JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1980, 13, 473-491 NUMBER 3 (FALL 1980)

THE EFFECTS OF AN ENVIRONMENTAL "ENRICHMENT" PROGRAM ON THE BEHAVIOR OF INSTITUTIONALIZED PROFOUNDLY RETARDED CHILDREN

R. DON HORNER

UNIVERSITY OF KANSAS

This study determined the effects of procedures designed to "enrich" the physical and social environment of an institutional ward on the "adaptive" and "maladaptive" child, adult, self, and object-directed behaviors of five profoundly retarded ambulatory females. Behavior observed in two treatment conditions, an environment "enriched" with toys and objects and an "enriched" environment coupled with differential reinforcement of adaptive behavior, was compared to behavior occurring in corresponding baseline or "austere" conditions and during a period of noncontingent reinforcement. The results generally revealed: (1) little change in adaptive and maladaptive child and adult-directed behavior across conditions, (2) an overall higher incidence of adaptive object-directed behavior and reduced self-directed maladaptive behavior in each treatment condition from that observed in corresponding control conditions, and (3) the use of an "enriched" environment and differential reinforcement of adaptive behavior resulted in maladaptive self-directed behavior being reduced and adaptive object-directed behavior being increased beyond that observed in the "enriched" environment alone. These behavioral gains were largely maintained during a follow-up condition by continuing the "enriched" environment and transferring the responsibility for differential reinforcement to direct-care staff.

DESCRIPTORS: adaptive behavior, differential reinforcement, environment, noncontingent reinforcement, retarded female residents

There are very few empirical studies on the effects of institutional environments on mentally retarded individuals. Several accounts of the "austere" nature of environmental conditions in some institutions for the mentally retarded have been provided (Blatt, 1970; Blatt & Kaplan, 1966; MacAndrew & Edgerton, 1964). Predictions of possible adverse effects that this type of residential environment could have on the development of severely and profoundly retarded children have been offered (Butterfield, 1967; Clarke & Clarke, 1953; Dentler & Mackler, 1964; Tizard, King, Raynes, & Yule, Note 1), but empirical evidence in support of these predictions is meager. Studies that have attempted to compare institutionalized with noninstitutionalized children generally have favored the latter (e.g., Centerwall & Centerwall, 1960; Farrell, 1956; Pasquale, Boroskin & Ross, 1971; Slobody & Scanlan, 1959). Such studies have encountered formidable problems of experimental control and are not definitive.

Haywood and Tapp (1966) pointed out that the nature of the physical environment will largely determine the type of behavior that will occur there. Kaufman (1967) and Eyman, Tarjan, and Cassady (1970) found evidence that the acquisition of social behavior and basic self-help skills can be slowed as a result of admission to an institutional program for the mentally retarded. Ball, Seric, and Payne (1971), after providing intensive self-help training to six pro-

The author thanks Doug Guess, Donald Baer, Gary Clark, John Hollis, Joe Spradlin, and Ann Rogers-Warren for reviewing the original version of this manuscript. Reprints may be obtained from R. Don Horner, Bureau of Child Research, University of Kansas, Lawrence, Kansas 66045.

foundly retarded boys, found a decline in self-help skills (once the boys were returned to their regular living unit) that was not regained until nearly 4 years later. Klaber, Butterfield, and Gould (1969) found that children residing in an institution where very little adult-child interaction occurred engaged in more adult-directed behavior in an experimental situation than did children from an institution where social interaction with adults occurred frequently.

Research involving modification of the physical environment of an institutional ward and the subsequent effects on mentally retarded residents also is limited. Lindsley (1964) and Bensberg, Colwell, Ellis, Roos, and Watson (Note 2) suggested the development of new prosthetic environments designed to allow retarded persons greater control over their surroundings. Gunzburg (1968) pointed out the influence environmental features can have on a retarded person's acquisition of various perceptual relationships. Cleland and Swartz (1969) suggested modification of the physical environment as one of the more promising methods for facilitating institutional improvement. Gorton and Hollis (1965) described a number of architectural modifications of an institutional living unit that apparently resulted in better research and programming for the severely retarded individuals residing there. Kimbrell, Kidwell, and Hallum (1967) reported anecdotally that substantial improvement in neuromuscular coordination, toileting, and eating behaviors of severely and profoundly retarded girls was accomplished by modifying the physical nature of the ward and playground.

The presence or absence of manipulable objects is another important aspect of the physical environment. Davenport and Berkson (1963) presented four novel manipulable objects to severely retarded individuals and found those who engaged in high rate stereotyped behavior manipulated objects less frequently than those whose rate of stereotyped behavior was low. In a subsequent study, Berkson and Mason (1964) found that handing toys to a subject and talking to him reduced stereotyped behaviors and increased environmental manipulation. In a second experiment, stereotyped behavior again was found to be correlated negatively with object manipulation. Hutt and Hutt (1965) observed autistic children under four conditions of increased environmental complexity and found a reduction in stereotyped behavior only when an adult intervened and attempted to engage each child in object manipulation. Flavell (1973) found it necessary to prompt and reinforce approximations to object manipulation individually to reduce the stereotyped behavior of three severely retarded children.

These studies imply that attempts to reduce the various forms of maladaptive behavior often observed in residents of an austere institutional environment might be successful if the environment can be arranged to occasion and reinforce adaptive behavior. Such arrangements have been effective in promoting adaptive behavior within a luxurious preschool environment for nonretarded children. For example, Hart, Reynolds, Baer, Brawley, and Harris (1968) found that the cooperative play of a 5 yr old significantly increased when an adult prompted and reinforced such behavior. Buell, Stoddard, Harris, and Baer (1968) found that a social reinforcement contingency increased the use of outdoor play equipment by a 3 yr old. In addition, there was a collateral increase in positive social interaction and a decrease in "babylike" behavior.

Spradlin and Girardeau (1966) suggested the adaptive behavior of moderately and severely retarded individuals might be increased by structuring the environment to provide reinforcement for behavior incompatible with maladaptive behavior. Data presented by Berkson and Mason (1964) indicate attempts to modify adaptive and maladaptive behavior through changes in the social and physical environment should be directed toward younger profoundly retarded individuals before their behavior is characterized by the paucity of responses and limited interaction with social and physical stimuli typical of profoundly retarded adults reared

in an impoverished environment. Unless intervention occurs, children who otherwise might have a chance to attain higher levels of adaptive behavior may remain in the "back wards" and be denied opportunities to develop even the most rudimentary skills needed for adjustment to the community. The institutional environment then begins to set the occasion for the development of the maladaptive behavior it was established to treat (Blatt, 1970).

One way to achieve an enriched environment is through active training programs. Such programs serve a dual function of providing adult interaction and establishing behaviors that compete with the appearance of maladaptive behaviors. There have been a large number of studies describing operant-based individual and group training programs for severely and profoundly retarded individuals in residential institutions. The effects of operant interventions on the behavior of profoundly retarded individuals have been consistently positive. However, interventions often have required hard to obtain funds, intense and systematic training of direct-care staff, and elaborate procedures to maintain the programs established. Maximum effects on the behavior of the profoundly retarded will continue to depend on such programs, but it should be determined to what extent a reduction in maladaptive behavior and/or improvement in adaptive behavior might be achieved through a modification of the social and physical environment that requires less expense, less staff training, and fewer maintenance problems. This investigation structured an environment "enriched" physically with toys and objects and socially with differential reinforcement and determined the effects of this environment on several classes of adaptive and maladaptive behavior of profoundly retarded institutionalized children.

METHOD

Participants

Five profoundly retarded ambulatory female residents of one living unit of a large state institution for the mentally retarded[1] were selected to participate. The first step in the selection procedure was to identify from the records of the living unit which of the 35 residents currently were in programs one hour per day or less and had at least "travel" vision. This list of 18 was narrowed to 9 who, in the opinion of the direct-care staff, demonstrated an abundance of maladaptive behavior. The five residents were selected from this list via a table of random numbers. The age, length of institutionalization, and psychometric data of each subject are presented in Table 1.

Table 1

Chronological age, length of institutionalization, intelligence quotient, measured intelligence level, and social quotient of each resident in the sample.

Resident	*CA*	*Inst.*	*IQ*[1]	*MI*[2]	*SQ*[3]
1	12.0	7.6	14	−5 (Profound)	19
2	12.8	6.8	Untestable		17
3	9.0	5.0	12	−5 (Profound)	23
4	14.8	5.8	10	−5 (Profound)	17
5	13.1	5.7	5	−5 (Profound)	17

[1]Measured by Cattell Infant Intelligence Scale (Cattell, 1940).

[2]IQ scores fall within the −5 level of measured intelligence in the Heber (1961) classification system and are equivalent to the "Profound" level in the Grossman (1973) revision.

[3]Measured by Vineland Social Maturity Scale (Doll, 1953).

All five residents were able to feed themselves with a spoon. All, on occasion, would throw their spoons during a meal. As a result, forks and knives never were available. The residents were unable to dress themselves, bathe themselves, or independently use a toilet. Their incontinence resulted in several baths and changes of clothes being a daily routine. In addition, each had specific behaviors that differed from the behavior of others. Resident 1 was physically abusive toward herself and others. Often, she

[1]The name and location of the institution will remain anonymous. The living unit described in this study has been replaced by one specifically designed and programmed to provide a physical and social environment as enriched and stimulating as possible.

would scratch her arms and face. Scratching incidents usually were met by staff-imposed physical restraint until she ceased to struggle. Four or five minutes of restraint might be required before she would relax. Resident 2 would knock other girls down by slamming her body into them. At times, she would refuse to wear shoes. She would kick other residents or the wall with her bare feet. Resident 3 often bit the other residents. Sometimes, the bites were so severe that pieces of nose, ear, and lip had been severed. Resident 4 would frequently wait until other residents turned away from her, then butt them in the back with her head. She also would dig at body orifices and smear feces on the walls or pack it in her hair. Resident 5 engaged in vigorous rocking. She would place the thumb of her left hand in her mouth and leap when shifting support from one foot to the other.

Setting

The study took place in the dayroom of a living unit constructed in the early 1900s. The room was approximately 25 ft (7.6 m) long by 15 ft (4.6 m) wide with high ceilings. The walls on two sides had banks of large windows covered with an expanded metal mesh. A shelf mounted on another wall contained a black-and-white television set protected by a wood and Plexiglas frame. The furniture consisted of two tables, two regular and five child-size chairs, and a large metal cabinet with secured doors. The living unit was usually void of other objects. This setting, as described, comprised the environment during the experimental conditions labeled "austere."

Environmental "Enrichment" Stimuli

The physical setting for the "enriched" environmental conditions was the same as for the "austere" conditions except that a large number of toys and objects were placed in the dayroom. The toys and objects were selected according to the following criteria: (1) capable of being manipulated in some manner, (2) resistant to destruction, (3) not likely to be swallowed or poked into body orifices, (4) difficult to use as a weapon, (5) low probability of producing injury if used as a weapon, and (6) could be cleaned or discarded when soiled. Examples of toys and objects include large plastic cars, plastic bottles, stuffed animals, inflatable toys, squeeze toys, balls, musical toys, talking toys, sponge blocks, cardboard boxes, tire inner tubes, push toys, pull toys, wooden puzzles, form boards, rocking chair, rocking horse, dolls, and doll buggy.

Response Definitions

A preexperimental phase was conducted to determine the relevant responses to be defined and measured. This consisted of the application of a system outlined by Bijou, Peterson, and Ault (1968) in a preliminary investigation of the range of behavior in the repertoire of each subject. On the basis of responses recorded during the preexperimental phase and possible responses when objects and toys would be introduced into the experiment, a list of responses serving as a sample of "adaptive" and "maladaptive" behaviors was derived. The responses were defined by specifying an action form of the verb, an object of that action, and a criterion for scoring an occurrence. Each response was judged as either an adaptive or maladaptive response within each category. Two judges, not associated with the study, were asked to judge each response. If the two judges independently agreed on the category (e.g., maladaptive self-directed behavior) the response was listed as a member of that behavioral category. If the two judges disagreed, a third judged how the response should be categorized. A procedure in case all three judges disagreed was never developed. The third judgment was always the same as one or the other of the two original judges. The specific responses recorded as instances of adaptive and maladaptive adult, child, self, and object-directed behavior are presented in Table 2.

Adult-directed behavior. This category provided a measure of responses that were: (1) initiated by the child, and (2) directed toward

an adult. Primarily, adaptive adult-directed behaviors involved nonverbal requests for assistance or attempts to obtain affection. Maladaptive adult-directed behavior involved attacks on an adult, primarily.

Child-directed behavior. This category provided a measure of responses that were: (1) initiated by the child being observed, and (2) directed toward another child. Adaptive child-directed behaviors also involved the seeking of

Table 2

Response Definitions for Each Category of Adaptive and Maladaptive Behavior

Action	*Object*	*Scoring information*
ADULT-DIRECTED BEHAVIOR		
Adaptive		
leads	adult	to a different location
hugs	adult	for less than 15 sec
seeks	adult	for assistance (e.g., clean nose, tie shoe)
gives	object	to an adult
Maladaptive		
clings	to adult	for more than 15 sec
hits	adult	with hand or object
pushes	adult	sufficient to change adult's direction or speed in existing direction
places	mouth	on body parts or clothing of adult
kicks	adult	sufficient to produce a response from that adult
pulls	hair	of adult
pulls	ear	of adult
pulls	clothing	of adult
CHILD-DIRECTED BEHAVIOR		
Adaptive		
leads	another child	to a different location
gives	object	to another child
hugs	another child	for less than 15 sec
provides	assistance	to another child (e.g., clean nose, tie shoe)
Maladaptive		
takes	object	from another child
pushes	another child	sufficient to change other child's direction or speed in existing direction
places	mouth	on body parts or clothing of another child
kicks	another child	sufficient to produce a response from that child or visible movement of the body part kicked
pulls	hair	of another child
pulls	ear	of another child
hits	another child	with hand or object
clings	to another child	for more than 15 seconds
SELF-DIRECTED BEHAVIOR		
Adaptive		
pushes	clothing snaps	one against the other
lifts	cup of liquid	to mouth
pushes	button	against button hole
puts	clothing item	on correct body part
observes	self-image	in mirror
draws	comb or brush	through hair

Table 2 *continued*

Action	*Object*	*Scoring information*
Maladaptive		
directs	clothing items	from body (unless instructed to do so by an adult)
slaps or picks at	one or more body parts	with object or another body part
bangs	one or more body parts	into object or another body part
rocks	upper part of body	10 or more back and forth movements in 15 sec
places	body part or clothing	against mouth 10 or more sec of a 15-sec interval or vice versa
pulls	hair	of own body
throws	self	on floor
places	objects	between clothing and skin
touches	saliva, feces, urine, etc.	with fingers
rubs	one or more body parts	against objects or another body part
OBJECT-DIRECTED BEHAVIOR		
Adaptive		
stacks	blocks	2 or more high
strings	beads	2 or more long
throws	ball or bean bag	2 or more feet
pulls	pull toy	2 or more feet
pushes	push toy	2 or more feet
turns	crank	with hand 2 or more times
places	ring	on peg
strikes	peg	with mallet
pulls	string	on "Farmer Says"
places	peg	in peg board
rolls	ball	2 or more feet
places	objects	in bottle
kicks	ball	2 or more feet
rocks	rocking chair or rocking horse	10 or more times in a 15-sec interval
places	puzzle piece	in correct position
places	form	in correct position on form board
pushes	chair	up to table
pulls	chair	back from table
transfers	objects	from one place to another
draws	brush or comb	through doll's hair
removes	clothing	from doll without tearing
puts	clothing	on doll without tearing
cradles	doll	in arms
puts	doll	in doll buggy or stroller
places	baby bottle	in doll's mouth
Maladaptive		
places	inedible object (other than spoon)	into or against mouth
throws	object	other than ball or bean bag
climbs	on furniture	with both feet in contact with furniture
kicks	object (other than a ball)	two or more feet
pulls, tears or unravels	threads or cloth	of clothing
twirls	mop string, etc.	10 or more sec of a 15-sec interval
tips	chair	over on front, back, or side
beats	objects	against floor, walls, or other objects

assistance or affection whereas maladaptive child-directed behaviors involved attacking another child, primarily.

Self-directed behavior. This category provided a measure of responses that were: (1) directed by the child toward herself, or (2) directed toward items clothing her body. Adaptive self-directed behaviors were related primarily to eating, drinking, dressing, and grooming. Maladaptive self-directed behaviors were primarily self-stimulatory, stereotyped, and self-injurious.

Object-directed behavior. This category provided a measure of responses that were: (1) child-directed toward objects, or (2) directed toward physical aspects of the environment other than items clothing her body. Adaptive object-directed behaviors involved manipulating toys and objects primarily as they were designed to be manipulated. Such behavior was labeled adaptive object-directed rather than play because play implies behavior that contains an element of amusement, diversion, or fun. This was considered too restrictive a description of the type of behavior likely to occur. The adaptive object-directed behavior of profoundly retarded individuals, although occasionally containing elements of play, was usually qualitatively different from the "typical" play behavior of nonretarded individuals (cf. Buell et al., 1968; Hart et al., 1968; Quilitch & Risley, 1973). Maladaptive object-directed behaviors involved abusive treatment of objects primarily.

Observing Procedure

A portable observation booth similar to one described by Gewirtz (1952) was positioned in one corner of the dayroom one week prior to the start of the study. This provided a period of time for the residents of the living unit to satiate on the novelty of its introduction and lessen the potential confounding effects that might result from simultaneous introduction of the booth and behavioral measurement.

An observation system developed by Boer (1968) was modified for use in this study. The time-sampling procedure consisted of recording the occurrence of adaptive and/or maladaptive adult, child, self, and object-directed behavior as defined. The measurement occurred across each 15-sec interval of three 5-min periods for each of the five residents. The measurements occurred between 8 a.m. and 12 p.m. each weekday. The behaviors were recorded by observers coding at the end of each 15-sec interval the occurrence during the interval of any behaviors listed as members of the adaptive and maladaptive categories presented in Table 2 (cf. Powell, Martindale, & Kulp, 1975). A behavior must have occurred at least once during the 15-sec interval to have been recorded.

The 15-sec intervals were signaled by the reset click of a recycling general purpose timer. The number of the interval was recorded on each of two counters (one for each observer) that advanced once on each activation of the timer. The three-person observation team shared observation periods so that two were always in joint but independent observation and the third was free to enter the dayroom. Each observed two 5-min periods for each resident. The five residents were observed sequentially in counterbalanced order across sessions throughout the study. At each session, the first resident was observed for 5 min, the second resident for 5 min, until all five residents had been observed. This sequence was repeated three times resulting in a total of 15 min of observation for each resident at each session (cf. Thompson, Holmberg, & Baer, 1974).

Interobserver Reliability

The percentage of interobserver agreement on the observations was computed using the exact agreement-response intervals only method (Repp, Deitz, Boles, Deitz, & Repp, 1976). The calculations were based only on intervals in which at least one observer recorded a response. An agreement was defined as an interval in which both observers recorded the occurrence of a response within the same category (e.g., maladaptive object-directed behavior). A disagreement was defined as an interval in which one

observer recorded the occurrence of a response and the other did not, or recorded the occurrence of a different response (e.g., one observer recorded maladaptive object-directed behavior and the other recorded maladaptive self-directed behavior or nothing for that interval). The number of intervals with interobserver agreement was divided by the sum of the agreements and disagreements, the quotient multiplied by 100, and the result reported as percent agreement between observers. The observations used to compute the percentage of agreement were preceded by 4 h of preexperimental observation training.

Experimental Design and Procedures

The experiment consisted of the time-sample measurement of four categories of adaptive and maladaptive behavior under five conditions arranged in ten phases. The first four phases provide an ABAB comparison of the effects of the "austere" and "enriched" environmental conditions on adaptive and maladaptive adult, child, self, and/or object-directed behavior. The first phase (condition B_1) consisted of recording the four categories of behavior in the "austere" conditions present before any attempt was made to modify the environment of the living unit. These measurements served as a baseline against which to later determine the effects of the second phase. The second phase (condition T_1) involved determining the effects on the four categories of behavior produced by "enriching" the environment with a large number of toys and objects. The third phase (condition B_1) was a return to the "austere" conditions of the first phase. The toys and objects were removed from the dayroom. The fourth phase (condition T_1) was a return to the "enriched" environment of the second phase. The toys and objects were returned to the dayroom of the living unit. The procedure during condition B_1 and T_1 was to measure the four categories of adaptive and maladaptive behavior as described under the heading *Observing Procedure.*

The fifth phase (condition T_2) involved maintaining the "enriched" environment of the second phase and coupling it with differential reinforcement of adaptive behavior (DR). Because there were three observers, observations were scheduled to permit each observer to be free 5 min of each 15-min period. During condition T_2 each observer served as experimenter during the "free" period. Each experimenter, upon entering the dayroom, went from resident to resident, dispensing social praise and either sips of a soft drink or small bits of marshmallow. The dispensing of reinforcers was contingent on the resident's behavior corresponding to any of the behaviors listed in Table 2 under the categories of adaptive adult, child, self, or object-directed behavior. If the child was not engaged in adaptive behavior, the behavior was prompted by the experimenter who presented an object or toy, encouraged the appropriate behavior through verbal praise for approximations to it, and moved on to the next resident. During the first five sessions of phase five, the experimenter returned to the observation booth after the fifth resident had been either prompted or reinforced, and remained outside the dayroom on a variable one minute (VI-1 min) intertrial interval. Upon the experimenter's reentry to the room, residents who were engaged in behavior categorized as adaptive were reinforced. Those not engaged in adaptive behavior were prompted. Beginning on the fifth day of phase five, the experimenter remained outside the dayroom on a variable three minute (VI-3 min) intertrial interval.[2] Otherwise, the procedure during the last five ses-

[2]The relay rack in the observation booth, in addition to containing a timer and counters to signal each 15-sec interval, contained a variable interval continuous loop tape programmer. Two tapes were prepared. One contained ten intervals averaging one minute and one contained five intervals averaging three minutes. The VI-1 min tape was used during the first five sessions of phase five and activated a light to signal the experimenter to enter the dayroom. After residents were reinforced or prompted, the experimenter left the dayroom, reentered the observation booth, and pushed a button to start the next intertrial interval. The VI-3 min tape was used the last five sessions of phase five and each session of phases seven, eight, and nine.

sions was identical to that of the first five. The sixth phase (condition T_1) was a return to the "enriched" environment of the second and fourth phases. The seventh phase (condition T_2) was a return to the "enriched" environment and differential reinforcement provided during the fifth phase. Phases four through seven provided an ABAB comparison of the effects of the "enriched" environment with the effects of the "enriched" environment plus differential reinforcement of adaptive behavior.

The eighth phase (condition T_3) was a control condition to determine if reinforcement had to be contingent on adaptive behavior to produce an increase, or if the effect was primarily a discriminative one and also might have been obtained through noncontingent reinforcement. The variable 3-min intertrial interval also was in effect during condition T_3 (phase eight). During condition T_3, all five residents were provided reinforcers in a random fashion each time the experimenter entered the dayroom, whether the resident's behavior at the time was adaptive or maladaptive. This was followed by a return to the "enriched" environment and differential reinforcement condition (T_2) in the ninth phase. Phases seven through nine provided an ABA comparison of the effects of contingent and noncontingent reinforcement on the four categories of adaptive and maladaptive behavior.

The tenth phase (condition T_4) was a follow-up and extension of the conditions present in phases five, seven, and nine. The major difference was the transfer of responsibility for reinforcer delivery to the direct-care staff. During condition T_4, three direct-care staff were assigned separate one-hour blocks between 9 a.m. and 12 p.m. each weekday. Three relief direct-care staff were assigned separate one hour blocks during the one or two days regular staff were off duty. Each was provided a schedule listing the times during that hour to observe the behavior of the five residents. They were instructed to provide reinforcement for, or prompt the occurrence of adaptive behavior as they had observed the experimenter's doing. The times listed on each schedule spaced the observation times to approximate the variable 3-min intertrial interval of phases five, seven, and nine. Each staff was provided a list of (and opportunity to discuss) the definitions of behaviors categorized as adaptive and maladaptive. During the first week of follow-up, corrective feedback was provided at the end of each session if maladaptive behavior was being reinforced or prompts were too brief. Positive feedback, consisting of examples of adaptive behavior being reinforced and skillful use of prompts, also was provided. Feedback was reduced to once a week during the remaining weeks (two through five) of the follow-up condition.

RESULTS

Reliability

Percentage of agreement figures ranged from a high of 100% to a low of 81% and averaged 90% overall. The mean and range of the percentage of agreement for each of the ten phases are presented below.

Phase Outcomes

The data on the percentage of 15-sec intervals containing one or more instances of adaptive and/or maladaptive adult, child, self, and object-directed behavior at each session across the ten phases of the study are presented by each category and the four categories combined in Figure 1. Each data point represents the mean performance of the five residents in the sample at each session. The vertical line extending above and below a data point represents the range of performance of the five residents in the sample.

Phase one—"austere" environment (condition B_1). In the "austere" environment or baseline condition of phase one, the occurrence of adaptive adult, child, self, *and* object-directed behavior averaged approximately 21% of the 15-sec intervals of the ten sessions in this phase. The occurrence of maladaptive adult, child, self,

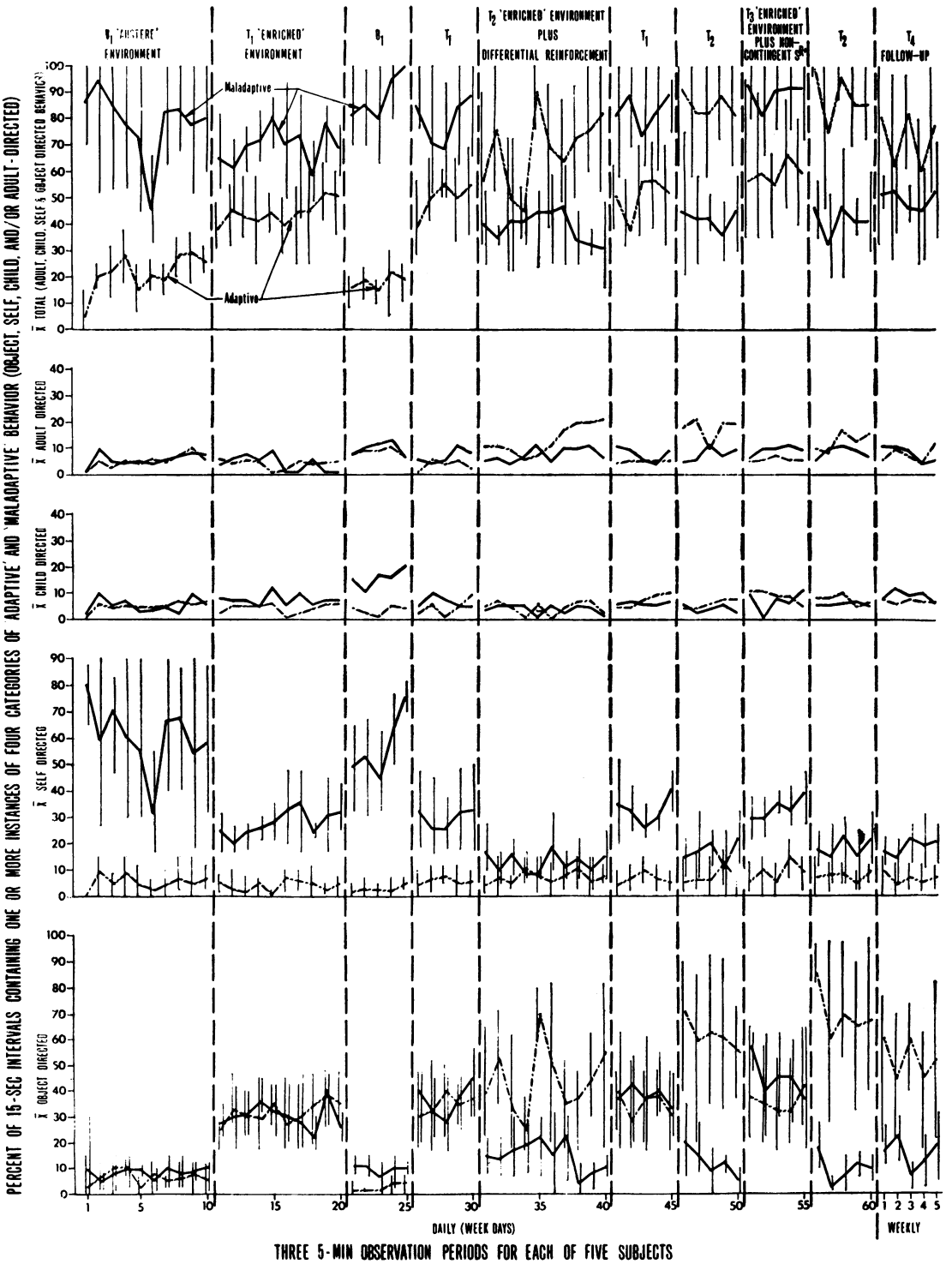

Fig. 1. Each data point represents the mean percentage of 15-sec intervals (of three 5-min observation periods across each of five residents) that contain one or more instances of four categories of "adaptive" and "maladaptive" behavior (object, self, child, and/or adult-directed behavior). The vertical lines immediately to the left (adaptive) and right (maladaptive) of a data point indicate the range of scores used to compute the mean percentage.

and object-directed behavior in phase one averaged approximately 79% of the 15-sec intervals measured. The reliability of the data collected in phase one ranged from 84% to 100%, with a mean of 92%.

Phase two—"enriched" environment (condition T_1). Once the "enriched" environment condition of the second phase was introduced, the average percentage of the four categories of maladaptive behavior across the five residents dropped immediately from 80% in the last session of phase one, to 65% in the first session of phase two. Overall, total maladaptive behavior fell from the 79% average across the ten sessions of phase one to approximately 70% across the ten sessions of the "enriched" environment of phase two. Maladaptive adult-directed and child-directed behavior were virtually unchanged, maladaptive self-directed behavior fell from 61% to 28%, and maladaptive object-directed behavior rose from 8% to 30%. The overall total of adaptive behavior during the enriched environment condition of phase two rose from an average of 21% in phase one to 44% of the 15-sec intervals across the ten sessions. This was double that observed in the austere environment condition of phase one. The data collected in phase two ranged in reliability from 85% to 100%, with a mean of 91%.

Phase three—"austere" environment (condition B_1). In the return to the baseline or austere environment condition, total adaptive behavior dropped from the 44% average of phase two to an average of 18% of the 15-sec intervals during the five sessions of phase three. This was very near the 21% average of phase one. The overall total of maladaptive behavior rose from an average of 70% in phase two to an average of 88% across the five sessions of the return to the austere environment of phase three. This was approximately 10% above the level observed during phase one. Phase three data had an average reliability of 87% with a range of 82% to 94% across sessions.

Phase four—"enriched" environment (condition T_1). Upon the reintroduction of the enriched environment in phase four, the average percentage of the four categories of maladaptive behavior across the five residents dropped immediately from 100% in the last session of phase three to 84% in the first session of phase four. Overall, total maladaptive behavior fell from the 88% average across the five sessions of phase three to an average of approximately 79% across the five sessions of the enriched environment of phase four. The average percentage of adaptive behavior for the four categories combined rose from 18% in the austere environment condition to 50% in the enriched environment condition. Adaptive object-directed behavior rose from 3% to 35%. The data collected during phase four had an average reliability of 89%, with a range of 81% to 94%.

Phase five—"enriched" environment plus differential reinforcement (condition T_2). When the enriched environment was coupled with differential reinforcement of adaptive behavior, an effect was produced on both adaptive and maladaptive behavior. The percentage of intervals containing one or more instances of the four categories of adaptive behavior rose from an approximate average of 50% in the enriched environment condition to 68% in the enriched environment plus differential reinforcement condition. The percentage of intervals containing one or more instances of the four categories of maladaptive behavior dropped from an approximate average of 79% of the 15-sec intervals in the enriched environment condition to 39% in the enriched environment plus differential reinforcement of adaptive behavior condition. The reliability of the data in phase five ranged from 81% to 100%, with a mean of 89%.

Phase six—"enriched" environment (condition T_1). When the enriched environment of phase four was reintroduced in phase six, the average percentage of the four categories of maladaptive behavior rose immediately from an average of 39% to an average of 82%. The average percentage of adaptive behavior fell from 68% in the enriched environment plus dif-

ferential reinforcement condition to 51% in the enriched environment condition. The mean percent agreement during phase six was 90%, with a range of 83% to 95%.

Phase seven—"enriched" environment plus differential reinforcement (condition T_2). Upon return to the enriched environment and differential reinforcement condition, the average percentage of adaptive behavior rose from 51% to approximately 86% across the five sessions of phase seven. The percentage of intervals containing maladaptive behavior dropped from an approximate average of 82% of the 15-sec intervals in the enriched environment condition to 42% in the enriched environment plus differential reinforcement of adaptive behavior condition. Phase seven data had a mean reliability of 90%, with a range of 83% to 95%.

Phase eight—"enriched" environment plus noncontingent reinforcement (condition T_3). The percentage of intervals containing one or more instances of the four categories of adaptive behavior dropped from an average of 86% during the enriched environmental plus differential reinforcement condition to 58% across the five sessions of the enriched environment plus noncontingent reinforcement condition. The percentage of intervals containing one or more instances of the four categories of maladaptive behavior increased from an average of approximately 42% during the enriched environment plus differential reinforcement condition to an average of 90% across the five sessions of the enriched environment plus noncontingent reinforcement condition. The reliability of the data in phase eight ranged from 83% to 96%, with a mean of 92%.

Phase nine—"enriched" environment plus differential reinforcement (condition T_2). The return to the enriched environment plus differential reinforcement of adaptive behavior condition resulted in an increase in the percentage of intervals containing adaptive behavior from an average of 58% in the enriched environment plus noncontingent reinforcement condition to an average of 88% in the enriched environment plus differential reinforcement of adaptive behavior condition. The percentage of intervals containing maladaptive behavior decreased from an average of 90% in the enriched environment plus noncontingent reinforcement condition to 42% across the enriched environment plus differential reinforcement condition. The mean reliability of the data collected in phase nine was 91%, with a range of 87% to 100%.

Phase ten—follow-up (condition T_4). During the five week follow-up phase, the percentage of intervals containing one or more instances of the four categories of adaptive behavior averaged approximately 73%. The averages during the two initial baselines in phases one and three were approximately 21% and 18% respectively. The percentage of intervals containing one or more instances of the four categories of maladaptive behavior averaged approximately 50%. The averages during the two initial baselines in phases one and three were approximately 79% and 88%, respectively. The data collected during phase ten had a mean reliability of 90% and ranged from 85% to 94%.

Condition Outcomes

Figure 2 presents the mean percentage of adaptive and maladaptive behavior for the adult, child, self, and object-directed behavioral categories across the five conditions of the study. Figure 3 presents the mean percentage of adaptive and maladaptive behavior when the four categories are combined. In both figures, the 10 phases of the study have been combined into the five conditions to illustrate the overall changes in adaptive and maladaptive behavior across conditions.

Figure 2 reveals little change in adaptive and maladaptive adult and child-directed behavior across the five conditions. Adaptive adult-directed behavior averaged 6% during baseline, 4% in the enriched environment alone, 8% when the enriched environment was coupled with differential reinforcement of adaptive behavior, 6% when reinforcement was noncon-

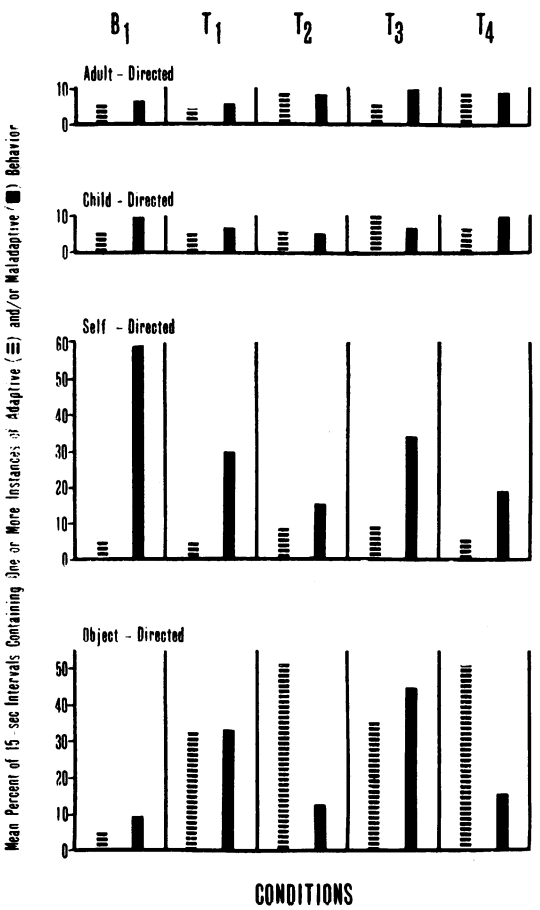

Fig. 2. Bar graphs showing the mean percentage of adaptive and maladaptive behavior for adult, child, self, and object-directed behavior across the five conditions of the study.

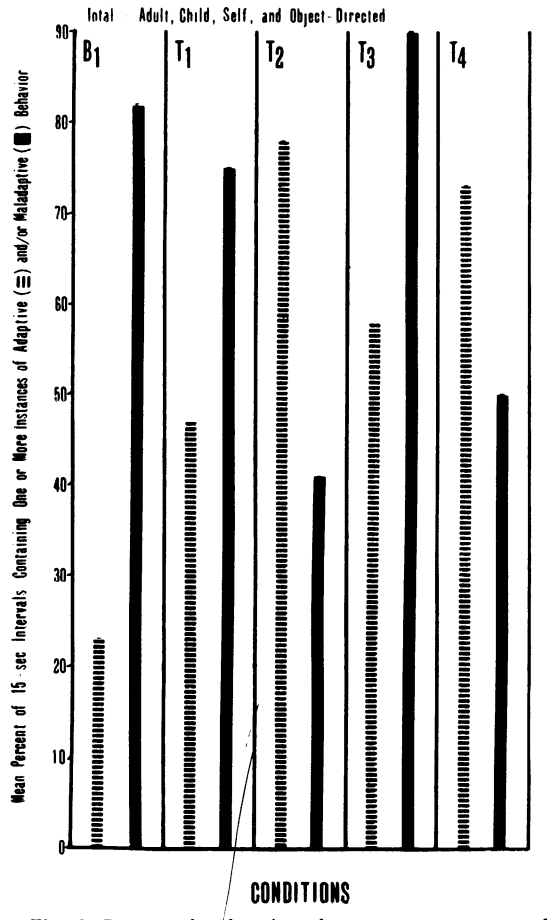

Fig. 3. Bar graphs showing the mean percentage of total adaptive and maladaptive behavior across the five conditions of the study.

tingent, and 8% during follow-up. The percentage of maladaptive behavior differed little from adaptive averaging 7%, 6%, 8%, 9%, and 8%, respectively, across the five conditions. A similar pattern appeared in child-directed behavior. Adaptive child-directed behavior was 5%, 5%, 6%, 9%, and 7% across the five conditions and maladaptive child-directed behavior was 9%, 7%, 5%, 7%, and 9%, respectively.

Figure 2 shows substantial change in maladaptive self-directed behavior across the five conditions. Maladaptive self-directed behavior averaged 59% during baseline, 30% in the enriched environment alone, 16% when the enriched environment was coupled with differential reinforcement of adaptive behavior, 33% when reinforcement was noncontingent, and 19% during follow-up. The percentage of adaptive self-directed behavior showed little change across the five conditions. The figures were 5%, 5%, 8%, 9%, and 7%, respectively.

Figure 2 reveals substantial change in adaptive and maladaptive object-directed behavior across the five conditions. Adaptive object-directed behavior averaged 5% during baseline, 33% in the enriched environment alone, 52% when the enriched environment was coupled with differential reinforcement of adaptive behavior, 36% when reinforcement was noncontingent, and 52% during follow-up. The percentage of maladaptive object-directed behavior was 9%, 34%, 13%, 45%, and 16% across the five conditions.

Figure 3 shows the change in total adaptive and maladaptive behavior across the five conditions. The percentage of intervals containing one or more of the four categories of adaptive behavior averaged 23% during baseline, 47% in the enriched environment alone, 78% when the enriched environment was coupled with differential reinforcement of adaptive behavior, 58% when reinforcement was noncontingent, and 73% during follow-up. The percentage of intervals containing one or more categories of maladaptive behavior averaged 82%, 75%, 41%, 90%, and 50%, respectively.

DISCUSSION

Reliability

Because two observers were always in joint but independent observation, percentage of agreement figures were computed for each session. Percentage of agreement was very high ranging from 100% to 81% and averaging 90% overall. This was partly a result of the consistency of behavior demonstrated by each of the residents, and partly a result of carefully selecting and defining specific behaviors for observation, training in the observation of those behaviors prior to the study, and the use of a relatively large (15-sec) time-sample unit. In retrospect, it probably would have been better to have selected a 10-sec time-sample unit. With behavior defined as maladaptive occurring at a high rate, it is possible that a maladaptive behavior in one of the categories may have been seen by observer one and not by observer two. Then, later in the 15-sec interval, another maladaptive behavior in the same category may have been seen by observer two and not by observer one. This would appear in the record as an agreement that one category of maladaptive behavior occurred during the interval, but in this example observers would not have been in agreement on the specific behavior recorded. The reliability data must be interpreted cautiously as agreement that one or more instances of a particular class or category of behavior occurred and *not* that both observers averaged 90% agreement that a *specific* behavior occurred.

Phase Comparisons

Phases one through four. The ABAB reversal provided by phases one through four of the study demonstrated that "enriching" the environment with manipulable toys and objects increased the amount of adaptive object-directed behavior above that occurring during baseline. Each time the environment was enriched, adaptive object-directed behavior increased. Each time the enriched environment was withdrawn, adaptive object-directed behavior decreased. Because few objects were present during baseline, a low level of adaptive object-directed behavior would be expected. A comparison of adaptive object-directed behavior in phases one through four is relevant only to show that placement of toys and objects in the room not only increased the *opportunity* for, but actually increased the *occurrence* of, adaptive object-directed behavior.

The data also revealed that as object-directed adaptive behavior increased, so did maladaptive object-directed behavior. Enriching the environment with toys and objects not only provided the opportunity for increased adaptive behavior, but also provided more opportunities for maladaptive object-directed behavior. All of the increases were object-directed. Other changes in adaptive (adult, child, and self-directed) and maladaptive (adult and child-directed) behavior were small. The toys and objects provided did not set the occasion for any marked increase or decrease in these types of behaviors.

There was a substantial reduction in maladaptive self-directed behavior in the enriched environment condition. As object-directed behavior increased, maladaptive self-directed behavior decreased. It appears that object-directed and self-directed behavior are somewhat incompatible (i.e., the frequency of occurrence of the two classes covary). These results agree with those of Hollis (1965a, 1965b, 1968, 1978), Guess and Rutherford (1967), and others who found that self-directed responses occurred at a

low frequency when "other-directed" responses (e.g., grasping, physical contact with the environment) were at a high frequency.

A slight increase in both adaptive and maladaptive adult-directed behavior was observed throughout the return to the baseline austere environment condition. This could have been chance fluctuation in the data or the result of an increased number of adults present in the dayroom during baseline conditions. Unfortunately, no measure of the number of adults present was taken. Anecdotally, an increased number was noted. This was primarily a function of attempts to correct an increased incidence of maladaptive child-directed behavior occurring during the return to baseline condition. During the enriched environment conditions, direct-care staff rarely entered the dayroom. When they did enter, it was to correct a potentially dangerous situation, to remove a child from the room for some purpose or to clean urine and fecal material from the floor.

Overall, the ABAB reversal of phases one through four demonstrated that enriching the environment with toys and objects resulted in a 20 to 30% increase in behaviors defined as adaptive and a 10 to 20% reduction in behaviors defined as maladaptive. This increase can be attributed to the fact that the presence of toys and objects set the occasion for an increase in adaptive object-directed behavior. The fact that the presence of the toys and objects also set the occasion for increased maladaptive object-directed behavior accounts for the smaller overall reduction in maladaptive behavior.

One caution in interpreting the data of the study must be presented. On a few occasions a child would engage in behavior originally judged as maladaptive, but if the context in which it occurred is considered it might be judged by some as adaptive. For instance, a child being observed might hit another child after being hit, or take an object from a child who had just taken it from her. Such behaviors continued to be scored as maladaptive because of difficulties anticipated in attempting to judge whether the context in which behaviors occurred indicated they were adaptive or maladaptive. A high rate of such instances could be considered to invalidate the study. The exact number of instances is unknown. A rough estimate is they constituted substantially less than one percent of the behaviors observed. Thus, adaptive and maladaptive behavioral categories could be slightly above or below the figure presented depending on individual judgments of the adaptive or maladaptive nature of similar behaviors in different contexts.

Phases four through seven. The ABAB reversal provided by phases four through seven of the study demonstrated that an enriched environment consisting of manipulable toys and objects combined with differential reinforcement of adaptive behavior resulted in a substantial increase in adaptive behavior and a substantial reduction in maladaptive behavior. The percentage of intervals containing one or more instances of adaptive behavior increased each time the enriched environment plus differential reinforcement condition was introduced. The only experimental change from one condition to the next was the introduction of differential reinforcement. There was no change across conditions four through seven in maladaptive adult and child-directed behavior, nor in adaptive child and self-directed behavior. As in phases one through four, the toys and objects did not set the occasion for this type of behavior often enough for consequences to serve a reinforcing function. The changes that did occur were entirely the result of increases in adaptive adult and object-directed behavior and decreases in maladaptive self and object-directed behavior.

The ABAB reversal of phases four through seven demonstrated that an environment enriched with toys and objects, coupled with differential reinforcement of adaptive behavior, resulted in an additional 20% to 30% reduction in behavior defined as maladaptive below that obtained in an enriched environment alone. Further, adaptive behavior increased an additional 30% to 40% above that obtained in an en-

riched environment alone. The fact that this increase was obtained only with the addition of the differential reinforcement procedure demonstrated convincingly the control provided by that procedure. However, at this point it was not clear whether the control resulted from reinforcing effects or discriminative effects.

Phases seven through nine. The abrupt change in behavior from the enriched environment condition to the enriched environment plus differential reinforcement condition is an indication that the addition of the differential reinforcement procedure had discriminative properties as well as reinforcing ones (Baer, Note 3). The switch from the enriched environment to the enriched environment plus differential reinforcement and back resulted in substantial stimulus change. It is possible that the immediate decrements and increments in adaptive and maladaptive behavior at the beginning of each of these conditions may be more a function of a sudden change in stimuli (i.e., the presence or absence of the experimenter entering the room every minute or so providing bits or marshmallow or a sweet liquid) than by an immediate strengthening or weakening of adaptive and maladaptive behavior through differential reinforcement. The entrance of the experimenter into the dayroom appeared to be a powerful discriminative stimulus. After the first 3 to 5 min, the residents consistently either held objects and manipulated them throughout the session or would begin efforts to locate an object as soon as the experimenter entered the room.

As a test of the extent discriminative properties of the differential reinforcement procedure were controlling behavior, a five session shift to a noncontingent reinforcement condition was programmed. Because the enriched environment was maintained, this condition provided minimal changes in the total stimulus conditions present. The discriminative properties provided by the presence of an experimenter delivering reinforcers were changed only slightly. However, the contingencies of reinforcement were altered considerably. Each resident received reinforcers independent of the occurrence of adaptive and maladaptive behavior. As a result, the rate of maladaptive behavior began to increase immediately, and the rate of adaptive behavior immediately dropped. In the noncontingent condition, behavior occurring in the early part of each session tended to persist. The high rate of both adaptive and maladaptive behavior resulted in many reinforcers being contingent on instances of adaptive and maladaptive behavior rather than totally noncontingent. Since maladaptive behavior usually dominated the early part of a session, it persisted. Many reinforcement deliveries also followed adaptive behavior. This could account for the overall level of adaptive behavior being slightly above that obtained in the enriched environment conditions alone. The change in levels of both adaptive and maladaptive behavior in the noncontingent condition from that observed in the enriched environment plus differential reinforcement conditions indicates the effectiveness of the addition of differential reinforcement was a result of more than just the discriminative properties of the conditions or stimuli accompanying reinforcement.

Phase ten. The follow-up data reveal an approximate drop of 15% in adaptive behavior from the enriched environment plus differential reinforcement condition of the ninth phase to the follow-up of the tenth phase. This drop was largely considered a result of inconsistent implementation of the conditions present in phase nine. Often the direct-care staff had to be reminded to conduct follow-up sessions. The excuses for not conducting sessions ranged from shortage of staff to assuming the program had ended. When sessions were conducted, the residents were often reinforced for maladaptive behavior and not reinforced for adaptive behavior. Despite the inconsistency of application, the use of direct-care staff or other nonprofessionals to carry out or maintain treatment programs in institutional settings is probably necessary if the program is to succeed (Guess, Rutherford, Smith, & Ensminger, 1970; Guess, Smith, & Ensminger,

1971). Fortunately, in this study the drop in adaptive behavior (around 15%) and increase in maladaptive behavior (around 10%) was not severe. The real gains are apparent when the follow-up data are compared to the original baselines in the austere condition. Overall, total adaptive behavior was 50% higher and maladaptive behavior was over 25% lower. These gains, although not as impressive as those involving direct attempts to reduce the maladaptive behavior of single individuals (e.g., Foxx & Azrin, 1973; Koegel, Firestone, Kramme, & Dunlap, 1974; Mulhern & Baumeister, 1969; Repp & Deitz, 1974; Rollings, Baumeister, & Baumeister, 1977) were obtained indirectly through environmental enrichment and a procedure designed to promote adaptive interaction with that richer environment rather than to punish inappropriate or maladaptive interactions. The use of mild deprivation of food and liquids, if approved, might have increased the effectiveness of the reinforcers, but the ethical issues raised by Bragg and Wagner (1968) and Cahoo (1968) brought into question whether such means could be justified by the anticipated gains. As a result, the only deprivation experienced by the residents was the time that had elapsed since breakfast.

Conclusions

The main conclusion to be derived from this research is that maladaptive self-directed behavior can be reduced if the adaptive object-directed behavior of ambulatory profoundly retarded females 9 to 14 years of age can be increased. One way an increase in adaptive object-directed behavior can be promoted is to structure an environment that prompts and reinforces adaptive behavior. This research has shown, as Davenport and Berkson (1963) and others have, that the overall level of maladaptive behavior is lower when objects are present in the environment. This research also has shown that where availability of toys and objects alone fails to keep maladaptive self-directed behavior at a low level, the availability of toys and objects coupled with differential reinforcement of behavior involving manipulation of those toys and objects can result in further reduction of maladaptive behavior and increased adaptive behavior. Differential reinforcement appears to maintain an interaction with the toys and objects that otherwise might cease over time. In this study, enriching the environment by providing manipulable toys and objects was not sufficient to maintain interaction with the environment at a rate high enough to compete effectively with maladaptive behavior. McClannahan and Risley (1975) in their design of a living environment for nursing home residents found only a 5% increase above baseline when manipulative materials were made available on request. When the materials were made available and the residents were prompted to use them, participation increased to a mean of 54% above baseline. Similarly, the availability of manipullative objects alone does not appear sufficient to sustain a profoundly retarded individual's adaptive interaction with his or her environment. It requires prompts and differential reinforcement of such behavior. The environment must be structured so that adaptive behavior is occasioned and reinforced. Individuals, whether profoundly retarded or normal, can satiate on the novelty of stimuli over time. For the profoundly retarded, an environment must be designed in which the child can initiate behaviors that produce reinforcers. This study has shown that the assumption that profoundly retarded individuals are incapable of engaging in adaptive interactions with a novel environment is at least partially incorrect. Profoundly retarded individuals, unless severely restricted by visual and/or ambulation deficits (Guess, 1966), may be able to learn a variety of socially acceptable adaptive interactions with even more complex environments, provided such interactions are systematically prompted and reinforced. Institutional environments should be designed to be rich in opportunities for learning adaptive behaviors rather than designed to withstand the

maladaptive behaviors assumed to result inevitably from being profoundly retarded.

REFERENCE NOTES

1. Tizard, J., King, R. D., Raynes, N. V., & Yule, W. The care and treatment of subnormal children in residential institutions. In *What is special education? Proceedings of the first international conference of the association for special education,* July 1966.
2. Bensberg, G., Colwell, C., Ellis, N. R., Roos, P., & Watson, L. S. *Report on symposium on environmental modifications for the profoundly retarded.* Albany, New York: New York State Department of Mental Hygiene, 1969.
3. Baer, D. M. *The varied functions of non-reinforcement.* Paper presented at the biennial meeting of the Society for Research in Child Development, New York, 1967.

REFERENCES

Ball, T. S., Seric, K., & Payne, L. Long-term retention of self-help skill training in the profoundly retarded. *American Journal of Mental Deficiency,* 1971, **76,** 378-382.

Berkson, G., & Mason, W. A. Stereotyped movements of mental defectives: IV. The effects of toys and the character of acts. *American Journal of Mental Deficiency,* 1964, **68,** 511-524.

Bijou, S. W., Peterson, R. F., & Ault, M. H. A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *Journal of Applied Behavior Analysis,* 1968, **1,** 175-191.

Blatt, B. *Exodus from pandemonium: Human abuse and a reformation of public policy.* Boston: Allyn & Bacon, 1970.

Blatt, B., & Kaplan, F. *Christmas in purgatory: A photographic essay on mental retardation.* Boston: Allyn & Bacon, 1966.

Boer, A. P. Application of a simple recording system to the analysis of freeplay behavior in autistic children. *Journal of Applied Behavior Analysis,* 1968, **1,** 335-340.

Bragg, R. A., & Wagner, M. K. Can deprivation be justified? *Hospital and Community Psychiatry,* 1968, **19,** 53-54.

Buell, J., Stoddard, P., Harris, F. R., & Baer, D. M. Collateral social development accompanying reinforcement of outdoor play in a preschool child. *Journal of Applied Behavior Analysis,* 1968, **1,** 167-173.

Butterfield, E. C. The role of environmental factors in the treatment of institutionalized mental retardates. In A. A. Baumeister (Ed.), *Mental retardation: Selected problems in appraisal and treatment.* Chicago: Aldine, 1967.

Cahoo, D. D. Balancing procedures against outcomes. *Hospital and Community Psychiatry,* 1968, **19,** 52-53.

Cattell, P. *The Cattell infant intelligence scale.* New York: The Psychological Corporation, 1940.

Centerwall, S. A., & Centerwall, W. R. A study of children with Mongolism reared in the home compared to those reared away from the home. *Pediatrics,* 1960, **25,** 678-685.

Clarke, A. D. B., & Clarke, A. M. How constant is IQ. *Lancet,* 1953, **2,** 877.

Cleland, C. C., & Swartz, J. D. *Mental retardation: Approaches to institutional change.* New York: Grune & Stratton, 1969.

Davenport, R. K., & Berkson, G. Stereotyped movements of mental defectives: II. Effects of novel objects. *American Journal of Mental Deficiency,* 1963, **67,** 879-882.

Dentler, M. A., & Mackler, B. Effects of sociometric status on institutional pressures to adjust among retarded children. *British Journal of Social and Clinical Psychology,* 1964, **3,** 81-89.

Doll, E. A. *The Vineland social maturity scale.* Minneapolis: American Guidance Service, Inc., 1953.

Eyman, R. K., Tarjan, G., & Cassady, M. Natural history of acquisition of basic skills by hospitalized retarded patients. *American Journal of Mental Deficiency,* 1970, **75,** 120-129.

Farrell, M. S. The adverse effects of early institutionalization of mentally subnormal children. *Journal of Diseases of Children,* 1956, **91,** 278-281.

Flavell, J. E. Reduction of stereotypies by reinforcement of toy play. *Mental Retardation,* 1973, **11,** 21-23.

Foxx, R. M., & Azrin, N. H. The elimination of autistic self-stimulatory behavior by overcorrection. *Journal of Applied Behavior Analysis,* 1973, **6,** 1-14.

Gewirtz, J. L. Plans for the construction of a portable one-way observation booth. *Child Development,* 1952, **23,** 307-314.

Gorton, C. E., & Hollis, J. H. Redesigning a cottage unit for better programming and research for the severely retarded. *Mental Retardation,* 1965, **3,** 16-21.

Grossman, H. J. (Ed.) *Manual on terminology and classification in mental retardation.* Washington, D.C.: American Association on Mental Deficiency, 1973.

Guess, D. The influence of visual and ambulation restrictions on stereotyped behavior. *American Journal of Mental Deficiency,* 1966, **70,** 542-547.

Guess, D., & Rutherford, G. Experimental attempts to reduce stereotyping among blind retardates. *American Journal of Mental Deficiency,* 1967, **67,** 984-986.

Guess, D., Rutherford, G., Smith, J. O., & Ensminger, E. Utilization of subprofessionals in teaching language skills to mentally retarded children: An interim report. *Mental Retardation,* 1970, **8,** 17-23.

Guess, D., Smith, J. O., & Ensminger, E. E. The role of the non-professional in teaching language skills to mentally retarded children. *Exceptional Children,* 1971, **37,** 447-453.

Gunzburg, A. L. Architecture and mental subnormality: Sensory experiences in the architecture for the mentally subnormal child. *Journal of Mental Subnormality,* 1968, **4,** 57-61.

Hart, B. M., Reynolds, N. J., Baer, D. M., Brawley, E. R., & Harris, F. R. Effect of contingent and non-contingent social reinforcement on the cooperative play of a preschool child. *Journal of Applied Behavior Analysis,* 1968, **1,** 73-76.

Haywood, H. C., & Tapp, J. T. Experience and the development of adaptive behavior. In N. R. Ellis (Ed.), *International review of research in mental retardation* (Vol. 1). New York: Academic Press, 1966.

Heber, R. A. A manual on terminology and classification in mental retardation. *Monograph Supplement, American Journal of Mental Deficiency,* 2nd ed., 1961.

Hollis, J. H. The effects of social and nonsocial stimuli on the behavior of profoundly retarded children: Part I. *American Journal of Mental Deficiency,* 1965, **69,** 775-771. (a)

Hollis, J. H. The effects of social and nonsocial stimuli on the behavior of profoundly retarded children: Part II. *American Journal of Mental Deficiency,* 1965, **69,** 772-789. (b)

Hollis, J. H. Chlorpromazine: Direct measurement of differential behavioral effect. *Science,* 1968, **159,** 1487-1489.

Hollis, J. H. Analysis of rocking behavior. In *Quality of life in severely and profoundly mentally retarded people: Research foundations for improvement.* AAMD Monograph No. 3, Washington, D.C.: American Association on Mental Deficiency, 1978.

Hutt, C., & Hutt, S. J. Effects of environmental complexity on stereotyped behaviors in children. *Animal Behavior,* 1965, **13,** 1-4.

Kaufman, M. E. The effects of institutionalization on development of stereotyped and social behaviors in mental defectives. *American Journal of Mental Deficiency,* 1967, **71,** 581-585.

Kimbrell, D. L., Kidwell, F., & Hallum, G. Institutional environment developed for training severely and profoundly retarded. *Mental Retardation,* 1967, **5,** 34-37.

Klaber, M. M., Butterfield, E. C., & Gould, L. J. Responsiveness to social reinforcement among institutionalized retarded children. *American Journal of Deficiency,* 1969, **73,** 890-895.

Koegel, R. L., Firestone, P. B., Kramme, K. W., & Dunlap, G. Increasing spontaneous play by suppressing self-stimulation in autistic children. *Journal of Applied Behavior Analysis,* 1974, **7,** 521-528.

Lindsley, O. R. Direct measurement and prosthesis of retarded behavior. *Journal of Education,* 1964, **147,** 62-81.

MacAndrew, C., & Edgerton, R. The everyday life of institutionalized idiots. *Human Organization,* 1964, **23,** 312-318.

McClannahan, L. E., & Risley, T. R. Design of living environments for nursing home residents: Increasing participation in recreation activities. *Journal of Applied Behavior Analysis,* 1975, **8,** 261-268.

Mulhern, T., & Baumeister, A. A. An experimental attempt to reduce stereotypy by reinforcement procedures. *American Journal of Mental Deficiency,* 1969, **74,** 69-74.

Pasquale, S., Boroskin, A., & Ross, R. T. TMR self-help skills: Public school vs. state hospital. *American Journal of Mental Deficiency,* 1971, **76,** 261-262.

Powell, J., Martindale, A., & Kulp, S. An evaluation of time-sample measures of behavior. *Journal of Applied Behavior Analysis,* 1975, **8,** 463-469.

Quilitch, H. R., & Risley, T. R. The effects of play materials on social play. *Journal of Applied Behavior Analysis,* 1973, **6,** 573-578.

Repp, A. C., & Dietz, S. M. Reducing aggressive and self-injurious behavior of institutionalized retarded children through reinforcement of other behaviors. *Journal of Applied Behavior Analysis,* 1974, **7,** 313-325.

Repp, A. C., Dietz, D. E. D., Boles, S. M., Dietz, S. M., & Repp, C. F. Differences among common methods of calculating interobserver agreement. *Journal of Applied Behavior Analysis,* 1976, **9,** 109-113.

Rollings, J. P., Baumeister, A. A., & Baumeister, A. A. The use of overcorrection procedures to eliminate the stereotyped behaviors of retarded individuals. *Behavior Modification,* 1977, **1,** 29-46.

Slobody, L. B., & Scanlan, J. B. Consequences of early institutionalization in mental retardation. *American Journal of Mental Deficiency,* 1959, **63,** 971-974.

Spradlin, J. E., & Girardeau, F. L. The behavior of moderately and severely retarded persons. In N. R. Ellis (Ed.), *International review of research in mental retardation* (Vol. 1). New York: Academic Press, 1966.

Thompson, C., Holmberg, M., & Baer, D. M. A brief report on a comparison of time-sampling procedures. *Journal of Applied Behavior Analysis,* 1974, **7,** 623-626.

Received September 24, 1979
Final acceptance April 7, 1980