ABSTRACT
AUGMENTATIVE AND ALTERNATIVE COMMUNICATION: EFFECTS OF SPEECH OUTPUT AND ICONICITY ON SYMBOL ACQUISITION
By: Diana L. Brown

The purpose of this study was to determine if the degree of iconicity of picture symbols and the presence and absence of speech output affects the acquisition and usage of symbols. This study consisted of a between subjects design with 48 children from the Southwest, Ohio area. The children were presented with iconic and opaque Blissymbols in both speech and no speech output condition. Results indicated that there was no significant difference in the number of trials needed to acquire transparent and opaque symbols with speech and no speech output. Clinical implications, future research, and limitations are discussed.
AUGMENTATIVE AND ALTERNATIVE COMMUNICATION: EFFECTS OF SPEECH OUTPUT AND ICONICITY ON SYMBOL ACQUISITION

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CHAPTER I
Introduction

Augmentative and Alternative Communication

Augmentative and alternative communication (AAC) is a method of communication used to supplement or enhance an individual’s verbal communication abilities. The term augmentative refers to building on an individual’s existing communication skills, while the term alternative refers to using a substitute method for more traditional means of communication, such as oral speech or gestures. Alternative communication may consist of using a computer device in place of using one’s voice to communicate. The purpose of AAC is to provide an individual a means to communicate in order to maximize their use of functional communication (ASHA, 2002). Functional communication refers to using an individual’s ability to interact with others in their natural environment to have their needs meet. This includes, but is not limited to, the ability to request, comment, and socialize with the intentions of fulfilling specific care needs, relating to others, sharing thoughts and gaining information (Glennen & DeCoste, 1997). An individual with special needs can benefit from the use of AAC because it allows him or her to communicate more effectively, thereby reducing frustration for both the communicator and the communicating partner. The use of AAC can also help to eliminate problematic or socially unacceptable behaviors. Reducing these barriers and relieving frustration enables the individual to socially relate to others.

Using AAC to meet functional communication needs can incorporate the use of sign language, gestures, picture symbols, visual schedules, devices with speech capabilities, and eye gaze boards. AAC also includes the use of assistive technology to enhance an individual’s skills and abilities.

Whatever the means of AAC, there are key components that are consistent with using an alternative and augmentative method of communication. These components include symbols, technique, and strategies (ASHA, 2002).

Symbols

AAC involves the use of symbols. Symbols are a means of representing something else, which can be called a referent. Sign language and gestures are a manual means of symbols to represent words. Graphic symbols are picture representations of objects, actions, and concepts (Beukelman & Mirenda, 1998). Specific sets of graphic symbols have been developed for the
AAC user. Each specific set of symbols can be classified according to its features. Names of symbol sets include: Blissymbols, Picsyms, Picture Communication Symbols (PCS), and DynaSyms.

Blissymbols were created by Charles Bliss in 1949 in his book *Semantography* and revised in 1965 (Bliss, 1965). The symbols were originally developed to assist cross-cultural language and communication. However, the symbols were found to be helpful for children with disabilities and have come to be used as a method of AAC. The symbols consist of an organized set of lines. The lines are combined to produces many different types of symbols. These symbols are used commonly around the world, but are not as popular in the United States (Fuller, 1997; Raghavendra & Fristoe, 1995).

Picsyms were created by Faith Carlson (1985). The symbols in this system are black, hand-drawn pictures on a white background. The symbols can be found in Carlson’s Picsyms Categorical Dictionary (1985). Picsyms are currently being used more often with AAC devices than in the past. Picsyms have been adapted into another symbol set referred to as the DynaSyms (Glennen & DeCoste, 1997). The symbols were designed specifically for the Dynavox, a computerized, speech output device. The symbols are similar to Picsyms. However, sometimes the backgrounds in DynaSyms consist of additional symbols in order to add meaning to the referent.

PCS are symbols that can be purchased through Mayer-Johnson (Johnson, 1981). These symbols depict their referent through pictures of objects, sign language, and combinations of symbols. Glennen and DeCoste (1997) indicate that PCS symbols are one of the most widely used symbols. The Mayer-Johnson Boardmaker program is a common means for people to obtain the PCS symbols.

Many different types of symbols sets have been developed for AAC users. However, despite the type of symbol, there are many ways to classify symbols according to their unique properties. The manner in which symbols are used can also be classified into aided and unaided communication (Beukelman & Mirenda, 1998; Glennen & DeCoste, 1997). Unaided communication refers to using only one’s body to communicate. Signs and gestures are considered to be unaided communication. Using a support, such as a graphic symbol or an object, signifies aided communication. If the AAC method incorporates using both aided and unaided means this can be referred to as combined symbol sets (Beukelman & Mirenda, 1998).
Iconicity is another means of classification for symbols. As described by Lloyd and Fuller (1997), the iconicity of a symbol is the degree to which the symbol resembles the referent. Symbols can be described as transparent, translucent or opaque. A transparent symbol directly resembles the entity that is the referent. Examples of this include miniature objects and photographs (Beukelman & Mirenda, 1998). Translucent symbols contain a specific property of their referent, but do not directly resemble it (Venkatagiri, 2002). In contrast, a symbol that is not visually comparative to the referent can be referred to opaque (Lloyd & Fuller, 1997). Transparent symbols are the easiest to identify, followed by translucent symbols. Opaque symbols are the hardest to identify because they are the most abstract.

Symbol classifications are carefully considered when choosing specific symbols for an individual who will use a method of AAC.

Techniques

The method that an individual utilizes to access their means of communication is identified as the technique. Technique describes how the symbols are displayed and how an individual chooses their symbols to create a message (ASHA, 2002).

The way symbols are displayed can be described as static and dynamic. The symbols in static displays do not move and their layouts remain constant. When the overlay of the static screen needs to be changed, it must be changed manually. In dynamic displays, the symbol layout changes in relation to how the symbols are accessed. Computer screened devices are an example of dynamic displays (Glennen & DeCoste, 1997). When a symbol is selected on the computer screen, the entire screen may change automatically to display a series of new symbols. The dynamic displays change without having to be changed manually like in the static displays. Dynamic displays offer the device user more options for creating messages.

Symbol selection can occur in two ways. The individual can directly select the symbol with their own body or an assistive pointing device. For example, an adult with cerebral palsy may use a pointer attached to his head to select the symbol. Another individual may be able to select the symbol by pointing with their finger. Both of these access methods are considered to be direct selection. However, not every individual will have the motor control to directly select a symbol. If a direct method cannot be used, a scanning, approach may be taken. This is a method in which a switch accesses the symbol through the device (Glennen & DeCoste, 1997). A switch can be described as a device that looks similar to a large button. When the button, or switch, is
pushed it will access the scanning of the device. Scanning is a selection method that offers the user a choice of what symbol they want to use. The symbol choice can be offered by highlighting or lighting up the symbols on the display. The desired symbol is chosen by the hitting the switch when the desired symbol is highlighted and then the message is delivered. An individual with autism who has poor motor control may require a switch to select the symbols on his device.

Choosing an appropriate combination of symbols and techniques for each individual based on their unique needs, including physical and mental capabilities, will allow the individual to communicate more effectively.

**Strategies**

In order to maximize the efficiency of message production, strategies are implemented to provide optimal output (ASHA, 2002). Word prediction, scanning speed, the gradual increase in the number of symbols on a display and how a display is organized are all examples of strategies that can increase an individual’s communication output.

Using voice output on a device is another strategy that may be used. Voice outputs can be categorized as digitized or synthesized speech (Schlosser, 2003). Digitized speech is a recorded voice that is programmed into the device, whereas synthesized speech is computer generated.

The combinations of the use of symbols, the technique for accessing the symbols and the user strategies are unique to each individual who is using an AAC device. Past research studies have examined various symbols, techniques, and strategies both individually and in relationship to one other in order to determine effective teaching methods and approaches to using the devices. Fuller (1997) found that highly translucent symbols should be taught before opaque symbols for maximum ability. Schlosser, Belfiore, Nigam, Blischak, and Hetzroni (1995) indicate that opaque symbols combined with speech output devices can produce more efficient learning of the symbols. Many of the studies have compared symbol sets in terms of the ease of learning. For example, Mizuko (1987) found that the PCS symbols were learned easiest followed by the Picsyms and Blissymbols in a study comparing the three symbols sets. The past studies have been conducted with adults and children, as well as individuals with typical development and developmental delays (Fuller, 1997; Mizuko, 1987; Reichie & Johnston, 1999; Romski, Sevcik & Pate, 1988; Yovetich & Young, 1988). However, studies involving individuals with
disabilities are often limited because of the diversity of the population. The limitation is often the lack of number of participants due to the unique nature of many of the disabilities or delays.

Schlosser and Sigafoos (2002) found that there are limited studies that compare multiple features of AAC devices in comparison to one another to determine the most effective means of teaching and using the devices. Schlosser and Sigafoos (2002) reviewed the literature concerning studies that researched graphic symbols. Forty research studies were analyzed by the variables that were manipulated in the study. The variables that were observed included the following: reinforcement value, iconicity, spoken referent comprehension, concreteness of the referent and the output. The literature review categorized the studies based on their methods and what was being researched. It was found by Schlosser and Sigafoos (2002) that there was a lack of studies that compared two variables of AAC in relationship to one another. The literature review indicated that future research should focus on iconicity and its role in relation to preferred and non-preferred reinforcement or on referents that are known and unknown by the user. Finally, the article called for future research investigating varying degrees of iconicity and the implications of using speech and non-speech output devices. The present study will focus on multiple features in relationship to one another, specifically the relationship of speech and non-speech output devices and the iconicity of symbols and their effect on the acquisition of symbols.

Statement of the Problem

Research on iconicity and graphic symbols has offered much information on how individuals acquire symbols based on their relationship to the referent (Schlosser and Sigafoos, 2002). Specifically, the more iconic the symbol is, the more easily it is acquired. However, research has been primarily focused on one aspect of iconicity in relation to the other, for example, transparent versus opaque symbols and how one symbol type is acquired more easily than the other (Fuller, 1997). Schlosser, Belfiore, Nigam, Blischak and Hetzroni (1995) studied on the acquisition of opaque symbols using speech output and no speech output and found that opaque symbols are acquired more easily when using the speech output device. There is a need for further research to focus on the iconicity of symbols in relation to other variables related to the acquisition of symbols, such as the teaching method, the speech output of devices, referents that are known and unknown, and preferred and non-preferred objects (Fuller, 1997; Schlosser & Sigafoos, 2002). This study will compare how symbols are acquired by manipulating the variables of iconicity versus the transmission of the symbols by speech and non-speech output.
methods. Schlosser and Sigafoos (2002) specifically proposed a need for studies that examined the relationship of symbols of varying iconicity and the method of output that is used to transmit the symbolic message.

Purpose of the Study

The purpose of this study is to determine if the degree of iconicity of picture symbols and the presence and absence of speech output affects the acquisition and usage of symbols. This study is designed to determine if teaching communication symbols of varying degrees of iconicity can be acquired more efficiently using speech or non-speech output devices. Fuller (1997) has found that highly translucent symbols are more easily acquired than symbols that are low in translucency or opaque. Furthermore, Schlosser et al., (1995) found that opaque symbols are acquired more easily when using a speech output device. This study will further examine the acquisition of symbols by varying the iconicity of the symbols in relation to speech output to determine the correlation of the two variables.

Hypothesis

It is hypothesized that the opaque symbols will be acquired in fewer trials using the speech output device than the non-speech output device, while the transparent symbols will be acquired in fewer trials than the opaque, but will not depend on the method of output.
CHAPTER II  
Review of the Literature

Brief History of AAC

In comparison to other specialty areas in speech pathology, AAC is a relatively new field, with its origin in the 1960’s. In the short amount of time that AAC has been a structured field of speech pathology, many advancements have been made. AAC began with the civil rights movement of 1960 and has developed through the implementation of new laws securing civil rights, especially for individuals with disabilities. With the growth of technology, AAC has developed into a field that has many professional organizations whose members are doing research and implementing AAC to benefit individual’s lives.

In the early years, AAC was only a solution for those who could not speak. If an individual could produce words or sounds, AAC was not used as an option for treatment even if communication was inefficient. In contrast, today AAC is used to enhance any skills of an individual with a disability, whether he or she can produce vocalizations or not. Currently, the goal of using AAC is to provide the individual a means of communication with others so that he or she may be functional in his or her daily life. Individuals who cannot speak now have the ability to use picture symbols and computer devices to order food at restaurants, maintain employment, and to socialize with others. Being able to communicate through augmentative or alternative means of communication in the absence or emergence of speech has become more important in the field of speech pathology over the years.

In the 1950’s and 1960’s, the foundation for AAC was established with the beginning of the civil rights movements and the advancements that were occurring in medicine and technology (Beukelman & Mirenda, 1998; Glennen & Decoste, 1997; Hourcade, Pilotte, West & Parette, 2004; Zangari, Lloyd & Vicker, 1994). In this time period, scientific advancements occurred that led to an increase in the survival rate for premature infants and the length of life for older adults. As more people survived events that once inevitably led to death, there was in increase in the number of people that needed to be seen for speech, language and communication difficulties as a result of trauma and developmental difficulties. Specifically, AAC methods were needed to provide a means for the people to communicate effectively.

Technological advances eventually sparked ideas that provided more methods to enhance communication. During the 1950’s and 1960’s, the ideas of aided and unaided
communication were developed (Beukelman & Mirenda, 1998; Glennen & Decoste, 1997; Romski, Sevcik & Pate, 1988). Aided communication refers to using technological equipment to communicate, while unaided communication refers to an individual’s ability to use only their own body to communicate. Examples of aided communication include picture communication boards, computer devices that produce speech output, and using pencil and paper to draw or write messages. Unaided communication includes vocalizations, head nods, sign language and gestures. In the 1950s, AAC began to use aided and unaided alternatives for those who could not communicate or speak effectively. The technological advancements of this decade were introducing better, more accessible means of aided communication.

The 1960s civil rights movement began to secure rights for individuals concerning their race and ethnicity. The deaf community sought civil rights for people with hearing impairments. This eventually led to the development of total communication in educational settings. Total communication refers to the use of a variety means or methods for using and teaching communication (Glennen & Decoste, 1997; Beukelman & Mirenda, 1998). An example of a total communication approach would be a young child that uses both sign language and verbal words to produce the most effective communication messages in specific situations. During the 1960s decade, public awareness for individuals with disabilities also began to occur. President Kennedy’s public acknowledgment of his sister with mental retardation developed public awareness for individuals with disabilities (Glennen & Decoste, 1997; Romski, Sevcik & Pate, 1988). As attention began to focus on individuals with disabilities, a movement was set in motion to provide services for individuals to improve communication methods. The use of services would then foster the development of AAC that would continue through the following decades.

The 1970’s marked the emergence of AAC. Many professionals began to collaborate in their efforts to work with and to develop methods to utilize AAC effectively with individuals with disabilities (Zangari, Lloyd & Vicker, 1994). Public Law 94-142, The Education for All Handicapped Children Act of 1975, provided that people with disabilities must receive free, appropriate, public education with non-discriminatory testing and placement for education in the least restrictive environment (Zettel & Ballard, 1979). Although this law did not specifically require the use of AAC for children with disabilities in the school systems, it required
professionals to work with the students to provide a free, appropriate, public education in the least restrictive environment and AAC was one method to providing these services.

Zangari et al. (1994) refer to the 1980s as a period of growth and refinement for AAC. The field of AAC was established and had a sturdy foundation. The details of AAC began to emerge, such as professional organizations and the development of research studies. The American Speech-Language-Hearing Association (ASHA) recognized AAC in their position statement in 1981 that mandated the use of technology to serve people who were classified as mentally retarded (American Speech-Language-Hearing Association, 1982). Also during the 1980s, The International Society for Augmentative and Alternative Communication (ISAAC) was created. ISAAC is a professional organization that developed the first peer reviewed journal for the publication of AAC research and continues currently to report research findings in the area of AAC, making it a valuable resource for consumers and professionals (Zangari et al., 1994). Following the development of ISAAC in 1991 the special interest division for AAC was formed within the American Speech Language and Hearing Association (ASHA) for professionals with a special focus in AAC. This special interest division continuously adds members each year.

Throughout the 1980s and 1990s, computer technology began to rapidly develop and resulted in the capacity for greater computer memory. Synthesized speech, or speech that can be generated from a repertoire of sounds on a computer, was also developed during this time period. In addition, new devices with dynamic displays, greater dependability and an increased speed of processing were introduced (Zangari et al., 1994). People could begin to rely strongly on the use of technology for quality communication, which was an advantage for professionals and caregivers because less time could be spend programming the devices. Programming seems to be a source of frustration for many caregivers and professionals to this day; Messages still must be recorded into devices and overlays still need to be made for use of the symbols.

The 1990s also showed an increase in the development of research and awareness of the field of AAC. Specifically, textbooks have been written outlining important terminology and theories of practice based on the research being published about AAC (Beukelman & Mirenda, 1998; Glennen & Decoste, 1997; Lloyd, Fuller, & Arvidson, 1997). These books provided organization of the terms and research of different aspects of AAC such as symbol types, iconicity, strategies, and techniques.
In 2001, the ASHA special interest division developed guidelines based on these textbooks. The guidelines outlined the knowledge needed for speech pathologist working within the area of AAC (American Speech-Language-Hearing Association, 2002). This article summarized core definitions used when working with AAC including the terms aided and unaided, iconicity, static and dynamic displays, techniques, and strategies. In the guidelines, the role of the speech pathologist and the necessary knowledge and skills needed for AAC assessment and intervention are listed. This list provides that the speech pathologists role is to assess the individual, to provide methods of functional communication, to provide appropriate intervention plans, to base AAC methods on measurable objectives, to collaborate with other professionals and to evaluate the use of the AAC system. The speech pathologist must be knowledgeable about speech and language development as well as the AAC technology available and how it can be utilized. A follow-up technical report was written by the special division of ASHA in 2004 to supplement the information given in the 2002 report to further define terms and skills needed. This report provided more in-depth information and called for more research to be conducted in the area of AAC concerning literacy, vocabulary development, delivery of services, and language acquisition (American Speech-Language-Hearing Association, 2004). Then, again in 2005, a position statement was released by the special interest division stating that speech pathologists who are practicing within the area of AAC must maintain the knowledge and skills that were described in the 2001 ASHA guidelines (American Speech-Language-Hearing Association, 2005).

The field of AAC is still relatively young. However, over the past 50 years much advancement has been made in the field in regards to the development of technology, organizations, research and clinical practice. As the field continues to expand with technological and scientific advancements and improving techniques, more research is needed to ensure that the methods of AAC are being used effectively and taught efficiently. With new advancements in research and technology, the field of AAC will continue to evolve and improve.

Iconicity

Iconicity is the visual representation of picture symbols to their referent. In the past 15 years, professionals have attempted to find a consistent terminology for iconicity (American Speech-Language-Hearing Association, 2002; Lloyd & Fuller, 1997). It has been concluded that within the description of iconicity there exists a classification system for the degree to which the
symbols compare to their referent. The symbols can be referred to as transparent, translucent and opaque. Transparent symbols highly resemble the idea it represents, translucent symbols resemble a part of the idea, and opaque symbols are abstract in representing the idea. A picture of a chair can be used to represent the difference between the transparent and translucent symbol types. The transparent symbol of a picture of a chair would directly represent a chair, while the translucent symbol using the picture of a chair would mean “sit”. Therefore, the iconicity of symbols plays a role in how people identify the symbols. Sevcik, Romski and Wilkinson (1991) report that individual experiences and how individuals organize their environment also affect the iconicity of the symbol. Several studies have examined the use of transparent, translucent and opaque symbols in relationship to the learning of or the acquisition of the symbols (Bloomberg, Karlan, & Lloyd 1990; Fuller, 1997; Hetzroni, Quist, & Lloyd, 2002; Yovetich & Young 1988).

Fuller (1997) concluded that symbols should be taught in a specific order based on the iconicity of the symbols and how the symbols are learned. Specifically, it was concluded that highly translucent symbols should be taught to the individuals first. This should be followed by less translucent symbols and then by symbols that are completely opaque and are unrelated to the referent. This study was conducted with 13 adults and 11 children and examined how the complexity of symbols in relationship to the iconicity of the symbols affected symbol acquisition of Blissymbols. Symbols that were high in translucency were easier to acquire for children and adults, but the complexity affected the acquisition of low translucent symbols only for children. Therefore, the order of teaching the symbols based on iconicity was developed because of the significance of the iconicity on both populations for acquisition of the symbols.

The iconicity of symbols was also tested within the environments in which they are presented. Durham (1989) suspected that the environment in which signs are presented may affect how the signs are perceived. The researcher was trying to identify if the environment and how the signs were presented affected the transparency of the symbols. Durham (1989) presented several manual signs that were suspected to have low transparency to 50 individuals from 14-21 years of age with moderate mental retardation. The signs were presented alone each in a neutral context and an environmental context and were also paired with a verb counterpart each in a neutral and environmental context. The results of the study suggested that there was no significant difference between the four situations. Although, there were individual differences in the values of transparency for each item presented. This suggests that the transparency of
individual symbols may be affected by how they are presented, but as indicated by the results, the environment and presentation of the symbol does not always affect how well the symbol is able to be perceived.

The studies on iconicity have offered much information on how individuals acquire symbols based on their relationship to the referent (Bloomberg et al., 1990; Fuller, 1997). Symbols that are highly transparent are acquired fastest. The environment that the symbols are depicted in may affect some symbols in regards to iconicity, but is not predictable for every symbol. However, research has primarily focused on one aspect of iconicity in relation to another aspect of iconicity, for example, the acquisition of different symbol types based on their transparency (Bloomberg, Karlan, & Lloyd 1990; Fuller, 1997; Hetzroni, Quist, & Lloyd, 2002; Yovetich & Young 1988). There is a need for the research to focus on the iconicity of symbols in relation to other variables related to the acquisition of symbols, such as the teaching method, the speech output of devices, referents that are known and unknown, and preferred and non-preferred objects (Fuller, 1997; Schlosser & Sigafoos, 2002).

**Blissymbols**

Iconicity can be demonstrated more in depth using a specific symbol type. There are several types of symbols sets developed from line drawings that are used in AAC. They can include, but are not limited to Picture Communication Symbols (PCS), Picsyms, Dynasyms, and Blissymbolics (Beukelman & Mirenda, 1998; Glennen & Decoste, 1997). Each symbol set includes a group of symbols that are depicted similarly to the others in the set. Therefore, each system has their own unique features that affect the iconicity of their symbol.

In 1942, in an effort to find a language for people of many languages to communicate, Charles Bliss began developing a system of symbols for the purpose of communication (Helfman, 1981). Charles Bliss published his developed symbols in a book titled *Semantography* in 1949. As described by Helfman (1981), Blissymbols were developed as a series of symbols that were combined to have unique meanings. Each symbol could be typed on a typewriter so that the symbols could be easily developed. Furthermore, most Blissymbols were made to look like what they represent. However, some symbols were arbitrary due to the nature of the idea it represented, such as the word ‘the’ or ‘a’. These symbols were included because Bliss felt articles were needed for communication.
In 1971, a teacher and an occupational therapist were in search of better means of communication for the children at the Ontario Crippled Children’s Centre in Toronto. In their efforts, they found Charles Bliss’ symbols. With a psychologist and a speech pathologist, the symbols were introduced to the children and they began using them effectively to communicate. With success of the symbols, an organization called the Blissymbolics Communication Foundation was established to regulate the symbols. Charles Bliss agreed that the organization could use his symbols. However, Bliss was disappointed because his symbols were not being used for international communication, but for people with disabilities. The organization continued to develop the symbols with changes made for people with disabilities, but they were printed as creations by the Blissymbolics Communication Foundation symbols and the revisions were not approved by Bliss (Helfman, 1981).

As the use of Blissymbols became more common, studies began to investigate the properties of Blissymbols. Bloomberg et al. (1990) researched the iconicity of several symbol sets in relation to one another across several parts of speech including verbs, modifiers, and nouns. Blissymbols were found to be the least translucent among the other symbols. Perhaps this is because the linear nature of the appearance of the symbols, while the other symbols appear to be more like pictures than line drawings. Bloomberg et al. (1990) conducted this study using undergraduate college students, who were required to label each symbol. The symbols that appeared to be the most translucent and easiest to learn for adults were also suspected to be the least problematic for children as they learn to associate the symbols to a referent. An inference about children’s abilities to acquire symbols was made based on the study with adults and not directly with children. The authors then realized the need for more research with iconicity using children as subjects.

Yovetich and Young (1988) used college students to determine the significance of the representativeness of the symbol to the referent and the concreteness of the referent on the recognition of symbols. The goal of the research study was to determine the degree of similarity that the symbol had with the entity that it was representing and if the concreteness of the entity being represented by the Blissymbol influenced the ability to recognize and associate that symbol with what it was representing. Blissymbols that were high in representativeness and symbolized highly concrete words were significantly labeled more correctly than those words that were still high in representativeness, but low in concreteness. This suggests that learning
Blissymbols that are highly transparent and representing concrete words may be the easiest for adults to identify.

Mizuko (1987) conducted a study with preschool children that concluded that Blissymbols were perceived the least transparent and harder to learn as compared to PCS and Picsyms. In general, the PCS symbols were the most iconic and easier to learn followed by the Picsyms and then by the Blissymbols. This study suggested that for improved speed of learning and for people with cognitive delays, the abstract symbols should not be chosen. However, it was suggested that abstract symbols may be more effective in the long term because these symbols may allow for more combinations of symbols and efficient communication.

Blissymbols and their iconicity were also researched with four preschool children using computer technology (Hetzroni et al., 2002). This study also confirmed that children learn the symbol faster when translucency is high. However, in this study, Hetzroni et al. also found that personal associations with specific words and symbols played a crucial role in the symbol acquisition. Those participants that had a strong association for one of the symbols acquired that symbol easier than the participants that did not have an association for that symbol, no matter what the degree of complexity or translucency.

Raghavendra and Fristoe (1995) investigated the acquisition and use of Blissymbols in 40 preschool children as well. This study was unique to the previous study in that it used pictorial enhancements or additions to the Blissymbols for commonly used words by young children to determine the effect on acquisition, retention and application of the symbols. It was found to be easier for the children to acquire and retain the symbols when the symbols were enhanced and the participants were given more information about the symbol. However, the use of enhancements and explanations were not significant when the symbols were applied to a narrative task. The narrative task consisted of the presentation of symbols through a story form; the children were required to receptively identify the presented symbols out of the context of the story. The results indicate that enhancements can provide support in the acquisition phase of the symbol, but do not play an essential role when applying the symbol to a specific activity.

The iconicity of Blissymbols has been researched in respect to other symbols and within the symbol set. In general, it has been determined that Blissymbols are the least iconic in comparison to other symbols (Bloomberg et al., 1990; Mizuko, 1987). On the other hand, within the set of Blissymbols there are degrees of iconicity. Some Blissymbols are more transparent
and some are more opaque. Just as with other symbols, iconic Blissymbols were learned faster than more opaque Blissymbols (Hetzroni et al., 2002; Yovetic and Young 1988). In general, the studies either rated the iconicity in comparison with other symbols or within the set of Blissymbols. However, the Blissymbols have not been researched in terms of the effect of iconicity with other variables that occur in augmentative and alternative communication, such as speech and non-speech output devices.

In the current study, Blissymbols were chosen because of the least likeliness of the children to have seen these symbols. Although Blissymbols are popular around the world, they are not well known in the United States (Fuller, 1997; Raghavendra & Fristoe, 1995). This study will research how Blissymbols are acquired in relation to transparency and speech output.

**Speech Output and Non-Speech Output**

Devices that are considered to be high-tech have speech output capabilities. Low-tech devices can also have speech output capabilities, but the speech output is usually digitized speech. Speech output devices are those that produce speech either through a computerized voice or by pre-recorded speech. Synthesized speech refers to computer generated speech while digitized speech refers to voice recordings programmed on the AAC devices. Synthesized speech can have the perceptual features of adults and children, male and female. Speech output can be accessed through activating a cell that contains a message. This cell can be accessed many different ways including: touching the cell with a finger, using a switch, and using a head pointing device. As cited in Glennen and Decoste (1998), when individuals who use AAC have a high-tech speech output device, their listeners are more likely to engage in conversation, rather than control the conversation as they do with low-tech devices that do not have speech output.

Individuals who use speech output devices are often viewed more favorably than those who do not use a speech output device. Gorenflo and Gorenflo (1991) conducted a study of 151 college undergraduate students. Each student was presented, through a videotape, a male without a disability and a female with a disability communicating with each other. Two groups were presented with the speech output as the variable. In one condition, the female used a speech output device to communicate, while in the other condition she used a non-speech output device. The research participants were required to rate their attitude toward the individual communicating with the AAC device using the Attitudes Towards Nonspeaking Persons scale.
The results indicated that the attitudes improved if the individual communicated with a speech output device.

A study was also conducted with children as participants to determine their attitudes of AAC users based on the device being utilized (Blockberger, Armstrong, O’Connor, & Freeman, 1993). One hundred elementary school children viewed video tapes of individuals communicating with high and low tech devices. The children were required to rate the individuals communication using the Chedoke-McMaster Attitudes Towards Children with Handicaps Scale (Rosenbaum, King (1988). The results indicated that there was no difference in attitudes towards the varying devices. The results, as indicated by the authors, are different from Gorenflo and Gorenflo (1991) because of the script of the conversation and the research population.

Speech output is an important feature for nonverbal AAC because it offers more social acceptance and opportunities for the use of more natural communication for individuals who cannot speak on their own. Many devices offer the ability to produce speech including those produced by Dynavox Technologies, the TechTalk produced by Advanced Multi-Media Devices, Inc., the SuperTalker progressive communicator produced by AbleNet, Inc., and the Pathfinder produced by Prentke Romich. Using speech output is beneficial for the device users because it provides a verbal model of the correct production of the word. When the user is attempting to speak to an intended listener, speech output is beneficial because it helps to obtain the listener’s attention. Devices without speech output do not offer a means for obtaining the listeners attention because there is no auditory cue to alert and engage the listener. Instead, the person must rely on gestures, facial expressions, vocal noises and other attention-getting methods to direct their communication partner’s attention.

Beukelman and Mirenda (1987) found that in terms of intelligibility, natural speech is more preferred by listeners than synthesized speech. However, there are many advantages to using synthesized speech (Beukelman & Mirenda, 1998). Synthesized speech allows communication to occur between partners at a distance. Also, the information can be presented in a familiar, non-threatening way. Furthermore, the listener is only required to interpret the speech being presented. Devices with no speech output require listeners to guess content or to ask for further clarification with yes/no questions to understand the message.
Digitized speech is preferred by many listeners because the message produced is recorded using natural speech, whereas synthesized speech sounds more robotic because it is computer generated. When the speech is recorded from a microphone and reproduced, the speech sounds very similar to the natural spoken speech (Beukelman & Mirenda, 1998). Digital speech will be used in this study to verify that listener can understand the words being produced from the speech output device.

Speech output also plays a role in how graphic symbols are acquired. Schlosser et al. (1995) conducted a study with three young adults with mental retardation. Arbitrary, or opaque, PCS symbols were paired with a speech and non-speech output condition. The participants were presented with a carrier phrase and were required to point to the correct symbol in the given conditions. Auditory feedback was provided by the device in the condition with the speech output device. The results of the study indicated that the synthesized speech output contributes to efficient acquisition of arbitrary symbols and also contributed to fewer errors.

Romski and Sevcik (1993) suggest that devices with speech output, specifically synthesized speech, can enhance an individual’s receptive and expressive language skills. The speech output provides auditory feedback with consistency. The messages that are produced are acoustically similar and may be easier for the individuals to learn. However, more research is needed to support this idea.

Speech output devices offer a natural alternative for individuals who cannot produce functional speech. There may also be benefits in terms of improving receptive and expressive language skills. In addition, speech output has been found to positively affect the acquisition of opaque symbols. The present study will further examine how digitized speech output affects the learning of transparent and opaque symbols.

Conclusion

Since the 1960s, AAC has grown and developed into a field that provides many opportunities for individuals with disabilities. ISAAC and ASHA have contributed to the uniformity of terms and methods of AAC usage that have been developed. Past research studies have investigated the iconicity of symbols, within and among symbols sets, and the relationship of how the symbols are acquired. In general, symbols that are more iconic are acquired more efficiently (Bloomberg et al., 1990; Fuller, 1997). Speech output devices have also been researched to determine how the auditory feedback affects symbol learning. It has been found
that the feedback from speech output devices contribute to the effective learning of opaque symbols.

Speech output and symbol iconicity are important factors in implementing an AAC device for an individual. Careful selection of devices and symbols are imperative for the successful production of communication. This study explores the role of speech output and iconicity and its affect on the AAC user to acquire symbols in order to contribute to the success of AAC users to produce communication.
CHAPTER III

Methods

Subjects

Children were chosen for this study based on individual and parental consent from schools and neighborhoods in the southwest Ohio area. All participants met the following inclusion criteria: 1) vision within normal limits-aided or unaided 2) hearing within normal limits 3) no previous exposure to Blissymbols 4) no known cognitive impairments 5) ability to name the objects used for the testing trials and 6) a chronological age of four to eight years.

Informed Consent

Parental consent forms were distributed and collected before the time of the study. The child’s parents reported on current hearing and vision status, and if hearing aids or glasses had to be worn. The parents were notified of the nature purpose of this study. All subjects gave consent for themselves and had parental consent forms signed for participation. The children and parents were given the opportunity to withdraw from the study at any time. Furthermore, the individual results of the study were kept confidential by assigning numbers to each child’s results. Individuals were identified by assigning their group number, either one or two, and a corresponding letter in the order they were assigned to the group. For example, the first person for the first group was identified as 1A.

Procedures

Each child participated in the study individually. The children were asked for their consent to participate in the study and had to have their parent’s consent to participate. If the consent was given, the children were assigned to one of two groups that would complete two sets of activities. The children were assigned to groups alternating between groups one and two in the order that they participated. Group one was given a set of eight transparent symbols using no speech output followed by eight abstract symbols using speech output via a Tech Talk. Group two was given transparent symbols with speech output on the Tech Talk followed by abstract symbols using no speech output. The transparent symbols were taught first because this is the order that research indicated that the symbols should be taught (Fuller, 1997). Each group was shown two groups of eight every day identifiable objects. The quantity of eight stimulus items was chosen based on the capacity for short term memory, as this study is only being completed in one session. Both groups were first asked to name each object to assure they knew what the
objects were. All participants were able to name the items presented. Then, each object was presented individually with the corresponding Blissymbol. The name of the symbol was not spoken in order to assure that an auditory model was not given. After all of the items were introduced, the child was shown one object and the child had to identify the corresponding Blissymbol from the overlay in front of them. If the correct symbol was chosen, a smiley face was shown to the child and the next object was presented. If the incorrect symbol was chosen, a sad face was shown and the correct symbol was pointed to and if it was presented on the Tech Talk, the cell with the picture was activated. The next object was then presented. All eight objects were presented in the same order for as many trials as the child needed to get all eight items correct. When the first set of objects finished the child had the opportunity to take a break and play the game *Monkey Business*. The break lasted for two minutes. The second set of presented stimuli followed the same procedures using eight different sets of objects and pictures. Both groups received the same sets of objects and symbols for the transparent and opaque icons. However, each set was presented in opposing output methods. The transparent Blissymbols that were presented represented an apple, banana, bowl, flag, stamp, fork, block, and truck. The abstract symbols included representations of popcorn, cookie, toothbrush, telephone, crayon, coin, hat and sock. Each child was given a pencil and a sticker after participating in the study.

**Experimental Design**

The study design is an experimental, between subjects design. The first group consisted of children who completed the tasks in this order: 1) transparent symbols with a device having no speech output, 2) opaque symbols with a device having speech output. The second group will consisted of children who completed the tasks in this order: 1) transparent symbols with the device having speech output, 2) opaque symbols with a device having speech output.

**Research Hypothesis**

The null hypotheses are as follows:

1. There will be no effect on the number of trials need to acquire transparent symbols with a speech versus non-speech output device.
2. There will be no effect on the number of trials needed to acquire opaque symbols with a speech versus non-speech output device.
3. There will be no significant difference between the number of trials needed to acquire both transparent and opaque symbols with a speech versus non-speech output device.
Research Questions

1. Does speech and non-speech output affect the number of trials needed to acquire opaque symbols?
2. Does speech and non-speech output affect the number of trials needed to acquire transparent symbols?
3. Does speech output affect the number of trials required for acquisition of both transparent and opaque symbols?

Data Gathering

The data collected will indicate the correct and incorrect responses of each object and the trials it takes to complete the acquisition of the symbol. The same form will be used to gather the data for each person. The forms will be kept confidential. Forms will be carried in envelopes at all times and stored in a file cabinet in a locked office at Miami University. The forms will be shredded when the data is no longer needed.

Statistical Analysis

The speech and non-speech output conditions within the transparent and opaque symbol conditions were analyzed using a two sample, independent t-test comparing the number of trials needed to acquire the symbols. The speech output and non-speech output trials, regardless of the symbol type, were analyzed using a two-way ANOVA. The data was considered to be significant if the p-value was less than .05. A retrospective power study was conducted on all the statistical tests given the sample size and a proposed difference of one and three trials to determine the ability of the sample size to predict a significant difference in the population.
CHAPTER IV

Results

Descriptive Statistics

Sixty children were recruited from the southwest Ohio area for this study. Four did not meet the age requirements and eight did not attend the data collection. Therefore, a total of 48 typically developing children participated in the study. The range of ages was four to eight years old. All of the children had normal hearing as reported by the parents. Those children without normal vision were required to wear their glasses. Each child that participated in the study was able to name all of the items presented to them. If they were unable to name an item on the first try, the correct name was given. After the other items were presented, the children were asked to name the item again using the preferred terminology. All of the children were reported to have never seen or used Blissymbols. Furthermore, all of the children who participated in this study were able to attend to the task.

Group one consisted of 10 girls and 14 boys. Group two consisted of 15 girls and 9 boys. The mean age for group one was 6.1 years and the mean for group two was 6.0 years. Table 1 indicates the age, number of the subjects, and the trials required to acquire the symbols in the first group conditions. Table 2 indicates the information for the participants in the second group. Table 3 indicates the mean of age, and trials one and two for both groups.
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<th>Trial Two</th>
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<td>Opaque With Speech</td>
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<td>3</td>
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Table 2

*Group Two Data*

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Table 3

*Means for Groups One and Two*

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<td>Group 2</td>
<td>6.042</td>
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**Inferential Statistics**

**Research Questions:** 1. Does speech and non-speech output affect the number of trials needed to acquire opaque symbols? 2. Does speech and non-speech output affect the number of trials needed to acquire transparent symbols?

A two-sample t-test was used to determine if there was statistical significance in the number of trials needed to acquire opaque symbols in the speech and non-speech output conditions, as well as, to determine significance for the number of trials needed to acquire transparent symbols in the speech and non-speech output conditions.

The two-sample t-test for the opaque symbols in the speech and non-speech output conditions was analyzed by comparing the data from the second conditions from groups one and two. The t-test for this data indicates a p-value of 0.737. With significance at p < .05, this data was not considered to be statistically significant.

The two-sample t-test for the transparent symbols in the speech and non-speech output conditions was analyzed by comparing the data from the first conditions in groups one and two. The t-test analysis indicates a p value of 0.394 for these conditions. With significance at p < .05, the number of trials was also considered not to be significant.

A retrospective power study was completed for both the transparent and opaque conditions to determine the probability that the statistical test could declare a significant difference of both one and three trials given the sample size of the study. In other words, was the sample size of this study large enough to detect statistical differences of one or three trials in the speech and non-speech output conditions for the transparent and opaque symbols, if this difference existed in the population? Statistical significance for the power study was considered for p < .05.
The power study for the opaque study indicates for a sample size of 24 and a difference of one trial, the power is 0.97770. For a difference of three trials and sample size of 24, the power is 1.0. The range of values for power determination is 0 to 1.0. Therefore, if a one trial difference to acquire opaque symbols in the speech and non-speech output existed in the population, this study would have a 0.97770 probability that it would be detected. If there was a three trial difference in the population, this study would have a 1.0 probability of detecting it.

The power study for the transparent study indicates for a sample size of 24 and a difference for both one and three trials, the power is 1.0. If there was a difference of either one or three trials in the population for the transparent symbols in the speech and non-speech output conditions, this study would have a 1.0 probability of detecting it.

**Research Question: Does speech output affect the number of trials required for acquisition of both transparent and opaque symbols?**

A two-way ANOVA was used to determine if there was a significant difference between the number of trials needed to acquire the symbols (regardless of iconicity) in the speech and non-speech output conditions. The speech conditions from both groups one and two were combined and compared to the collective non-speech data from both groups. The non-speech data was gathered from the first condition in group one and the second condition in group two. The speech data was gathered from the second condition of group one and the first condition in group two. The two-way ANOVA indicated a p-value of 1.0. This p-value occurred because the means of the speech and output speech conditions were equal with a mean of 1.77083 trials. With statistical significance at \( p < .05 \), the difference between the trials required for speech and non-speech output was not considered to be statistically significant. The power study indicated that for a difference of one trial, the power is 0.87982 and for a difference of 3 trials, the power is 1.0. Table 4 summarizes the information found from the inferential statistical analyses.
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<td>3: 1.0</td>
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<td>(combined symbols)</td>
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<td></td>
<td>3: 1.0</td>
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CHAPTER V

Discussion

Explanation of the Results

The purpose of this research was to investigate speech output and the acquisition of symbols. Specifically, the study investigated the effect speech and non-speech output on learning transparent and opaque symbols. The statistical results of this study indicate that there was not a statistical difference in the number of trials that were required for the participants to acquire transparent or opaque symbols. In addition, with all of the symbols used collectively, speech output and non-speech output were not found to have an affect on symbol acquisition. In fact, the means of the speech and non-speech output conditions were the same for the combined symbol sets, which indicates that it took the same number of trials on average to acquire symbols in both conditions. It can be concluded by looking at these statistics that speech output does not significantly affect the acquisition of opaque and transparent symbols when presented as a short term memory task.

The power study indicated a strong probability that if there was a difference that would impact the acquisition of symbols with a difference of one trial between the speech and non-speech output conditions, that this study could have detected it. Therefore, it can be concluded with confidence that this study’s results can be generalized to similar groups of children.

Relationship to Past Research

This study is consistent with the studies conducted by Hetzroni et al. (2002) and Yovetich and Young (19886). The iconicity within the set of Blissymbols affected how quickly the symbols were learned. The transparent symbols were learned in 1.3 less trials than the opaque symbols in both groups. This supports the concept of iconicity, stating that the symbols that are more transparent will be learned more easily than the symbols that are opaque (Fuller, 1997).

Schlosser et al. (1995) found that the presence of speech output affected the acquisition of opaque symbols. The data found in this study was inconsistent with the study conducted by Schlosser et al. (1995); they found that opaque symbols were acquired more easily for three young adults with mental retardation. The current study found that there was no significant difference in the two opaque conditions. This difference may be explained by the diversity in participants in terms of their age and cognitive ability. The study conducted by Schlosser et al. (1995) investigated the acquisition of PCS symbols with three adults who were labeled as having
mental retardation. The current study looked at typically developing children between the ages of four to eight. The learning styles of the children and adults may be different. Furthermore, the potential for storing information in their memory may also be different. It may have been easier for the typically developing children to remember the symbols. The speech output may have been more beneficial to the adults because it was helping to encode the information.

In addition, the study conducted by Schlosser et al. (1995) used only three people, while the current study investigated the performance of 48 individuals. The sample size may have an affect on the statistical significance of the results. With a larger sample size, the data is more likely to represent that actual population. The power study used to analyze the data from the study supports this idea. The power study indicates that the data from this study would be able to indicate significant differences in the speech and non-speech output in the population if they existed.

Schlosser et al. (1995) used PCS symbols in their study. PCS symbols have been found to be more iconic in general than Blissymbols (Bloomberg et al., 1990; Mizuko, 1987). Because Blissymbols should be more difficult to learn due to their abstract nature, the results obtained were not expected. This can be attributed to the design of the study. Scholosser et al. (1995) indicated in the results of the study that noticeable differences in speech and non-speech output trials did not occur until the symbols were presented after several sets. It was concluded that the voice output was reinforcing over the long term. This study, on the other hand, looked primarily at the short term acquisition of symbols. The speech output may have not been shown to be effective with the Blissymbols because the study was not conducted over a longer period of time.

The design of the current study is comparably different with the design of the study conducted by Schlosser et al. (1995). The unique variables contribute to results of the study. Even though speech output was tested in these two studies, the symbol type, sample size, and characteristics of the participants were different. Therefore, the results indicate that all of the features that contribute to an AAC method have an impact on an individual’s communication.

Hetzroni et al. (2002) suggested that personal associations with specific words and symbols played a crucial role in the acquisition of symbols. All of the objects used in this study were common objects. The children were able to recognize the objects and make associations with the symbols. Several children in the study used internal memory strategies to remember the symbols. The children would comment that part of a symbol looked like the object. They would
also relate the objects shown to objects they had at home. The experiences that the children entered the study with may have been a confounding variable in the study. Less known objects could be used in a future study to determine the role of speech output in symbol acquisition for unknown referents.

**Interpretation of the Results**

From a clinical perspective, the results of this study could indicate that clinicians could teach a child transparent or opaque symbols with either speech or non-speech output with similar results. However, if the data is examined further, without considering statistical significance, the frequency of the number of trials that occur for the non-speech output condition for the opaque symbols reveal a higher occurrence of a larger number trials needed to acquire the symbols. *Figure 1* shows the frequency of the number of trials that occurred for opaque symbols.

The maximum number of trials required by the participants to acquire the opaque symbols in the speech output condition was three, while the maximum number of trials needed to acquire the non-speech output symbols was five. All of the participants in the speech output group could acquire the symbols after three trials. When teaching opaque symbols in a clinical setting, given a speech output condition, a client could possibly acquire opaque symbols with fewer trials given the speech output condition than the non-speech output condition. The clinician must decide if a possibility of a two trial difference is beneficial in teaching the symbols with speech output. Other benefits of using speech output may be considerable in this choice. For example, speech output devices are more favorably viewed by peers (Gorenflo and Gorenflo, 1991). Individuals are also more likely to engage in conversation with a person who uses a high tech speech output device (Glennen and Decoste, 1998). Speech output offers the individual more opportunities to communicate and a more interactive partner. Romski and Sevcik (1993) indicate that speech output can contribute to the growth of receptive and expressive language abilities. The natural communication that speech output gives an individual is also supportive of using speech output.

The frequency of trials and no statistical significance for transparent symbols indicates that the transparent symbols can be taught in either the speech or non-speech condition. These results can be attributed to the concept of iconicity. Because the transparent symbols directly represent their referents, the visual association is strong enough to elicit a correct response. The opaque symbols require more exposure to learn, regardless of speech output, because the
symbols are more abstract and not guessable based on appearance. This effect is observed in the means of both the speech output and non-speech output conditions for the transparent and opaque symbols. The number of trials that the transparent symbols required for acquisition was at least one trial less than the trials required for the opaque symbols. *Figure 2* shows the frequency of trials that occurred in the transparent condition with the speech and non-speech conditions.

*Figure 1.* Frequency of the number of trials needed to acquire opaque symbols in speech and non-speech output conditions.
Figure 2. Frequency of the number of trials needed to acquire transparent symbols in speech and non-speech output conditions.

Limitations of the Study

This study presents limitations in its design and population sample used. The participants were restricted by geographic location and age. Furthermore, Blissymbols were the only symbols used in the study. The results of the study may differ with varying symbol types. Also, the study was conducted in one session with short term retention. A long term study could show how the acquisition of the symbols occurs over time.

Future Research

The special interest area of AAC is still relatively young within the field of speech pathology. More research is currently needed in the area of iconicity and speech output to determine effective clinical teaching methods. Future research could target speech output and iconicity with people of all ages with and without cognitive disabilities. The tasks required of the participants could range over a long term and could target communication in natural contexts. Romski and Sevcik (1993) suggest that speech output can affect language skills. Potential studies could include examining the effect of symbol types and the output method on receptive and expressive language abilities.

Symbol systems have been investigated in relationship to one another (Bloomberg et al., 1990; Mizuko, 1987). Future research could compare the effect of speech output on specific
symbol systems and how speech output individually affects each system. Although Blissymbols were shown in this study to be unaffected by the speech output mode, other symbols may be affected.

An observation from the current study revealed that some participants used internal strategies to remember several of the symbols. The use of strategies may also be significant in how a user identifies specific symbols. Studies could examine the effect of teaching specific strategies on the acquisition of the symbols. If opaque symbols can be learned more efficiently with strategies, an AAC user may benefit because more novel and versatile communication can occur.

Romski and Sevcik (1993) indicate that synthesized speech can enhance an individual’s receptive language abilities. In addition, Hetzroni et al. (2002) found that when given verbal feedback, children preferred to use a computer instead of an adult’s natural voice. Future research may focus on the impact of digitized versus synthesized speech in the role of acquiring symbols.

Clinical Implications

This study found that there was no significant effect of speech and non-speech output on the acquisition of symbols, both transparent and opaque. Based on these results, it can be concluded that symbols can be taught with the similar learning outcomes to an AAC user with either speech or no speech output. This is important for clinical application because there are different methods of augmentative and alternative communication that are characterized by the use of speech and non-speech output devices. When choosing an appropriate device, the teaching of symbols with speech versus non-speech output is not significant in the decision in regards to which device to choose.

When choosing transparent and opaque symbols for clinical use, Fuller (1997) suggests teaching transparent symbols first. Based on this study, transparent symbols can be taught using either speech or non-speech output devices with similar success. However, when teaching opaque symbols, there maybe a chance of quicker success using the speech output device, even though the results do not indicate statistical significance.

Furthermore, the use for the symbols being learned may have an effect on how the symbols are taught. The current study found that, for a short term memory task, speech output did not affect how the symbols were learned. However, Schlosser et al. (1995) concluded that
speech output had an effect on the long term acquisition of symbols. If a clinician is requiring a student to learn symbols only in the short term, than the use of speech output is not significant to symbol learning. An example in which a clinician would require a person to learn symbols for the short term is using symbols that relate to a book. A child may learn symbols for characters or the title of the story. These symbols are only learned for the length of time that the story is being studied. The symbols are not pertinent to symbols that would be used in everyday conversation to indicate needs or to make comments.

In conclusion, this study indicates that there is no statistical evidence that choosing a speech output and non-speech output will affect how a user acquires the symbol. However, depending on the variation of the individual, more trials could be needed to acquire the opaque symbols on the non-speech output device. As with any clinical assessment, a clinician must make their decision based on the individual clients, including the individual and family needs.
References


Bliss, C. (1965). *Semantography (Blissymbolics): A simple system of 100 logical pictorial symbols, which can be operated and read like 1+2=3 in all languages.* Semantography (Blissymbolics) Publications.


Appendix A

**Opaque Symbols**

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**Transparent Symbols**

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Appendix B

Identifying Objects

**Check if Identified.

Set 1- Transparent
_____ apple
_____ banana
_____ bowl
_____ flag
_____ stamp
_____ fork
_____ block
_____ truck

Set 2- Abstract
_____ popcorn
_____ cookie
_____ toothbrush
_____ telephone
_____ crayon
_____ coin
_____ hat
_____ sock

GROUP___LETTER___
## Appendix C

### DATA SHEET
**(ABSTRACT – SPEECH OUTPUT)**

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Appendix G

PARENT LETTER

October 24, 2005

Dear Parents/Guardians,

My name is Diana Brown. I am a graduate student at Miami University. I am currently doing a research project as part of my Master’s Degree in Speech Pathology. I need children between the ages of four and eight to participate in my study. This study will help develop teaching methods for children who need help learning to communicate.

Research will be conducted at your child’s school. Your child’s involvement in my research study would be greatly appreciated. If your child participates, he/she will be naming objects and matching the objects to symbols. A short game will be played and your child will receive a pencil and a sticker for participating. The study should take about 10 minutes to complete. If you want your child to take part, please read the following informed consent paper, sign at the bottom of the sheet, and have the child return it to his/her teacher. Also, please fill out the parent questions. The questions are used as a screening tool to assure accurate data.

Thank you for your time. If you have any questions, you may contact me by phone at 513-529-2500 or by email at browndl@muohio.edu.

Thank you,

Diana L. Brown
browndl@muohio.edu
Appendix H

INFORMED CONSENT

Research Title: “Augmentative and Alternative Communication: Effects of Speech Output and Iconicity on Symbol Acquisition”

The purpose of this study is to determine effective communication learning strategies for children. The data gathered from the research study will be used to develop teaching techniques for children who need devices to communicate. The research should take approximately 10-15 minutes. Your child will be identifying everyday objects and matching the objects with a symbol. Your child’s responses will be kept confidential at all times using a number letter code system.

There are no risks involved in this study. Potential benefits include finding effective teaching strategies for teaching children to communicate.

Your child’s participation in this research study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which your child is otherwise entitled. Your child may discontinue participation at any time or refuse to answer specific questions without penalty or loss of benefits to which your child is otherwise entitled.

If you or your child has any questions about the study, please contact the graduate student Diana Brown at 529-2500 or browndl@muohio.edu. You may also contact the faculty advisor, Dr. Hutchinson at 529-2500 or hutchik@muohio.edu. For information on the rights of research participants, you may contact the Office for the Advancement of Research and Scholarship at 513-529-3734 or humansubjects@muohio.edu.

If you agree to your child participating in this research study, please sign at the bottom of this page. Your child will also verbally be asked if they are willing to participate before the study begins.

I agree that my child can participate in the research study described above.

___________________________________
Your Child’s Name

___________________________________
Parent/Guardian Name (Please Print)

___________________________________
Parent/Guardian Signature Date