A Comparison of Two Non-Vocal Language Systems for the Severely Physically Handicapped

Hurlbut

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Bonnie I. Hurlbut
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A COMPARISON OF TWO NON-VOCAL LANGUAGE SYSTEMS FOR THE SEVERELY PHYSICALLY HANDICAPPED.

WESTERN MICHIGAN UNIVERSITY, M.A., 1979

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In the past several years the need for non-vocal communication systems for the severely physically handicapped has become increasingly more apparent (Balfour, 1972; Elder and Bergman, 1978; Fealock, 1958; Hagan, Porter, and Brink, 1973; McDonald and Schultz, 1973; Reid and Hurlbut, 1977; Vanderheiden, Brown, MacKenzie, Reinen, and Schiebel, 1975). Neuromuscular dysfunction frequently prevents the development of intelligible speech among handicapped persons, especially those with cerebral palsy and other encephalopathic disorders. Lack of expressive language, however, does not prohibit the acquisition of receptive language (McDonald and Schultz, 1973; Vanderheiden, et al., 1975; Vicker, 1973). Because these persons can discriminate in terms of receptive skills, it seems paramount for educators to provide them with effective means of verbally affecting the environment (i.e., an expressive language). In doing so, however, educators encounter many decision points. They must select the most appropriate (1) communication aid, (2) vocabulary, (3) language system, and (4) training procedure.

The symbol or picture board is the most frequently used communication aid for this population. Descriptions in previous reports have ranged from easily-construced
homemade boards (Feallock, 1958; McDonald and Schultz, 1973) to electromechanical devices (Bullock, Dalrymple, and Danca, 1975; Elder and Bergman, 1978, Hagan et al., 1973). Case reports of persons using communication boards have also been presented (Bullock et al., 1975; Hagan et al., 1973; McDonald and Schultz, 1973; Vanderheiden et al., 1975). Thus, much literature has focused on discussions relating to the construction of communication boards and their value to the user.

The selection of pictures or symbols to be placed on the board (vocabulary) should be determined by the functional value of the objects and actions that they represent (Jeffrey, 1972; Risley and Wolf, 1967; Skinner, 1957). Objects and actions that serve as reinforcement are usually considered the most functional. Symbols or pictures representing these objects and actions are more easily acquired and maintained, because the audience can mediate reinforcement by providing the object or action requested. In this way, the person's environment and verbal community automatically maintain expressive language.

Different language systems, symbolic and pictographic, are available for use by the severely physically handicapped (Bliss, 1965; Clark, Davies, Woodcock, 1974; McNaughton, 1976a). Blissymbolics is one language system which is often used (Fristoe and Lloyd, 1978). This system was designed as
a universal written language which would supplement all other existing language systems. In some cases, symbols were designed so that they would pictorially approximate objects as they appear in the environment. However, because of the presupposition that the user already has a complete language, symbols more often represent abstract concepts rather than concrete objects. (For example, a student would learn the symbol for "school" as "house-gives-knowledge.") The abstract concepts are represented by geometric shapes. This could cause acquisition and maintenance problems for persons whose discrimination histories are often very inadequate. An alternative for the beginner may be a pictographic, or iconic, language system. Each picture would have formal similarity with the environmental object it represents (Skinner, 1957). Colored pictures designed to exactly represent real objects as they appear in the environment may be easier for the handicapped person to acquire and maintain.

Another consideration is generalization of learned responses to other objects in the same stimulus class. It has been argued that the utilization of Bliss symbols, rather than pictures, would facilitate generalization. This is because the "conceptualization of a thought or idea is not tied to a specific picture" (Vanderheiden, et al., 1975). Since it is possible to create a new Bliss symbol by combining other symbols, handicapped persons might also respond
appropriately to untrained Bliss symbols if they had been trained their component parts.

One purpose of the present study, then, was to compare the abstract Bliss symbol system with an iconic picture system which incorporated formal similarity. The dependent variables were trials to acquisition, maintenance of trained symbols and pictures, generalization to other objects in the same stimulus class, generalization to untrained pictures and symbols, and spontaneous symbol and picture usage.

Very few experimental analyses of training procedures with communication boards have been done (Elder and Bergman, 1978; Reid and Hurlbut, 1977). Further analyses are needed not only of training procedures but of procedures for maintenance and generalization as well. Therefore, the second purpose of this study was to explore the effectiveness of a training package of teaching non-vocal communication through the use of communication boards.

Method

Subjects and Setting

Two multiply handicapped students attending an educational program for the severely mentally impaired participated in the study. Both had spent most of their lives in institutions and were totally dependent on others for fulfillment of all survival needs.

Randy was a 14-year-old male who exhibited severe
physical limitations and was diagnosed as having cerebral palsy with resulting spastic quadriplegia. He was restricted to a gunnel chair moved by teachers and aides. Results of the Denver Developmental Screening Test showed a level of 17 months for personal social skills, 7.5 months for fine motor skills, 10 months for expressive language, and 2.5 years for receptive language.

Tom was an 18-year-old male who exhibited moderate physical limitations and was diagnosed as having cerebral palsy with resulting quadriplegia and an athetoid component. He obtained mobility both by crawling and by pushing a wheelchair or walker. The Vineland Test resulted in a social quotient of 7 months. Results of the Denver Development screening Test showed a level of 16.5 months for personal social skills, 7.5 months for fine motor skills, and 13.5 months for language skills.

Classroom staff reported that both students exhibited high degrees of receptive language. This fact was also noted year after year throughout the students' permanent records in reports written by institutional and educational staff. Expressive language was limited to yes/no responses, idiosyncratic gestures, two Bliss symbols for Randy and three Bliss symbols for Tom. Both students had been receiving training in Blissymbolics for approximately one year.

The study was conducted in the students' classroom.
in a special education facility. All of Randy's sessions were held in an enclosed booth within the classroom and Tom's sessions were held in the open classroom.

**Apparatus**

The students' communication boards were similar to traditional models (Feallock, 1958; McDonald and Schultz 1973). Tom's board was made of two pieces of 46 by 53 by .635 cm plexiglass placed back-to-back. Moveable 7.5 by 7.5 cm pictures and symbols fit, also back-to-back, between the plexiglass pieces. Pictures and symbols remained approximately 1.5 cm apart. Randy's board was constructed of a sheet of 1.27 cm thick plywood covered by .635 cm thick plexiglass. Both pieces were 61 by 35 cm and rested on a tray which was attached to his gunnel chair. Moveable 4 by 4 cm pictures and symbols were placed underneath the plexiglass approximately .75 cm apart.

**Selection of Stimulus Items and Board Placement**

Each student's receptive language was assessed during pre-baseline in two ways. It was determined whether or not each student could respond correctly when shown each of 60 environmental objects and body parts. The verbal discriminative stimuli were presented so that correct responses were either "yes" or "no". Randy responded by vocalizing "uh-huh" or "uh-uh"; Tom answered by pointing to the word "yes" on the upper left section of his tray or to the word "no" on the upper right section. For example,
the trainer presented a cup and gave the $S^D$, "Is this a cup?" (Yes.); next the trainer presented a plate and asked, "Is this a fork?" (No.) The students were given ten seconds to respond after the presentation of the verbal $S^D$. Reinforcement was given for correct responses as well as appropriate non-target behaviors, and consisted of social praise ("You're really working hard today." "You're holding your head up. I like to see your face." "That's right! This is a plate. Nice job!"), tokens (Randy only), and edibles. Receptive language was determined by the number correct on these 60 trials. From this list of 60, 20 environmental objects and body parts to which the student responded correctly (henceforth called "items") were chosen for baseline stimulus items. Item selection was based on functionality for the student. The student came into contact with all of these items at least once per day.

Receptive language was also determined through each student's ability to follow commands. Each student was given ten different commands with a fifteen second time limit to respond after each (for example, "__________, lift your head, please."). A receptive language score was determined by the number of commands correctly followed.

Twenty Bliss symbols and 20 iconic pictures (colored line drawings of the training items), representing the 20 experimental stimulus items were randomly placed on each student's communication board. The school's speech
therapist created Bliss symbols for the 3 items for which a Bliss symbol did not already exist. Each picture and symbol had its printed word beneath it. The placement order of the pictures and symbols was randomly changed before each acquisition session in order to control for the possibility that a student may "learn" a picture or symbol by attending to its location on the board rather than making visual discriminations among symbols and pictures (Elder and Bergman, 1978).

Response Definitions

Correct points were defined as follows. Randy was to place the thumb of either hand within or on the boundaries of the appropriate picture or symbol and say "uh" within 30 seconds after the presentation of the verbal $S^D$. If his thumb was on the boundaries of both a correct and an incorrect picture and/or symbol, the response was scored correct. A correct point for Tom was the placement of the tip of the pointer finger of either hand within or on the boundaries of the correct symbol or picture for a minimum of two seconds within 30 seconds after the presentation of the verbal $S^D$.

Several different types of responses were considered incorrect. Randy (1) placed his thumb within or on the boundaries of an incorrect symbol or picture and said "uh" within 30 seconds after the presentation of the verbal $S^D$. Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
(2) did not place a thumb within or on the boundaries of a picture or symbol within the time limit, or (3) placed a thumb correctly but failed to say "uh" within the time limit. Tom (1) placed the tip of a forefinger on an incorrect symbol or picture for a minimum of two seconds within thirty seconds after the presentation of the verbal S^D or (2) did not place a forefinger within or on the boundaries of a picture or symbol for a minimum of two seconds within the time limit.

**Trials**

Each trial throughout the study began when the student had his head in an upright position and was making eye contact with the trainer. The trainer presented an item and asked the question, "What is this?" The student was then given 30 seconds in which to respond, using his communication board.

**Experimental Conditions**

**Baseline.** Each student's ability to tact each of the 20 items with the use of his communication board was assessed. Each item was presented to each student five times. Two correct responses for the same language system demonstrated an ability to correctly tact that item. The tacted item and its corresponding Bliss symbol and iconic picture were eliminated from the study and a new object (chosen from the original pre-baseline list), Bliss symbol, and iconic picture took their places. Therefore, the resulting list con-
sisted of 20 items correctly tacted a maximum of one out of five opportunities during baseline.

This list was then randomly divided into two groups of 10 items, one group designated as the list of symbols or pictures to be trained and the other group used to assess response generalization. All twenty pictures and all twenty symbols remained on the board throughout the study.

The list of symbols or pictures to be trained was then divided into groups of five for both students. Because most items were the same for both students, Randy was trained on items 1-5 in iconic pictures and 6-9 in Bliss symbols. (Item #10 was different for each student.) This was to ensure that items trained in one language system were not more conducive to acquisition than items trained in the other language system. During the baseline, reinforcement was contingent on both correct responses and appropriate non-target behaviors.

Pre-training. Before training began for the list of symbols or pictures to be trained, both students were brought to acquisition on the Bliss symbols which were components of the Bliss symbols to be used in the study. For example, Randy was taught the symbols for "clothing", "leg", and "protection" which, together, form the symbol for "pants". Both students learned all component parts which made up symbols appearing on their boards regardless
of whether any given item was to be trained in a Bliss sym­
bol or an iconic picture. Again, correct responses and
non-target behaviors were reinforced.

Training. Training sessions took place each school
day morning and consisted of acquisition trials and review
trials. Acquisition trials were presented for one Bliss
symbol and one iconic picture per day. All trials pertain­
ing to one language system were presented before trials
pertaining to the other language system were introduced.
The order of presentation of Bliss symbol trials and iconic
picture trials was randomly alternated, using a flip of a
coin, across training sessions. For each session acqui­
sion trials for each picture and symbol were conducted
until (1) 10 trials were presented without the student
reaching the criterion of 10 consecutive correct responses
or (2) the student reached criterion. (Up to 8 consecu­
tive responses could be carried over from the previous
day's session.) If criterion was not met, the picture or
symbol went back to the top of the list of items to be
learned. If criterion was met, review trials began.

The purposes of the review trials were; (1) to main­
tain previously learned symbols and pictures and (2) to
ensure that the student was making a specific response
in accordance with the specific item being shown to him
by the trainer. Review trials consisted of nine trials
presented in a random order. On three of these trials
the trainer presented the item for which the student had met criterion. If the student scored 3/3 correct, that item was placed on the list of learned items. If not, the item went back to the top of the list of items to be trained. On the other six trials, the trainer presented three trials on each of two items from the list of learned items. The student had to score at least two out of three correct in order for an item to remain on the list of learned items. Otherwise, the item went to the top of the list of items to be trained. Learned items were rotated such that each picture or symbol was reviewed every few sessions, with first-learned items receiving about the same number of review trials during the study as later-learned items. If three sessions were conducted without the student meeting criterion during acquisition, review trials were conducted on three items from the list of learned items.

The correction procedure for incorrect responses was run for acquisition trials only. The trainer held up the training item and said, "What is this?" He then pointed to the correct symbol or picture on the board while vocally tacting the item. The student was then to emit a correct response. If he did not, however, the trainer held up the training item and said, "What is this?" He then pointed to the correct symbol or picture while vocally tacting the item and said, "Point to the picture/symbol for______." If the student still did not emit a correct response, the
second step was repeated and the trainer physically prompted the student's response.

Reinforcement was delivered for correct responses and non-target responses for both acquisition and review trials. Correct responses during the correction procedure were reinforced by social praise only.

Probes

Maintenance. Each student was presented with one probe during the afternoon session on each picture and symbol from his list of learned items. This was to determine whether or not learned symbols and pictures were maintained while new symbols and pictures were being trained.

Stimulus Generalization. Again, one probe was presented for each item from the student's list of learned items. When a picture or symbol was learned, 3-7 other items were chosen from its stimulus class. During stimulus generalization probes, one of these items was presented to the student. The purpose of these probes was to determine whether or not the student could generalize from the training item to other items on the same stimulus class.

Response Generalization. One probe was conducted each day on the ten objects reserved for assessing response generalization. The purpose was to determine whether the student could respond correctly to untrained items as a function of training on other items.
Reinforcement contingent upon appropriate non-target behaviors was given throughout the afternoon probe sessions. The quantity of reinforcers given during probes was roughly equal to the quantity given during sessions in which correct responses were reinforced.

**Spontaneous Usage**

All spontaneous responses emitted throughout the school day were recorded. Upon the emission of a response, the student was asked if he knew what the picture/symbol meant. If he answered in the negative, the response was ignored and not recorded. If he answered in the affirmative, he was asked to point to the item (always within sight in the classroom) the picture/symbol represented. If he did so correctly, his response was then reinforced. This was to control for any inadvertent learning or confusion that may result.

By asking the student yes/no questions, staff members were able to ascertain the controlling variables for a response. Generally, the student was asked if he wanted something pertaining to the response.

**Examples:**

1. response: "tape"
   
   question: "Do you want the tape player on?"

2. response: "cup"
   
   question: "Do you want your cup?"
In these cases, the reinforcement for responding was the item manded. If it was determined that the student was not manding he was asked, for example, "Did you just want to say tape because you saw it over on the table?" If it was, in fact, the case that the student was tacting, his response was reinforced with praise, pats on the shoulder, etc.

If the student was neither manding nor tacting, he was asked if he wanted to talk about the item. If so, he was praised for using his board and asked "yes/no" questions until the staff member could ascertain what the student wanted to say.

**Reliability**

Reliability was taken for over 50% of pre-baseline trials, 50% of all acquisition/review and probe sessions, and approximately 33% and 45% of all instances of spontaneous usage for Randy and Tom respectively.

A strict reliability procedure was followed. The trainer (primary observer) administered reinforcement or began a correction procedure two seconds after a response was made. During the two second period the reliability observer scored the trial on a small numbered piece of paper and dropped the paper in a box on the floor. If at
the end of the two seconds the paper was not in the box, 
an automatic disagreement was scored. If a response did not occur by the end of 30 seconds, an automatic agreement on "incorrect response" was scored. The purpose of this procedure was to give the student feedback on the correctness or incorrectness of his responses as immediately as possible while keeping primary and reliability observations independent. If the trainer had waited until the end of the 30 second time limit to give feedback, a potential 29 second delay between response and reinforcement or correction could have occurred. Without the 2 second delay, however, the scoring by the reliability observer may have been differentially affected by the trainer's application of consequences.

For session data, reliability was calculated by dividing the number of agreements plus disagreements and multiplying by 100. An agreement was scored only if both observers scored a correct response or if both scored an incorrect response on a given trial. Reliability for spontaneous usage was calculated daily. The same formula was used but, in this case, an agreement was scored only if both observers marked the same actual word, language system (e.g., both marked the Bliss symbol for "table" or agreed on the iconic picture for "hair"), and reason for responding (tacting, manding, or conversing).

Reliabilities for session data averaged 98% and 99%
for Randy and Tom respectively. Reliabilities for spontaneous usage were 100% for both students throughout the study. More specific information for correct and incorrect pointing responses is presented in Table 1.

Insert Table 1 here

Experimental Design

It was desirable that training in the two language systems be simultaneous in order to reduce the likelihood of sequence effects that may result from one independent variable following another. Therefore, a multielement design (Ulman and Sulzer-Azaroff, 1975) was used with replication across students so that the independent variables, the two language systems, could be trained concurrently.

Results

The number of correct "yes" and "no" responses for both students during pre-baseline was 59 out of the 60 possible. Commands were correctly followed in every case, yielding a score of 10 out of 10 for both students.

During baseline, Randy required the presentation of 22 items before the list of 20 items to be trained was obtained. He responded to the two eliminated items by using the iconic picture system. Tom required the presentation of 39 items before his list of items to be trained.
was obtained. He responded to 18 out of the 19 eliminated items in the iconic picture system; one item was responded to in the Bliss system.

Table 2 provides a summary of trials to acquisition for each picture and symbol. In some cases, it was necessary to retrain items. The first entry after each word represents the number of training trials to initial acquisition. Further entries represent subsequent sets of training trials necessary for reacquisition. The final, and in some cases the only, entry after each word represents total trials to final acquisition, or trials necessary for the symbol or picture to be maintained. Both students required retraining for four out of the five Bliss symbols. All iconic pictures were maintained after initial acquisition. Table 3 also reflects mean trials to acquisition for all Bliss symbols trained and for all iconic pictures trained for each student. Both Randy and Tom required approximately four times more trials to learn their five Bliss symbols than their five iconic pictures.

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Table 3 shows the results of the maintenance and stimulus generalization probes. The students were given equal numbers of both types of probes for each picture and symbol. Randy received from 20 to 52 probes per picture and symbol.
Tom received a total of 50 probes for each picture and symbol. The results of the probes are shown as the proportion correct of the total probes given for each symbol and picture. Randy was able to respond correctly in the iconic picture system for an average of 31% more maintenance probes and 39% more stimulus generalization probes than in the Bliss symbol system. Tom averaged 12% more correct responses in the iconic picture system.

\[\text{Insert Table 3 here}\]

Figure 1 shows the daily number of correct responses made in each language system for response generalization probes. Randy failed to correctly respond to untrained Bliss symbols as a function of daily training in that language system. On the day of the third response generalization session, Randy acquired his first iconic picture. During that session, he made three correct responses out of the ten possible. He had previously made one correct response per session. From the third through the sixteenth response generalization session, Randy maintained an average of 2.9 correct responses per session. On the day of the seventeenth generalization session, he acquired his fifth iconic picture. From that day until the end of the study, Randy averaged 5.6 correct responses per session. Tom averaged 5.7 correct iconic pictures and .65 correct
Bliss symbols during response generalization for the entire study. For the last week, he averaged 8 correct iconic pictures and 1.2 correct Bliss symbols.

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Insert Figure 1 here
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Daily spontaneous usage for both students is shown on Figures 2 and 3 as average number of pictures/symbols used per hour. The graphed data are broken down into six categories. Two categories, "Trained Bliss Symbols" and "Trained Iconic Pictures" represent symbols and pictures for which the student had reached acquisition and maintained during review trials. The next two categories, "Untrained Bliss Symbols" and "Untrained Iconic Pictures" represent two groups of items: (1) items on the list of items to be trained and (2) items for which the student had reached acquisition in one language system and had, for spontaneous usage, transferred to the other language system. The final two categories include both language systems for response generalization items.

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Insert Figures 2 and 3 here
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Randy spontaneously emitted 142 total responses in the Bliss symbol system during the study. This was an average of 2.7 symbols per day. He at no time emitted a response in the Bliss system under the "Untrained Bliss System" or "Response Generalization: Bliss System" cate-
gories. Spontaneous responses in the iconic picture system totalled 639 for the study. This was an average of 12.1 pictures used per day. A breakdown of this total reveals 195 (average of 3.7 per day) pictures used in the "Trained Iconic" category; 412 (average of 7.8 per day) pictures used in the "Response Generalization: Iconic Pictures" category, and 32 (average of .6 per day) pictures used in the "Untrained Iconic Pictures" category. All of the "Untrained Iconic Pictures" responses represented transfers from trained Bliss system responses. Tom spontaneously emitted 15 responses in the Bliss symbol system during the course of the study, an average of .39 symbols per day. No responses were emitted in the "Untrained Bliss System" or "Response Generalization: Bliss System" categories. A total of 166 responses were emitted in the iconic picture system. Tom's breakdown reveals 85 (average of 2.18 per day) pictures used in the "Trained Iconic" category; 78 (average of 2 per day) pictures used in the "Response Generalization: Iconic Pictures" category; and 3 (average of .08 per day) pictures used in the "Untrained Iconic Pictures" category. Two of the "Untrained Iconic Pictures" responses represented transfers from trained Bliss system responses.

Discussion

Results of this study showed that both students re-
quired four times as many acquisition trials for Bliss symbols as they did for iconic pictures. In addition, both required retraining on 80% of their Bliss symbols while all iconic pictures were maintained after initial acquisition. These results suggest that the greater the formal similarity between the training item and the response, the easier the response will be to acquire and to maintain. Three facts are worth noting here: (1) the students were taught pictures and symbols representing functional items from their own environments. Previously, students began their Bliss training on the standard 100 vocabulary board, regardless of whether the symbols on the board represent functional items or not; (2) The students were taught the component parts of each Bliss symbol before training for this study began. This is usually not the case when a student learns Blissymbolics. In fact, some symbols on the 100 vocabulary Bliss board contain components which, individually, do not even appear on the board; (3) The students were taught some of the least abstract of the Bliss symbols. All but one symbol pictorially approximated the object it represented. Had any or all of the above-mentioned facts not been the case, the performance differences between symbol and picture acquisition may have been even greater.

Afternoon maintenance probes were taken on a given picture or symbol only if the student had correctly
responded a minimum of two out of three times during his last morning review trials. Maintenance probes were not run when it was indicated by review trial data that the student was not maintaining a symbol. Therefore, these occasions of a total lack of maintenance are not reflected in the maintenance probe data. Had they been reflected, the performance differences between Bliss symbol results and iconic picture results may, again, have been greater. Nevertheless, results of the maintenance probes indicate that an iconic picture system is more likely to maintain over time.

Stimulus generalization occurred with both students in both language systems. Apparently, training an iconic picture does not tie a response to the specific item it pictorially represents. Rather, that response will occur in the presence of other items in the same stimulus class.

Results of the response generalization probes indicate that an iconic picture system is conducive to the correct utilization of untrained pictures. Although Randy averaged 5.6 correct responses per session, he often used as many as 7 response generalization pictures appropriately per day in spontaneous usage. Although he had acquired the component Bliss symbols, Randy responded correctly to their combinations only twice. One of these correct responses occurred when his thumb crossed the borders of both the correct iconic picture and the correct Bliss symbol. Tom
finished the study averaging 8 correct responses per session in the iconic system. Seven of these 8 often occurred in spontaneous usage during the study. Although Tom often responded correctly with one Bliss symbol, the data were sporadic and the response never occurred in spontaneous usage. Results for Bliss usage, then, are inconclusive, but it is apparent that both students could appropriately use untrained iconic pictures.

Randy frequently interacted with his environment with the use of his communication board. Because data were taken on the controlling variables for a response, a certain progression in his symbol and picture usage became apparent. Soon after the acquisition of a certain response, Randy both tacted and manded the item it represented. Over time, he ceased tacting and only manded. This period was followed by one in which he both manded and initiated conversation. At this stage, he began responding in 2-picture chains.

Tom did not engage in as much spontaneous usage as Randy. This is understandable for two reasons: (1) Tom responded correctly to many items during baseline. Because of this, these functional items were eliminated from the study and unavoidably replaced by less functional items. During the study his rate of responding for the remaining functional items was high; his rate of responding for less functional items was much lower. Therefore, his overall
spontaneous usage was lower than Randy's. It was the case, however, that Tom's progression of symbol usage was similar to Randy's; (2) Tom was somewhat mobile and frequently met his own needs and wants independently. He, therefore, had less occasion to require assistance in obtaining wanted items.

There was one occasion, however, in which Tom did require much mediated reinforcement. He became seriously ill on a Saturday afternoon and required hospitalization. School staff did not learn of his illness until the following Monday morning. A call to the hospital revealed that Tom had refused to eat anything but popsicles. He was lying in bed crying and "acting frustrated." Hospital staff reported that they had tried everything they could and requested any assistance we could give in helping them communicate with him. School staff immediately took a replica of his communication board to the hospital. He responded by manding peanut butter bread ("bread") and a ride down the hallway ("door"). After eating the bread, Tom proceeded to eat almost half of his regular meal. After his ride, he again responded "door". He was indicating that he wanted to stay in the nurses' station and visit the nurses rather than go back to his room. Hospital staff reported that Tom continued to use his board after school staff had gone and successfully communicated with the nurses, who reported that they were grateful and
pleased that they were able to talk to him. For the remainder of his stay, there was no more refusing to eat, no more crying, and no more "acting frustrated".

Additional points about the students' spontaneous usage are noteworthy. Because the number of possible responses was limited, students sometimes used a response to mand items related to that response. For example, Tom often used "bread" to mand cookies and "straw" to mand juice. Randy used "foot" to mand that his leg be repositioned and "door" to mand a trip outside. These responses may be considered forms of extended mands (Skinner, 1957). Future research on this topic would increase our understanding of the variables involved in evoking these responses.

Another interesting phenomenon which occurred during spontaneous usage concerned the transfer of responses from the Bliss system to the iconic system. Randy transferred fairly often (about 3 times per week) and Tom did so to a lesser extent. It was noted that during spontaneous usage the students would occasionally get symbols which contained similar geometric shapes confused. As a result they did not obtain the reinforcers they had intended to mand. It may have been easier and less punishing to mand a reinforcer via a picture.

The last aspect of spontaneous usage not evident in
the data concerns Randy's Bliss symbol responses. Toward the end of the study, his Bliss responding substantially increased. However, this is mainly due to the acquisition of the symbol for "door" on day #37. From day 37 to the end of the study, he responded in the Bliss system 98 times. Sixty (63%) of those responses were "door". Iconic picture responses made during the study were evenly distributed across different pictures.

The ability to communicate with others can bring forth many reinforcers. However, non-verbal people have never come into contact with these reinforcers, and, therefore, do not know the value of communicating. The educator's initial concern, then, should be to train communication responses which can be easily learned and quickly reinforced. It appears that in these respects, an iconic picture system has advantages over an abstract symbol system. Needless to say, iconic pictures cannot be drawn of some other parts of speech (e.g., adjectives and adverbs). However, by the time the newly-verbal person is ready to learn abstract symbols, communicating will be a very strong operant.

At this point, a transfer of stimulus control procedure (Corey and Shamow, 1972; Sidman and Stoddard, 1967; Striefel, Bryan and Aikens, 1974; Touchette, 1968) may be effective in training abstract symbols. Although research in this area has been done concerning visual di-
mensions (Corey and Shamow, 1972; Sidman and Stoddard, 1967), the specific stimuli used are not present in this case. Therefore, a variation using the same type of procedure may be appropriate. Small symbols could be drawn beside the iconic pictures. Over time, these symbols could be made larger and larger while the pictures are made smaller and smaller. Eventually, the pictures could be faded out completely. From there, new symbols could be trained using the procedures in this study.

The training procedures used in the study were very effective. In three months, the students maintained from three to five times more Bliss symbols that they had in the previous year of training. Using both language systems, they effectively communicated for the first times in their lives. Many teaching techniques comprised the overall procedure, however, and an analysis of the most effective components would be desirable.

The need for future research is great, both in the specific area of communication board training and in verbal behavior as a whole. Many topics are made apparent by the present study alone: (1) mand vs. tact training; (2) evoking and/or training intraverbals; (3) expressive training vs. receptive training; (4) analyses of which aspects of a picture and/or symbol evoke a response; and (5) transferring stimulus control from iconic pictures to symbols. At any rate, the application of research results
such as those of the present study should prove beneficial in providing handicapped persons with a more stimulating existence.
Table 3

Proportion of Probes Correct out of Number of Probes Given for Each Picture and Symbol

<table>
<thead>
<tr>
<th>Item</th>
<th>Bliss Symbol</th>
<th>Iconic Picture</th>
<th>Bliss Symbol</th>
<th>Iconic Picture</th>
<th>Bliss Symbol</th>
<th>Iconic Picture</th>
<th>Bliss Symbol</th>
<th>Iconic Picture</th>
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<tr>
<td>Sock</td>
<td>.84</td>
<td>.92</td>
<td></td>
<td></td>
<td>.84</td>
<td>.65</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>Foot</td>
<td>.85</td>
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<td></td>
<td>.85</td>
<td>.88</td>
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<td>.96</td>
<td>.38</td>
<td>.67</td>
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<tr>
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<td>.96</td>
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<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>Randy</th>
<th>Tom</th>
<th>Randy</th>
<th>Tom</th>
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<tr>
<td>( \bar{x} )</td>
<td>.58</td>
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FIGURE 1. Number of correct responses on response generalization probes per session.
FIGURE 2. Average number of pictures and symbols used spontaneously per hour per day.
FIGURE 3. Average number of pictures and symbols used spontaneously per hour per day.
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