Jim Desson
Protestant School Board of Greater Montreal

Augmentative Communication Systems:
Communicating with the non-vocal handicapped — Part I

Abstract

Individual development is briefly outlined as the interdependent development of five skill areas: language, cognition, social, perceptual-motor, and psycho-spiritual/moral. In the context of this model augmentative communication systems for non-vocal severely handicapped people are reviewed. Symbol definition, prerequisite skills, and some criteria for the selection of an appropriate symbol system are discussed. There is also a review of representational, abstract, and symbolic language code systems for non-vocal severely handicapped people.

INTRODUCTION

If the Prime Minister or President of a Federal Government and his entire cabinet were suddenly striken with a paraplegic condition which rendered them unable to walk, to use their arms effectively, or to speak clearly; would they be put in an institution to be fed, clothed, toiletted, and provided with recreation? Or would the nation's resources be marshalled into providing them with an ideal augmentative communication system (ACS) and state-of-the-art computer technology so that they might continue to fully participate in the political life of the nation? For non-vocal severely physically handicapped (NVSPH) people, to a large extent, their essential needs are a question of time,

resources, and money. This, in turn, is based upon society's commitment to meeting the essential functional needs of its fellow NVSPH citizens. Partly, this is a factor of public education. Most important of all, though, it is a question of the degree to which society recognizes in NVSPH people the same innate human spirit which all humanity shares. Implicit in any assistance for handicapped people is the moral imperative that, by virtue of their being human, their nobility and dignity demand that these essential functional needs be met and that services be made available to allow them to fully participate in society. Implicit in the provision of these needs and services is the moral imperative that the nobility and dignity of collective humanity itself are raised as a result. Truly, the individual and society are developmentally interdependent. However, even with the ideal amount of time, resources, and money, we still may not adequately meet the needs of NVSPH people.

Because of the very complex nature of providing services for NVSPH people, it is necessasry to have the involvement of a wide range of professionals and technicians. Furthermore, the challenges require those involved to be eclectic in their approaches and philosophy. This demands a higher degree of cooperation than most other professions.

Over the last decade, there has been amazing progress in augmentative communication systems and the technical aids to implement these symbol systems. Coupled with this has been the progress made in public awareness and concern for handicapped people. A small but significant international community of people dedicated to servicing the needs of the handicapped is emerging.

In addition, the cumulative effect of progress in linguistics, augmentative communication systems, artificial intelligence, and microcomputers is also responsible for the progress to date and the major advances which will, in all likelihood, reach fruition in the next ten to fifteen years.

In this paper, I will briefly review the issues surrounding augmentative communication systems for the non-vocal severely handicapped of school age. The nature and problems of communication for NVSPH people will be discussed, and the language models appropriate to ACS will also be touched upon. This language model reflects the developmental interdependence between all five dimensions (social, perceptual-motor, cognition, language, and psycho-spiritual/moral) of communication. There follows a discussion of symbol systems, the diagnostic assessments relating to the selection of an ACS, and a review of those symbol systems which have been used by NVSPH people.

The five dimensions of communication

Language is conventionally described as a triad of semantics, syntax, and pragmatics; or, as Bloom and Lahey (1978) describe it, as content, form, and use. Functionally, "good" language is a symbol system which achieves the desired social effect in the quickest and most efficient manner (Rice, 1978). Communication is the ultimate goal of language. But communication is more than just the attempt to externalize our internal thoughts. As well as expression, we inevitably seek to produce some effect upon the listener. The goal of communication, then, is only achieved when the listener indicates whether the communication has had the desired effect (Seth and Gutherie, 1935).

Halliday (1975) sees language as one form of the realization of meaning. He explains that as the child learns language, he is learning the culture and so becomes a primary mode for its transmission. In other words, the social system, like language, is another related semiotic system.

Language and communication

Chapman and Miller (1980b), a personal communication cited by Schiefelbusch and Hollis (1980), list the following major functions of language and communication. They illustrate very well Halliday's pragmatic view of language.

1.	To give information for	(a) Reference
		(b) Prediction
2.	To get information	
3.	To describe an ongoing event	
4.	To get the listener to	(a) Do something
		(b) Believe something
		(c) Feel something
5.	To express one's own	(a) Intention
		(b) Beliefs
		(c) Feelings
6.	To indicate a readiness for further communication	
7.	To solve problems	
8.	To entertain	

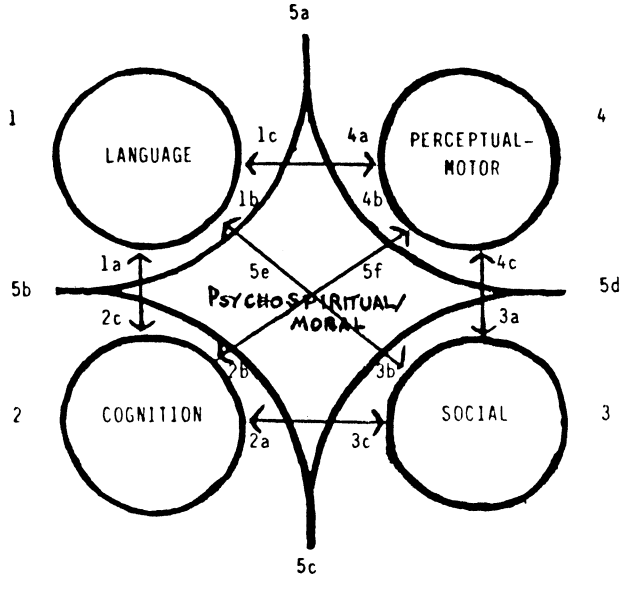
(p.19)

Hymes (1974) and Halliday (1973) have suggested that language is a means by which a child organizes and encodes his or her experiences, perceptions, and observations. The converse is also true. The child's use of the various means of interacting motorically, perceptually, and socially stimulates the development of symbolic representational skills (Harris and Vanderheiden, 1980). As well, cognition is also considered to have a major role in the development of communication skills (Chapman and Miller, 1980a). The relationship between communication skills and cognitive

development is so strong that it is unlikely that there would be progress in one without some acquisition of skills in the other (Carrier, 1974). And, of course, communication requires the medium of a perceptual-motor system to function. Any handicap in either one of the five senses, or their integration in the psycho-motor system, can affect the development of linguistic, cognitive, or social skills. Finally, implicit in the social component of communication, reflecting the developmental interdependence between the individual and society, is the moral principle that our actions are the implementation of our perceptions of someone's nobility and dignity. As a result, these perceptions and attitudes affect the degree of motivation of an NVSPH person (or any person) to communicate or to use an ACS. Silverman, McNaughton, and Kates (1978) state that the physical, mental, and social aspects of the whole child are linked together and influence each other.

To summarize, communication takes place through the developmental interdependence of the five dimensions of the whole person.

The following diagram and the accompanying explanation illustrate a few examples of ways in which the five dimensions might developmentally interact.



Note: The arrows indicate the interaction between the

components, all of which pass through (are affected by) the psycho-spiritual component.

1-a Language and cognition (1-a and 2-c) are thought to have such a strong relationship that the growth of one affects some development of skills in the other. People will be motivated to speak their personal ideas if they feel that their ideas will be appreciated and respected (5-b).

1-b Language is a vehicle for social skills (1-b and 3-b); and social goals, in turn, become a **raison d'être** for language. Language is critical in a society's coming to an understanding of each other so that its members work in concert toward common objectives (5-f) for their mutual benefit.

1-c Language is a means by which a child encodes and organizes his perceptual-motor skills which, in turn, assist in the development of language skills (1-c and 4-a). What a person is told about himself affects his self-esteem and thus his general ability to make sense out of the myriad impressions that pass through his perceptual-motor system. The converse is also probably true: If a person feels "good" or "together", he will communicate his ideas in a more positive manner (5-a).

2-a Social interaction is an impetus for the development of cognitive skills (2-a and 3-c), which, in turn, help to better organize and thus make more effective, the child's social interaction; for example, to understand and to work in concert with others (5-c).

2-b Theorists have articulated models of cognitive development which perceive a developmental relationship between perceptual-motor skills and cognition (2-b and 4-b).

3-a Motor skills are a vehicle for social skills; and social goals, in turn, become a **raison d'être** for motor skills (3-a and 4-c). We strive to perform (especially as children or adolescents) for others so that we may receive social encouragement which, in turn, motivates us to improve our performance even more (5-d).

Effective communication

People adjust and adapt to their physical and social environments through the medium of speech (Gray and Wise, 1959). And, as a result, "The life of human society persists and develops in and through communication" (Seth and Gutherie, 1935,

pp. 64-65). Communication patterns, though, are much more specific to the speed of communication than they are to the mode of communication (Harris and Vanderheiden, 1980). Few people will stop in the hallway to ask, "How are you doing?" if it takes twenty minutes to answer. Society itself, in this century, has experienced dramatic change as a result of new communication technologie3h have increased the speed of communication over great distances (Ferguson, 1973).

As a result of this developmental relationship between the individual's need for communication and society's need for semiotic systems, if the handicapped are unable to adequately communicate, they are effectively prevented from full participation in society (Bram, 1955). Their status and rights as citizens are disenfranchised.

This inability to effectively communicate affects their ability to interact and to explore their environment, including interaction with other people. It affects their ability to express emotions, needs, thoughts, and that consistent, reliable, and socially effective exchange of information which is the essence of communication (Harris and Vanderheiden, 1980). Much of our culture is subtly transmitted through intonation and stress patterns of speech. Those insensitive to the handicapped may incorrectly assume that, due to a lack of verbal skills, the handicapped are culturally ignorant. The severe reduction of communication can affect cognitive skills as well as social and linguistic skills. The sensori-motor period of development is seen as the essential stage prerequisite to the growth of symbolic and representational skills of language and cognition (Harris and Vanderheiden, 1980).

Yarrow et al. (1975) would also include the loving, kinesthetic, and sensori-motor stimulation which cultures place in the environment of the very young. The young non-vocal severely physically handicapped child is often in an environment which changes infrequently and lacks that hugging, touching, throwing-up-in-the-air combination of emotional and sensori-motor stimulation. Furthermore, adults around the handicapped child may inhibit their interaction with the child even more because the adult does not receive the response of a typical child's social reinforcement, such as giggling and baby-talk. In later years, the non-vocal, handicapped child might miss those opportunities for that dialogue of questions and answers which Ginsburg and Opper (1969), Halliday (1973), and Aulls (1978, 1982) have seen as playing an important role in the development of cognitive, linguistic, and reading skills.

Nevertheless, despite these barriers to communication and development, "It is often amazing how a severely handicapped... child will demonstrate in some way his understanding and comprehension of what is expected of him" (Denhoff, 1966, p. 69). Even the most severely handicapped person communicates (Shane,

1980). It just takes more time to get to know and become sensitive to motor movements, gestures, facial expressions, and other behaviors which are means of communication (Harris and Vanderheiden, 1980).

Often, the introduction of an electric wheelchair with an adequate seating insert and tray will result in dramatic improvements in motivation, new-found playful assertiveness, and communication. This, combined with an effective symbol system and efficient means to access it, can transform a passive, uninvolved NVSPH person into an active, contributing member of society.

SYMBOL SYSTEMS: Definition, prerequisite skills, and selection criteria

The NVSPH person requires a symbol system to **augment** whatever vocal sounds, facial expressions, and gestures are already being used, and to act as an **alternative** for dysfunctional speech mechanisms. Hollis and Carrier (1978) point out that the handicapped person's use of these augmentative communication systems (ACS) are a response made for a natural language which has already been acquired or, as they put it, has been mapped cognitively. As a result, symbol systems resemble a spoken language such as English. Curiously, in those situations where speech production is physiologically possible, an ACS does not discourage or decrease speech production. On the contrary, an ACS has been found to enhance production in those cases where it was possible but largely absent (Harris and Vanderheiden, 1980; Wilbur, 1980; Silverman, 1980; Musselwhite and St. Louis, 1982). These authors cite many other references which support this view.

Definition

What is a symbol? What are the prerequisite skills and assessment? What are the principles governing the selection of symbol systems for the NVSPH child? These questions will now be addressed.

> A symbol system is a set of sensory (visual, auditory, or tactile) images, or signs, that suggest, or should stand for, something else by reason of relationship (association) or convention.... A sign can function as a symbol because of a structural relationship (isomorphism) between it and what it symbolizes, or by reason of convention (it being assigned a particular meaning or meanings). A sign bears a structural relationship to its referent (or is isomorphic to its referent) if it is somehow associated with (or suggestive of) it, or both of these. (Silverman, 1980, p.86)

Hollis and Carrier (1978) classify their review of symbol systems as: (1) representational (iconic); (2) semantic (arbitrary symbols which directly or indirectly refer to an idea, or icon); and (3) phonetic. This paper will use the Musselwhite and St. Louis (1982) classification of symbol systems and their sub-headings.

1. **Representational:** iconic symbols or symbols which graphically suggest something. Examples are pictures, line drawings, rebuses, and Blissymbols.

2. **Abstract:** symbols whose graphic design or appearance do not directly suggest their meaning. Examples are Yerkish lexigrams, Premack-type tokens, and the Non-SLIP program (Carrier and Peak, 1975).

3. **Symbolic language codes:** symbols which refer to letters or sounds. Examples are alphabets, Braille, and Morse Code.

In general, those responsible for the implementation of an ACS should first determine why an ACS is required, what areas are to be assessed, and who will perform the assessment and with what methods (Harris-Vanderheiden and Vanderheiden, 1977).

Prerequisite skills

As previously stated, there are five developmentally interdependent dimensions to the communication needs of the whole person: language, cognition, social, perceptual-motor, and psycho-spiritual. Prerequisite skills fall into the following division of these five dimensions (see diagram on p. 44).

1. **Language:** The symbol user should be able to follow oral directions and have the receptive and "inner" language skills which reflect the demands of the chosen ACS. An environment which is both perceptually and motorically stimulating is the best assurance of maximizing the NVSPH person's potential, especially at a very early age (Harris-Vanderheiden and Vanderheiden, 1977; Silverman, 1980).

2. **Cognition:** Symbol users should be able to follow directions. They should be mentally able to represent attributes, locality, and function by the classification and categorization of persons, places, and things. They should have object permanence so that he can respond appropriately to a mental image of a sequence of actions. The average three-year old, to some degree, demonstrates all of these skills. However, there are simpler symbol systems (e.g., a one- or two-photograph or real-object communication board) which do not require all of these cognitive skills (Silverman, 1980; Premack, 1976; Harris-Vanderheiden,

1975).

3. **Social:** Symbol users must have something to communicate. If they sit in a hospital bed and/or in a wheelchair in a hallway day after day, they simply won't have anything to say. They will have needs - everyone has, at least, toiletting and feeding needs. But if they are generally ignored, it should not be surprising if they fail to communicate even the most basic of human needs. In situations like this, caregivers themselves quickly "burn out". People need people. The individual and society are developmentally interdependent. Therefore, for the mental health of both handicapped people and their caregivers, it is essential that there be a stimulating, periodically novel social milieu. Activities should be both directly and indirectly organized by caregivers and should be stimulating to both handicapped persons and caregivers. There should be an appropriate balance of both structured activities and informal activities, such as playtime and "chit-chat", which is sensitive to the developmental level of the handicapped person. Free playtime has a critical role in the development of young people (Eden, 1984). To summarize, any communication system must be implemented in a social milieu which is stimulating, periodically novel, and both formally and informally structured. Without these aspects, it is quite likely that the ACS will be little used.

4. **Perceptual-Motor:** Symbol users should be able to attend to a sequence of symbols. They should have the eye contact and tracking skills to recognize a string of symbols. They should have the sensori-motor skills required by the symbol system and the means to access it. For example, hand- and finger-pointing abilities are required for most simple matrix communication boards. Eye-movement pursuits are necessary to use the eye-coding system of accessing symbols on a matrix board. Finally, all symbol systems require some muscular movement to indicate a symbol selection. Both the choice of a symbol system and the means to access it are affected by perceptual-motor skills of the symbol users (Silverman, McNaughton, and Kates, 1978; Harris-Vanderheiden, 1976; Silverman, 1980).

5. **Psycho-Spiritual:** The fundamental basis of the social component, reflecting the developmental interdependence of the individual and society, is the recognition in the NVSPH person of the same innate human spirit which all humanity shares. Furthermore, this developmental interdependence suggests the moral principle that our actions are the implementation of our perceptions of someone else's nobility and dignity. As a result, these perceptions and attitudes affect the degree to which an NVSPH person (or any person) is motivated to communicate or use an ACS. Like the handicapped person, if caregivers are treated like someone making an important, and therefore special, contribution to someone else's life, they will be motivated and inspired to renew themselves periodically and to try new

approaches and systems. All too often, this vital relationship between individuals and the group is ignored; yet professionals and other caregivers wonder why "the system" occasionally fails to service someone despite the best intentions of the individual caregivers.

Selection criteria

Musselwhite and St. Louis (1982) list seven questions to consider when selecting an ACS.

1. How can the client respond?
2. What type of interface (e.g., input switch) is needed, if any?
3. What modes of output should be selected?
4. What type(s) of symbols will be utilized?
5. What will be the content of the communication board (e.g., how many symbols will be included and what level of language will they represent)?
6. How will the communication board be organized (e.g., what will be the spacing, size, and boldness of the symbols, and what type of display will be used)?
7. What methods of training are most appropriate for the client? (p.147)

When reviewing the various symbol systems available, Musselwhite and St. Louis (1982) suggest the following distinguishing characteristics: (1) level of cognition required (i.e., Piagetian stages); (2) interpretation (pictographic, ideographic, abstract); (3) structure (primarily English, unique, or relatively unstructured); and (4) vocabulary size.

Silverman (1980) suggests that the caregiver make a list of those symbol systems which the specific NVSPH person would be capable of using and then choose the optimal system. Alpert (1980) proposed that a trial therapy be conducted with the two most optimal ACSs. Musselwhite and St. Louis (1982) should look at the functional structure of the ACS, the client's spontaneous use of the ACS and the response of other people to the ACS.

A REVIEW OF SYMBOL SYSTEMS

As previously mentioned, Musselwhite and St. Louis (1982) classify symbol systems as representational, abstract, and symbolic language code. This paper will use this division to review some of the symbol systems which have been used by the handicapped.

Representational symbol systems

1. **Pictures, photographs, and line drawings:** Pictures, especially when used with gestures and sounds, are the most basic type of symbol system. They can be used either as a self-contained symbol system or in combination with other symbol systems. There are several dimensions to pictures such as size, level of abstraction, degree of complexity, degree of ambiguity, and the number of messages which can be encoded in a system (Silverman, 1980). Silverman explains the functions of abstraction, complexity, and ambiguity in representational symbols (and, to various degrees, in all symbol systems).

> The level of abstraction of a picture is a function of the amount of detail (or information) present in the object or event depicted that is included in the picture. The more detail (or information) omitted, the higher the level of abstraction. (p.87)
>
> The degree of complexity of a picture is partially a function of the extent to which its foreground stands out from its background. (p.89)
>
> The degree of ambiguity of a picture is a function of the number of concepts it could be used to encode. The more meanings that could be reasonably assigned to it, the greater its ambiguity...(Reducing complexity is one way of reducing ambiguity). (p.90)

While pictures are a poor vehicle for abstract ideas, they can be combined with symbol systems which can express abstract ideas (Musselwhite and St. Louis, 1982).

Williams and Fox (1977) suggest that, for those unfamiliar with formal symbol systems, one could start with real objects, people, and events: proceed to photographs with simple backgrounds; then to the more abstract line drawings; and, finally, to photographs with complex backgrounds. This reflects a movement from simplicity with little ambiguity, to photographs with greater detail (i.e., complexity), to systems with greater meaning per symbol (i.e., ambiguity). Pictures and photographs can also function as an intermediary stage between real objects and iconic systems such as Picsyms, rebuses, or Blissymbolics. Finally, only a person at near the Piagetian sensori-motor stage 5 in cognitive development is able to learn to use a picture symbol system.

2. **Picsyms:** Musselwhite and St. Louis (1982) briefly describe a picture-like symbol system called "Picsyms" which was developed by Carlson and James (1980). Picsyms was specifically developed for non-vocal or language-disordered people. According to Musselwhite and St. Louis's report, this semantically-based symbol system follows "logical principles of development". Arrows denote

direction of movement for action symbols, and time symbols are enclosed in a square as on a calendar. New symbols can be invented by using the logical principles of Picsyms. There is a dictionary of 1,800 symbols.

3. **Blissymbols:** Blissymbolics is a nonalphabet graphic communication system which was invented, developed, and expanded from 1942 to 1965 by Charles K. Bliss (McNaughton and Kates, 1980). Mr. Bliss envisioned Blissymbolics as an international language which would be used by politicians and scientists around the world; yet its "simple semantics, logic, and ethics" would assist "even children" to solve problems, and ultimately be of some assistance in the establishment of harmonious, peaceful relations between all peoples of the world (Bliss, 1965; McNaughton and Kates, 1980; Silverman, 1980; McDonald; 1980a; McDonald, 1980b; Musselwhite and St. Louis, 1982).

Blissymbolics consist of pictographics and ideographic symbols - some of which are already in wide use. There are also compound symbols.

The meaning of each symbol is determined, aside from its ideographic and/or pictographic meaning, by configuration, size, position, direction, spacing, pointer, number, positional referents, and compound symbols. There are also indicators for thing; past, present, and future action; description (adjective); and plurality. Finally, there are symbols for changing the meaning of a symbol. These strategies, when exploited by the Blissymbol user, increase the potential number of symbols far beyond the actual 512 Blissymbols on a typical Blissboard. McDonald (1980b) provides clear explanations accompanied by numerous examples of the symbols, their indicators, and so on. The syntax of Blissymbolics allows expression of all, or almost all, messages that can be expressed in natural language. **Blissymbols for Use** (Hehner, 1980) is a dictionary of about 1,400 symbols. By using the various symbol strategies, of course, the potential number of symbols is far greater.

Since Blissymbolics is a semantically-based system, visually concrete, often pictorial in representation, and has the English (or other language) equivalent over each symbol, the syntax is not as difficult as it may appear from a quick reading of a list of syntax rules and strategies. Also, the developmental entry level for initial use of Blissymbolics is simple enough for one with a mental age of two years. While a fully implemented Blissymbolics system, due to the level of symbol complexity and syntax, may not be the best choice of an ACS for the severely and profoundly mentally handicapped, Blissymbolics can at least be introduced very early to a NVSPH child.

Abstract symbol systems

1. **Premack-Type Tokens:** The Premack type of symbols originate from Premack's (1970) work with chimpanzee communication. Carrier (1976) and Carrier and Peak (1975) developed the Non-SLIP symbols for their Non-Speech Language Initiation Program as a means of starting children in the process of learning linguistic communication skills. It is not intended to be used as a total language program (Carrier, 1976). Non-SLIP uses a set of plastic symbols. Each symbol has a unique shape, is color coded, and is keyed as to each symbol's sequential position. Each symbol has the English equivalent printed on it. The symbols are designed to be manipulated manually.

The program, in a highly-structured, finely-graded fashion, from basic to terminal goals, teaches such skills as sequencing (by color/number codes), labelling (by matching symbols to pictures), and the meaningful use of nouns, verbs, and prepositions (Musselwhite and St. Louis, 1982).

With reference to NVSPH children, Musselwhite and St. Louis point out that "...the abstract nature of the symbols, the logistical difficulty of keeping numerous bulky symbols within reach, and the necessity to manipulate the symbols may make this system unusable for many severely handicapped clients" (p.172). One wonders if the reported success (Carrier, 1976) is based more on the highly-structured, behaviorally-based nature of the program than on the communicative viability of the symbol system for the severely handicapped population. If simple photographs, or even concrete objects, are the most fundamental symbols, how much more effective would Carrier's program have been if symbols of a pictorial or iconic nature were used? Deich and Hodges (1978) reported difficulties in attempting to adapt Premack-type symbols into a functional communication system (which Carrier did not intend) by making them iconic or representational.

2. **Yerkish Lexigrams:** Another symbol system based upon animal communication research is Yerkish Lexigrams which were used in Project Lana (Rumbaugh, 1977). The correctional grammar, with its automatic parser, in Project Lana was devised by Von Glassersfeld (1977). Each symbol consisted of one or more of nine basic shapes; for example, a dot, a circle, or a diamond. Each symbol represents a word and may have a color-coded background (Rumbaugh & Savage-Rumbaugh, 1978).

The abstract nature of the symbol system with its combination of nine design elements may be considered too difficult (i.e., for reasons similar to those for the Premack-type) for the severely physically handicapped. Nevertheless, the intriguing aspect of the application of Yerkish lexigrams by Rumbaugh and Savage (1978) is the use of a computer with a group of six profoundly retarded children. The user presses a

lighted colorful key on a keyboard. The computer then prints out the symbol. More significantly, the computer is able to monitor and evaluate grammaticalness and record all linguistic events. The machine is able to automatially parse a sentence of lexigrams, and immediately inform the user of the correctness or incorrectness of his sentence. The symbol system itself was designed to allow this type of learning feedback.

Symbolic language code

1. **Phonemic Alphabet:** Due to a lack of one-to-one correspondence between sounds and letters in English, a number of programs offer phonemic alphabets which have such a correspondence. Musselwhite and St. Louis (1982) briefly review these programs which are designed as initial reading programs and include alphabets such as the International Teaching Alphabet and the International Phonetic Alphabetic (IPA). A modified IPA, consisting of 45 English phonemes, is the basis for the PHONIC MIRROR Handivoice. This is a portable electronic device which produces synthetic speech (Cohen et al., 1979). Another tool specifically designed for NVSPH people is the SPEEC which was developed by Goodenough-Trepagnier and Prather (1979). SPEEC consists of a communication board with a set of single phonemes and those phoneme sequences which occur with the highest frequency in English. Goodenough-Trepagnier and Deser (1980) demonstrate that a greatly reduced number of selections from a communication board is possible with SPEEC compared to one with the traditional arrangement of the English alphabet.

Users of SPEF other phonemic symbol systems require good visual discrimination skills; cognitive development from the late preoperational stage to the early concrete operational stage; and, obviously, sound-blending skills (Cohen et al., 1979). Goodenough-Trepagnier and Prather have attributed the usefulness of SPEEC to its lack of a complex set of rules and exceptions which are part of traditional orthography.

2. **Traditional Orthography:** Musselwhite and St. Louis also draw upon other approaches to teaching reading. They cite Clark and Woodcock (1976) for their division of adaptations of traditional orthography into "controlled" and "elaborated". An example of controlled would be "A fat cat sat on a tan mat". The elaborate consists of additional symbols, markings, or color codings without altering the traditional spelling. Approaches like these inevitably lead to the use of a standard orthography. For some NVSPH people, an initial reading program isn't needed as much as a quicker and more efficient method of accessing traditional orthography. The WRITE system is an example of just this.

The WRITE was developed by Ms. Cheryl Goodenough-Trepagnier. Similar to her SPEEC system, the WRITE

consists of a communication board with a matrix of the statistically most frequently occuring letter clusters in traditional English orthography. Demasco and Foulds (1982) report that, with a 400-cell matrix on a WRITE communication board, "...the average number of selections per word is 1.54" (p.180).

While the WRITE requires a higher level of language and cognitive skills, it is essentially a quick-spelling system; each communication board has an unlimited vocabulary and uses the natural language of the milieu.

3. **Symbolic representations of traditional orthography:** In addition to phonemic and traditional orthographic forms of symbolic language codes, Musselwhite and St. Louis (1982) also review two widely-used codes which represent traditional orthography. They are Braille and Morse Code. Most ACS's are in graphic form on a communication board with the image of the symbol shared between the user and the listener. However, Braille and Morse Code are means by which to efficiently access traditional orthography. Thus, they require spelling skills, as well as the ability to memorize a code and translate it into a natural language. In the case of Braille, the blind are able to access text through the medium of touch. With Morse Code, through the medium of one or two switches which generate a short and long tone, an NVSPH person is able to access a computer which can produce a synthetic voice or printed copy of a natural-language message (Schwejda and Vanderheiden, 1982; McDonald et al., 1982).

CONCLUSION

Fundamental to programs for handicapped people is the necessity of society recognizing in even the most severely handicapped the same innate spirit which all humanity shares. By virtue of their human spirit and the socially significant contribution which their lives can make, their dignity and nobility demand that their essential needs be met and that services be made available to allow them to fully participate in society. The individual and collective humanity are developmentally interdependent. Furthermore, individual development can be described as the interdependent development of five skill-area dimensions: language, cognition, social, perceptual-motor, psycho-spiritual/moral. In the context of this spiritual/moral principle and this model of individual development, this paper reviewed the issues concerning augmentative communication systems for non-vocal severely physically handicapped people. A brief mention was made of the necessity of an eclectic inter-disciplinary approach due to the multifaceted nature of communication for the handicapped. There was a discussion of how the model of development relates to the communication needs

of the handicapped. There followed a definition of symbols, prerequisite skills, and some criteria for the selection of a symbol system. Finally, there was a review of representational, abstract, and symbolic language code systems which have been used by non-vocal severely handicapped people.

(Editor's note: This article is part one of a two-part series. Part II will appear in the Spring 1985 issue.)

REFERENCES

Alpert, Cathy. (1980). Procedures for Determining the Optimal Nonspeech Mode With the Autistic Child. In R.L. Schiefelbusch (Ed.), **Nonspeech Language and Communication: Analysis and Intervention** (pp. 389-420). Baltimore, MD.: University Park Press.

Aulls, Mark W. (1982) **Developing Readers in Today's Elementary School.** Boston, Mass.: Allyn and Bacon, Inc.

Aulls, Mark W. (1978) **Developmental and Remedial Reading in the Middle Grades.** Boston, Mass.: Allyn and Bacon, Inc.

Bliss, C.K. (1965). **Semantography.** Syndey, Australia: Semantography Publications.

Bloom, Lois and Lahey, Margaret. (1978). **Language Development and Language Disorders.** New York, NY.: John Wiley and Sons.

Bram, J. (1955). **Language and Society.** New York, N.Y.: Doubleday and Co.

Carlson, F., and James, C.A. (1980). Picsyms system and symbol system. Unpublished paper cited by C.R. Musselwhite and K.W. St. Louis. (1982). **Communication Programming for the Severely Handicapped: Vocal and Non-vocal Strategies.** Houston, Texas: College Hill Press.

Carrier, J.K. (1974). Application of functional analysis and a nonspeech response mode to teaching language. In L.V. McReynolds (Ed.), **Developing Systematic Procedures for Training Children's Language.** ASHA Monograph, 18.

Carrier, J.K. and Peak, T. (1975). Non-Speech Language Initiation Program. Non-speech Language Initiation Program Lawrence, KS.: H. and H. Enterprises.

Carrier, J.K. (1976). Application of a nonspeech language system with the severely language handicapped. In L.L. Loyd (Ed.), **Communication Assessment and Intervention Strategies** (pp. 523-548). Baltimore, MD.: University Park Press.

Chapman, R.S. and Miller, J.F. (1980a). Analyzing Language and Communication in the Child. In R.L. Schiefelbusch (Ed.), **Nonspeech Language and Communication: Analysis and Intervention** (pp. 159-198). Baltimore, MD.: University Park Press

Clark, C.R., and Woodcock, R.W. (1976). Graphic systems of communication. In L.L. Lloyd (Ed.). **Communication assessment and intervention strategies** (pp. 549-605). Baltimore, MD.: University Park Press.

Cohen, C., Montgomery, J., and Yoder, D. (1979). **Phonic Mirror Handivoice Seminar Manual.** Mill Valley, CA.: H.C. Electronics, Inc.

Deich, R.F., and Hodges, P.M. (1978). **Language Without Speech.** New York, NY.: Brunner/Mazel.

Demasco, P., and Foulds, R. (1982, September). A New Horizon for Nonvocal Communication Devices. **Byte, 7**(9), 166-182.

Denhoff, E. (1966). Cerebral Palsy: Medical aspects. In W.Cruickshank (Ed.), **Cerebral Palsy: Its Individual and Community Problems,** Syracuse, NY.: Syracuse University Press.

Eden, S. (1984). **Early Experiences.** Scarborough, Ont.: Nelson Canada.

Ferguson, Gloria H. (1973, Fall). Telecommunication Administration: Patterns for Peace. **World Order, 8**(1), 35-46.

Ginsburg, H., and Opper, S. (1969). **Piaget's Theory of Intellectual Development.** Englewood Cliffs, NJ.: Prentice-Hall.

Goodenough-Trepagnier, C., and Deser, T. (1980). **Rate of Output with a SPEEC Non-vocal Communication Board.** A paper presented at the International Conference on Rehabilitation Engineering, Toronto, Canada.

Goodenough-Trepagnier, C., and Prather, P. (1979). **Manual for Teachers of SPEEC.** Boston, MA.: Biomedical Engineering Center, Tufts - New England Medical Center.

Gray, G.W., and Wise, C.M. (1959). **The Bases of Speech.** New York, NY.: Harper and Brothers.

Halliday, M.A.K. (1973) **Explorations in the Functions of Language.** London, England: Edward Arnold Ltd.

Halliday, M.A.K. (1975). **Learning How to Mean - Explorations in the Development of Language.** London, England: Edward Arnold Ltd.

Harris, D., and Vanderheiden, G. (1980). Enhancing the Development of Communicative Interaction. In R.L. Schiefelbusch (Ed.), **Nonspeech Language and Communication: Analysis and Intervention** (pp. 227-257). Baltimore, MD.: University Park Press.

Harris-Vanderheiden, D. (1976). Blissymbols and the mentally retarded. In G. Vanderheiden and K. Grilley (Eds.), **Non-vocal Communication Techniques and Aids for the Severely Physically Handicapped** (pp.120-131). Baltimore, MD.: University Park Press.

Harris-Vanderheiden, D., and Vanderheiden, G.C. (1977). Development of communicative and interactive skills for nonvocal severely handicapped. In E. Sontag, J. Smith, N. Certo (Eds.), **Educational Programming for Severely and Profoundly Handicapped.** Reston, VA.: Division on Mentally Retarded, Council for Exceptional Children.

Hehner, B. (Ed.). (1980). **Blissymbolics for Use.** Toronto, Ont.: Communication Institute.

Hollis, J.H., and Carrier, J.K. (1978). Intervention strategies for nonspeech children. In R.L. Schiefelbusch (Ed.), **Language Intervention Strategies** (pp. 57-100). Baltimore, MD.: University Park Press.

Hymes, D. (1974). **Foundations in Sociolinguistics.** Philadelphia, PA.: University of Pennsylvania Press.

McDonald, E.T. (1980a). Early Identification and Treatment of Children at Risk for Speech Development. In R.L. Schiefelbusch (Ed.), **Nonspeech Language and Communication: Analysis and Intervention** (pp. 49-79). Baltimore, MD.: University Park Press.

McDonald, E.T. (1980b). **Teaching and Using Blissymbolics.** Toronto, Ont.: The Blissymbolics Communication Institute, at the Ontario Crippled Children's Centre.

McDonald, J.B., Schwejda, P., Marriner, N.A., Wilson, W.R., and Ross, A.M. (1982) Advantages of Morse Code as a Computer Input Method for School-Aged Children with Physical Disabilities. In **Computers and the Handicapped - Tutorial** (pp. 95-106). Ottawa, Ont.: The Biomedical Engineering Research Program, National Research Council of Canada.

McNaughton, S., and Kates, B. (1980). The Application of Blissymbolics. In R.L. Schiefelbusch (Ed.). **Nonspeech Language and Communication: Analysis and Intervention** (pp. 303-321). Baltimore, MD.: University Park Press.

Musselwhite, C.R., and St. Louis, K.W. (1982). **Communication Programming for the Severely Handicapped: Vocal and Non-vocal Strategies.** Houston, TX.: College Hill Press.

Premack, D. (1970). A functional analysis of language. **J. Exp. Anal. Beh., 14,** 107-125.

Premack, D. (1976). Personal communication cited by J.H. Hollis and J.K. Carrier. (1978). Intervention Strategies for non-speech children. In R.L. Schiefelbusch (Ed.). **Language Intervention Strategies** (pp. 57-100). Baltimore, MD.: University Park Press.

Rice. (1978). Children with Language Disorders. In R.L. Schiefelbusch (Ed.), **Language Intervention Strategies.** Baltimore, MD.: University Park Press.

Rumbaugh, D.M., (Ed.). (1977). **Language Learning by a Chimpanzee: The Lana Project,** New York, NY.: Academic Press.

Rumbaugh, D.M., and Savage-Rambaugh, S. (1978). Chimpanzee language research: Status and potential. **Beh. Res. Meth. Instrumen., 10,** 119-131.

Schiefelbusch, R.L., and Hollis, J.H. (1980). A General System for Nonspeech Language. In R.L. Schiefelbusch (Ed.). **Nonspeech Language and Communication: Analysis and Intervention** (pp. 5-23). Baltimore, MD.: University Park Press.

Schwejda, P., and Vanderheiden, G. (1983, September). Adaptive-Firmware Card for the Apple II. **Byte, 7**(9), 276-314.

Seth, G., and Gutherie, D. (1935). **Speech in Childhood: Its developments and disorders.** London, Eng.: Oxford University Press.

Shane, H.C. (1980). Approaches to Assessing the Communication of Non-Oral Persons. In R.L. Schiefelbusch (Ed.). **Non-speech Language and Communication: Analysis and Intervention** (pp. 197-224). Baltimore, MD.: University Park Press.

Silverman, F.H. (1980). **Communication for the Speechless.** Englewood Cliffs, NJ.: Prentice-Hall.

Silverman, F.H., McNaughton, S., and Kates, B. (1978). **Handbook of Blissymbolics.** Toronto, Ont.: Blissymbolics Communication Institute.

Van Glassersfeld, E. (1977). The Yerkish language and its automatic parser. In D.M. Rambaugh (Ed.), **Language Learning By a Chimpanzee: The Lana Project.** New York, NY.: Academic Press.

Wilbur, R.B. (1980). Nonspeech Symbol systems. In R.L. Schiefelbusch (Ed.), **Nonspeech Language and Communication: Analysis and Intervention** (pp. 81-90). Baltimore, MD.: University Park Press.

Williams, W., and Fox, T. (Eds.). (1977). Communication. In **Minimum Objective Systems for Pupils with Severe Handicaps: Working Draft Number One,** Vol. 1. Burlington, VT.: Centre for Special Education, University of Vermont.

Yarrow, L., Klein, R., Lomonaco, S., and Morgan, G. (1975). Cognitive and motivational development in early childhood. In B. Friedlander (Ed.), **Exceptional Infant,** Vol. 3. New York, NY.: Brunner/Mazel.