and to follow instructions explicitly and repetitively has made it an invaluable tool for business, industry, education, government, technology, and individuals. For NVSPH persons, the computer can provide "flexible, cost-effective solutions to a wide range of problems" (Vanderheiden, 1981, p. 54). The primary advantage of a computer is that it can alleviate, to some extent, the two major restrictions to communication for NVSPH people: slow rate of response and dependence on a second party (Wier, 1982).

The advantages of a computer for the NVSPH are not limited to communication. Perhaps the most exciting feature the computer has to offer is access to his environment, including education, vocations, information/resources management, and recreation. (The access to these materials is not limited to the NVSPH and includes all severely...
physically disabled, cognitively sound individuals. For the purposes of this paper, however, these advantages will be described as if for the NVSPH only.

Despite the many positive factors computers have to offer the NVSPH population, there is one major barrier -- the NVSPH individual's physical inability to operate the computer. A computer is designed to accept information in a specific manner, often requiring physical dexterity beyond the capabilities of the NVSPH person. The advantages of the computer and possible solutions to the access problem will be discussed below.

3.1 Advantages of Computers

3.1.1 Increased Rate of Response

The NVSPH person is able to indicate his responses relatively quickly. It is possible that computer scanning may outdistance other forms e.g., electronic scanning. Methods such as "anticipatory spelling" (Thomas, 1981) and "frequency of occurrence tables" (Demasco and Fould, 1982) can greatly increase the speed of spelled out responses. With these methods the user only needs to indicate the first few letters or abbreviate words and the computer will "fill in" the
missing ones. Vanderheiden (1981) argues that a "speed differential of even four or five (the average for a motor-impaired person is ten to twenty) can mean two hours versus eight hours of homework a day or the ability to do two hours of homework which would otherwise take eight to ten hours" (p. 55). In addition, a computer combined with a word processor can provide the NVSPH person with immediate feedback. He can edit, augment, correct, or erase his message as he is composing it. He is not locked into "having to keep the whole message in mind" (Harris, 1982, p. 25). Given the speed of a computer and immediate feedback, the user has more flexibility and can more easily accommodate the capricious aspect of many conversational interactions.

3.1.2 Independence

A NVSPH person can control a computer with a limited number of commands. These commands can, in turn, "call up" a variety of responses and programs. For example, a NVSPH person who must rely on scanning responses can select a program such as "food". The computer will present a list of foods and the user can indicate his choice by another command. Thus, in two commands the NVSPH person has been able to choose a particular type
of food without another person being directly involved. The composition of various choice lists and responses depends on the needs and interests of the user, rather than the size or capacity of the prosthesis.

3.1.3 Education

Many educational programs are available for the handicapped. (Geoffrion and Goldenberg, 1981; Bennett, 1982; Ragghianti and Miller, 1982; Budoff and Hutten, 1982; Foulds, 1982; Detamore, 1980; Hertzler, 1970; Cohen, 1983; Hannaford, 1983; Muller, 1983; Beckerman, 1983; Browning and Nave, 1983). The primary advantage to the NVSPH is that a computer can provide independence for both the student and the teacher by allowing the learner to proceed at his own pace. Traditionally, the slow rate of response of the NVSPH student has forced a teacher to be continually monitoring progress in order to provide appropriate instruction. Specially designed computer programs can provide a variety of learning tasks from routine drills to logic and application of science and mathematics. The computer can allow the NVSPH learner to manipulate, learn by trial and error, use logic, follow hypotheses, develop sequential activities, and execute formulae.
Feedback as to the success or failure of various activities is provided immediately. The feedback is transmitted in a "non-questioning, non-judgmental manner" (Browning and Nave, 1983, p.57). The computer can provide the NVSPH access to virtually all educational programs.

3.1.4 Vocation

Once a NVSPH person has acquired computer skills, he can participate in a variety of vocational activities. A recent survey in British Columbia (B.C.), Canada, revealed that 77% of the adult, non-mentally handicapped, cerebral palsied population were unemployed (Graystone, 1983). The annual cost in 1983, to maintain one of these individuals in Canadian institutions, was $91,000. An Apple II computer with appropriate modifications would cost between $5,000 and $10,000 (based on 1983 Canadian prices). With such a computer, the NVSPH person would have access to the same material as his more physically able peers (Graystone, 1983). This does not necessarily mean that the NVSPH person would have similar employment opportunities. Though computer technology opens up vocational possibilities, it should be remembered that the NVSPH person will be competing with peers who have
adequate physical abilities as well as computer skills.

3.1.5 Information/Resource Management

The NVSPH person need not be dependent on others for access to information. The computer can provide information such as filing systems, reference materials, notebooks, or phonebooks to the NVSPH person, arranged to accommodate his needs, rather than the needs of the person who must retrieve the information for him.

3.1.6 Recreation

The computer allows a NVSPH person to play various games with peers, relatives and friends. With adaptations, games can be played on a fairly equal basis. Game playing can foster interactive skills as well as provide enjoyment and relaxation. Games may also provide an entree for the NVSPH child to social and interactive skills such as turn-taking.

3.2 Physical Inaccessibility to Computers

The aforementioned advantages, though enticing, are often difficult for the NVSPH to attain because of his physical
inability to operate a computer. A way to remove this obstacle is to provide selection techniques similar to those used with traditional augmentative communication: direct selection, scanning, and encoding. The problem with these access techniques, however, is that the computer only accepts specific, predesignated input instructions. In order for the machine to accept alternate forms of input it must be "tricked into thinking" that it has received the input it expected. The modified input must be "transparent"; i.e., the computer must not "know" it has been changed. There are two obvious solutions to this dilemma.

3.2.1 Software Solution

The first possibility is to modify the software (the material used to provide a computer with programs). This is the cheapest to implement and probably the most expensive to develop (Vanderheiden, 1981). It requires that the software be adapted to act as modules for the specific programs. In other words, each particular piece of software ranging from games to mathematical application, would have to be modified to the input needs of the NVSPH. Problems such as the variety of machine languages and protected programs would continually limit this type of modification. In turn,
it would severely reduce the number of programs available to the NVSPH.

3.2.2 Hardware Solution

The second approach is to modify the hardware, i.e., the physical aspect of the machine itself. For example, keyboards can be expanded or modified to accommodate the NVSPH, or encoding such as Morse Code can be developed to provide input instructions. The difficulty with hardware modification is that it can affect the internal workings of the computer. Vanderheiden (1981) states that:

Through elaborate means, enough memory might be hidden and the interrupt structure sufficiently linked to use Central Processing Unit (CPU) intelligence for both input processing and function level program execution. With this approach, however, there is no guarantee against contention for the same areas of memory — and thus possible collision of the two programs. It also requires the development of custom hardware, which is not easily supported or repaired (p. 60).

Vanderheiden (1981) argues that a "rehabilitative" computer must have features and capabilities which are not part of a "normal" computer. The particular features he calls for are:

"information-amplification/expansion and multitasking control" (p. 58). The former allows the user to expand
the use of signals, or to use a limited or reduced number of signals to gain access to the computer. The latter refers to the ability of a computer to "jump back and forth between different programs while keeping all programs active in memory in the computer at the same time" (Vanderheiden, 1982, p.139). Multitasking is crucial to physically handicapped persons because they cannot simply pause to look up bits of information or to answer the phone and return to the computer. They must use the computer for all of these functions. If everytime a physically handicapped person had to perform a different activity, he had to turn off the computer, reprogram it, risk losing his original program, and then return to his original program, it would be cumbersome, tedious, laborious, and frustrating. Multitasking would deal with these problems.

3.2.3 Dual-Nested Computer Solution

Vanderheiden's (1981) solution to these problems is to use "dual-nested computers; one for the input level programs and the other for the function-level programs" (p.60). In other words, one computer would be programmed, adapted, and modified to the needs of the physically handicapped and it, in turn, would run the
other computer. Vanderheiden argues that dual-nested computers are the most flexible and in most cases the least expensive solution to the access dilemma. The computers need not be of the same make or model. The input computer can be programmed for a variety of input routines without putting pressure on machine memory because the machine is not being asked both to accept modified input and to run another program. Its only task is to modify input to the specifications of the other computer. The second computer would not have to be "bothered" by the modifications and would perform as programmed. This approach would provide the least amount of modification. Perhaps even more important, the modification would allow the physically handicapped person access to all the software available for a particular computer. This would provide the NVSPH with vocational, educational, and recreational materials identical to his more physically able peers.

The computer is an exciting tool for the NVSPH. It can provide for communication as well as for a variety of other functions. In the realm of communication, it allows for a more "natural" form of interaction because it increases both the rate and independence of the user. It can be programmed with an "unlimited" vocabulary. For the NVSPH person who has developed reliable computer skills, the computer has the
capability to provide him with a wide array of opportunities. Many of the access problems discussed above will probably be reduced or eradicated in the future, making computers more accessible to the NVSPH population.
Chapter 4

Interviews

4.1 Introduction

The following interviews are with victims of amyotrophic lateral sclerosis (ALS). The first is with the surviving spouse of an ALS victim and the second is with an ALS victim and his wife. In both cases, the ALS patient lost his ability to communicate with recognizable speech or gestures within a year after the initial diagnosis of the disease.

ALS is a disease of the central nervous system whose origin is unknown. It is characterized by muscle atrophy and fibrillation with varying degrees of motor dysfunction. These symptoms are caused by degeneration of the motor neurons of the spinal cord or medulla oblongata. The disease affects five out of every 100,000 persons but men are twice as likely as women to suffer from ALS, with onset usually occurring between the ages of 40 and 60 years. Despite these motor dysfunctions, cognition and language abilities are not affected. One description of the course
of ALS states that it is chronically progressive, showing paralysis of muscles of speech and swallowing in its later stages. Death is usually from paralysis of muscles of breathing associated with pneumonia. The average duration of the disease is about three years; when the site of lesion is the spinal cord, survival of ten or more years is observed in occasional cases. The course is rapid when the nuclei of the medulla oblongata are involved at onset. (Encyclopaedia Britannica, 1984, p.1056)

4.2 Interview with the surviving spouse of an ALS victim

Marty, aged 44, a retired United States Air Force colonel, was diagnosed as suffering from ALS in December, 1979. Marty's communication skills began to degenerate a year later. By March, 1981, he was not able to use recognizable speech or gestures to communicate. Marty died in the fall of 1981. His wife Betty was able to understand her husband by "guessing" at the meaning of his various noises. She verified her guess by asking yes/no questions which Marty answered with eye blinks. She used a spelling-scanning type of technique when she was not able to figure out his utterances. She would go through the alphabet orally and Marty would indicate with eye blinks the letters in the word he wanted to use.

Marty was placed in a nursing home in the summer of 1981. While in the nursing home, he came in contact with a
speech pathologist who provided him with a Zygo electronic communication board. The board contained the alphabet, numbers, and a list of high-use words (e.g., bathroom, eat, drink, help and up) and operated on a scanning type of technique. A cursor would traverse the items on the board and stop at items indicated by a signal from a control switch. Since Marty had some voluntary control in part of his right hand, the control switch was taped to it. The switch was sensitive and allowed Marty to control the cursor with minimal pressure.

Betty reported that both she and her husband found the board frustrating. She said that it was seldom used when they were together. Their communication system of vocalizations, guessing, and spelling-scanning was more efficient for them. Betty revealed that many of Marty’s friends found his board fascinating and seemed to treat it as some sort of a toy. This irritated him and sometimes caused him to reject using it.

The board was useful to indicate his basic needs to the staff at the nursing home if Betty wasn’t there to relay his messages. Betty said, though, that she didn’t feel that the staff took the time to learn how to use the board with Marty. As a result, it was seldom used unless she was there to supervise.
4.3 Interview with an ALS patient and his spouse

David, aged 34, a former United States Army sergeant and police officer, was diagnosed as suffering from ALS in 1979. Within a year his ability to communicate by either gestures or recognizable vocalizations had been severely reduced. His wife Pris has been the only person who can consistently understand him for the past four years. They communicate with each other through a system of facial gestures, vocalizations, eye blinks and spelling-scanning, similar to the system used by Marty and Betty. This system is amazingly efficient for them.

It is difficult for an unfamiliar listener to understand how they communicate so well. David releases a series of seemingly similar and indistinguishable vocalizations, and Pris almost immediately comes back with a translation. David nods if her interpretation is correct and continues with his message. If her interpretation is not correct, he goes back and produces more sounds. If she still can't understand him, she implements spelling-scanning. She can usually figure out the complete word after she has the first two or three letters. They proceed in this manner for the course of the conversation.
A third party, such as the interviewer, can easily participate in the conversation because Pris acts as a translator. Though the conversation is certainly slower than normal, once one adjusts to the pace, it flows smoothly and seemingly rapidly. It is probably similar to any type of conversation which has to be transmitted through an interpreter. There is no doubt that David is an active participant throughout the conversation.

Since David could not communicate without Pris to translate, an augmentative system of communication was suggested by a speech pathologist, rather than use a language board similar to the one used by Marty. Through community efforts, money was raised to purchase a Franklin Ace 1000 and an adaptive firmware card (designed and manufactured by Paul Schwejda). By installing this card in the computer, David could control the computer by means of one microswitch activated by moving the one finger he could still control voluntarily. The control switch is essentially an on/off switch which operates a scanning system.

Despite the many advantages the computer had to offer (see chapter 3), it caused a variety of frustrations and disappointments. At the time of this writing, David had only used the computer a few times and with limited success. Despite repeated and time consuming efforts by
both the speech therapist and Paul Schwejda, designer of the board, they were not able to successfully adapt the Franklin Ace 1000 to David's needs. In the instances that the computer was used, access and control were difficult and tiring for David. He had to follow a sequence of commands using the on/off switch, and if he did not get the input sequence correct, the computer displayed "syntax error" and he had to start over. Just getting the program he wanted required a series of error-prone steps. In order to use the computer, he had to have someone else set it up and insert the program he wanted. In short, the computer provided David with frustrations similar to those Marty experienced with his language board. There was a major difference, however, David's problems were directly attributable to computer access.

4.4 Impressions from the Interviews

Perhaps the most salient feature from the interviews was that both of these men who were nonverbal, in terms of recognizable sounds, could communicate very well with their spouses. In each case, the couples had developed a system of communication which allowed them to carry on in-depth conversations, as well as provide for the needs of daily living. The intrusion of an augmentative system, though
welcomed initially in both cases, was rejected as being too time consuming and frustrating. The augmentative systems were viewed as responding devices, as opposed to communication devices. They were useful only when the spouse translator was not available.

Obviously, these two men do not represent all NVSPH persons, but they may represent a subgroup of NVSPH adults who have acquired nonvocal status but have retained their communicative and interactive skills. The assumption that the persons in this group are noncommunicative may be invalid. Perhaps augmentative devices should be presented to this group as "responding" devices. This way their aspirations for the prosthesis would not be inflated and, hopefully, some of the frustrations of not being able to communicate with it would be relieved. The device might also be designed to aid the verbal spouse in translating words she or he could not interpret. This might cause the couple to use it in their own conversations, thereby providing both practice and familiarity to the patient without the pressure to communicate with someone who could not understand him.

In both cases, the patients were expected to learn to use augmentative devices when they were already severely disabled. Perhaps in predictably degenerative diseases such as ALS, the patient should be introduced to an augmentative
device when he is more physically capable. It could be used to supplement his communication before it was actually needed. This type of pre-use might encourage and facilitate the use of the augmentative prosthesis when it was needed.

In both cases it appeared to this interviewer that the communication device was not used extensively enough for the user to be completely comfortable with it. A major reason for this lack of extensive use appeared to be that the patients could communicate so well with their spouse they felt no compelling need to become proficient with the aid. Perhaps in cases such as the two described above, all aspects of communication should be considered so that an augmentative system truly supplements an established system.
Though the focus of this paper has been on the NVSPH, they are not the only group of communicatively handicapped who can benefit from computer technology. The computer is an excellent vehicle for drill work and practice routines. It can provide these types of programs in a personalized and individualized manner. As well as providing a means of practice, the computer is able to keep accurate records of progress. These records allow a therapist to adapt and/or modify programs so they can better suit the needs of the patient. With a computer to keep records and data, more professional time can be spent interacting with patients and individualizing programs.

Katz (1984), who is using computers with aphasics, states that the primary value of computers in therapy is to "provide stimulation and practice, specifically, the opportunity to respond many times with a high degree of accuracy" (p.20). To date, Brinker and Lewis (1982) have published one of the few studies that involve
computer-assisted therapy. They reported that the "major advantage of the computer is its ability to handle large amounts of information quickly (p.165)."

Perhaps one of the most exciting areas of computer use is with the NVSPH child. Trachtman (1984) is using computers to simulate manipulative and interactive experiences with young children. With a properly programmed computer they can learn by trial and error, manipulate the controls to achieve a goal, and engage in problem-solving activities. Programs, such as games, can be modified to develop reciprocal interaction skills. Basic concepts can be learned by manipulation similar to the way a normal child learns them. The computer can allow the NVSPH child to learn language and communication skills in a more normal fashion.

The future holds many intriguing possibilities for the communicatively handicapped. Baker (1982) has developed a program based on semantic context. The user need only select a few basic ideas and the computer will compose sentences based on the context indicated. Voice synthesizers are already providing a more "normal" response mode for some NVSPH individuals (Moses, 1983; Acronyms, 1982). This type of device, combined with programs using strategies such as semantic context, may significantly reduce the communication barriers facing the majority of the
NUSPH population. As communication becomes more "normal" in terms of rate, independence, and computer access, many more NUSPH persons may become functional members of our society.
Appendix A

BIBLIOGRAPHY


Beckerman, Judith, "You Don't have to Know the Language," The Computing Teacher, February, 1983, pp.23-25.


