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Facilitating Independent Communication for an Adult with Severe, Nonfluent Aphasia Using a Voice Output Communication Aid

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THESIS APPROVAL

The abstract and thesis of Jane Mary Stayer for the Master of Science in Speech Communication: Speech and Hearing Science were presented July 15, 1994, and accepted by the thesis committee and the department.

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ABSTRACT

An abstract of the thesis of Jane Mary Stayer for the Master of Science in Speech Communication: Speech and Hearing Science presented July 15, 1994.

Title: Facilitating Independent Communication For An Adult With Severe, Nonfluent Aphasia Using A Voice Output Communication Aid

Aphasia is an acquired general impairment of the language processes resulting from brain damage that is frequently caused by cerebrovascular accidents (CVAs). Persons with aphasia have a history of retaining important communication competencies that have the potential for helping them succeed in using augmented communication systems. Using augmentative and alternative communication (AAC) systems by adults with aphasia has been studied, but few studies have reported successfully using AAC systems in rehabilitating adults with aphasia. New advanced technologies including the availability of devices that talk, store a lot of information, and are relatively small can give AAC the potential to affect a greater change in functional communication skills for more persons with aphasia, particularly as experience with AAC rehabilitation grows.

The purpose of the present study was to determine whether an adult with severe, nonfluent aphasia could communicate independently by adding a voice output communication aid (VOCA) to his natural communication repertoire. This study also sought to answer the following question: Does the addition of a VOCA to natural expression facilitate independent communication in an adult with severe, nonfluent aphasia?

One subject was drawn from the out-patient members of a recreation-oriented communication treatment group which is conducted at the Portland Veterans' Affairs Medical Center. The subject had been diagnosed with severe, nonfluent aphasia by a certified Speech/Language Pathologist. This study used a single-subject, component assessment research design to explore the relative effectiveness of components in an aphasia and AAC treatment package. It compared the relative effectiveness of Promoting Aphasics' Communicative Effectiveness (PACE) only treatment using natural communication strategies with that of PACE treatment for natural strategies plus a VOCA component. The subject's attempts to convey information were videotaped and analyzed using mean scores and a split-middle method of trend estimation to determine whether performance differences existed under two treatment conditions.

The data for the number of conversational turns show an increase in the number of conversational turns which confirms an overall decrease in efficiency of communication for a severely aphasic person in this structured task in the augmented condition. Second, although the data for the number of communication breakdowns, the number of repair turns, and the repair turns as a percentage of total turns show a decline which would confirm an overall increase in effectiveness, this study does not conclusively demonstrate that the use of a VOCA enhances communication in this setting for this person compared to PACE only treatment. Lastly, the data for the number of messages conveyed correctly show little change which confirms by the measure used in this study, no difference in accuracy of communication for this activity in the augmented condition.

FACILITATING INDEPENDENT COMMUNICATION FOR AN ADULT WITH SEVERE, NONFLUENT APHASIA USING A VOICE OUTPUT COMMUNICATION AID

by

JANE MARY STAYER

A thesis submitted in partial fulfillment
of the requirements for a degree of

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in
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CHAPTER I

INTRODUCTION

"Aphasia is an impairment, due to acquired and recent damage of the central nervous system, of the ability to comprehend and formulate language" (Rosenbek, La Pointe, & Wertz, 1989, p. 53). Most individuals acquire aphasia following a cerebrovascular accident (CVA), commonly referred to as a stroke (Brookshire, 1992). A stroke interrupts the brain's blood supply causing an injury or a lesion to the brain. Aphasia frequently affects more than one language function, including speaking, writing, auditory comprehension, reading, and using gestures and pantomimes. Aphasia may or may not be complicated by or interact with other neurological disturbances such as sensory and motor deficits. Each year it is estimated that there are 500,000 new cases of stroke in the United States. Of these, approximately 20 percent result in aphasia (Garrett & Beukelman, 1992). Aphasia sometimes occurs after traumatic brain injury, intracranial tumors, infections, chemical toxicities, or nutritional deficiencies, but "when it does, other cognitive and communicative impairments usually accompany the aphasic language disturbance" (Brookshire, 1992, p. 34).

Treatment of aphasia has evolved over the last 30 years from direct linguistic stimulus-response approaches to more functional approaches. In the 1960s, traditional linguistic stimulation treatment was introduced which focused on using linguistic drills to improve language deficits in an attempt to return to the level of communication displayed prior to the impairment. Lyon (1992) commented that "linguistic stimulation drills alone proved to be only a partial solution" (p. 7), as approximately half of the individuals with aphasia being treated with stimulation drills remained unable to communicate effectively. In the 1970s, alternative stimulation approaches were developed as a way to access and stimulate the intact right hemisphere of the brain in an attempt to improve effective communication further. However, in many cases, the effective use of language was only partially met and linguistic deficits remained (Lyon 1992). Davis and Wilcox (1985) introduced a treatment called Promoting Aphasics' Communicative Effectiveness (PACE) which focused on functional communication and conveying the content of messages relevant to daily life in natural settings.

This review of the literature discusses aphasia treatment in three domains: traditional linguistic stimulation, alternative stimulation, and functional treatment. In addition, this study extends aphasia treatment further and introduces the principles of functional communication from the field of augmentative and alternative communication (AAC) into aphasia treatment.

AAC professionals attempt to provide functional strategies for people with communication disabilities. The AAC model involves an assessment of an individual's needs and capabilities and attempts to address all issues which affect communication, involving the person, the family, and the environment. AAC is composed of a group of communication strategies that may include gestures, speech, signs, drawing, vocalizations, letters, a manual communication board, and sometimes, a more sophisticated voice output electronic device. The American Speech-Language-Hearing Association (ASHA) defined an AAC system as "an integrated group of components, including the symbols, aids, strategies, and techniques used by individuals to enhance communication. The system serves to supplement any gestural, spoken, and/or written communication abilities" (Asha, 1991, p. 10).

Kraat (1990) observed that AAC for persons with aphasia has a history of teaching symbols and gestures within labeling tasks but not in natural communication environments. In addition, new AAC technologies have been minimally applied to aphasia rehabilitation, and rarely mentioned in the literature to date.

Kraat (1990) believed that the time has come for exploring the use of electronic communication aids with aphasic adults. New advanced technologies including the availability of devices that talk, store a lot of information, and are relatively small may give AAC specialists the opportunity to affect a greater change in functional communication skills for more persons with aphasia, particularly as experience with AAC rehabilitation grows.

STATEMENT OF PURPOSE

The purpose of this study was to determine whether an adult with severe, nonfluent aphasia could communicate independently by adding a voice output communication aid (VOCA) to his natural communication repertoire.

The question this study addressed was:

Does the addition of a VOCA to natural expression facilitate independent communication in an adult with severe, nonfluent aphasia?

The research hypothesis for this study was as follows:

An adult with severe, nonfluent aphasia will improve his independent communication when a VOCA is added to his natural communication repertoire. Specifically, the subject will communicate more efficiently and effectively when a VOCA is added so that the total number of conversational turns and the frequency of turns per breakdown sequence decrease in a structured communication task and the total number of correct messages conveyed (number of wooden blocks placed correctly) increases in a timed communication period.

There were three working hypotheses for this study based on three dependent variables. The independent variable was the presence or absence of the communication device during a structured communication task between an aphasic adult and a naturally speaking cohort. Dependent variables included: the efficiency of communication, as measured by the number of communication turns taken to complete a structured communication task; the effectiveness of the interaction, as measured by the number of communication breakdowns and conversational breakdown sequences (repair turns) and by the percent of communication breakdowns and conversational breakdown sequences (repair turns) that occur during a structured communication task over the total number of communication attempts; and the accuracy of communication attempts, as measured by the total number of correct messages conveyed (number of individual wooden blocks placed correctly for each block design). Hypotheses for each dependent variable follow:

Hypothesis 1. An aphasic adult will take fewer conversational turns during an interaction to accomplish a structured communication task when he is using a Voice Output Communication Aid in addition to his usual communication modalities.

Hypothesis 2. An aphasic adult will take fewer turns to repair a communication breakdown during an interaction to accomplish a structured communication task when he is using a Voice Output Communication Aid in addition to his usual communication modalities.

Hypothesis 3. An aphasic adult will convey more correct messages (total number of wooden blocks placed correctly) during an interaction to accomplish a structured communication task when he is using a Voice Output Communication Aid in addition to his usual communication modalities.

DEFINITION OF TERMS

Agrammatism: Agrammatism is an impairment of the ability to produce words in their correct sequence.

Aphasia: "Aphasia is an impairment, due to acquired and recent damage of the central nervous system, of the ability to comprehend and formulate language" (Rosenbek, La Pointe, & Wertz, 1989, p. 53).

Apraxia: Apraxia is an articulation disorder caused by a cerebral lesion that disrupts prosody and prevents voluntary execution of the complex motor activities required for speech production (Wertz, La Pointe, & Rosenbek, 1984).

Augmentative and Alternative Communication (AAC): "An area of clinical and educational practice that attempts to compensate temporarily or permanently, for the impairment and disability patterns of individuals with severe communication disorders" (Asha, 1991, p. 9).

<u>AAC System</u>: An AAC system is "an integrated group of components, including the symbols, aids, strategies, and techniques used by individuals to enhance communication. The system serves to supplement any gestural, spoken, and/or written communication abilities" (Asha, 1991, p. 10).

<u>Communication Device</u>: A communication device is a physical object "used to transmit or receive messages (e.g., a communication book, board, chart, mechanical or electronic device, or computer)" (Asha, 1991, p. 10). A communication device is known commonly as a communication aid.

<u>Conversational Breakdown</u>: Conversational breakdown is the time during a conversation in which the listener does not understand the speaker's message.

<u>Conversational Breakdown Sequence</u>: Conversational breakdown sequence is the conversational turns which occur as a result of conversational breakdown.

<u>Conversational Turn</u>: A conversational turn is a basic feature of conversation in which partners do not talk simultaneously, but alternate between the roles of speaker and listener. Conversational turn also is referred to as turn-taking.

<u>Functional Treatment</u>: Functional treatment is any approach that stresses communication. It focuses on increasing the ability to get the message across using multiple communication strategies.

Multimodal Communication: Multimodal communication is a method of communicating which uses "the individual's full communication capabilities, including any residual speech or vocalization, gestures, signs, and aided communication" (Asha, 1991, p. 10).

Nontraditional/Alternative Stimulation Treatment: Nontraditional/alternative stimulation treatment involves stimulation of the intact right hemisphere of the brain through use of visual imagery, melody, gestures, pantomime, and drawing.

Traditional/Linguistic Stimulation Treatment: Traditional linguistic stimulation treatment is structured, direct stimulus-response linguistic drills. It focuses on increasing communication by reducing deficits in language functions, specifically, listening, reading, speaking, and writing.

Voice Output Communication Aid (VOCA): An electronic device that stores information and is used to transmit and produce messages using synthesized or digitized speech output.

CHAPTER II

REVIEW OF THE LITERATURE

For the adult with severe, nonfluent aphasia who is unable to communicate with speech, natural participation in everyday conversational interactions is limited. What was taken for granted prior to the disorder now becomes unavailable or, at least, unlikely to return to the level of communication prior to the impairment (Brookshire, 1992). This study investigated facilitating communication for an adult with severe, nonfluent aphasia by adding a voice output communication aid (VOCA) to an aphasic adult's usual communication modalities. Thus, this study presents a review of the literature regarding treatment approaches for aphasia. Literature pertaining to traditional linguistic stimulation, nontraditional alternative stimulation, functional treatment, apraxia treatment, and augmentative and alternative communication (AAC) treatment for individuals with aphasia will be discussed.

SEVERE, NONFLUENT APHASIA: A DEFINITION

"Aphasia is an impairment, due to acquired and recent damage of the central nervous system, of the ability to comprehend and formulate language" (Rosenbek, La Pointe, & Wertz, 1989, p. 53). Most individuals acquire aphasia following a cerebrovascular accident (CVA), commonly referred to as a stroke (Brookshire, 1992). A stroke interrupts the brain's blood supply causing an injury or a lesion to the brain. Aphasia frequently affects more than one language function, including speaking, writing, auditory comprehension, reading, and using gestures and pantomimes. Aphasia may or may not be complicated by or interact with other neurological disturbances such as sensory and motor deficits. Frequently, apraxia of speech (Rosenbek, La Pointe, & Wertz, 1989) can coexist with aphasia. Brookshire (1992) stated that apraxia oftentimes co-occurs with aphasia when damage to the frontal or anterior parietal lobes has taken place. Apraxia is an articulation disorder caused by a cerebral lesion that disrupts prosody and prevents voluntary execution of the complex motor activities required for speech production (Wertz, La Pointe, & Rosenbek, 1984).

TREATMENT OF APHASIA

Aphasia treatment has included a mix of approaches designed to improve communication inside and outside the clinic setting. Some approaches are highly structured, some have a low level of structure, and some are a combination of the two.

Brookshire (1992) in describing traditional stimulation treatment stated that, in general, treatment emphasizes one specific input or output modality, but typically combines modalities, and leads the client through repetitive language activities having progressive levels of complexity. Traditionally, stimulation treatment of aphasia has focused on increasing communication by reducing deficits in language functions, specifically, listening, reading, speaking, and writing. Traditional treatment requires direct stimulus-response manipulation within a hierarchy of tasks from least to most difficult, with intervention starting at the place where difficulty is experienced first. Structured, stimulus-response drills are repeated until the client reaches criterion. Once the individual's performance reaches criterion, more difficult tasks are presented along the hierarchical performance continuum.

Nontraditional alternative stimulation approaches to aphasia treatment focus on involving the intact right hemisphere of the brain through the use of visual imagery, melody, gestures, pantomime, or drawing. They are used to teach clients how to communicate effectively using alternate means of communication. It is hypothesized that the increased role of the right hemisphere may support the damaged left hemisphere which remains the language dominant center.

The functional approaches emphasize less structure and control and more naturalness to accomplish improved communication in everyday activities. The focus is communication, not linguistic eloquence. Functional treatment seeks to facilitate the individual's ability to convey thoughts that are personally relevant. The clinician encourages the client to use the best communication method available, gives natural feedback, and presents language redundantly to improve client performance.

Traditional/Linguistic Stimulation Treatment

Traditional aphasia treatment emphasizes language content and thus, its goal is recovery of language functions using traditional stimulus-response activity methods. Contrastively, the goal of AAC treatment is enhancement of communication using AAC methods and/or traditional stimulus-response activity methods.

In 1965, Schuell, Jenkins, & Jimenez-Pabon defined aphasia treatment stating that the clinician's primary task was to increase communication with the patient and to stimulate disrupted processes by repeated sensory stimulation, specifically auditory and visual. Schuell (1974) believed that language was dependent on the auditory system and that the client acquired language in the same way s/he first did -- by hearing it. These researchers advocated a combination of auditory and visual stimulation in order to provide a means of multimodality feedback. In addition, they reported that repeated sensory stimulation of meaningful material was an effective method of eliciting language which became gradually more complex, leading to its functional use. The clinician did not teach, but stimulated disturbed language processes (Schuell, 1974). The role of the clinician was to stimulate the disordered language processes by providing meaningful, high frequency, adequate stimuli for an increased length of time, at an increased loudness, and at a slower rate. These researchers emphasized that each stimulus needed to elicit a response. They professed that it was critical to hand-tailor treatment by working individually at the patient's level in each language modality.

Rosenbek, La Pointe, & Wertz (1989) also proposed individual aphasia treatment with emphasis on the traditional stimulus-response drills of all communication modalities, either singly or in combination. Their treatment method focused on combining strong and weak modalities in an effort to improve the less intact modality. This type of therapy strategy was referred to as deblocking. Although Rosenbek et al. (1989) believed that auditory comprehension training played a part in treatment, they proposed that some tasks be functional and related to daily living. In contrast to Schuell (1974) and Schuell et al. (1965), Rosenbek et al. (1989) defined an adequate stimulus as one that helped the individual recognize an error and facilitate self-correction. Treatment included modeling, shaping, prompting, cueing, and reinforcement through pairing modalities.

In 1978, Rao & Horner described the use of gestures as a method to deblock nonfunctional input and output modalities. The use of gestures for some aphasic adults facilitated both auditory and visual comprehension as well as vocalizations. In a case study of a 38 year old male with severe aphasia, an American Indian (Amer-Ind) treatment program was used concurrently with traditional language treatment. Gestures were used to access residual language abilities. Improved communication abilities as reflected by improved overall scores (35th to 45th percentile) on the Porch Index of Communicative Ability (PICA) (Porch, 1981) indicated that use of gestures served to facilitate nonfunctional input (visual) and output (naming) modalities. Based on their findings, Rao & Horner (1978) concluded that Amer-Ind had the potential to improve a client's prognosis.

Another method of pairing modalities was developed by Helm & Barresi (1980) called Voluntary Control of Involuntary Utterances (VCIU) in which reading and speech were combined. Clients read aloud words which they had produced spontaneously. At the point where the aphasic adults produced about 200-300 words, these researchers observed that the adults expanded their own vocabulary voluntarily. They concluded from these results that pairing reading and speaking of involuntary utterances facilitated (deblocked) voluntary control of the utterances. In effect, what were once automatic words and phrases became intentional attempts to communicate. In 1987, Helm-Estabrooks, Emery, & Albert sought to improve oral expression further and advocated treatment of perseveration (TAP) itself. TAP taught aphasic adults to become aware of their perseverations and to learn how to control them. Similar gains in confrontation naming occurred on the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan, 1983) when VCIU treatment was used by itself as compared to when TAP was alternated with VCIU, but using TAP was more effective in reducing perseverations than was VCIU (38 percent reduction versus 11 percent reduction).

A linguistic treatment approach to aphasia therapy that focused on grammatical form was the Helm Elicited Program for Syntax Stimulation (HELPSS) (Helm-Estabrooks & Albert, 1991). In a 1981 study, Helm-Estabrooks & Albert used HELPSS to treat aphasic adults. HELPSS was based on the underlying presumption that adults with aphasia with agrammatism possessed syntactic knowledge, but lacked the ability to access it reliably. HELPSS was hierarchically structured using a story completion format to elicit specific sentence constructions. In the most advanced level of HELPSS treatment, the aphasic adults spontaneously produced the response target to an appropriate question. After HELPSS treatment, aphasic adults showed significant changes in phrase length on the BDAE. The results of this study indicate that for some aphasic individuals stimulating and facilitating grammatical speech have the potential to improve communication.

In summary, improvement of verbal behavior in specific subjects have been shown using traditional aphasia treatment. On the other hand, the data are inadequate to generalize the results of the efficacy of formal language treatment to all levels of severity.

Nontraditional/Alternative Stimulation Treatment

Nontraditional alternative stimulation approaches to aphasia treatment focus on involving the intact right hemisphere of the brain through the use of visual imagery, melody, gestures, pantomime, or drawing.

Glass, Gazzaniga, & Premack (1973) questioned whether globally aphasic persons had the conceptual and cognitive abilities to regain language. These researchers taught seven globally aphasic adults an artificial language system using paper symbols which were equivalent to words. These adults successfully produced simple same-different, negation, and interrogative phrases in structured, task-level contexts. This finding led Glass et al. (1973) to conclude that some globally aphasic adults retained conceptual systems and some symbolization, albeit not verbal.

In 1976, another attempt was made to provide the aphasic individual with an artificial language system. Gardner, Zurif, Berry, & Baker (1976) developed a card-based system of visual symbols called the visual communication (VIC) system. This work proved that with VIC, some aphasic clients improved their communication beyond the level of their natural language ability. Although communication improved, the large number of VIC cards were difficult for the aphasic individuals to manipulate. VIC was used for research purposes only. It was adapted 10 years later for clinical treatment programs using a computer for symbol storage and retrieval (Steele, Weinrich, Wertz, Kleczewska, & Carlson, 1989).

Sparks, Helm, & Albert (1974) developed another form of language therapy called Melodic Intonation Therapy (MIT) which involved musically intoning a sentence with a limited range of pitch variation so that stress, rhythm, and inflection were similar to natural speech prosody. MIT is a three-level hierarchically structured program that combines intonation of each target accompanied by pictures or cues. The client moves from humming the target while the clinician taps the patient's hand for each syllable, to providing the target sentence as an appropriate response to a question. These researchers reported that six of the eight severely aphasic individuals improved the phrase length of their oral expression for trained sentences in a post-MIT examination.

Although not supported by empirical investigation, Meyers (1980) encouraged using materials in treatment that evoked strong visual images. This investigator theorized that materials which stressed interaction by placing action in context stimulated the intact right hemisphere of the brain and encouraged more language.

Helm-Estabrooks, Fitzpatrick, & Barresi (1982) also focused on visual imagery therapy and developed a nonvocal approach to treatment called Visual Action Therapy (VAT). VAT required the client to represent absent objects gesturally. Like other treatment approaches, VAT is hierarchically ordered along a performance continuum from the least to the most difficult tasks. These researchers treated eight globally aphasic stroke individuals using VAT and found that they significantly improved their pantomimes as well as auditory comprehension and reading on the PICA subtests.

Drawing was another form of aphasia treatment, proposed by Morgan and Helm-Estabrooks (1987) and Lyon and Sims (1989) as an effective method to enhance everyday communication. The Morgan and Helm-Estabrooks (1987) approach trained clients to draw cartoons from memory with the goal of using drawing to communicate when other communication modes failed. The Lyon and Sims (1989) approach incorporated Promoting Aphasics' Communicative Effectiveness (PACE) principles (see Functional Treatment) by requiring that the normal adult also communicate by drawing. Eight subjects were trained in the Lyon and Sims (1989) approach and rated on communicative effectiveness and recognition of drawings. These adults attained 88 percent of the normal adults' communicative effectiveness score and 65 percent of the recognition score, but also showed significant improvements on the PICA subtests for copying and pantomime. In addition, these researchers observed that these adults frequently produced verbal labels while drawing. This observation led these researchers to conclude that drawing acted to deblock and facilitate the use of verbal expression.

In summary, some aphasic clients have made gains as a result of nontraditional/alternative stimulation treatment. There are, however, no group studies subjected to scientific rigor which investigate treatment efficacy.

Functional Treatment

The functional treatment of aphasia includes any approach that stresses communication. Holland (1982) defined functional communication strategies as the ability to get the message across in multiple ways including grammatically correct utterances to appropriate gestures. She reported the results of observing the functional communication of 40 aphasic subjects and concluded that communication competence was preserved. So, functional communication is defined for each client individually, while functional treatment tries to improve the client's reception, processing, and expression of information relative to conducting daily activities, interacting socially, and expressing physical and psychological needs (Aten, 1986).

Davis and Wilcox (1985) introduced one of the first functional treatment approaches at the 1978 Annual Convention of the American Speech-Language-Hearing Association called Promoting Aphasics' Communicative Effectiveness (PACE). Davis and Wilcox (1985) concluded that PACE could fill the gap that existed between communication in the clinic and communication in the aphasic individual's everyday world. Davis (1986) saw the treatment of pragmatics as the strategy enabling the transfer of a client's language performance in the clinical setting to the individual's natural setting. Davis and Wilcox (1985) based the activities of PACE on traditional stimulation and behavior modification methods, but used stimuli and contexts that were natural. PACE was based on four principles: the clinician and client participated equally as sender and receiver of messages; the interaction consisted of an exchange of new information; the client chose the method of communication; and the clinician gave natural feedback relative to the communication and similar to that received in natural settings. In a typical PACE treatment session, a topic of genuine concern to the individual is chosen and the client and clinician role play activities participating equally as senders and receivers of messages. The client has a choice as to the communication mode used and the clinician provides feedback based on whether or not the message is understood. Davis and Wilcox (1985) summarized the benefits of PACE for the severe aphasic client as: (1) an opportunity to practice alternative modes of communication (e.g., gestures, drawing), (2) an opportunity to discover modes of communication not currently being used, and (3) as an opportunity to practice receptive and expressive skills in a natural situation. PACE introduced several new changes into aphasia therapy, including the dynamics of new information, the importance of effective communication, the experience of using nonverbal communication modes, and the combination of communication modes. The original design of PACE employed a structured core activity using stimulus cards in a barrier game format, but as the value of PACE rehabilitation was recognized, other researchers (Aten, 1986; Collins, 1986; Lyon & Sims, 1989) incorporated PACE principles in defining new intervention strategies.

Aten (1986) defined functional communication treatment (FCT) in contrast to traditional treatment in that FCT focused on improving the client's social interactions and on expressing needs in a practical sense. Aten (1986) stated that traditional linguistically oriented, stimulus-response approaches "stress language or process stimulation as the sine qua non of intervention" (p. 267). Aten (1986) reported that since language recovery in aphasia was limited, success in communication should be stressed over linguistic accuracy. Aten (1986) proposed that language content and form be worked on only as they impact the success of the communication and only in the later stages of treatment. Aten (1986) advocated using PACE principles emphasizing topics of relevance to clients while they were encouraged to use their best communication mode. The clinician's role was to provide natural feedback. Aten (1986) advocated facilitating communication by using traditional cloze procedure techniques to increase verbal output and by presenting language redundantly to improve client performance. The clinician's role also included transferring communication skills to group experiences and training significant others to create a supportive communication environment.

Two efficacy studies support Aten's view of traditional aphasia treatment. In 1982, Lincoln et al. reported the results of a treatment study with 191 aphasic adults. Traditional aphasia therapy was provided for 104 individuals twice a week for 24 weeks while 87 individuals received no treatment. They found no significant differences in treatment approaches. Hartman and Landau (1987) compared 24 aphasic adults receiving traditional aphasia therapy with 26 aphasic adults receiving counseling. Both therapies were provided twice weekly for six months. No significant differences in improvement on the PICA were manifested. The investigators concluded that traditional therapy is no more effective than is counseling therapy.

Collins (1986) and Salvatore & Thompson (1986) argued that the adult with global aphasia had no outstanding intact language modality and therefore, traditional language treatment would be ineffective. These researchers disagreed with the assessment that global aphasia was irreversible, and that it precluded the potential for recovery. Structured drills focusing on the ability to imitate, copy, and match did not necessarily precede functional communication skills (Collins, 1986), and the key ingredient to treatment was assisting the client in choosing a symbol system that was useful and meaningful to the client (Salvatore & Thompson, 1986). Research findings to support this view was reported by Aten, Caligiuri, & Holland (1982). They provided 12 weeks of functional communication therapy twice weekly to a group of 7 chronic aphasic individuals. Treatment emphasized the use of personally relevant activities in which the clients were encouraged to use all available communication modalities. Statistically significant improvement was reported between pre- and post-treatment scores from the Communication Abilities in Daily Living (CADL) (Holland, 1980) test, but not the PICA for all subtests. Collins (1986) supported group treatment and stroke clubs, that focused on functional communication which created a positive therapeutic environment by alerting the client that communication was about to occur, talking about concrete topics, and using nonverbal cues.

Based on their clinical experience in both alternative stimulation and functional treatment methods, Collins (1986), DiSimoni (1986), and Salvatore & Thompson (1986) encouraged a treatment model of total communication, using the aphasic adult's residual communication skills and any other modality that brought about effective communication. Some methods that may offer the potential for improving functional skills are computer-assisted programs, Visual Action Therapy (VAT), gestures, artificial language training, novel pictoral stimuli like Blissymbols, PACE, communication boards, drawing, and Voluntary Control of Involuntary Utterances (VCIU).

Kearns & Simmons (1985) moved aphasia therapy closer to communication in the natural environment when they described group therapy for aphasia at Veteran's Administration medical facilities nationwide. Kearns & Simmons (1985) concluded that group therapy was a rich source of treatment for language stimulation and socialization, but its effect on communication at home or in the community remained largely unstudied.

Then in 1989, Lyon proposed an expanded scope to aphasia treatment which incorporated the aphasic adults' psychosocial well-being and communication with unfamiliar partners. Lyon (1989) concluded that allowing adults to choose their own activities with an unfamiliar communication partner filled the gap between the clinic and the residential setting. Lyon (1989) has proposed recruiting volunteers from the local community to spend time with aphasic adults.

In summary, the functional approaches to aphasia therapy, have moved toward less clinician control, more natural contexts and feedback, and more conversation. Group therapy and unfamiliar communication partners have also been incorporated. Functional treatment methods allow the aphasic adult to experience conditions much like s/he will face outside of clinic, thus generalization most likely will occur.

Treatment of Apraxia of Speech in Aphasic Patients

As previously mentioned, apraxia of speech frequently co-occurs with aphasia. Therefore, its treatment must be considered in any review of aphasia treatment. Wertz, La Pointe, & Rosenbek (1984) described apraxia treatment as including imitation, phonetic placement, and phonetic derivation (similar to progressive approximation). They suggested that these techniques, with practice, will help make it easier to talk spontaneously. In addition, alternative stimulation treatments, including Melodic Intonation Therapy, HELPSS, and VCIU treatment have proven successful (Wertz et al.,1984; Tonkovich & Peach,1989) with apraxic clients. As a last resort when all else fails, the aphasic-apraxic person should be taught total communication (Wertz et al., 1984; Tonkovich & Peach, 1989), including gesture, writing, drawing, and use of communication boards.

Cueing is another facilitative technique for treating apraxia of speech (Rau & Golper,1989). It is based on the presumption that an external stimulus can trigger an internal process (Rau & Golper, 1989). Cues stimulate the most intact function in order to help the more impaired one. Rau & Golper (1989) recommended using clinician-controlled activities initially, as well as PACE, to observe and record the client's natural self-cues. By taking samples during PACE therapy, the clinician discovers the most frequent and most successful self-cues and treats these self-cues while momentarily interrupting PACE therapy.

In summary, these investigators recommend that apraxia treatment incorporate a mix of traditional stimulus-response methods within a hierarchy of tasks, alternative stimulation treatment, and functional treatment. Indeed, they adhere to the principle that therapy needs to optimize successful responses (verbal and nonverbal) in order to facilitate independent communication.

AUGMENTATIVE AND ALTERNATIVE COMMUNICATION: A DEFINITION

The American Speech-Language-Hearing Association (ASHA) defined an augmentative and alternative communication (AAC) system as "an integrated group of components, including the symbols, aids, strategies, and techniques used by individuals to enhance communication. The system serves to supplement any gestural, spoken, and/or written communication abilities" (Asha, 1991, p. 10). ASHA defined a symbol as "a visual, auditory and/or tactile representation of conventional concepts" and defined an aid as "a physical object or device used to transmit or receive" (Asha, 1991, p. 10).

AAC includes both unaided and aided symbols and nonelectronic and electronic aids. Examples of unaided symbols are gestures and vocalizations, gestural codes like Amer-Ind, and manual sign systems like American Sign Language (ASL), Pidgin Sign English, and Signing Exact English. The symbols are made naturally with the body and do not require any external aids. Aided symbols include objects, photographs, and line drawings like Picture Communication Symbols (PCS), rebus symbols, Picsyms, Pictogram Ideogram Communication (PIC) symbols, and Blissymbolics. Yerkish lexigrams and Non-SLIP symbols which were developed from primate research are also aided symbols. Aided orthographic symbols include Morse code and Braille (Beukelman & Mirenda, 1992).

Nonelectronic aids do not have electronic or mechanical parts and include communication books and alphabet boards. Electronic aids require an electrical outlet or batteries for power and store information or produce output. Examples of electronic aids are dedicated speech/writing aids or general-purpose computers with custom software and hardware (Fishman, 1987). The configuration of an electronic aid is based on several device features including the mode of output, selection technique, vocabulary/symbol representation, and system portability.

AAC TREATMENT

AAC treatment refers to the enhancement of communication for persons who cannot communicate independently due to diseases, syndromes, and traumas (Beukelman & Garrett, 1988). The communication needs and capabilities of the individual, the etiology of the communication disorder and its natural course, and whether the person is a child or adult determines current AAC treatment goals and considerations for future management.

AAC treatment started approximately 30 years ago with communication boards for children who had neuromotor impairment (cerebral palsy) who did not respond to traditional speech treatment (Munson, Nordquist, & Thurma-Rew, 1987). Since then, AAC has branched out to help individuals with other physical impairments such as amyotrophic lateral sclerosis (ALS), Friedreich's ataxia, and spinal cord injury; people with physical and cognitive impairments such as Huntington's disease and closed head injury; and individuals with language impairments including intellectual disabilities and aphasia (Beukelman and Garrett, 1988).

AAC literature contains mostly single case or group reports of treatment paradigms. Empirical research questioning the efficacy of AAC treatment for persons with severe speech and physical impairments, regardless of age or diagnosis, is just beginning (Buzolich, King, & Baroody, 1991; McNaughton & Tawney, 1993; Iacono, Mirenda, & Beukelman, 1993; Spiegel, Benjamin, & Spiegel, 1993).

Buzolich, King, & Baroody (1991) measured AAC treatment efficacy when they taught three physically disabled AAC system users, ages 9-12, how to sustain a conversation by using preprogrammed comments. These researchers concluded that treatment influenced the subject's ability to exert more conversational control and maintain conversation longer.

Evaluating efficacy of AAC treatment has drawn some attention theoretically, as well. Light (1989) highlighted the importance of defining communicative competence for individuals using AAC systems. Like Holland (1982), Light's (1989) AAC definition was based on functional communication. AAC users need to acquire the knowledge and skills to use the AAC system both operationally and linguistically. Linguistic competence involves mastery of the spoken language as well as the vocabulary/symbolic code and syntax of the AAC system. Operational competence involves the skills to operate the system including on/off switches, volume control, and selection techniques. Light (1989) stated that if mastering system operation requires too great a cognitive load, then effective communication will be impaired. Effective communication then requires that use of the linguistic code and system operation be automatic processes that are accurate and performed in a timely manner. AAC users also need to demonstrate social and strategic competencies to ensure functional use. Social competence involves both sociolinguistic and sociorelational aspects. Sociolinguistic skills include discourse management and sociorelational skills, which contribute to effective communication, include a positive self-image, a desire to communicate, a willingness to make mistakes, and active participation in conversations. Strategic competence by AAC users is the ability to communicate in the best way they know to compensate for linguistic, operational, and social limitations.

AAC TREATMENT FOR APHASIA

In reviewing the research on AAC treatment for acquired adult communication disorders, Beukelman and Garrett (1988) reported that a minimal amount existed, and that "there is little information on the ability of aphasics to learn how to use specific AAC system components and improve their interactional skills" (p. 115). Beukelman and Garrett (1988) concluded that the AAC research needs for the aphasic population is "truly enormous and needs . . . systematic documentation of successful case study interventions including the instructional strategies and the specific AAC techniques employed" (Beukelman & Garrett, 1988, p. 120). Aphasia investigators were in agreement that AAC treatment for aphasia offered the potential for functional communication and language stimulation, but that it had not been adequately tested (DiSimoni, 1986; Salvatore & Thompson, 1986).

Kraat (1990) viewed augmentative communication for persons with aphasia as a way to enhance communication, not replace it with an alternative mode. Kraat (1990), like Holland (1982), believed communicative competency was the ability to get the message across in everyday life.

Both nonelectronic and electronic AAC treatment have been used for persons with aphasia, although electronic AAC treatment has had extremely limited application. Kraat (1990) commented that using spoken output devices for aphasia rehabilitation is relatively unexplored.

Nonelectronic AAC Treatment

Several investigators have used Amer-Ind sign, alternative symbol systems, line drawings, and other nonelectronic AAC treatment approaches for aphasia (Skelly, Schinsky, Smith, & Fust, 1974; Gainotti & Lemmo, 1976; Dowden, Marshall, & Tompkins, 1981; Guilford, Scheurele, & Shirek, 1982; Moody, 1982; Coelho & Duffy, 1990). Amer-Ind sign training has been used frequently as a method to increase expressive skills. Contrasting results have been reported in the literature.

In 1974, Skelly, Schinsky, Smith, & Fust conducted an experiment in which they presented a sign with its verbal meaning and encouraged the aphasic adults to imitate the manual sign and the verbal output. They reported that Amer-Ind sign facilitated the oral expression of persons with aphasia and apraxia as evidenced by gains in verbal scores on the Porch Index of Communicative Ability (PICA) (Porch, 1981) following Amer-Ind treatment. However, a study conducted by Kearns, Simmons, & Sisterhen (1982) showed that unimodal Amer-Ind training did not facilitate oral expression, and furthermore, that improvement in verbalization occurred only after extensive multimodality treatment.

Guilford, Scheurele, & Shirek (1982) reported successful acquisition and use of 20 signs from American Sign Language (ASL) and Amer-Ind. No difference was found in ease of acquiring or using the signs between the two sign systems for eight aphasic adults. However, auditory comprehension skills were significantly related to the subjects' abilities to learn signs.

In 1982, Moody conducted a single case study in which an aphasic adult was taught a combination of sign language and speech. He reported that adding speech facilitated the acquisition and understanding of signs. Contrastively, Coelho & Duffy (1985) documented limited success of sign use and highlighted that acquisition of signs was not indicative of functional communicative use. In fact, these investigators reported that the more spontaneous the situation, the fewer the number of trained signs were used and the less successful they were.

Dowden, Marshall, & Tompkins (1981) added that to affect generalization and Amer-Ind use in functional communication, training must occur in natural contexts.

Gainotti & Lemmo (1976) reported the results of comprehension of symbolic gestures by 53 aphasics, 26 nonaphasics left-brain damaged, and 49 right-brain damaged adults. They found that the aphasic subjects performed significantly worse than the other two groups. The inability to understand gestures was highly related to the number of semantic errors obtained by a verbal comprehension test.

Coelho & Duffy (1990) reported successful sign acquisition by aphasic subjects with moderate-severe limb apraxia. The results of this investigation led these experimenters to conclude that the severity of the aphasia influenced the success of sign acquisition, not the influence of limb apraxia.

Alternative symbol systems have been used to improve the communication ability of the aphasic population (Glass, Gazzaniga & Premack, 1973; Gardner, Zurif, Berry, & Baker, 1976; Steele, Weinrich, Wertz, Kleczewska, & Carlson, 1989). The underlying presumption was that if an individual could not process linguistic, orthographic symbols, perhaps they could rely on nonlinguistic graphic symbols for expression. Blissymbols, a graphic-based language of symbols, has also been used.

Bailey (1983) described some limited success using Blissymbols with an individual with dysphasia and dyspraxia who had unintelligible vocalizations and could not match written or spoken words to objects. After successfully using a 200-symbol Blissymbolic chart, the client began to rely spontaneously on written words and work with Blissymbols stopped. This investigator concluded that Blissymbolics was not an ideal alternative communication system and did not relieve the frustration of dyspraxia which was the original goal.

Lane & Samples (1981) described a multimodality Blissymbols treatment program with aphasic adults who also had severe verbal apraxia. These investigators presented a symbol and named it, then encouraged the clients to draw the symbol, write the word, and say the word. Only one of the four group members used Blissymbols spontaneously, while the others were reluctant, preferring writing or speaking. These investigators concluded that an individual had to be highly motivated to use a nonverbal system, and that generally, aphasic clients are reluctant to adopt any method of communication that was not natural.

In 1989, Funnel & Allport investigated teaching Blissymbols to adults with aphasia in an effort to attain the performance results that Glass et al. (1973) and Gardner et al. (1976) had reported with other nonlinguistic graphic symbol sets. Blissymbols were taught with their equivalent written words and the clients practiced reading, writing, and matching the spoken word to the symbol. Although these individuals were successful in recognizing and producing symbols that referred to concrete objects, they were unable to show that using Blissymbols helped these clients exceed their natural language abilities, and instead, chose to practice reading the written word. They concluded that Blissymbols provided no communication advantage compared to alphabetically written language.

Bertoni, Stoffel, & Weniger (1991) investigated the use of pictographs to improve communicative interactions. Pictographs, in contrast to Blissymbols, have the advantages of being more explicit and familiar as they are encountered in everyday situations. Bertoni et al. (1991) reported that one 58-

year old aphasic adult had some success in spontaneous production of line drawings after the pictograph treatment program, although for some of the productions, the intent of the communication remained ambiguous. These investigators concluded that pictographs had the potential to lead to more effective communication because of their concreteness.

In 1989, Garrett, Beukelman, & Low-Morrow reported one of the few multimodality augmentative and alternative communication systems for an adult with Broca's aphasia. The client demonstrated a severe expressive language deficit that was characterized by nonspecific, telegraphic utterances and apraxia. The client had been using natural gestures, writing, drawing, and his residual natural speech. Components of the AAC system that were recommended included a word dictionary, an alphabet card, a technique for carrying new information, a card with clue phrases to help resolve communication breakdown, and conversational control phrases in a notebook, in addition to natural communication (gestures, writing, drawing, and speech). These investigators initially assessed the subject's use of an electronic AAC device, and found after a brief trial period that the system did not meet the subject's needs because of portability issues. Once the components were assembled, the subject spent approximately eight months in training to learn how to use the system components individually and in combination during conversation. Choosing the most efficient strategy and shifting strategies during an interaction posed the most difficulties for the client. Data gathered after treatment during dyad interaction revealed that there were fewer turns per breakdown sequence with the multimodality system. This led Garrett et al. (1989) to conclude that communication was more efficient in the augmented condition as compared to the condition without augmentation.

Electronic AAC Treatment

Reporting the implementation of electronic AAC systems with aphasic adults has been limited in the literature, but current technological trends no longer preclude their use.

In 1980, Rabidoux, Florance, & McCauslin described the use of a Handivoice, a synthesized speech output device, by one aphasic and two apraxic subjects. The apraxic subjects experienced decreased message transmission times and resumed active life styles. Both subjects produced novel utterances and expanded the Handivoice's use to new situations. These investigators reported little success as measured by spontaneous, independent generation of messages with the patient with severe aphasia. The subject learned approximately 25 words, began to use trained two-word utterances, but did not produce novel utterances. However, by using the Handivoice, the subject successfully made his needs known at home in a limited way and had access to an emergency help message for use with a telephone.

In 1981, Colby, Christinaz, Parkison, Graham, & Karpf developed a software program with word-finding capability interfaced to a speech synthesizer targeted for use with aphasic-anomic patients. The goal of the program was that once the subject gave a clue or pointer to a target word, the program searched its data base to find a semantic equivalent. System limitations in memory aborted program implementation.

Enderby & Hamilton (1983) developed speech link (SPLINK), a device which gave access to an electronic word board with 950 words, letters, numbers, and phrases. The word board was connected to a modified television via a microprocessor and infra-red link, so that words were displayed on the television screen. The listener then read the selected message on the screen.

While the methods of this study were not well-defined, the experimenters reported that nine aphasic/apraxic subjects found SPLINK useful in communication but needed guidance; 12 subjects used SPLINK as an extension of therapy but did not use it spontaneously; 13 subjects were unable to use SPLINK; and three subjects did not use SPLINK as it made them anxious and they were afraid of breaking it. These investigators concluded that SPLINK could possibly be used as a therapeutic tool for tapping receptive abilities, but did not affect spontaneous, independent communication.

One case report in particular described the use of a voice output communication aid in a multiple component AAC system. In 1985, Beukelman, Yorkston, and Dowden documented a case report of a 47-year old individual with aphasia and apraxia. The subject graduated to a multicomponent AAC system comprised of communication books, gestures, a limited amount of natural oral expression, and a speech output device. During the first year of treatment, these experimenters focused on auditory comprehension drills using communication books which included family activities and work-related items. To practice reading, words were added to the communication book. Once the word and photograph were consistently identified, they were removed from the book and the subject was encouraged to use the word without the photograph. Spontaneous use of gestures was reported, although the subject's repertoire was limited due to severe limb apraxia. Melodic Intonation Therapy became part of treatment to train speech. The subject produced approximately 40 words and phrases. As a result of the subject's desire to return to work, a speech output device was recommended, the Handivoice 130, which was programmable in the field with user-specified messages. The subject was also able to take advantage of the device's multilevel capability. Beukelman et al.

(1985) reported that the subject had communicated successfully with the Handivoice 130 in both business and social situations along with his communication books, gestures, and minimal speech, but continued to need training to use the components in combination with each other during conversation.

In 1989, Steele, Weinrich, Wertz, Kleczewska, & Carlson described a computer-aided Visual Communication (C-VIC) system, based on the earlier work of Gardner et al. (1976), and implemented on an Apple Macintosh(R) computer. The earlier limitations of the card-based system had been overcome by adapting the VIC system to a computer, but the system did not meet portability needs. Since the studies were reported, a device called the Lingraphica which relies on the VIC software and resides in a PowerBook, a compact lap-top computer, is being marketed nationally to the aphasia community. Steele et al. (1991) reported that icon access times and message construction times were faster and less variable than with the manual VIC system. The C-VIC system displayed the iconic message and an English translation facilitating communication with non-system users. Five aphasic adults who received training on the C-VIC system showed improved communicative abilities, asking and answering questions, responding to commands, and describing situations that were structured and drilled previously. The subjects were better receptively than expressively, but occasionally produced novel uses of communication. Consistent with Gardner et al. (1976), Steele et al. (1991) observed that : (1) performance using C-VIC exceeded natural language abilities, (2) most errors occurred in using verbs, prepositions, and conjunctions, and (3) system use did not affect the subjects' natural language abilities. Steele et al. (1991) concluded that severely impaired individuals remain unable to use the system innovatively.

AAC Framework for Aphasia Intervention

Garrett and Beukelman (1992) proposed a classification system for persons with severe aphasia based on "the severity of the communication deficit as it relates to the individual's ability to meet current needs and to participate in communication exchanges" (p. 251). The classification provides multimodality treatment (gestures, nonelectronic applications, and electronic devices) based on the person's language abilities. Five types of communicators were included:

1. Basic Choice Communicator-- a person with chronic global aphasia and severe neurological impairment. This individual could not speak but could make basic choices with the help of a partner. Intervention focused on the communication partner.

2. Controlled Situation Communicator-- a person with chronic global, Broca's or Wernicke's aphasia who could initiate communication with assistance. Limb apraxia was often present. Some speech might be present. Intervention focused on teaching choice making and AAC strategies to participate in structured conversations.

3. Comprehensive Communicator-- a person with chronic Broca's and conduction aphasia who could use multimodalities to communicate and who wanted to communicate in more that one environment. Intervention might include a technical communication system.

4. Specific Need Communicator-- crossed all other categories. Intervention focused on providing assistance with a specific activity, for example, using the telephone.

5. Augmented Input Communicator-- a person with Wernicke's aphasia who had auditory processing deficits and might speak well. Intervention focused on the partner identifying breakdowns and giving key words.

While Garrett & Beukelman (1992) classified client communication needs based on communication abilities, Light (1988) developed a communication model for AAC treatment based on the social purposes of interactions. Light (1988) outlined four purposes of communication: (1) wants/needs, (2) information transfer, (3) social closeness, and (4) social etiquette. The goal of expressing wants/needs is " to regulate the behavior of the partner to provide a desired object or to perform a desired action" (Light, 1988, p. 76). The purpose of information transfer is to share new information. The goal of social closeness is "to establish, maintain, and/or develop an interpersonal relationship" (Light, 1988, p. 77), and the goal of the fourth area is "to conform to social conventions of politeness" (Light, 1988, p. 77). The effectiveness of intervention, then, can be measured by how well these communication needs are met (Light, 1988).

The classifications outlined by Garrett and Beukelman (1992) in combination with the communication framework provided by Light (1988) could be used as a construct to define the individual's disabilities, to prescribe the AAC techniques to pursue for intervention, and to measure treatment efficacy.

<u>Summary</u>

The reports of using augmentative and alternative communication for severe, nonfluent aphasic adults have been single case reports and limited experimental trials. This study offers one of the first opportunities to control subject variables and language tasks, and to examine the efficacy of introducing voice output communication technology as one communication modality to the severe, nonfluent aphasic adult for structured communication tasks. Differences in efficient and effective communication that can be related to the addition of VOCAs may be useful clinically in making treatment recommendations for the functional communication of adults with severe, nonfluent aphasia.

CHAPTER III

METHODS AND PROCEDURES

SUBJECT

One subject was drawn from the out-patient members of a recreation-oriented communication treatment group which is conducted at the Portland Veterans' Affairs Medical Center (see Appendix A and B). The subject had been diagnosed with severe, nonfluent aphasia by a certified Speech/Language Pathologist.

Subject JK is a 57-year old male who suffered a left CVA in October 1992. He has adequate use of his left upper extremity for functional tasks, but has hemiparesis of the right arm. Subject JK has lost his ability to produce meaningful speech and currently uses gestures, pantomime, writing, drawing, and communication books to express himself. He also uses a Zygo Parrot communicator (a direct selection, hand-held voice output communication aid with five customized messages stored digitally) at home for telephone use. His Revised Token Test (McNeil & Prescott, 1978) overall mean score is 11.14 which indicates good auditory comprehension skills. His PICA (Porch, 1981) reading subtest score is 11.85 and his PICA graphics scores are 12.75 for the copying subtest and 6.48 for the writing subtest. JK writes legible letters given verbal or visual cues, but is less accurate in spelling common single words when dictated. He has received individual speech-language pathology treatment since November 1992 and group treatment since April 1993. His individual treatment focused on strengthening reading skills, auditory comprehension, writing abilities, and vocabulary. He continues to receive group treatment which targets functional communication.

PROCEDURES

Research Design

This study used a single-subject, component assessment research design (Kearns, 1986) to explore the relative effectiveness of components in the treatment package. It compared the relative effectiveness of PACE treatment using JK's natural communication modalities with that of PACE treatment plus a voice output communication aid (VOCA) component.

The sequence of experimental phases consisted of an initial baseline phase (A), followed by PACE treatment (B), followed by PACE treatment plus VOCA condition (BC), followed by a return to PACE treatment alone (B), followed by replication of the PACE treatment plus VOCA condition (BC), and concluded by a final follow-up phase (D). In the last phase, the subject was allowed to use all communication methods learned during the treatment phases, including the VOCA. Thus, design elements were arranged in an A-B-BC-B-BC-D sequence.

The subject's attempts to convey information were analyzed using three measures: (1) the total number of conversational turns, (2) the total number of conversational breakdowns, turns to repair breakdowns, and repair turns as a percentage of total turns, and (3) the total number of correct messages conveyed (total number of blocks placed correctly) during a structured communication task.

The subject participated in 30 one-hour sessions which were conducted three times weekly for 10 weeks. Each experimental phase was conducted for five sessions.

Setting

During all experimental sessions, the investigator and the subject were seated in a clinic room at a table across from each other on the opposite sides of an opaque screen so that they were visible to each other above the chest. A video camera was set up prior to each session. During each session only the subject and the investigator were present.

Experimental Design Task

The design of the experimental task during the baseline and treatment phases was based on a method of study described by Glucksberg, Krauss, & Weisberg (1966), called a barrier game.

In this study, the aphasic adult and the investigator participated in a barrier game with block designs. The object of the barrier game was to build a set of matching block designs. The primary sender was given a set of five unique blocks laid out in a predetermined design. The primary receiver was given a set of matching blocks laid out in front of him/her in random order. The receiver could not see the sender's predetermined block design because of the opaque screen barrier. The sender instructed the receiver on where to place the blocks so that they match the predetermined block design.

There were 16 novel block designs based on 10 blocks plus a base on which all block designs were placed. A Random Number Generator software tool determined the order of presentation of the block designs to control for possible order effects. Table 1 gives the order of presentations. The individual blocks and the block designs are shown in Appendix C.

Table 1

<u>Order Of Presentations Of Block Designs Generated By A Random Number Generator</u>

Session	Investigator	Subject
1	-	11
2	-	4
3	-	6
4	-	2
5	-	12
6	8	7
7	12	10
8	9	15
9	6	1
10	15	14
11	15	7
12	11	8
13	12	5
14	3	7
15	7	13
16	14	14
17	12	7
18	11	7
19	6	1
20	12	11
21	5	13
22	14	6
23	10	3
24	6	4
25	5	6
26	-	5
27	-	1
28	-	9
29	-	15
30	-	12

The investigator taught the subject how to operate the VOCA (e.g., operation of the on/off and volume control switches and how to activate the message boxes). This insured that any difficulties with the VOCA encountered during the experiment were not attributed to the subject's lack of operational competence with the VOCA. The investigator also conducted two one-hour sessions on how to use the VOCA linguistically (see Appendix F for the training protocol).

Baseline Phase Procedures

During baseline, the subject used his traditional communication methods to send messages to the investigator. Baseline measures of the subject's performance were obtained during the first five sessions.

Each baseline session employed a unique block design based on the order generated by a Random Number Generator software tool. The investigator gave the subject a photograph of the block design without the investigator knowing which design was picked (except for its numerical identification). The subject constructed the design, then in random order gave the investigator the blocks required to complete the construction. Using his current communication skills, the subject instructed the investigator on where to place the blocks so that they matched the subject's block design. The investigator acknowledged messages nonverbally and did not use verbal prompting, modeling, or reinforcement.

Treatment Phase Procedures

During the next 20 treatment sessions, PACE therapy consisted of teaching the subject, within a natural context, the communication skills needed to perform the experimental task. PACE therapy requires that the investigator demonstrate the communication methods for completion of the task, and then provide natural feedback regarding the success of the subject's use of the same methods.

Thus, the subject and the investigator alternated between the roles of primary sender and receiver. In the role of primary sender, the investigator used only nonverbal communication. In the role of primary receiver, the investigator used verbal and nonverbal modeling, prompting, and reinforcement giving natural feedback relative to the communication.

The second set of five sessions used PACE therapy to teach the subject to use his traditional communication skills (nonverbal) to perform the barrier game. The investigator picked a photograph of a set of five unique blocks laid out in a predetermined design. The subject received a set of matching blocks laid out in front of him in random order. The investigator using nonverbal communication methods (gesture and drawing) instructed the subject on where to place the blocks so that they matched the investigator's block design. Then, the investigator and subject changed roles and the subject acted primarily as a sender of information. The subject was given a photograph of a set of five unique blocks laid out in a predetermined design. Using his traditional communication skills, the subject instructed the investigator on where to place the blocks in front of her, which had been presented in random order, so that they matched the subject's block design. The investigator acted primarily as a receiver of information and gave verbal and nonverbal natural feedback relative to the communication, similar to that received in natural settings.

The third set of five sessions used PACE therapy to teach the subject to use the VOCA plus his traditional communication strategies to perform the barrier game. Again, the investigator modeled the instructions for constructing a block design, using the VOCA in addition to other nonverbal communication strategies (gesture and drawing). The VOCA was used as the initial and primary communication method during the PACE and VOCA condition. Upon completion of the task, the roles of primary sender and receiver were reversed. The subject then used the VOCA in addition to using his current communication strategies to instruct the investigator on how to build a block design. The subject was given a photograph of a set of five unique blocks laid out in a predetermined design. The subject instructed the investigator on where to place the blocks in front of her, which had been presented in random order, so that they matched the subject's block design. The investigator acted primarily as a receiver of information and gave natural feedback relative to the communication, similar to that received in natural settings.

The fourth set of five sessions repeated the conditions used in the second set of sessions. The fifth set of five sessions repeated the conditions used in the third set. The sixth set of five sessions (follow-up) repeated the conditions of the first set; however, the subject was allowed to use all communication methods he had learned including the VOCA.

INSTRUMENTATION AND EQUIPMENT

Block Specifications

Ten unique blocks were selected to construct 16 novel block designs that were used to perform the structured communication task, called the barrier game. Each block design had a set of five unique blocks chosen from the original 10 blocks. Each block design used the same base. The blocks were wooden and unpainted. The 10 blocks and the 16 block designs are shown in Appendix E. The block designs are numbered from 1 to 16. The dimensions of each block follow: long rectangle (2" x 8" x 1"); short rectangle (2" x 4" x 1"); long square (1" x 8" x 1"); short square (1" x 2" x 1"); long round (8", 1" diameter);

short round (2", 1" diameter); big triangle (3.5" x 4" x 2", 2" wide); small triangle (2" x 2" x 2.5", 1" wide); half circle (3" diameter, 1" wide); bridge (4", 1" wide); base (4" x 10" x .5").

Microsoft (R) EXCEL Computer Program

The Random Number Generator tool in the Microsoft (R) EXCEL software program was used to generate random numbers for ordering the presentation of block designs. The software resided in an Apple Macintosh (R) Plus computer. The tool fills a range with independent random numbers drawn from one of several distributions. This study used standard normal distribution from 1 to 16 with two columns of data (see Table 1).

VOCA

The Words+ MessageMate 40 (TM) voice output communication aid was selected for this study. The MessageMate is a small (5" x 10"), hand-held voice output communication aid that records speech digitally. It stores 40 messages that are accessed by pressing 3/4" x 3/4" boxes. Criteria for VOCA selection were: the subject's receptive language skills, the number of messages required for the task, and the device's message capacity (number of messages) on one level of presentation (see Appendix H).

Vocabulary For The VOCA

The MessageMate does not contain preselected vocabulary. The user, and in this case the investigator, must choose words and phrases that are stored digitally in the device. The investigator selected vocabulary for the VOCA from that used by a naturally speaking adult male cohort of the aphasic adult (see Appendix G). The cohort is a 78-year old male who holds a BA degree in Business Administration and is a retired Industrial Relations/Human Resources Manager. Since the structured communication task inherently limited the vocabulary which was needed for this study, choosing vocabulary from one cohort's vocabulary was adequate. The cohort, acting primarily as sender of information, played the barrier game using all 16 block designs. He used natural speech and all messages were audio tape recorded and then transcribed. Criteria for vocabulary selection was based on frequency of use (each word or phrase used more than six times) and the device's message capacity on one level of presentation (40 target messages could be placed on one display). Advanced Revelations, Version 2.1 database software from Revelations Technologies, Inc. was run on an IBM 386 personal computer to calculate frequency of vocabulary use.

The vocabulary programmed into the VOCA included 13 single words, 21 multi-word phrases, and six conversational control phrases. The single words were a mixture of nouns, verbs, adjectives, and prepositional phrases. As each key accessed a single target, the subject was required to produce original phrases and sentences through multiple key selection. The control phrases assisted with discourse management and with needed repairs. Each word or phrase was represented on the VOCA orthographically.

Audio-Visual Equipment

A Panasonic RX-CS700 audiotape recorder was used to record messages during the barrier game played by an adult male cohort from which vocabulary was selected. A Panasonic Camcorder PV-IQ303 VHSC was used to videotape record all sessions in which the aphasic individual played the barrier game.

DATA ANALYSIS

All baseline and treatment sessions were video recorded. The investigator viewed the videotapes and performed all coding and counting procedures.

Data were collected in three areas: (1) the total number of conversational turns necessary to accomplish a structured communication task, (2) the total number of conversational breakdowns, turns to repair breakdowns, and repair turns as a percentage of total turns, and (3) the total number of correct messages conveyed (total number of blocks placed correctly) during a structured communication task. All communication behaviors exhibited by the aphasic adult were counted including gesture, facial expression, drawing, vocalization, and electronically aided communication (i. e., VOCA). These variables were thought to survey a range of communication behaviors necessary for transferring new information effectively, efficiently, and accurately in a structured communication task.

Since this study used a single-subject design, the subject functioned as his own control. This design provided a way of comparing performance data under two treatment conditions which helped define communication techniques that could contribute to the effectiveness within daily interactions.

Conversational Turns

A conversational turn or turn taking is a basic feature of conversation in which partners do not talk simultaneously, but alternate between the roles of speaker and listener. Davis and Wilcox (1985) described conversational turns as moves which can be divided into two categories: housekeeping moves and substantive moves. Housekeeping moves control turn taking and do not necessarily contribute to providing messages. Gestures, eye gaze, and hand movements are considered important housekeeping moves which can initiate or maintain a speaker's turn or switch roles from listener to speaker or vice versa. A substantive move is a turn that contains information. One communication partner attempts to convey a message while the other participant is the listener and attempts to comprehend the meaning.

In this study, the interaction was coded for the use of conversational turns. A conversational turn score was calculated, indicating the number of conversational turns taken by the aphasic adult and the investigator. After viewing the videotape, the investigator counted the conversational turns. Any communication behavior, including multiple communication modes marking active participation in the interaction, fulfilled a turn. A turn ended when the roles of speaker and listener were switched.

The number of turns taken determined the efficiency of the interaction. It was hypothesized that fewer turns to accomplish the experimental task using a VOCA in addition to the usual communication strategies indicates that more precise information is produced and fewer turns are required to resolve breakdowns. It was also hypothesized that the fewer number of conversational turns suggests that the aphasic adult is able to initiate exchanges and demonstrate greater control.

Conversational Breakdowns

Conversational breakdown is the time during a conversation in which the listener does not understand the speaker's message. Conversational breakdown sequence is the conversational turns which occur to repair conversational breakdown. Davis and Wilcox (1985) described several outcomes in the sequence: resolution, in which the speaker confirms that the listener's interpretation of the speaker's message was correct; breakdown, in which the listener has made an incorrect guess; revision, in which the speaker modifies the message after a breakdown; and repair, in which the speaker improves the message after the listener has provided a correct interpretation.

In this study, the communication was coded for conversational breakdowns and conversational turns taken to repair breakdown. A communication act was counted as a breakdown when the listener did not understand the speaker's message and responded with a request for information. Conversational turns were counted during the breakdown sequence from the time that the listener responded with a request for information to the time that a resolution was formulated. A score was calculated, indicating the number of breakdowns and the number of turns per breakdown over the total number of communication attempts. After viewing the videotape, the investigator counted the total number of breakdowns and the conversational turns per breakdown sequence.

The number of breakdowns and turns per breakdown determined the effectiveness of the interaction. It was hypothesized that fewer turns to resolve a breakdown when using a VOCA in addition to the usual communication modalities indicates that more precise information is produced, less time is needed to accomplish the task, and resolution of breakdowns occurs more efficiently and effectively.

Accurate Placement of Targets

In this study, the object of the experimental task was to build two matching block constructions. Sixteen novel block designs were constructed. The sender of information was given a photograph of a set of five blocks laid out in a predetermined design. The receiver was given a set of five matching blocks in random order. The participants were separated by a partition. This required that the sender of information be precise in his instructions. After each interaction about the placement of the blocks, the investigator counted the number of blocks which were placed in the same order and orientation as the predetermined block design.

The focus of the interaction was information transfer, so the content of the communication was important (Light, 1988). Counting the number of individual blocks placed correctly by the investigator as instructed by the aphasic adult indicated the accuracy of the message which was sent. It was hypothesized that the more blocks placed accurately in a session indicates more precise information is generated and fewer turns are devoted to resolving breakdowns. More accurate block placement also indicates that the sender is able to transfer information independently at a rate that was appropriate for the interaction.

The Split-Middle Method Of Trend Estimation

The split-middle method of trend estimation provides a way to describe the rate of behavior change over time. It estimates the slope or line of progress. The line of progress, referred to as a celeration line, is derived from ascending and descending rates of change.

To determine the celeration line, the treatment phase is divided in half, then each half is halved again. Next, the median value for each half is calculated based on the dependent variable values and a horizontal line is drawn through the median value until it intersects with the vertical line (the line which divided the phase in quarters). To determine a slope, a line then connects the two medians in each half. The change in level or slope summarizes the differences in performance.

Reliability

In addition to the investigator, a certified Speech-Language Pathologist spot scored the videotape recordings. The investigator and Speech-Language

Pathologist calibrated the techniques of scoring prior to reliability being performed. A sample score sheet appears in Appendix I. Point-to-point interscorer reliability was examined for one out of every five sessions within each phase of the study. Point-to-point interscorer reliability was 93.3% for conversational turns, 100% for conversational breakdowns, and 92.4% for repair turns per breakdown.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

The objective of this study was to determine whether an adult with severe, nonfluent aphasia could communicate independently when a voice output communication aid (VOCA) was added to his natural communication repertoire. The research question this study addressed was:

Does the addition of a VOCA facilitate independent communication in an adult with severe, nonfluent aphasia on measures of efficiency, effectiveness, and accuracy which include: conversational turns, conversational breakdowns, turns to repair breakdowns, repair turns as a percentage of total turns, and correct messages conveyed?

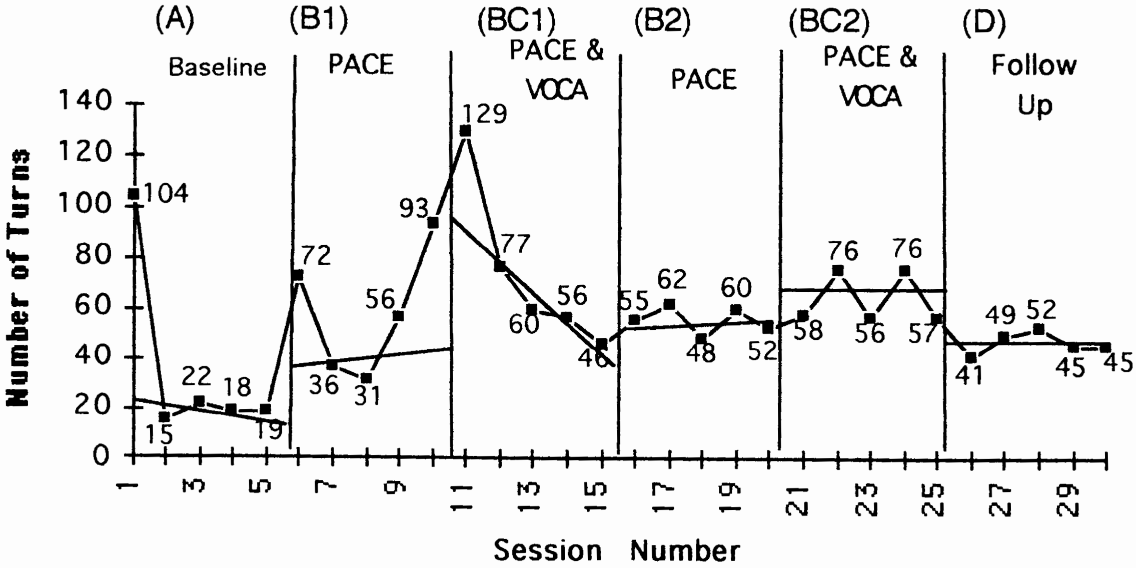
The data were analyzed using the split middle analysis to determine whether performance differences existed under two treatment conditions of the structured communication task. Three single-subject design measures were used to examine the data: patterns of shifts from one treatment phase to the next; amount of change from one phase to the next; and the trend and slope of the trend in the data.

Conversational Turns

Conversational turns were defined as basic features of conversation in which partners do not talk simultaneously, but alternate between the roles of speaker and listener. A conversational turn also was referred to as turn-taking.

It was hypothesized that an aphasic adult would take fewer conversational turns during an interaction to accomplish a structured communication task when he is using a voice output communication aid (VOCA) in addition to his usual communication modalities. Figure 1 shows the number of conversational turns taken during each experimental session. The data do not support the hypothesis that the subject would take fewer conversational turns to complete the task when using the VOCA.

Figure 1. A comparison of conversational turns for all sessions (split-middle analysis).



Key: The solid slope line denotes the celeration line and indicates the line of progress over time.

An examination of the graph indicates that the baseline was rather stable after the first session. If the first session is discarded due to the novelty of the task and difficulty in a new setting, then the next four baseline sessions contained between 15 to 22 turns (mean = 18.5). In contrast, the follow-up sessions contained between 41 to 52 turns (mean = 46.4). The interaction in the follow-up sessions (sessions 26 through 30) was characterized by a 150% increase overall in the number of conversational turns compared to the baseline sessions.

Using a split-middle technique to compare data in each condition reveals an increase in the level (total number) of conversational turns with the slope initially rising in B1, then falling in BC1, and then becoming stable at a level higher than baseline in all subsequent phases. Results suggest that neither PACE treatment nor PACE with the introduction of the VOCA decreased the total number of conversational turns per session. Moreover, in the follow-up phase when baseline conditions were reproduced and no encouragement was provided for the subject to use any specific communication modalities or strategies, the total number of conversational turns remained above baseline level.

Comparison of treatment phases reveals between 31 and 93 turns in B1 (mean turns = 57.6); a large range of 46 to 129 turns in BC1 (mean turns = 73.6); a limited range of 48 to 62 turns in the B2 condition (mean turns = 55.4); and a range of 56 to 76 turns in BC2 (mean turns = 64.6). Comparison of PACE only treatment phases reveals a 3.8% decrease in the number of turns in the B2 condition over the B1 condition. Comparison of VOCA condition phases reveals a 12.2% decrease in the number of turns in the BC2 condition over the BC1 condition. There was a slight decrease in the number of PACE alone turns over time and a slightly greater decrease in the number of PACE + VOCA turns over time.

Comparison of the four treatment conditions reveals a mean number of turns ranging from 57.6 (B1), 73.6 (BC1), 55.4 (B2), to 64.6 (BC2). A positive shift in level of conversational turns in the first treatment phase (B1) points to an increase in conversational turns. Further increase in conversational turns occurred during the first VOCA phase (BC1) compared to the first PACE phase (B1). A decreased shift in level then occurred during the second B phase (B2), when the VOCA was unavailable, which was followed by an increased level in the second BC phase (BC2), when the VOCA was available. A steady decrease in conversational turns with the addition of the VOCA was predicted but is not apparent. In fact, it was expected that a very prominent rise in turns would be seen in the B phases with a very significant decrease in turns for the BC phases. The number of conversational turns actually rose whenever the VOCA was added to the condition.

Conversational Breakdown Sequences (Repair Turns)

Conversational breakdown sequences were defined as the conversational turns which occur to repair conversational breakdowns. A breakdown was defined as the times during a conversation in which the listener does not understand the speaker's message. It was hypothesized that an aphasic adult would take fewer turns to repair a communication breakdown during an interaction to accomplish a structured communication task when he is using a voice output communication aid in addition to his usual communication modalities. Figure 2 and Table 2 show the data on the number of repair turns for all sessions. The data do not conclusively demonstrate the hypothesis that the subject would take fewer turns to repair a communication breakdown to complete the task when using the VOCA.

Figure 2. A comparison of turns to repair breakdowns for all sessions (split-middle analysis).

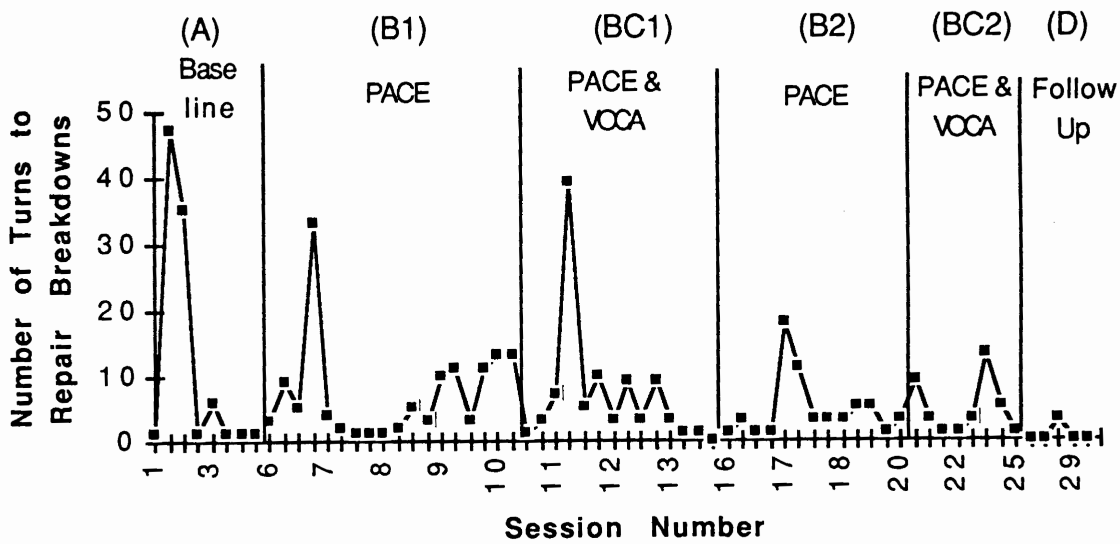


Table 2
Repair Turns Per Breakdown By Session

Session #	Brkdwn 1	Brkdwn 2	Brkdwn 3	Brkdwn 4	Brkdwn 5
1	1	47	35		
2	1				
3	6				
4	1	1			
5	1				
6	3	9	5	33	
7	4				
8	2	1	1	1	
9	2	5	3	10	
10	11	3	11	13	13
11	1	3	7	39	5
12	10	3	9		
13	3	9	3		
14	1	1			
15	0				
16	1	3			
17	1	1	18	11	
18	3	3	3		
19	5	5			
20	1	3			
21	9	3	1		
22	1				
23	3				
24	13				
25	5	1			
26	0				
27	0				
28	3				
29	0				
30	0				

An examination of the data indicates that baseline sessions contained between 1 to 83 repair turns (mean = 18.6). In contrast, the follow-up sessions contained between 0 to 3 repair turns (mean = .6). The interaction in the follow-up sessions (sessions 26 through 30) was characterized by a 96.7% decrease overall in the number of repair turns compared to the baseline sessions.

Comparison of treatment phases reveals between 4 and 51 repair turns in B1 (mean = 26); a large range of 0 to 55 in BC1 (mean = 18.8); a limited range of 4 to 31 (mean = 11.6) in the B2 condition; and a range of 1 to 13 (mean = 7.2) in the BC2 condition. The data on turns to repair breakdowns show a declining trend with treatment. When treatment was introduced in the B1 phase, an increase in level and trend occurred initially, then declined. When the first VOCA treatment (BC1) was introduced, an increase occurred initially, then decline occurred again. The level inclined and declined again in the B2 and BC2 phases.

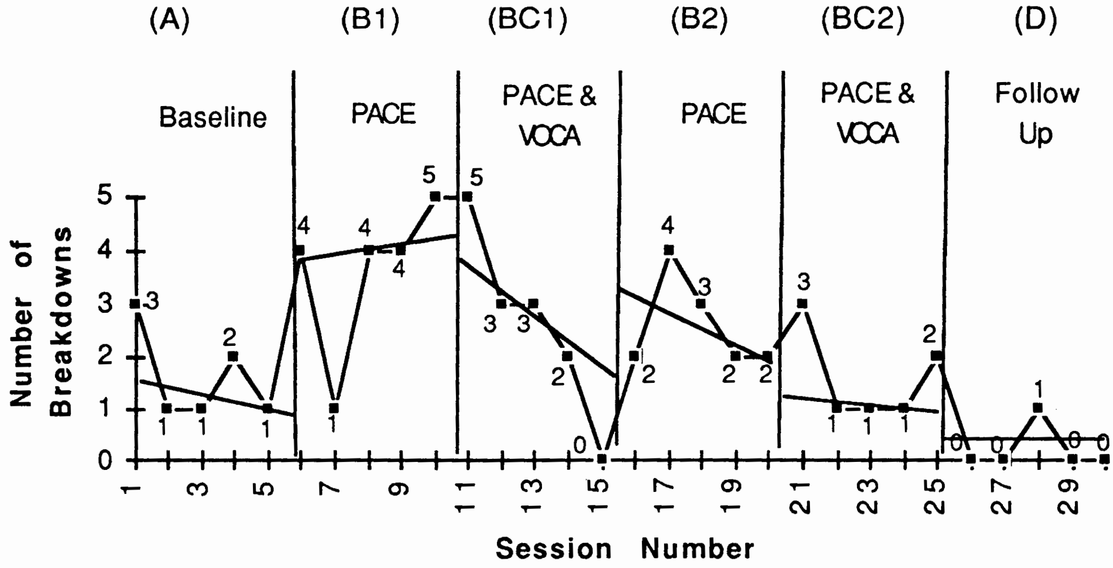
Comparison of PACE only treatment phases reveals a 55.4% decrease in the number of repair turns in the B2 condition over the B1 condition. Comparison of VOCA condition phases reveals a 61.7% decrease in the number of repair turns in the BC2 condition over the BC1 condition.

Comparison of the four treatment conditions reveals a mean number of repair turns ranging from 26 in B1, to 18.8 in BC1, to 11.6 in B2, to 7.2 in BC2. A steady decrease in conversational repair turns with the addition of the VOCA was predicted and was seen. However, due to the continued decrease in repair turns over all sessions, no one single treatment component can be confirmed with certainty.

Conversational Breakdowns

Conversational breakdowns were defined as the times during a conversation in which the listener does not understand the speaker's message. Figure 3 shows the data on number of conversational breakdowns for all sessions.

Figure 3. A comparison of conversational breakdowns for all sessions (split-middle analysis).



Key: The solid slope line denotes the celeration line and indicates the line of progress over time.

An examination of the graph indicates that the baseline condition was rather stable and ranged from 3 to 1 breakdowns (mean = 1.6). In contrast, the follow-up phase contained only one breakdown in 5 sessions (mean = .2). The interaction in the follow-up sessions (sessions 26 through 30) was characterized by a 87.5% decrease overall in the number of conversational breakdowns compared to the baseline sessions (sessions 1 through 5).

The four treatment conditions had similar numbers of breakdowns. B1 condition breakdowns ranged from 1 to 5 with a mean of 3.6; BC1 had a range of 0 to 5 breakdowns with a mean of 2.6; B2 condition had a range of 2 to 4 breakdowns with a mean of 2.6; and BC2 ranged from 1 to 3 breakdowns with a mean of 1.6. When treatment was introduced in the B1 phase, an increase in level of conversational breakdowns occurred. When BC1 was introduced, a decline in breakdowns occurred after session 11. The level increased initially in the B2 phase. The BC2 phase showed a sharper decrease in the level of conversational breakdowns.

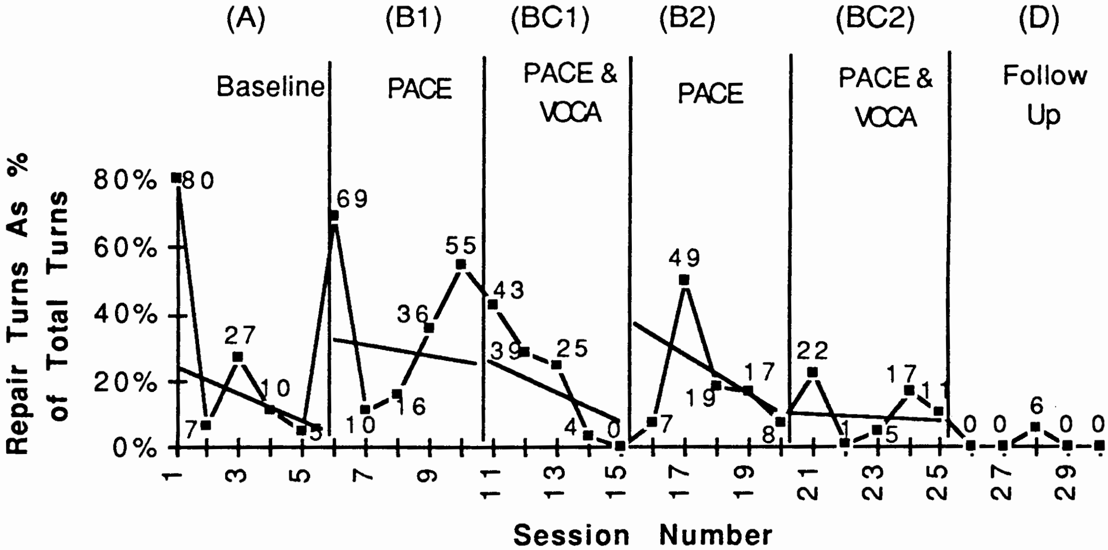
In comparing PACE only treatment phases, a 27.7% decrease in the number of conversational breakdowns in B2 over B1 was found. JK had fewer breakdowns with PACE only treatment. In comparing VOCA condition phases, a 38.5% decrease in the number of breakdowns in BC2 over BC1 was found. JK had an even greater reduction in the number of breakdowns over treatment time when the VOCA was added.

Using a split-middle technique to compare data in each condition reveals an increase in the level (total number) of conversational breakdowns following baseline with the slope initially rising in B1, then falling in BC1. In B2, the slope initially rises, then falls, and falls again in BC2. In the follow-up phase, the level remains below the baseline level.

Conversational Turns To Repair Breakdowns As A Percentage Of Total Turns

Figure 4 shows the number of conversational turns to repair breakdowns as a percentage of total turns.

Figure 4. A comparison of turns to repair breakdowns as a percent of total turns (split-middle analysis)



Key: The solid slope line denotes the celeration line and indicates the line of progress over time.

An examination of the graph indicates that the baseline was rather stable after the first session. If the first session is discarded, then baseline contained between 5% to 27% repair turns as a percentage of total turns (mean = 12.3%). In contrast, the follow-up sessions contained between 0% to 6% repair turns as a percentage of total turns (mean = 1.2%). The interaction in the follow-up sessions was characterized by a 90% decrease overall in the repair turns as a percentage of total turns compared to the baseline sessions.

Using a split-middle technique to compare data in each condition reveals an increase in the level of repair turns as a percentage of total turns with the slope initially rising in B1, then falling in BC1. In B2 the slope initially rises then falls in BC2, becoming stable at a lower level than baseline.

Comparison of treatment phases reveals a large range of 10% to 69% repair turns as a percentage of total turns in B1 (mean = 37.2%); a range of 0% to 43% in BC1 (mean = 22.2%); a range of 7% to 49% in B2 (mean = 20%); and a limited range of 1% to 22% in BC2 (mean = 11.2%). When B1 was introduced, an increase in the level of repair turns as a percent of total conversational turns occurred. With the introduction of the VOCA in BC1, a change in the level of repair turns was evidenced in the opposite direction. The level shifted slightly (2.2%) in the opposite direction when the VOCA was removed (B2). With the introduction of the VOCA in the BC2 phase, the level of repair turns as a percent of total turns declined again.

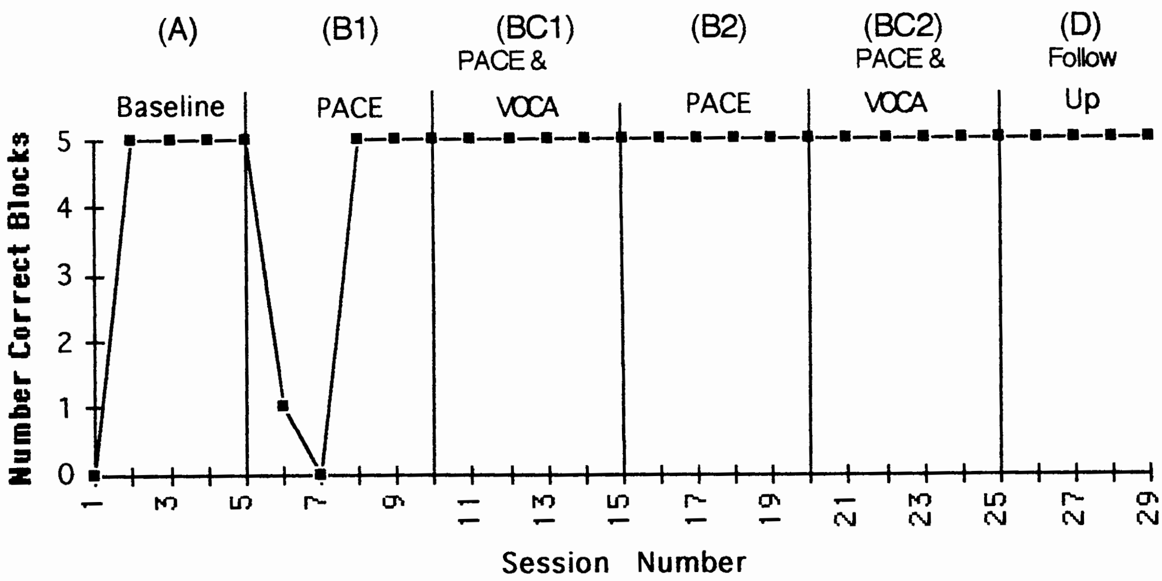
Comparison of PACE only treatment phases reveals a 46.3% decrease in the number of repair turns as a percentage of total turns in the B2 condition over the B1 condition. Comparison of VOCA condition phases reveals a 49.5% decrease in the BC2 condition over the BC1 condition. There was a decrease in repair turns as a percentage of total turns over time in both the PACE alone treatment and the PACE + VOCA condition.

Comparison of the four treatment conditions reveals a mean number of repair turns as a percentage of total turns ranging from 37.2% (B1), 22.2% (BC1), 20% (B2), to 11.2% (BC2). A steady decrease in the mean number of repair turns as a percentage of total turns was evidenced.

Correct Messages Conveyed

Correct messages were defined as the number of individual wooden blocks placed correctly for each block design. It was hypothesized that an aphasic adult would convey more correct messages (total number of wooden blocks placed correctly) during an interaction to accomplish a structured communication task when he is using a voice output communication aid in addition to his usual communication modalities. Figure 5 shows that the number of correct messages conveyed, as measured by the number of wooden blocks placed correctly, was 5 and remained unchanged for all but three sessions. This is 100% accuracy since there were five blocks per design. In sessions 1, JK did not correctly convey the block design at all. In session 7, JK reversed right to left, but otherwise the blocks were placed correctly on the base. In session 6, he correctly conveyed information for the placement of 1 out of 5 blocks.

Figure 5. A comparison of the number of blocks placed correctly for all sessions.



DISCUSSION

The purpose of the study was to determine whether an adult with severe, nonfluent aphasia could communicate independently when a voice output communication aid (VOCA) was added to his natural communication repertoire. The data collected to answer the research question regarding the independent communication performance of an adult with severe, nonfluent aphasia, shows that treatment affected a change in conversational turns, breakdowns, turns to repair breakdowns, and repair turns as a percent of total turns. Treatment did not appear to affect the correct number of messages conveyed as evidenced by stability in the data with no trend or slope.

Conversational Turns

The data regarding conversational turns do not support the research hypothesis for this study which specifically stated that the subject would take fewer conversational turns when adding a VOCA during a structured communication task. These findings confirm an overall decrease in efficiency of communication for a severely aphasic person in this structured task when a VOCA is introduced.

These data are consistent with the findings of Garrett et al. (1989) who evidenced a 65% increase in conversational turns within a 6 1/2 minute period during augmented conversation. Garrett et al. (1989) correlated these data with a reported decrease in repair turns and concluded that the preaugmented conversation was actually less efficient because more turns were spent resolving breakdowns. Furthermore, they concluded that the augmented conversation was in fact more efficient since the number of repair turns decreased while the number of assertions increased. Another conclusion reached by Garrett et al. was that their subject expressed more satisfaction when using an AAC system as it allowed him more equal partnership in communication and gave him the ability to initiate conversations more easily and repair breakdowns more efficiently.

While the data for this study show a decline in efficiency, one may speculate that a decrease in efficiency may not be as negative an impact on the communication itself as hypothesized. One may conclude from this study that an increased level of conversational turns indicates that the interaction between the partners increased and that the nature of the interaction differed, becoming more like a partnership. The videotaped sessions show that JK increased the number and variety of communicative acts. The subject used more control phrases, asked more questions, and provided more affirmations. Indeed, JK's role in the interaction clearly changed from simple pitch alterations of his stereotypy to mixing gestures, three-dimensional drawings, and the VOCA. Other actions taken which resulted in a loss of efficiency were JK's more frequent use of confirmation and use of turn-taking control phrases. He used the VOCA routinely for social control to start and end the action. He also adopted the convention of confirming the block order number, confirmed steps in the construction, and initiated conversation.

In conclusion, the present study proposed that efficiency of communication as measured by the number of conversational turns signified successful communication. However, the subject's role in communication leading to more control and participation may be more indicative of success and a sense of partnership.

Conversational Breakdowns

The data on conversational breakdowns show a linearly declining trend in the number of breakdowns. One may conclude that fewer conversational breakdowns support the effectiveness of the interaction and of treatment. However, due to the continued decrease in conversational breakdowns and the fact that no change in level or slope was evidenced as a result of the removal of the VOCA, one cannot identify which treatment approach is responsible for the change (McReynolds & Kearns, 1983).

These data are inconsistent with that reported by Garrett et al. (1989) who reported that the number of breakdowns more than doubled when the communication was augmented although fewer repair turns were experienced.

One may argue however that comparison of these results is difficult since the task in the Garrett et al. study was a one-time event in which unfamiliar partners were instructed to spend 6 1/2 minutes to get to know each other. This study's task was structured with a specific goal and took place over 30 treatment sessions.

It appears that JK benefitted from treatment for this task but attributing the benefit to a specific treatment component is not verifiable. One may speculate about certain treatment components that this investigator modeled frequently which may have contributed to a decline in the number of breakdowns. For example, this investigator preferred using gestures to specify and confirm the orientation of blocks, to control turns, and to identify block order. JK used drawing almost exclusively during baseline which was slow, laborious, and non-interactive. By the first PACE and VOCA phase, JK began to use gestures routinely to identify change of turn, block order, and block orientation. Compared to drawing, gesturing resulted in a quicker conversational pace and more partner interaction through more eye and facial contact. Although JK appeared to have the most confidence in drawing, it became a secondary communication strategy that JK used when he was unable to produce the gesture or when he questioned the investigator's understanding.

Another treatment variable that one may speculate reduced the number of breakdowns was an understanding of the linguistic conventions and rules established by the communication partners which reflected JK's language abilities. For example, JK used the VOCA to produce the verb "take + adjective + object" but used the prepositional phrase only for identification of block location. The investigator understood JK's syntactical convention and did not provide feedback that more information could have been supplied for a more syntactically correct message. In fact, the message was communicated accurately and further information was not required for effectiveness. This dyad relationship therefore resulted in fewer breakdowns.

The decline in the number of communication breakdowns (only one breakdown in the last five sessions) supports the speculation that for someone with similar communication skills as subject JK, the more communication choices available, the fewer number of conversational breakdowns. JK showed that he was able to switch from one mode to another with ease and in the follow-up phase chose the VOCA as the primary communication tool while infrequently using drawing to communicate position of blocks and confirmation of comprehension.

Conversational Turns To Repair Breakdowns

It was expected that an aphasic adult would take fewer turns to repair a communication breakdown during a structured communication task when adding a VOCA. The data do not conclusively demonstrate the hypothesis. The data suggest, however, that an AAC multimodality treatment approach enhanced communication.

These data are consistent with the findings of Garrett et al. (1989) who reported a dramatic decline in mean number of turns per breakdown sequence (15 to 4) in the augmented condition. Garrett et al. also concluded that while the number of repair turns declined and the number of turns increased, more information was transferred. Furthermore, the subject reported more satisfaction with the communication as he was able to resolve breakdowns more efficiently.

In the present study, perhaps PACE only treatment decreases the number of repair turns because when the VOCA was unavailable, the number of repair turns actually continued to decline. Indeed, subject JK preferred repairing breakdowns with drawing primarily because he was confident in his graphic ability. Often after using the VOCA, he confirmed understanding his message with drawing. It appeared that the visual representation of the block design acted as a safety measure for comprehension. In contrast, JK appeared to recognize that the VOCA and gestures were more brisk and interactive, engaging the investigator more. One may speculate that the VOCA and gestures served to provide more conversation, thereby supporting a true dialog which would mean more satisfaction with the communication for the subject.

These results also show that an increase in shift and level of repair turns occurred when making the transition from one treatment approach to another (PACE only treatment to PACE & VOCA). Each time a transition occurred, the number of repair turns increased per session. Perhaps, the shift from one treatment approach to another affected JK's ability to adapt to the new communication style and caused some amount of additional cognitive processing and formulation time in which to learn or re-learn the conventions of the approach.

Conversational Turns To Repair Breakdowns As A Percentage Of Total Turns

The data on turns to repair breakdowns as a percent of total turns show a linearly declining trend. These findings correlate with the decline in the number of turns per breakdown sequence and are consistent with the findings of Garrett et al. (1989). One may conclude, as did Garrett et al., that treatment increased the effectiveness of the interaction by reducing the effort spent in repairing breakdowns.

Furthermore, these data may be correlated with the increased number of conversational turns. As such, one may further conclude that more time was devoted to accomplishing the task than spent in repairing breakdowns and more turns were devoted to confirmation and exchanging new information. This finding is consistent with that of Garrett et al. (1989) who reported an 11% decrease in turns to resolve breakdowns in the augmented condition. These data also indicate that prior to treatment, the interaction was relatively inefficient and more conversational turns were used to repair breakdowns. In summary, this individual benefitted from treatment but the specific treatment component responsible for the change is not identifiable.

Correct Messages Conveyed

The findings for the correct messages conveyed do not support the hypothesis that, with the addition of a VOCA, accuracy would be enhanced as measured by the number of blocks placed correctly. For all but three sessions, 100% accuracy was attained.

One may interpret these data in different ways. Knowing that JK has received approximately two years of speech treatment and is continuing in group treatment, it seems appropriate to speculate that for another severe aphasic adult who is less facile in communication and switching communication modalities, a greater change in accuracy may have occurred as a result of treatment. In addition, the type of structured task in this study may have influenced accuracy in that it was a spatially related, concrete and visual which favored someone with graphic ability like JK. JK's ability to draw and his use of drawing to confirm accuracy and to repair breakdowns influenced accuracy levels. For an aphasic individual with less graphic ability, accuracy of messages conveyed certainly would have been negatively impacted.

CHAPTER V

SUMMARY AND IMPLICATIONS

SUMMARY

Aphasia researchers and AAC professionals are finding that assessment of communication competencies, needs, and environment of the individual with aphasia play a critical role in providing successful AAC systems. Multimodality AAC techniques demand that the individual have a desire to communicate, actively participate in communication, have the skills to operate the system in a timely manner, and have the appropriate AAC system to enhance the efficiency and effectiveness of communication.

The purpose of the present study was to determine whether an adult with severe, nonfluent aphasia could communicate independently with the addition of a voice output communication aid to his natural communication repertoire. The subject was drawn from the out-patient members of a recreation-oriented communication treatment group conducted at the Portland Veterans' Affairs Medical Center. The subject was diagnosed with severe, nonfluent aphasia by a certified Speech/Language Pathologist. This study used a single-subject, component assessment research design (Kearns, 1986). to explore the relative effectiveness of components in an aphasia and AAC treatment package. It compared the relative effectiveness of PACE only treatment using natural communication strategies with that of PACE treatment for natural strategies plus a voice output communication aid (VOCA) component.

The subject's attempts to convey information were videotaped and analyzed using three measures: (1) the total number of conversational turns, (2) the total number of communication breakdowns and the number of turns in a breakdown sequence (repair turns), and (3) the total number of correct messages conveyed (total number of blocks placed correctly) during a structured communication task.

The data were analyzed to determine whether performance differences existed under two treatment conditions of the structured communication task in order to answer the research question. Three single-subject design measures were used in evaluating the data: (1) patterns of shifts from one treatment phase to the next, (2) amount of change from one phase to the next, and (3) the trend and slope of the trend in the data.

The data for the number of conversational turns show an increase in the number of conversational turns which confirms an overall decrease in efficiency of communication for a severely aphasic person in this structured task. Second, although the data for the number of communication breakdowns and the number of repair turns show a decline which would confirm an overall increase in effectiveness, this study does not conclusively demonstrate that the use of a VOCA enhances communication in this setting for this person compared to PACE only treatment. Lastly, the data for the number of messages conveyed correctly show little change which confirms by the measure used in this study, no difference in accuracy of communication for this activity.

IMPLICATIONS

Research Implications

Applying AAC techniques to aphasia treatment is relatively new and offers the potential to enhance functional communication. The communication task for this study emphasized transferring instructions verbally that were visual in nature and may have been more suitable to drawing and gesturing. As such, the task favored someone with strong graphic skills. Garrett and Beukelman's (1992) AAC classification of treatment by language abilities and needs might be used to determine if there is a need for a voice output device. Introduction of a voice output device should be evaluated if activities require the aphasic person to give brief verbal interactions where interpretation of drawing is difficult or drawing ability is limited and there is a need for more frequent turn-taking to keep the communication partner engaged. Future research of interest would be to measure an individual's performance difference when drawing is not an option or when the subject has little or no graphic ability. Another variation in subject selection would be to choose someone with less skill in switching between communication modalities. Further research of interest would be to change the type of communication task to one that is more conversational in nature for the purpose of basic needs or social closeness.

In the present study, the investigator as sender of information during the VOCA condition modeled the use of the VOCA as the primary method of communication, secondarily used gestures, and finally drawing. JK used a similar patterned switching of modalities. Future research possibilities would be to vary the presentation of the VOCA with gestures and drawing in order to study the effects on the subject's performance. This may be important as it would represent more realistically the demands of a communication setting in daily activities. One could then measure the facility of the individual to switch and adjust communication modalities as the situation demanded, rather than in a patterned set as was demonstrated in this structured communication task.

In the present study, the VOCA's vocabulary was orthographically represented. The subject reliably used one verb, two adjectives, all nine nouns, all control phrases, and approximately 40% of the prepositional phrases. Perhaps the specific VOCA used had an effect on results. Several device features could be altered for further research, for example, reduce the number of linguistic choices or supply line drawing representations of the messages. Other VOCA characteristics that might have research implications are alteration of the size of the boxes, the variety of colored overlays, the presentation order of the vocabulary, clarification of vocabulary groupings by subject headings, and alteration of the space between VOCA boxes for more visual appeal.

In the present study, the measure that was selected for efficiency (total conversational turns) may not be the most appropriate measure for looking at this aspect of communication. Perhaps a ratio of conversational turns to time might be more revealing. This would reflect those changes in turn-taking that were observed in this study, but appeared in the data merely as an increase in number of turns.

Other measurements for future investigation that relate to daily use of the AAC system outside of the clinic might include AAC user satisfaction, performance differences with an untrained listener, and a count of the number and variety of speech acts. The number and variety of speech acts may be important in calculating equal partnership by measuring the amount of new information transferred, the ability of the individual to control the interaction, and to clarify understanding. Measuring communicative competence with untrained listeners may be an appropriate measure in predicting the individual's willingness to use an AAC system in the community as it would increase the individual's confidence and reduce frustration caused by misunderstanding. Finally, user satisfaction may be the single, most important measure that could predict success in the functional use of the device in daily activities. If user satisfaction is reflected in more conversational control, equal partnership, and engagement of the partner in a dialog, the individual may be more inclined to use the AAC system and initiate conversation in the community.

Clinical Implications

While the communication abilities of other individuals may differ from the one described in this study, several treatment implications may apply. Linguistic training in use of the AAC system was critical to the success of the communication task. Individuals with aphasia may need additional coaching to master the vocabulary of the AAC system. Although this study does not conclusively demonstrate that use of a VOCA enhances communication in this setting for this person, it does suggest that a similar person could incorporate a VOCA into his repertoire. If a comprehensive needs assessment is conducted, as is standard practice in an AAC evaluation, it would be possible to determine if there was a need for a voice output device. The present study suggests that at least for a similar type of aphasic person, introduction of a VOCA should be considered if there is a need. Activities similar to this task which might require voice output include games that require bidding (bridge, pinochle, etc.) or other tasks which require the aphasic person to give brief verbal interactions with predictable vocabulary, for example, job related tasks or activities shared with partners where interpretation of gesture is difficult and there is a need for more frequent turn-taking to keep the listener engaged.

The findings from this study suggest that even though the VOCA provided a quick and relatively easy method to communicate specific object names, object descriptions, and control phrases, it was more difficult to use in terms of selecting accurate linguistic terms to describe relationships between objects. In fact, for this particular task it was often more effective to gesture or draw the positioning of the blocks relative to one another. This indicates the importance of developing and encouraging the use of a multimodality AAC system which meets the needs of the individual, the type of interaction, and the requirements of the communication environment.

In addition to working on linguistic competency, the sociolinguistic skills of an individual should be addressed. Subject JK was very motivated to communicate and used appropriate discourse management skills including turn-taking, questions, and confirmations. This indicates the importance of residual capabilities and the additional training of these skills for someone with different abilities. In terms of AAC use, sociolinguistic skills may define the AAC system itself.

While JK was competent in the area of sociolinguistic skills, he had difficulty adapting to new treatment environments as shown by the initial increasing trends in conversational turns, breakdowns, and repair turns as a percentage of total turns at the beginning of each different treatment phase. These initial peaks influenced the results in efficiency measures. It may not be appropriate to measure efficiency clinically by total turns. More importantly, perhaps is user satisfaction and equal partnership in a dialog.

The partner, in this case the investigator, preferred the interaction when the subject used the multimodality AAC system. The conversation was livelier, with more eye contact and facial expression. The subject kept this partner's attention. To this investigator, the subject appeared to be quite pleased with the communication when using the VOCA. He accomplished what he wanted to in the conversation and took an active role.

Lastly, the partners in a communication dyad are important clinically. Although this study does not conclusively demonstrate that adding a VOCA enhances communication, it does appear that the VOCA provided a platform from which syntactical rules, transfer of information, and conversational control were established. The present study suggests that introduction of a VOCA should be considered if the individual has experienced frustration from partner misunderstanding and the partners show a need for clarifying understanding more easily.

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Appendix A

Human Subjects Research Form

OFFICE OF RESEARCH AND SPONSORED PROJECTS

DATE: NOVEMBER 1, 1993

TO: Jane Stayer

FROM: Martha Balshem, Chair, HSRRC 1993-94

RE: HSRRC Approval of Your Application titled "Facilitating Independent Communication for an Adult with Severe Nonfluent Aphasia Using a Voice Output Communication Aid"

In accordance with your request, the Human Subjects Research Review Committee has reviewed your proposal referenced above for compliance with DHHS policies and regulations covering the protection of human subjects. The committee is satisfied that your provisions for protecting the rights and welfare of all subjects participating in the research are adequate, and your project is approved.

Any changes in the proposed study, or any unanticipated problems involving risk to subjects, should be reported to the Human Subjects Research Review Committee. An annual report of the status of the project is required.

c. Office of Graduate Studies

Appendix B

Consent Form

DESCRIPTION OF STUDY

I have been asked to participate in a research project being conducted by Lynn Fox, M. A., a V. A. Medical Center staff speech pathologist, Melanie Fried-Oken, Ph. D., a professor of Neurology at OHSU, and Jane Stayer, a Portland State University graduate student.

I have been asked to participate in this project because my physician has diagnosed me with severe nonfluent aphasia.

The purpose of the study is to determine whether an adult with severe nonfluent aphasia can communicate independently using a speaking machine called a voice output communication aid. This machine will produce recorded words and phrases when I press its buttons.

PROCEDURES

I understand that participating in this project involves 30 one-hour treatment sessions which will be conducted twice weekly for 15 weeks.

The treatment will take place in a treatment room at the Portland VA Medical Center. During the treatment I will be completing a communication task called a barrier game.

During some sessions, I will be using communication methods with which I am already familiar.

During some sessions, I will be using a speaking machine in addition to my other methods of communication.

Each session will be videotaped. These tapes will be reviewed to see how well and how completely I have communicated.

BENEFITS AND RISKS

It is possible that I will be better able to use a speaking machine for communication as a result of my participation in this study. Although I may not benefit from this study, my participation may help benefit others in the future.

The only risk of participating in this study may be some frustration. I understand that the person working with me will end our session if I express any discomfort.

ALTERNATIVE TREATMENTS

Currently there is no treatment typically used to teach use of speaking machines to aphasic people. The treatment that will be provided in this project has been used to teach aphasic people how to use other forms of communication. Now it is being used to teach the use of a speaking machine.

CONFIDENTIALITY

I understand that the results of this project may be used for publication or for scientific purposes; however, my identify will not be disclosed.

Videotaped recordings used in this project will be viewed only by the investigators and will be stored in the principal investigator's office. Any other use of the videotapes will require separate written consent and will be discussed with me prior to such use.

RIGHT TO WITHDRAW/VOLUNTARY CONSENT

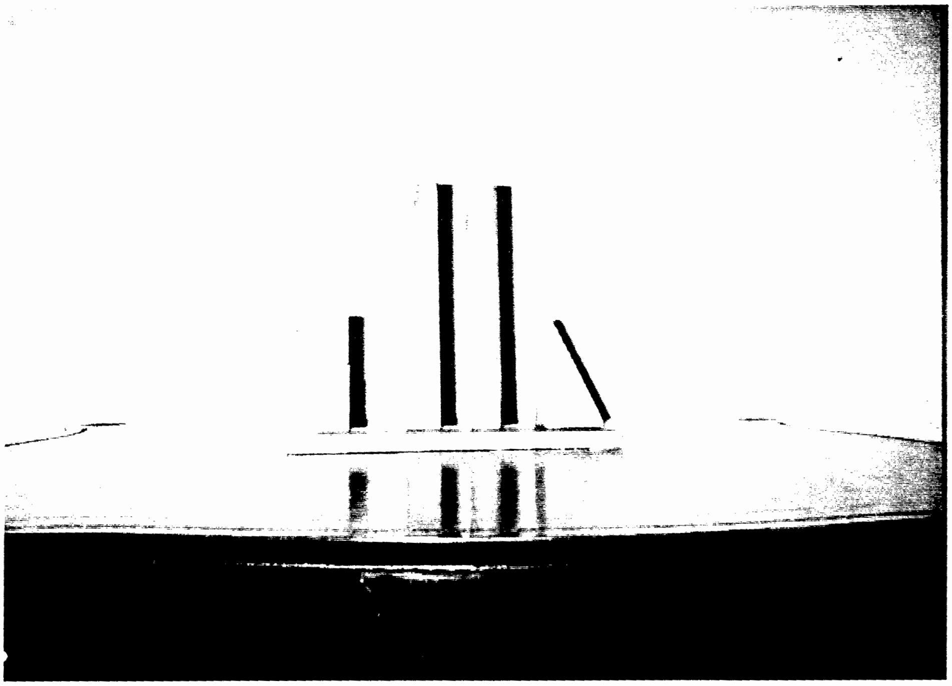
I understand that I may withdraw from or refuse to participate in this study at any time without affecting my treatment at the Department of Veteran's Affairs Medical Center, Oregon Health Sciences University, and Portland State University. I have read and/or understood the above and give my consent to participate in this project.

LIABILITY

Every reasonable effort to prevent any injury that could result from this study will be taken. In the event of physical injuries resulting from the study, medical care and treatment will be available at this institution. For eligible veterans, compensation damages may be payable under 38 USC 251 or, in some circumstances, under the Federal Tort Claims Act. For non-eligible veterans and non-veterans, compensation would be limited to situations where negligence occurred and would be controlled by the provisions of the Federal Tort Claims Act. For clarification of these laws, I can contact District Counsel (503) 326-2441. I have not waived any legal rights or released the hospital or its agents from liability or negligence by signing this form. If I have any questions about my patient rights, I may contact the Patient Relations Coordinator for the Portland Veterans Affairs Medical Center at (503) 273-5308.

Appendix C

Individual Block Designs



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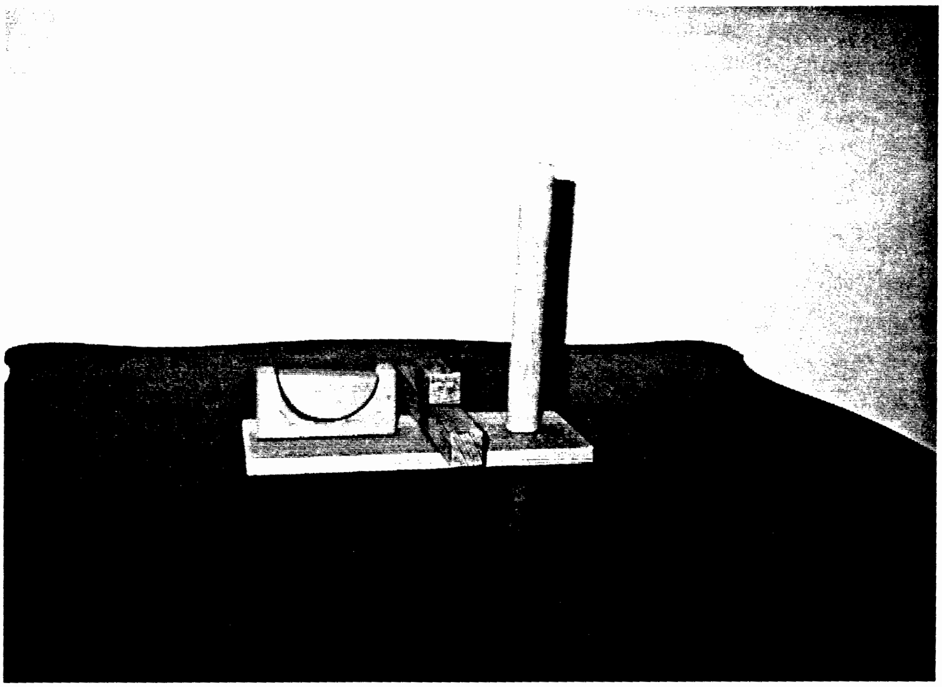

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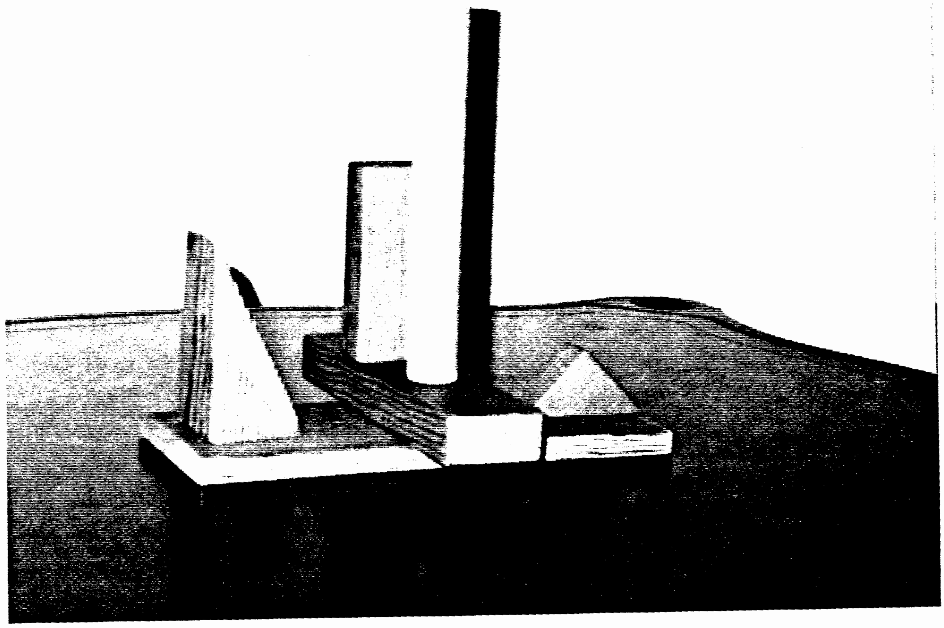

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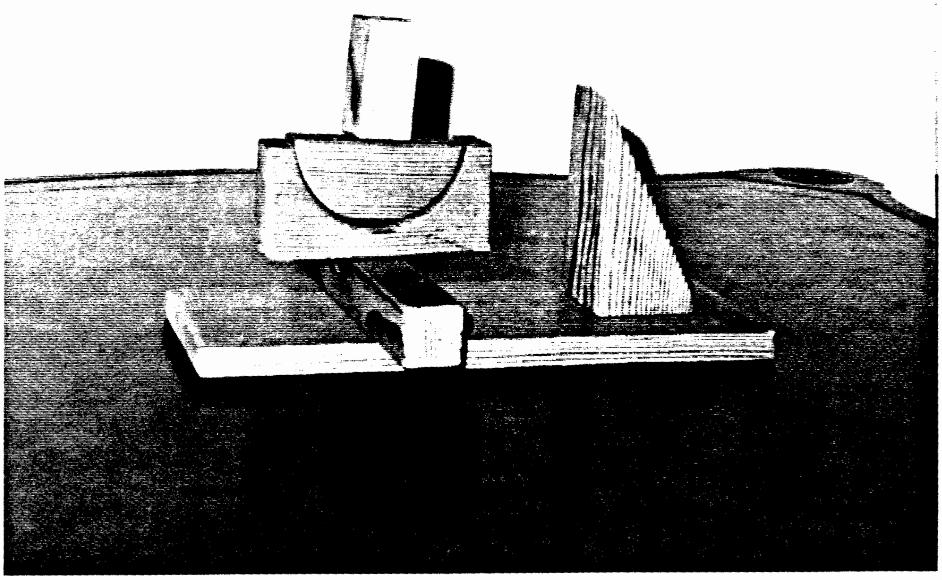

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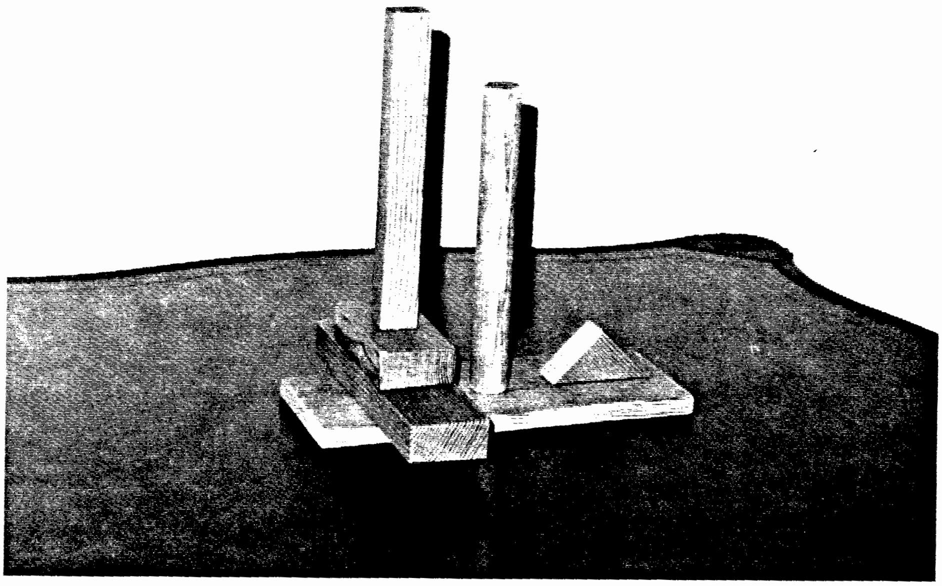

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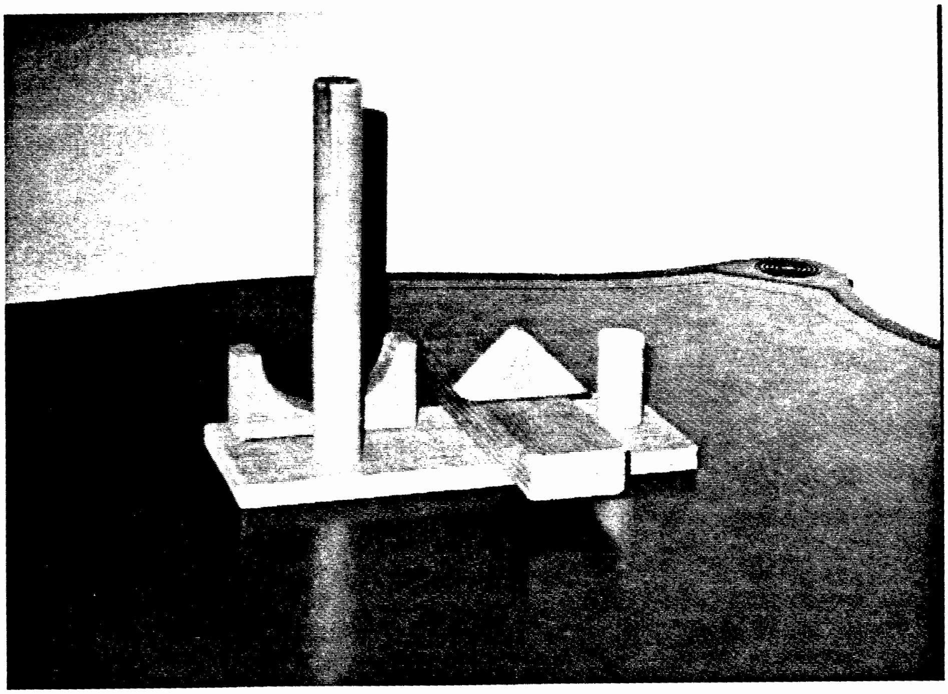

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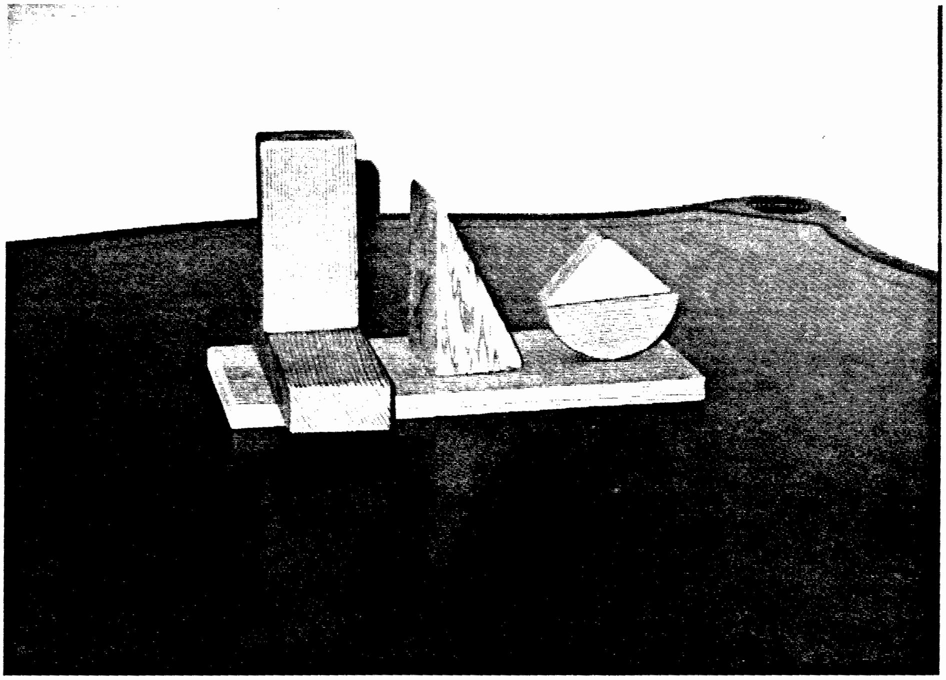

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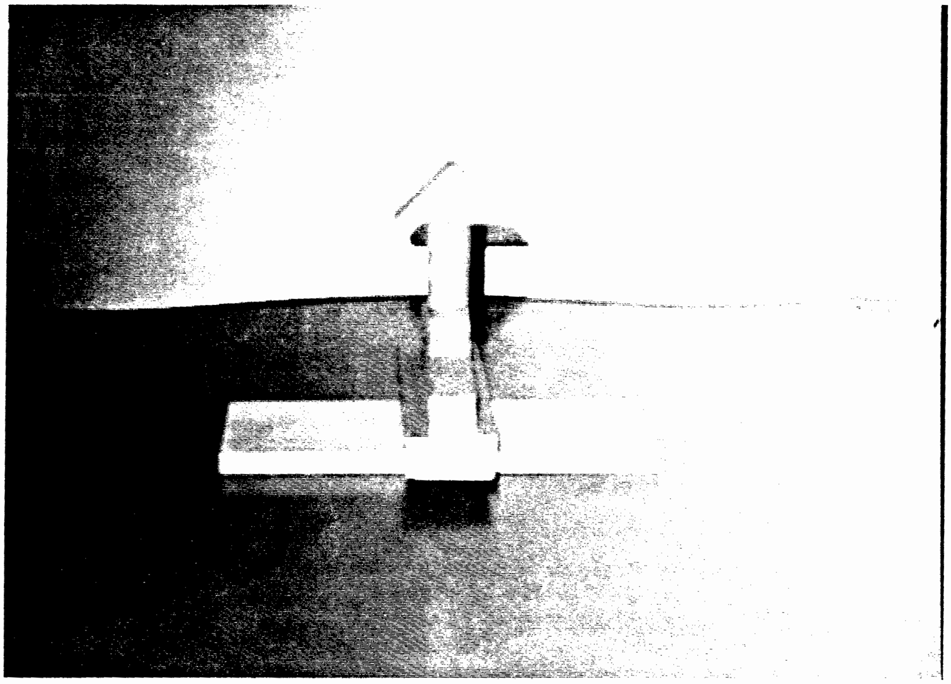

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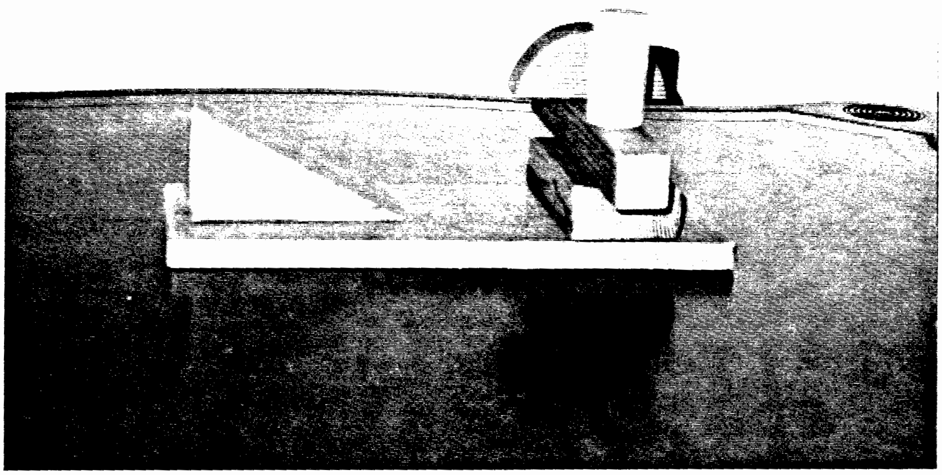

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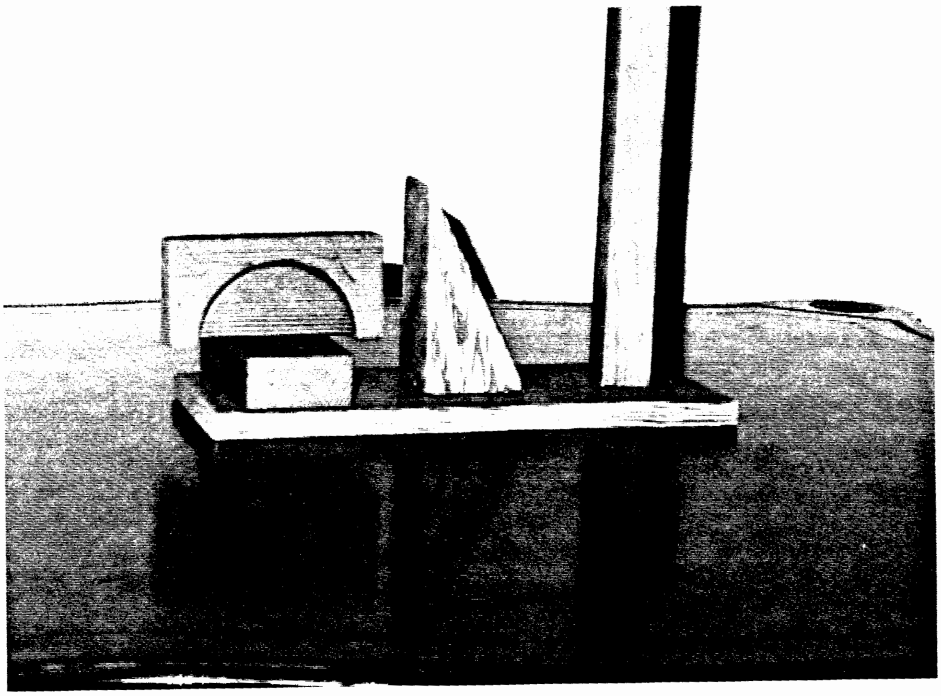

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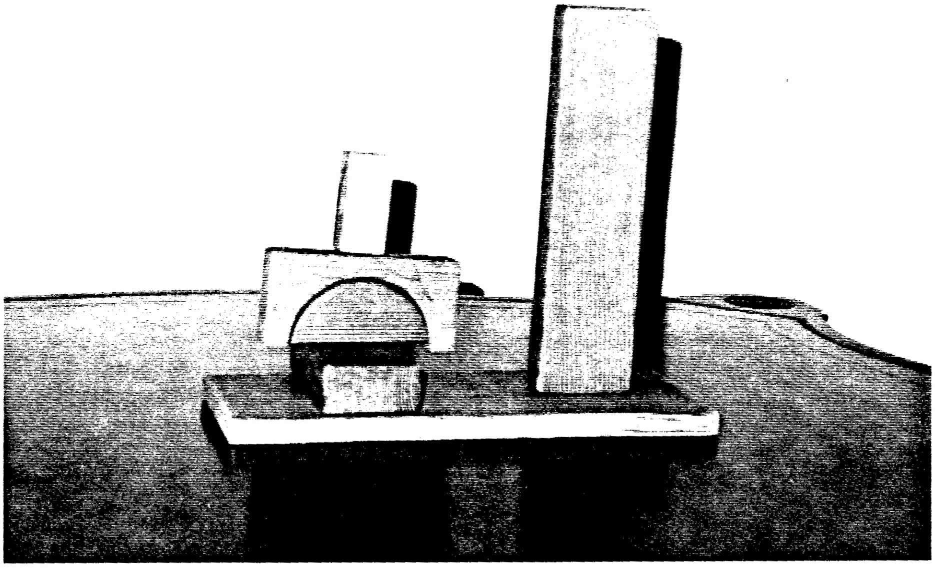

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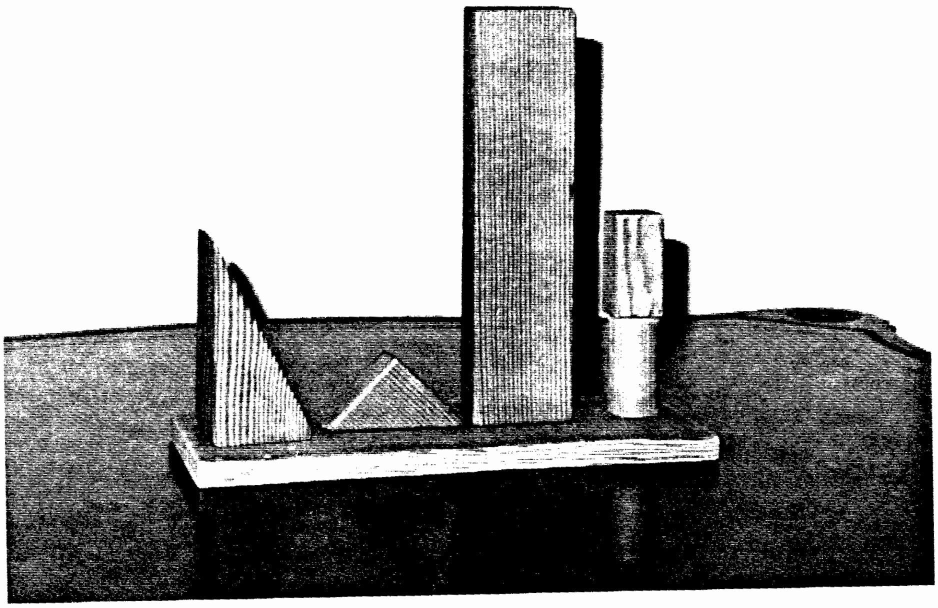

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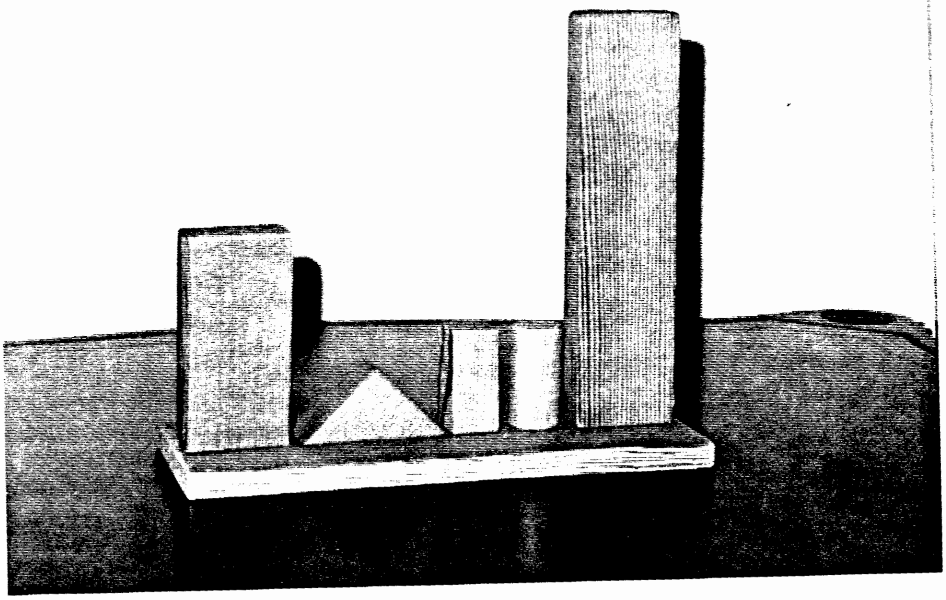

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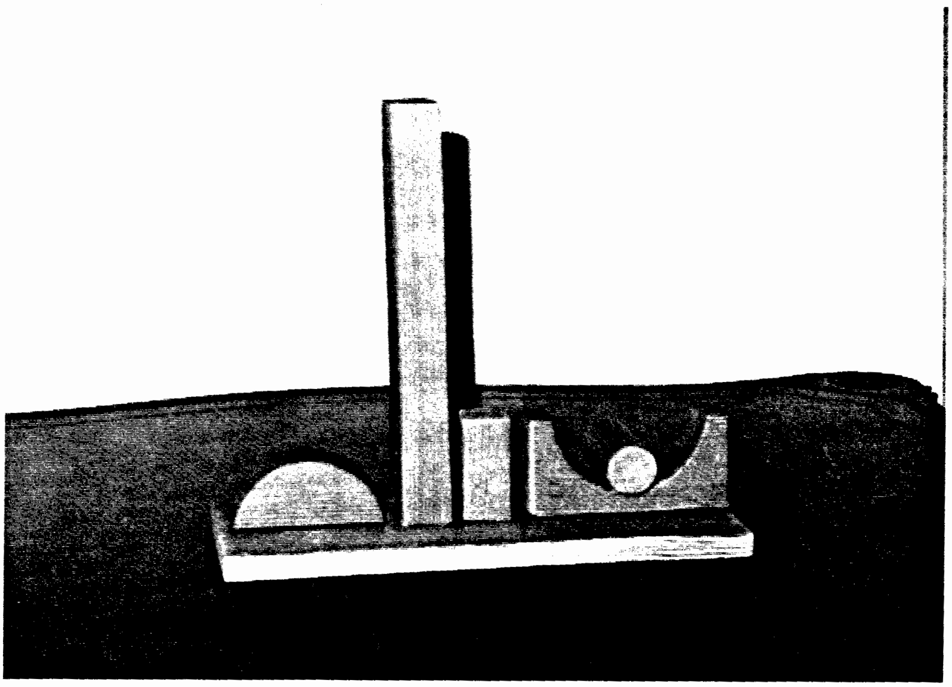

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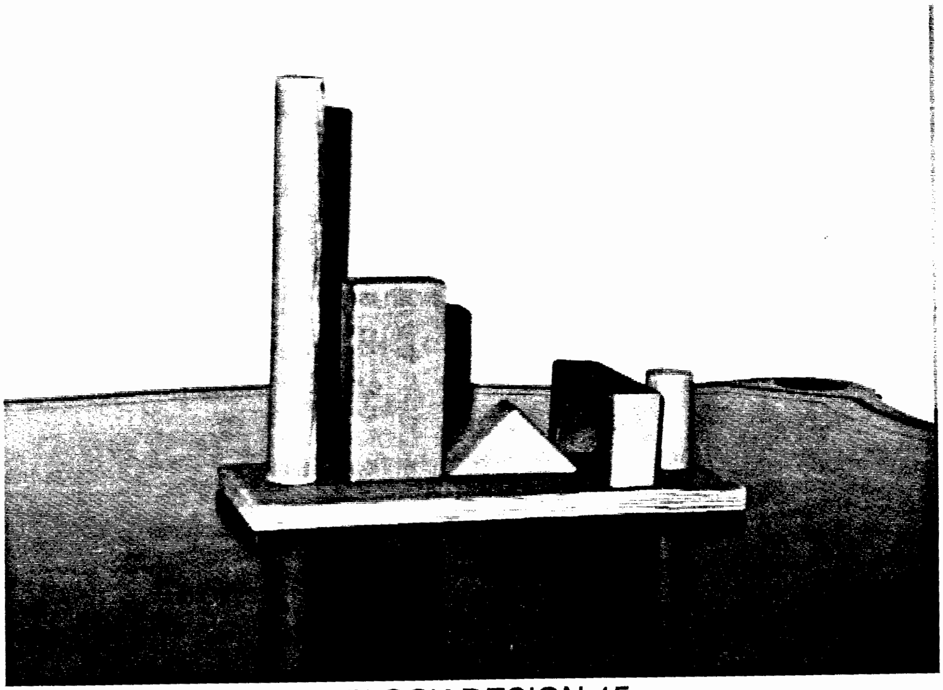

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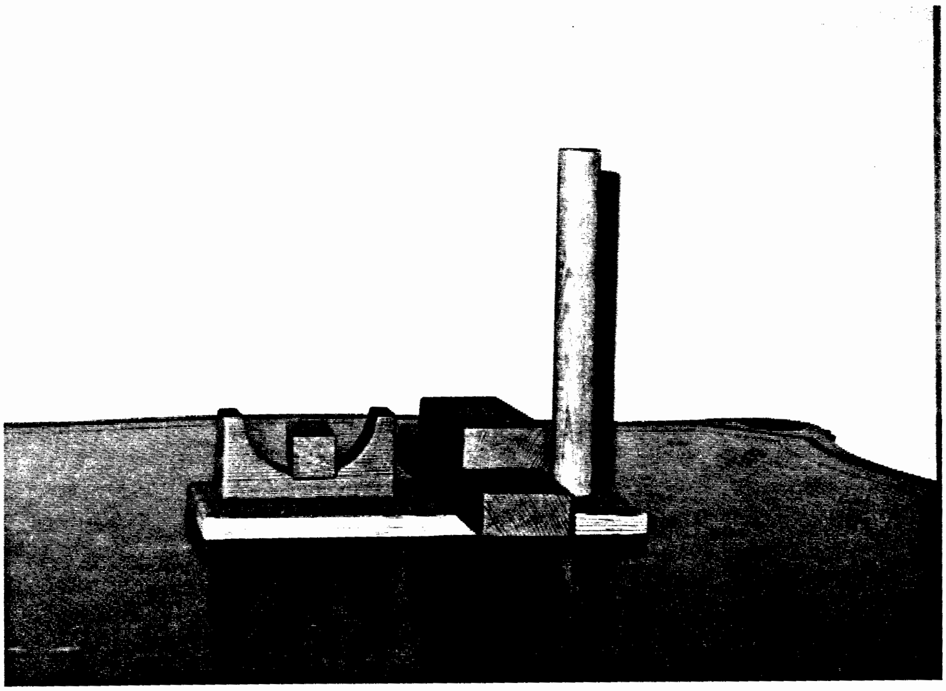

BLOCK DESIGN 16

Appendix D

Instructions For Barrier Games

Depending on the treatment phase, the investigator gave the following instructions at the beginning of each session.

Instructions For Baseline Sessions

Today, we're going to build a block construction. You have five blocks in a specific order, pattern, and position. I have the same five blocks but they are in no specific order and I don't know what your block construction looks like. Using your everyday communication methods, I want you to tell me how to build my block construction to match yours. In today's session, I will give only nonverbal feedback and acknowledge that I have received and understand the message or that I do not understand the message. I won't be asking any verbal questions.

Instructions For PACE Treatment Sessions

Today, we're going to build two block designs. First, I'll be the primary sender of information and tell you how to build your blocks to match mine. I'll use only nonverbal communication. Then, we'll switch roles and you'll tell me how to build my blocks to match yours using your everyday communication methods. During that part of the session, I'll use both verbal and nonverbal communication. Do you have any questions? Ok. Let's begin.

Instructions For PACE Treatment Plus VOCA Condition Sessions

Today, we're going to build two block designs. First, I'll be the primary sender of information and tell you how to build your blocks to match mine. I'll use the VOCA and other nonverbal communication. Then, we'll switch roles and you'll tell me how to build my blocks to match yours using the VOCA and your everyday communication methods. During that part of the session, I'll use both verbal and nonverbal communication. Do you have any questions? Ok. Let's begin.

Instructions For Follow-Up Sessions

Today, we're going to build a block construction. You have five blocks in a specific order, pattern, and position. I have the same five blocks but they are in no specific order and I don't know what your block construction looks like. Using the VOCA and your everyday communication methods, I want you to tell me how to build my block construction to match yours. In today's session, I will give only nonverbal feedback and acknowledge that I have received and understand the message or that I do not understand the message. I won't be asking any verbal questions.

Appendix E

Block Identification

Prior to giving the specific instructions on how the barrier game was to be played for the session, the investigator asked the subject to point to specific blocks which the investigator named. The following block names are listed in the order of presentation.

1. rectangular block
2. round dowel
3. half-moon block
4. bridge block
5. square dowel
6. the base
7. triangular block
8. wedge-shape block
9. long square dowel
10. short round dowel
11. small rectangular block

Appendix F

VOCA Training Protocol

The investigator conducted two one-hour training sessions on the linguistic operation of the VOCA. The investigator used the following protocol with three linguistic structures in three stimulus-response phases: spoken word, object/action and spoken word, and action. In the first phase, the investigator said the word, then pressed the matching VOCA key. The investigator then asked the subject to press the key which matched the word spoken by the investigator. In this phase, only one key stroke of the VOCA was used. In the second phase, the object/action and spoken word phase, the investigator said the word(s) giving an object/action cue, then pressed the matching VOCA key(s). The investigator then asked the subject to press the key(s) which matched the object/action cue and the word(s) spoken by the investigator. In the second phase, no more than two key strokes were required. In the final phase, the investigator gave an object/action cue and matched it with a VOCA spoken word. The investigator then asked the subject to match an object/action cue with a VOCA spoken word. In the final phase, a maximum of three key strokes were used.

	Spoken Word	Object /Action & Spoken Word
take	x	
place it	x	
stand it	x	
turn it	x	
long	x	x
short	x	x
small	x	x

flat side	x	x
the base	x	x
rectangle block	x	x
triangle block	x	x
square dowel	x	x
round dowel	x	x
bridge	x	x
half moon	x	x
wedge shape block	x	x
block	x	x
crosswise to	x	x
down	x	x
in the middle of	x	x
in front of	x	x
next to	x	x
on end	x	x
on top of	x	x
opening	x	x
parallel to	x	x
toward the right end	x	x
toward the left end	x	x
OK	x	
?(I have a question)	x	
Ready let's begin	x	
yes	x	
no	x	

	Visual Cue/Action
all done	x
take + noun phrase (adj. + N)	
take small rectangular block	x
take long rectangular block	x
take short square dowel	x
take long square dowel	x
take short round dowel	x
take long round dowel	x
take bridge	x
take half moon	x
take wedge shape	x
place it + PP (Prep. phrase) + N	
place it crosswise to the base	x
place it flat side down	x
place it in the opening	x
place it in the middle of the base	x
place it in front of the rectangular block	x
place it next to the rectangular block	x
place it on the rectangular block	x
place it on end	x
place it on top of the rectangular block	x
place it parallel to the base	x
place it toward the right end of the base	x
place it toward the left end of the base	x

Appendix G

Vocabulary Selection

The following is a transcription of the utterances used by a naturally speaking adult cohort of the aphasic adult while playing the barrier game with the 16 block designs. The investigator segmented the utterances into single words and word groups using the following rules:

1. Words defining the size of the blocks were segmented into separate units.

2. Verbs which always occurred with a direct object were segmented into one unit, for example, "place it," "stand it," and "turn it."

3. Conjunctions were segmented into separate units.

4. Prepositional phrases which defined directional placement of the blocks were grouped together, for example, "in the middle of", "toward the right end," "in front of," and "on top of."

The goal of vocabulary selection was not to parse into syntactic classes, but to have the subject independently use telegraphic utterances to direct the behavior of another.

Criteria for vocabulary selection was based on frequency of use and the device's message capacity on one level of presentation. Advanced Revelations, Version 2.1 database software from Revelations Technologies, Inc. was run on an IBM 386 personal computer to calculate frequency of vocabulary use. Thirty-four words occurred 6 or more times in the corpus. Another six control phrases, for example, "ready let's begin" and "I have a question" were selected to manage the conversation.

Block Design #1

Pick up the wedged shape block. Place it on the right end of the base, with the flat side inward. Yeah. No. The flat side, toward the center of the base, right. That means that the slant side is toward the edge of the base. Next. Pick up the round dowel, the long round dowel. Place that about 3 inches from the block that you just put in, in the middle of the base, stand it on end in the middle of the base. Pick up the long square dowel, do the same thing with that, place it next in line about 3 inches from the round dowel. Pick up the small square dowel, place it on the end of the base about 1/2 inch from the end, from the opposite end of the wedge. One is on one side and the other is just on the other side. Now pick up the small round dowel and place it on top of the small square dowel.

Block Design #2

Pick up the round dowel and place it on the right, toward the right end of the base. Pick up the long square dowel and place it crosswise to the base in the middle of the base. Pick up the small square dowel and place it on top of the long square dowel, in the middle. No, flat. Pick up the block with the U cut out and place it lengthwise of the base on the left end. Now that is running longitudinally with the base. Pick up the round cut out piece and place it in the cut out in the block. Put it in there so it fits in there.

Block Design #3

Take the small triangular block and place it on the base on the right hand edge parallel to the base. Take the large rectangular block and place it crosswise on the base, flat side down, like in the middle of it. Right. Take the small rectangular block and place it in the upright position about even with the edge of the base so it corresponds to the rectangular block and base. In other words, in the upright position and it is parallel to the base. In other words, it's as though the small block is joined with the larger block so the edges match, on top of the long one, upright position and the longest dimension is parallel to the base. Upright means the small block is standing on its end. All right? Let me run that again. You've got the large rectangular block crosswise to the base and the small rectangular block standing on end and on top of the large rectangular block and the longest dimension of the small block runs parallel to the base. OK? Pick up the round dowel and place that on the long rectangular block on the opposite end, even with/close to the edge of the base. Pick up the wedge, stand it on end on the left end of the base, turn the block so the flat side is toward the end of the base. We still didn't get that right.

Block Design #4

Take the wedge shape block stand it up on the base, turn it so the slant side is toward the right end, about 1/2 inch in from the right end. Pick up the long square dowel and place it crosswise on the base about 4 inches from the left end. On top of that, take the rounded out block, the cut out piece and turn it so that the cut out piece is up and put it crosswise of the square dowel. Put the cut out piece in the cut out piece. Put the small square dowel and place it in the middle of the cut out piece standing up, straight on in. I think we got one. I think we got that one solved. That was hard to describe.

Block Design #5

Take the small triangular piece, place it long side down, toward the right end of the base with the long dimension parallel to the base. Take the long round dowel, set it upright in the middle of the base. Take the long rectangular block, place it crosswise on the base near the left end, flat. Place the small rectangular block on top of the longer block, facing the same way, lying flat running perpendicular. Take the square dowel, stand it upright on top of the small rectangular block.

Block Design #6

Take the small round dowel, place it upright near the right end of the base. Take the long rectangular block, place it crosswise of the base , flat side down close to the middle, a little bit toward the right side. Take the triangular block with the long dimension down, place it on top of rectangular block with the long dimension running parallel to the base. Take the cut out piece, open end up, place it on the left top quadrant of the block with the long dimension running parallel to the base. Take the round dowel, place it in the lower left quadrant, on end.

Block Design #7

Take the curved piece that came out of the cut block, stand it upright on the curved side, not the flat side, parallel to the base toward the right end, that gives you a flat surface upright. Place the long flat surface of the triangular block on top of that flat surface. Take the wedge shape, stand it upright in the middle of the base, turn it so the flat side is to your left. Take the big long rectangular block, place it crosswise to the base toward the left end.

Block Design #8

Place the long rectangular block in the middle of the base, crosswise of the base. Take the square long dowel, place it on top of rectangular dowel, also running crosswise, parallel to the long rectangle. Take the small square dowel, place it on top of the middle of the long square dowel running in the same direction, lying flat. Take the small round dowel, stand it on end in the middle of the short square dowel. Take the triangular piece, place it on top of the round dowel piece with the long side down so you've got a peak roof and it is crosswise of the square dowel, parallel to base.

Block Design #9

Take the rectangular piece, place it near the right end of the base, crosswise of the base, flat side down. Take the square dowel, lay it on top of the block, running in the same direction, crosswise to the base. Take the cut out piece, flat side down, place on top of square dowel, toward the top of the base, crosswise of the dowel, flat side down. Top is further away from you. Take the round short block, stand it on its end, on top of the square dowel, toward the lower end of the base. Take the wedge shape piece, flat side down, place it on the left side of the base, turn so that the flat surface is toward the left end of the base.

Block Design #10

Take the square dowel, place it near the right end of the base in an upright position, and the sides of the dowel is parallel to the base, square to the base. Take the wedge shape, stand it on end, upright position, in the middle of the base, turn it so the flat side is toward the left end of the base. Take the rectangular block, place it on the left side of the base, perpendicular, crosswise of the base, flat side down. Take the cut out piece, lay flat side crosswise of the rectangular block, parallel to the base in the middle of the block. Take the cut out piece and place it over the piece it fits.

Block Design #11

Take the long rectangular piece, stand it on end toward the right end of the base, turn it so that the long dimension is parallel to the base. Take the small rectangular piece, place it toward the left end of the base, crosswise of the base, and flat. Take the semi-circular piece, place it flat side down, crosswise of the small rectangular block. Take the cut out block, place it on top of the semicircular piece so it fits in the opening. Take the small square dowel, stand it upright on the middle of the flat side of the cut out block, running crosswise, standing on end.

Block Design #12

Take the small round dowel, stand it on end toward the right end of the middle of the base. Take the small square dowel and place it on top of the round dowel, parallel to the base, standing on end. Take the long rectangular block, stand it on end, in board so the left edge is toward the middle, turn it so the long dimension is parallel to the base. Yes. Front to back, and the left end is at the middle right half of the base. Take the triangular piece, place it long flat side down, to the left of the block you just put down, with the long dimension parallel to the base. Take the wedge shape piece, stand it on end, flat side toward the left end.

Block Design #13

We have five blocks on the base which is the first time it's happened. Take the long rectangular piece, place it upright on the base toward the right side with the longest dimension parallel to the base, next to it, place the short round dowel. Place it on end, next to the block you just put down. Take the short square block, place it on end in the middle of the base. Take the triangle, place it on the base with the flat side down and the longest dimension parallel to the base. Take the short rectangle block, place it on end on the base with long dimension running parallel to the base.

Block Design #14

Take the cut out opening block, place it on the right end of the base so that the long dimension is parallel to the base, with the opening up. Take the round dowel, place it in the middle of the opening, crosswise to the base. Take the small square dowel, stand on end in the middle of the base. Take the long square dowel, stand it on end next to the short square dowel. Take the cut piece, flat side down parallel to the base on the left side.

Block Design #15

We have all five pieces on the base. Take the small round dowel, stand it on end toward the right end of the base. Take the cut out block, place it crosswise to the base with the opening down, flat side up. Take the triangle, place it on the base long dimension down and parallel to the base. Take the rectangle, stand it on end with the long dimension parallel to the base. Take the round dowel, stand it on end on the left end of the base.

Block Design #16

Take the long round dowel, stand it on end toward the right side of the base. Take the long rectangle, place it on the base, crosswise to the base toward the right side of the base, flat side down. Take the short rectangular block, place it on top of the larger block running in the same direction, flat side down. Take the cut out block, place it on the left side of the base with the open side up and the long dimension running parallel to the base. Take the short rectangular block, place it in the half-moon opening, crosswise to the base.

<u>Control Phrases</u>

All done

No

OK

Ready, let's begin

Yes

? (I have a question)

<u>Object Names</u>

Block

Bridge

Half-moon block

Rectangular block

Round dowel

Square dowel

The base

Triangular block

Wedge-shape block

<u>Orientation Descriptors</u>

Crosswise to

Down

In

In the middle of

In front of

Next to

Of

On

On end

On top of

Opening

Out

Parallel to

Toward the left end

Toward the right end

Up

With

<u>Size/Quality Descriptors</u>

Flat side

Long

Short

Small

<u>Verbs</u>

Place it

Stand it

Take

Turn it

Words+ MessageMate 40 (TM) Overlay

TAKE	LONG	THE BASE	ROUND DOWEL	BLOCK	IN THE MIDDLE OF	ON	OUT	UP	READY LET'S BEGIN
PLACE IT	SHORT	rectangle block	BRIDGE	crosswise to	IN FRONT OF	ON END	parallel to	WITH	YES
STAND IT	SMALL	triangle block	HALF MOON	DOWN	NEXT TO	ON TOP OF	toward the right end	OK	NO
TURN IT	FLAT SIDE	SQUARE DOWEL	WEDGE SHAPE	IN	OF	opening	toward the left end	?	ALL DONE

Appendix I

Data Sheet
