TEACHING NONVOCAL COMMUNICATION SKILLS TO MULTIHANDICAPPED RETARDED ADULTS¹

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A training program for teaching communication skills to nonvocal retarded adults was evaluated in three experiments. The four subjects were severely disabled physically and had never demonstrated functional speech. Each person was taught to use either a prosthetic head pointer or to point with a hand in using a communication board for expressive language. Following baseline in Experiment I, coordination training was implemented, consisting of instructions, manual guidance, praise, feedback, and practice. Each person demonstrated a higher frequency of accurate pointing to designated areas on the board during coordination training than during baseline. In Experiment II, identification training, consisting of instructions, praise, feedback, and practice was introduced after baseline. Subjects pointed more frequently to specific word-photograph combinations to correspond to descriptive verbal labels after introduction of identification training. Social validation measures in Experiment III indicated that the communication board skills were functional in providing a method of expressing a choice of a leisure activity to people who previously could not understand the subjects' communication attempts. The acquired skills maintained throughout a seven-week followup period.

DESCRIPTORS: language, expressive language, nonvocal communication, generalization, retardates

Behavioral technology has been applied to a diverse set of communication behaviors among retarded populations (*e.g.*, Baer and Guess, 1973; Clark and Sherman, 1975; Jeffrey, 1972; Rubin and Stoltz, 1974). However, despite the rapidly accumulating number of investigations on communication skills (*e.g.*, Snyder, Lovitt, and Smith, 1975), the major emphasis has centered on development of vocal abilities. Investigations focusing on nonvocal interaction methods have been infrequent, although nonvocal communication may be the only means of interaction available to persons with severe

physical impairments that prohibit vocalization.

Neuromuscular deficiencies frequently present among retarded persons with severe cerebral palsy (Hagen, Porter, and Brink, 1973; McDonald and Schultz, 1973; Shaffer and Goehl, 1974), quadriplegia, and other encephalopathic disorders (Vanderheiden, Brown, Mackenzie, Reinen, and Scheibel, 1975), can prevent development of intelligible vocalizations. The neuromuscular impairment can prohibit voluntary control of respiration, phonation, and articulation processes necessary for speech development (Hagen *et al.*, 1973; McDonald and Schultz, 1973). However, physical disabilities that stop speech development do not necessarily prohibit acquisition of receptive language. Retarded persons without vocal skills who comprehend spoken language have been noted frequently (Goda, 1969; McDonald and Schultz, 1973; Shaffer and Goehl, 1974; Vanderheiden *et al.*, 1975; Vicker, 1973). Commonly, these persons comprehend conversational speech but

¹The investigation was conducted while both authors were employed at Sunland at Tallahassee, Tallahassee, Florida. Appreciation is expressed to the administration of Sunland for its support of the project, and to Charles H. Madsen, Jr., and Jon S. Bailey for their assistance in various aspects of the project and manuscript preparation. Reprints may be obtained from Dennis H. Reid, Psychology Department, Colin Anderson Center, St. Marys, West Virginia 26170.

actually communicate with only a limited number of people (generally institutional staff) who can interpret their nonvocal idiosyncratic movements. To provide these persons with skills in addition to receptive language, such that productive communication is possible, nonvocal training seems needed.

One form of available nonvocal communication that has several advantages is the word-picture communication board. With this approach, handicapped persons can express their desires by pointing to a picture with a descriptor word that can be interpreted by others in the environment (Feallock, 1958; Gertenrich, 1966; Hagen *et al.*, 1973; Levett, 1969). The word-picture combination is applicable to handicapped persons without reading skills (Vickers, 1973) and pointing responses are easily interpreted by people with whom the subject is attempting to interact.

Experimental research with communication boards appears limited. Previous reports have focused on discussions relating the value of communication boards (*e.g.*, Feallock, 1958) and descriptions of teaching apparatus (*e.g.*, Phillipot, 1975). A variety of case reports also have been presented (Bullock, Dalrymple, and Danca, 1975; McDonald and Schultz, 1973; Vanderheiden *et al.*, 1975). However, an experimental analysis of training processes with communication boards has been lacking and appears warranted (Keane, 1972; Vickers, 1973).

Several skills appear necessary in learning to use communication boards. One set involves developing the coordination necessary to point to various areas on the board. Once a person develops coordinated pointing responses, the skills necessary to point to various word-pictures on the board in response to appropriate verbal descriptors appear necessary. Finally, one successful outcome would be pointing to word-picture combinations in response to related questions from others in a manner that could be understood easily. The present investigation examined the effects of a training program on the use of a communication board by multihandicapped re-

tarded adults. The first experiment involved teaching coordinated pointing movements; the second involved using the pointing skills to designate specific word-photograph combinations to correspond to verbal labels. The third experiment tested the residents' abilities to use the skills to communicate with strangers when asked a question.

METHOD

Subjects and Setting

Four physically disabled residents in a state retardation institution participated. All had spent most of their lives in institutions and all exhibited severe physical limitations. The subjects were almost totally nonvocal due to their physical handicaps and had not profited from previous attempts at speech and language therapy for vocal development. IQ estimates drawn from previous psychological reports were all below 36, although formal testing had been limited due to the lack of vocal skills and the physical impairment. None of the four possessed sufficient skills to move their limbs in a coordinated manner and all were restricted to mobile recliners moved by ward aides. Each subject was totally dependent on assistance from ward staff for fulfillment of all health and survival needs. Specific information for each resident is presented individually.

Jill: a 34-yr-old female with a medical diagnosis of spastic paralysis with generalized athetosis and encephalopathy due to injury at birth. She was restricted to a sitting or horizontal position due to skeletal deformities.

Pete: a 34-yr-old male with medical diagnosis including encephalopathy, grand mal seizure activity, and spastic paralysis generalized with athetosis. He was confined to a horizontal position.

Robert: a 31-yr-old male described in his medical file as being severely retarded physically and as very spastic. Robert was restricted to a semi-horizontal position with seriously contracted legs.

Victor: a 33-yr-old male with severe spasticity. He was restricted to a horizontal position due to severe muscle rigidity.

Residents were selected for the program based on recommendations from ward staff. Direct care personnel from a unit consisting of some 50 severely disabled, nonambulatory adults were asked to indicate residents who possessed the most intellectual potential beyond what was currently demonstrated. Generally, there was infrequent educational training or activities on the ward relative to other units with less disabled residents. The experimenters chose to solicit the names of residents from that particular ward based on their informal observations of interactions between staff members and residents. Several staff persons who had long histories of working with the residents appeared to interact successfully with each subject selected for the study through idiosyncratic movement of their eyes, facial expressions, and/or small movements of their limbs. However, volunteers and staff persons who were unfamiliar with the residents appeared unsuccessful in communicating with them.

Apparatus

A head pointing device, the Enabler², constructed of lightweight plastic was used by three subjects. The device consisted of padded straps which fit over the top, back, and sides of the head. A removable strap fit under the chin and was connected to the two side straps. An aluminum pointer, which was adjustable in length and shaped similarly to a pencil, protruded from the strap at the top of the head. When worn by a person, he/she viewed the pointer stemming from the top of the headgear as one would view the bill of a baseball cap and controlled its pointing direction by moving the head.

The communication boards used by all subjects were similar to traditional models (Feal-

lock, 1958; McDonald and Schultz, 1973; Vicker, 1973). The boards were constructed of a sheet of plywood, 37.5 by 62.5 cm and 0.63 cm thick. Twelve to 16 rectangular blocks of approximately 7.5 by 12.5 cm were drawn on the boards, each of equal size. The surface of the board was covered with transparent plastic.

Observation System

Subjects were observed for their proficiency in pointing to designated blocks on the communication board. Three pointed with the head pointer, Robert pointed with his right hand. Each pointing response was preceded by a specific request from a staff trainer. A correct point was defined as the end of the head pointer (or the most protruding portion of the hand for Robert) stopping within the border lines of the block on the communication board designated by the trainer. The pointer, or hand, had to touch the board without movement within the block for a minimum of 1 sec and had to occur within 10 sec of the trainer's request.

An incorrect point was defined as follows: (1) end of pointer (or hand for Robert) stopping on any part of the board for a minimum of 1 sec except the trainer's designated block or (2) end of pointer (or hand) not stopping on any part of the board for a minimum of 1 sec within 10 sec of the trainer's request. If the subject pointed to two or more blocks for a minimum of 1 sec each within 10 sec of a trainer's request, the first block pointed to determined whether the response was correct or incorrect.

The primary observer was the staff person who conducted all baseline, training, and test sessions for each resident. Reliability observers were the senior author and two staff members from the institution. The staff members were selected as reliability observers because they had demonstrated proficiency in previous behavioral projects and shared training responsibility for residents on that unit. Observers were trained through verbal and written instructions concerning response definitions from the experimenter. Also, each observer received approxi-

²The device, "The Enabler", is available with description and instructions from Adaptive Therapeutic Systems, Inc., 36 Howe Street, New Haven, Connecticut 06511.

mately 30 min of practice through modelling by the experimenter and observing residents while being fitted with the head pointer before observing baseline or test sessions.

During all baseline and test sessions, the staff trainer recorded whether a response was correct or incorrect on a coded data sheet immediately after each trial. For each resident who used the head pointer, the trainer stood about 30 cm behind the recliner. For Robert, the trainer stood in front and 30 cm to the side of his recliner. When reliability observations were conducted, a second person stood on the side of the resident opposite the trainer and recorded a correct or incorrect point after each response. Formal observations and reliabilities were conducted only during baseline and test sessions and not during training sessions.

Reliability was calculated by dividing the number of agreements concerning the correctness or incorrectness of each pointing response by the number of agreements plus disagreements and multiplying by 100. An agreement was tallied only if both observers scored a correct response or if both scored an incorrect response on a given trial.

Trainer

A staff member (second author) conducted all sessions. She was the unit director on the unit where the subjects lived. Her background included a BS degree in psychology, with experience in conducting self-help skill-training programs and functioning as an observer in previous research projects. She had been employed at the institution for approximately 18 months and had participated in several in-service training classes in behavior analysis.

EXPERIMENT I: COORDINATION TRAINING METHOD

Procedures

Prebaseline evaluation. Before initiating training procedures, physical therapy evaluations

were completed for each subject; they were told that a program was being established with communication boards to assist them in communicating with persons and in indicating their desires. A licensed physical therapist evaluated each subject to determine if a head pointer was feasible, considering their degrees of mobility. As a result of the evaluations, all except Robert were fitted with head pointers. It was decided that Robert displayed sufficient use of his right arm to permit pointing with his hand. He demonstrated gross, athetoid movement of his right arm when extended with a clenched fist. The physical therapy evaluation also indicated the extent of the subjects' range of motion with the head pointer over the surface area of the communication board. Based on the portion of the board that the pointer (or hand) could reach, functional areas on the board were divided into 12 blocks. A final result of the evaluation was determination of the most advantageous postural position of each subject in his/her recliner for board usage.

Baseline. During baseline, sessions were conducted individually for each subject one to three times daily (mean of 6.5 days of baseline per resident) in a corner of the living ward. At the onset of each session, the staff trainer presented the subjects with the head pointer and/or communication board. Throughout baseline, the board consisted only of blank blocks. The board was held by the trainer directly in front of each subject's face approximately 40 to 50 cm away. The tip of the head pointer touched the board when the subject leaned forward. For Robert, the board could be touched by lifting his extended right arm.

Once the head pointer and/or communication board was in place, the trainer requested the subject to point to a block on the board. A verbal request ("Point to this block" or "Point to this one") was presented, along with the trainer physically pointing to a block with her finger. The trainer waited 10 sec, scored the response, and then requested the subject to point to the next block as determined by a random

list previously established. A trial for each of the 12 board blocks was presented once per session.

Periodically during baseline, the trainer verbally approved of the subjects' efforts to follow her requests of pointing. The praise was presented in an attempt to maintain task-oriented efforts. On several occasions, subjects were also presented with refreshments (*e.g.*, fruit juice or coke) for attending to the task. However, no approving or disapproving statements directed toward the correctness or incorrectness of individual pointing responses were presented.

Coordination training. Following baseline, each subject participated in coordination training sessions one to three times daily (mean of 11.75 days of training per resident). The training was implemented in multiple-baseline fashion across subjects. Training sessions lasted approximately 20 min and were conducted individually with each subject by the staff trainer. Training sessions consisted of verbal instructions, praise, corrective feedback, manual guidance by the trainer, and repetitious practice at pointing. The trainer requested the subject to point to specific areas in a manner similar to baseline sessions. For every correct response, the trainer verbally approved (*e.g.*, "Nice job, that's exactly where I wanted you to point.", "You're doing a good job of holding the pointer in the center of the block," *etc.*) smiled, and generally expressed pleasure. For every incorrect response, the subject was informed why the response was incorrect (*e.g.*, wrong block touched first) and was requested to repeat the attempt. On the second attempt, manual guidance was provided by the trainer accompanied by verbal instructions regarding what to do. The trainer placed her hands on the back and sides of the subject's head and manually turned his/her head until the pointer was touching the correct block. As this procedure was repeated, the trainer faded the amount of guidance until she was guiding the head with only her finger tips. Gradually, the trainer removed her hands and merely followed

head movements with her hands held approximately 2 cm away from the subject's head. The trainer completely removed her hands from the subject's head as he/she began to point accurately to the designated block on the communication board. The fading of the manual guidance generally occurred within each training session for pointing to a given block. When a subject pointed incorrectly, practice with that particular block continued during the session until the subject pointed to it correctly at least once without guidance. Throughout the guidance, verbal instructions were presented (*e.g.*, "Lift your head higher", "Lean forward more", *etc.*) as were praise statements (*e.g.*, "That's better!", "Nice work", *etc.*) following successful attempts. Subjects practised pointing to several different blocks each session such that they moved the head pointer in many angles and directions. After every trial, the subject's head returned to an upright position so that the pointer was directly facing the center of the communication board before the trainer presented another request.

Coordination training sessions for hand pointing with Robert followed the same general format as with the subjects using a head pointer. Instructions, verbal praise for correct responses, corrective feedback for incorrect responses, and repetitious practice were conducted as before. Manual guidance was employed with the same contingency as with the other subjects, although the guidance was conducted with Robert's hand (which was consistently clenched due to muscle rigidity with the thumb protruding outward). The amount of pressure exerted on Robert's hand was gradually faded until the trainer merely touched his hand as he moved it to the block. Eventually, all guidance by the trainer was withdrawn. Throughout all training sessions for each subject, the trainer frequently praised residents for attending to the pointing tasks as well as for accurate pointing.

Test sessions. Throughout coordination training, test sessions were conducted with procedures identical to baseline procedures. Each

test session occurred within 30 min after a training session. No training was conducted during test sessions and each of the 12 blocks was presented in random order once per test session. Periodic verbal praise and refreshments for subject attention to the trainer and communication board during test sessions was presented as during baseline, noncontingent on accuracy of responses.

Reliability

For each subject, at least three reliability checks occurred during baseline and during test sessions following coordination training. Reliabilities averaged 87%, 82%, 84%, and 83% for Jill, Pete, Robert, and Victor, respectively. More specific information for correct and incorrect pointing responses is presented in Table 1. The lowest reliability ranges occurred where the frequency of targeted responses was lowest.

RESULTS

The results from baseline and test session are presented in Figure 1. During baseline, all four residents emitted consistently low frequencies of correct pointing to the communication board blocks requested by the trainer. Once coordination training began, immediate increases in per cent of correct pointing responses occurred for each resident. Jill increased to 73% correct responses, with her frequency eventually stabil-

izing at approximately 80% correct. Pete increased to 67% on the first test session and never dropped below 92% for the remaining sessions. Once coordination training began for Robert, correct pointing increased to 75% on the fourth session and stabilized at approximately that frequency. Victor's increase in accuracy was less noticeable, climbing gradually before levelling at 68% for the last five sessions.

DISCUSSION

Experiment I analyzed the effect of coordination training on the accuracy of pointing to different areas on a communication board by four nonvocal, multihandicapped persons. An increase in pointing accuracy occurred after training was introduced and at different times for each person, suggesting a causal relationship with the coordination training. Three of the subject's frequencies of correct pointing following coordination training appeared to stabilize at a level below 100% of test trials. While it was desirable to achieve 100% accuracy for each subject, a criterion level of accuracy for proceeding to the next experiment was established before baseline of a minimum of five correct responses ($5/12 = 42\%$) on at least five consecutive test sessions. The ability to point correctly to five areas was sufficient to begin the next phase, as the purpose was to teach pointing to five word-photographs on the communication board in response to corresponding verbal labels.

Table 1
Reliability Data for Each Subject

Subject	Correct Point		Incorrect Point	
	Mean	Range	Mean	Range
EXPERIMENT I				
Jill	88%	50-100%	86%	50-100%
Pete	83%	0-100%	81%	0-100%
Robert	79%	0-100%	89%	0-100%
Victor	79%	42-100%	87%	67-100%
EXPERIMENT II				
Jill	98%	67-100%	96%	67-100%
Pete	94%	50-100%	92%	75-100%
Robert	100%		100%	

EXPERIMENT II:
IDENTIFICATION TRAINING

Experiment II was designed to teach subjects to point to a picture and descriptor word on the communication board in response to a verbal request. It was decided to teach communication board usage to indicate what subjects would like to do during unstructured times during the day. The rationale for teaching leisure expression was as follows. First, it appeared desirable to teach a content area that could be immediately reinforcing, such that the communication-board

Fig. 1. Number of correct pointing responses during baseline and test sessions for each subject. Robert pointed with his hand; the other three subjects used a head pointer.

system could establish reinforcing value and be more easily employed to teach additional skills. Once the subjects learned to indicate what they

would like to do, they could be taken to the appropriate activity area by staff or volunteers. Second, previous time samples had indicated

that subjects spent the major portion of their day on recliners in an isolated area of the ward with no apparent activity. It appeared desirable to teach subjects expressive skills that might assist in increasing the amount of time engaged in a leisure activity.

A final rationale evolved from recent developments indicating the relevance of leisure services for retarded persons. A number of reports have discussed the value of providing leisure activities for the retarded (Bull, 1971; Gozali and Charney, 1972; Quilitch and deLongchamps, 1974). However, research directed toward teaching retarded persons specific leisure skills has been initiated only recently (Johnson and Bailey, 1977) and further investigation seems warranted. Also, recent legislation (Florida Bill of Rights for Retarded Persons), which mandates the right of every retarded person to have leisure services, suggests the increased significance of leisure programs and the need for research to develop means of teaching leisure skills. Teaching the behaviors to express a leisure desire was viewed as an initial step in developing other leisure-related skills.

METHOD

Procedures

Leisure areas. Five places were selected as leisure areas for the subjects, based on recommendations from staff who had known and worked with them. The areas were those that subjects seemed to enjoy visiting, as expressed by the staff members or other residents in the facility. The five areas were as follows. *Television cubicle:* the area on the living unit directly in front of the television. *Radio area:* the space immediately in front of the radio on the living unit. *Library:* the resident library on the second floor, which included audio visual equipment, stereos, filmstrips, etc. *Lobby:* the front lobby of the institution where residents gathered along with visitors to the facility. *Porch:* the front porch of the facility where residents gathered along with visitors. Each of the areas

was represented in a separate block on the communication boards by a color photograph of each actual area with a descriptor word printed underneath. The five blocks on which the photographs and descriptor words were attached were those board areas that subjects had most frequently pointed correctly to during test sessions in Experiment I.

Baseline. Baseline sessions consisted of presenting the communication board to the subjects, as in Experiment I with the addition of the five photographs and descriptor words on the surface. For each of the places, subjects were asked in individual sessions what would they do if they wanted to go there. For instance, if the library response was being tested, the trainer asked the subject: "What would you do if you wanted to go to the library?" The trainer recorded whether the subject pointed correctly or incorrectly to the board block representing the place requested. Baseline sessions were conducted one to three times daily with an average of three days of baseline sessions per resident. Within each session, the leisure areas on the board were requested one time by the trainer in random order.

Identification training. To teach subjects to point to communication-board blocks to correspond with the verbal names of the five leisure areas, identification training was introduced following baseline in a multiple-baseline format across three residents. Victor did not participate in identification training because he correctly pointed to board areas on 28 of 30 trials (six sessions) during baseline. Before the first identification training period, each subject was escorted once to the physical place denoted by the word-photograph combination. There, using the board for illustration, it was explained that the place was represented by the particular word-photograph combination on the communication board.

Individual identification training periods were conducted one to three times daily (average of four days of training sessions per subject) for 20 min each session. Training components

were similar to coordination training, in that verbal instructions, praise, corrective feedback, and repetitious practice were used. However, no manual guidance was employed. The subject was verbally instructed during training periods as to what the photograph and descriptor word in each of the five block areas represented. Generally, the trainer stated a simple description such as: "This is a picture of the library. This word says library". Following instructions, the trainer asked the subject to point to indicate that he/she wanted to go to that particular place (e.g., "Show me where you would point if you wanted to go to the library"). If the subject pointed correctly, the trainer praised the response. Following an incorrect point, the trainer described the mistake (e.g., "No, that is not the library, that is the front porch"), and repeated the process until the subject pointed correctly. The entire procedure was repeated for each activity area on the board as much as possible during the 20-min training period.

Test sessions. Throughout the identification training condition, test sessions were conducted under conditions identical to baseline sessions and followed training periods. As with baseline sessions, one to three test sessions were conducted daily. When each subject demonstrated 100% accuracy on three consecutive test sessions, the number of training periods per day was decreased. No training periods were conducted between the final two test sessions of the identification training condition.

Followup test sessions were conducted after terminating identification training at intervals of five and seven weeks for Robert and Pete and six and seven weeks for Jill.

Generalization Measures

Measures were conducted to investigate whether subjects could identify each of the five leisure areas with the communication board when they were actually present in those places. Once during baseline and once following identification training (before followup test ses-

sions) each subject was escorted individually by the staff trainer to each of the five leisure areas. Using the communication board, subjects were asked to respond to the trainer's question of "Show me where you are". A correct point was scored according to definitions used throughout the investigation and required the subject to point to the block representing the correct location.

Reliability

Reliability assessments were conducted during baseline and test sessions for each subject. Reliability averaged 100% for Robert, 93% for Pete, and 97% for Jill. Additional information is provided in Table 1. Reliability observations were also conducted for every response on generalization measures in the five leisure activity places. No disagreements were recorded for Jill, Pete, or Victor. For Robert, there was one disagreement concerning the correctness of one response.

RESULTS

The number of correct pointing responses during baseline and test sessions for Robert, Pete, and Jill is shown in Figure 2. During baseline, no subject consistently pointed to correct blocks. After identification training was implemented, correct responding increased for all three subjects. Each subject correctly pointed to all five areas on each of the followup test sessions.

On the generalization measures taken in the actual activity areas during baseline, Jill accurately indicated where she was by pointing to the correct block in three of the five areas, Pete correctly pointed to one, and Robert to none. After identification training terminated, Jill and Robert correctly pointed to the board block in four areas and Pete pointed correctly in all five. Victor pointed correctly in all five areas during baseline.

DISCUSSION

The increase in accuracy of pointing to correct word-photographs to correspond to verbal labels

Fig. 2. Number of correct pointing responses during baseline and test sessions for each subject. The followup data represent observations conducted five to seven weeks after identification training terminated.

occurred only when training was implemented and at different times for the three subjects, indicating a functional relationship with the training. Also, the increase in accuracy by the subjects to indicate where they were when escorted to the actual physical location following identification training suggested that generalization did occur. These results suggested that the subjects could use the communication boards successfully with the trainer. Experiment III was conducted to evaluate whether the boards could be used for communication with other persons.

EXPERIMENT III:
SOCIAL VALIDATION

METHOD

Situations were presented after identification training and before followup to determine if the pointing response and communication board were functional in allowing subjects to communicate to persons who had not previously interacted with them. Seven adults participated: four staff secretaries, one volunteer assistant from the local community, one job applicant,

and one staff supervisor from another unit in the institution. None of the volunteers had met the subjects previously. Before meeting the volunteer, it was explained to each subject that they would meet a new person and that person would ask what they wanted to do. The subject was asked to indicate what he/she wanted to do on the board for the staff trainer and to express that information to the volunteer when asked. The subject was told that once the volunteer interpreted what he/she wanted to do they would then be escorted to that activity area. Pete, Jill, and Robert interacted with two volunteers, Victor with one. The interactions took place individually with each subject in a room adjacent to the living unit.

Before meeting the subjects, each volunteer was informed that his or her participation would be part of a project to evaluate a communication system. Each person was instructed to ask the subject what he/she would like to do and to interpret the answer. To prepare the volunteers for the communication difficulty that might occur, the general physical limitations were described before meeting the subject. Following an introduction between the subject and volunteer by the staff trainer, each person asked the subject what he/she would like to do. No communication board or pointer was present at that time. Once the person told the trainer what he/she thought the subject wanted (or said they could not determine what the subject wanted), the staff trainer positioned the head pointer where necessary and held the board in front of the subject. The volunteer, according to prior instructions, repeated the process of asking the subject what he/she wanted to do and interpreting the response.

An observer recorded both subject and volunteer responses. Reliability measures were conducted for three subjects by a second observer standing at the side of the subject opposite the primary observer. Observers recorded what the subjects indicated they wanted to do and then recorded the volunteer's interpretation of what the subject wanted, both with and without the board. No disagreements were recorded between

observers regarding the subject's choice of activity or regarding the novel volunteer's interpretation of what the subject wanted to do (whether the volunteer's interpretation agreed or disagreed with what the subject previously indicated).

RESULTS

No volunteer correctly interpreted what the subject wanted to do when the communication board was not available. When the head pointers and/or boards were present, each volunteer correctly stated what the subject wanted to do on every occasion.

DISCUSSION

The improvement of persons in interpreting the subject's responses when using the communication board *versus* the subjects using their own idiosyncratic methods of communication further suggested that the training was useful in aiding functional communication. The inability of novel persons to interact successfully with the subjects without the boards was consistent with many staff members' reports and with the authors' initial attempts at communication with the subjects. The fact that the strangers could accurately interpret the board responses provides relevance to the procedure.

GENERAL DISCUSSION

Results of the three experiments indicate that a pointing response with a communication board is a viable means of nonvocal communication for severely handicapped persons. The acquired skills maintained during the five- to seven-week followup period, demonstrating that the improvement was not of brief duration.

Following termination of Experiment II, unit staff were assigned to interact with each subject at specified times during the day with the head pointer and/or communication board. After asking what they would like to do, staff escorted the subjects to the area expressed on the board. While only casual observations were conducted, it appeared that staff frequently carried through

with the interactions. The practice and reinforcement entailed in these activities may have accounted for the 100% accuracy of each subject on followup sessions.

Although considerable generalization appeared to occur when the subjects were requested to identify actual physical places with the communication board in Experiment II, the accuracy fell short of 100%. The incorrect response by Jill and Robert may have been due to stimulus similarity between the lobby and front porch, as the front porch was adjacent to and could be viewed from the lobby. Also, the photographs of both places consisted of part of the lobby and porch. Both residents misidentified the lobby as the porch. However, the precise cause of the increase in generalization measures cannot be ascertained from the present design. One plausible explanation is that the subjects had previously associated the physical place with its verbal name through experience and through identification training paired the communication board representation with the verbal name. It seems logical that subjects could then respond to the board stimulus to represent the actual place, especially when combined with the descriptions by the trainer at the onset of identification training with the subjects in each of the physical areas. Additional research specifying generalization facilitators seems desirable.

Other avenues for further research also seem indicated. In the present program, several teaching techniques comprised each of the training phases. Analyses of the most effective components would be desirable. Research with other nonvocal techniques and content areas other than leisure choices should also prove beneficial. As noted earlier (Vanderheiden *et al.*, 1975; Vicker, 1973), no single approach has been demonstrated as the most advantageous. While the word-photograph board employed in this study had the advantage of stimuli that were easily interpreted by persons interacting with residents, as well as cost economy, the board and head pointer were somewhat cumbersome to prepare and/or maneuver. The head pointers also

appeared bizarre to some staff and volunteers and could evoke unneeded stares or possible ridicule. Evaluation of other forms of nonvocal communication may lead to techniques with a more desirable public appearance. Finally, research documenting means of teaching residents to interact with each other through nonvocal methods could prove beneficial.

In interpreting the results, the chronological ages of the residents should be considered, along with the extent of handicap. The relationship between the results of the present program and effects with younger persons with varying ranges of receptive skills (Bullock, Dalrymple, and Danca, 1975; McDonald and Schultz, 1973; Vanderheiden *et al.*, 1975) warrants investigation.

The significance of the results is highlighted when considering the 30-yr period that the four subjects were without comparable abilities to communicate leisure desires. It is plausible that with continued research, other persons who had previously been confined to a barren existence could be taught skills to allow considerably more interaction with their environments. Considering the large number of multihandicapped persons in retardation institutions (*e.g.*, Goda, 1969; Keane, 1972), it is likely that many other persons are being deprived of useful interactions. Application of research results, such as the training program here, to other seriously handicapped persons should prove beneficial in providing a more desirable existence.

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Received 3 August 1976.

(Final acceptance 31 January 1977.)