

THE UNIVERSITY OF MANITOBA

VARIABLE RATIO PUNISHMENT WITH A MILD PUNISHER TO
DECREASE PERSISTENT UNDESIRABLE BEHAVIOR DURING
POSTURE TRAINING WITH PROFOUNDLY RETARDED ADULT FEMALES

by

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ABSTRACT

The present study examined (1) the effectiveness of a variable ratio (VR) schedule of punishment using a mild punishing stimulus (a hand slap with a newspaper) in reducing a variety of persistent, high rate behaviors in four profoundly retarded females, (2) the generalization effects of the punishment contingency on the punished behaviors in another setting, (3) generalization effects of the punishment contingency on other undesirable, but unpunished behaviors in the same setting, and (4) unplanned punishment side effects on an alternative, desirable behavior.

The VR6 schedule of punishment resulted in a decrease in rate of punished responses for all four subjects. Only one subject did not show a decrease to a near zero level of responding. An FR1 schedule further decelerated the behavior of one subject while it remained at near zero levels for the other three. Punishment failed to decelerate responding of the punished behaviors in another setting where the punishment contingency was not in effect. A decrease, however, in a second undesirable but unpunished behavior occurred in three subjects in the same setting. For the fourth subject, the base rate was too low to evaluate a punishment generalization effect. A desirable punishment side effect on the duration of the alternative, desirable sitting posture occurred for all subjects.

The results are discussed along with the implications of the use of punishment on clinically important behavioral problems in populations whose members are unable to comprehend the goals and



methods of behavior therapy and have no control over the contingencies
controlling their lives.

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CHAPTER I

INTRODUCTION

B. F. Skinner's best-selling book Beyond Freedom and Dignity raises social, ethical, and philosophical implications of a technology based on principles derived from the experimental analysis of behavior known as operant conditioning. Like Darwin's evolutionary theory which attributes the survival of species to selection of species' adaptive characteristics, Skinner's operant theory states that the environment which includes social and physical events selects behavior, after it occurs, by means of reinforcement. There are two kinds of reinforcement: positive and negative. As defined by Skinner (1953) a positive reinforcer is "... any stimulus the presentation of which strengthens the behavior upon which it is made contingent (p. 185)." A negative reinforcer is "... any stimulus the withdrawal of which strengthens behavior (p. 185)."

When operant conditioning principles are applied to problems of human behavior, they are sometimes referred to as behavior modification. Behavior modification, however, is a rubric encompassing a variety of techniques employed for the purpose of changing behavior. These techniques have included aversive conditioning (such as delivering shock to a child molester each time a picture of a child is flashed), behavioral drugs (tranquilizers, energizers, and nausea inducing agents), implanted electrodes, and brain surgery. In the popular press, Skinner's name has been identified with behavior

modification, and by implication, the whole array of technological devices employed in the modification of behavior, have been attributed to operant conditioning. Time magazine (March 11, 1974), in a review of current behavior modification programs in prisons says, "Using the carrot and stick approach.... or aversion therapy.... the various approaches draw on B. F. Skinner's positive and negative reinforcement precepts...." The article then questions, on legal and ethical grounds, uses of aversion therapy, behavioral drugs, and brain surgery. These concerns are very real, but Skinner warned us of them in Beyond Freedom and Dignity. Indeed, the whole thrust of the book was aimed at alerting its readers to the need of designing a culture with built-in controls to prevent an individual or small group using despotically the power conferred by a science of behavior. Nevertheless, the response to the book was a storm of controversy approaching religious fervor. Some critics simply dismissed it as nonsense, but many evoked images of 1984 and A Clockwork Orange whereby the principles of operant conditioning will be used to impose tyrannical and totalitarian methods by aversive means.

Skinner has always been against aversive control, and in his book, he talks more explicitly than ever before of the consequences and alternatives to punishment: that punished behavior reappears in the absence of the punishing agent, that it generates attempts to escape altogether the punisher, that the punished individual might retaliate or show signs of complete behavioral suppression (cowering) and develop feelings of anxiety and guilt, and worst of

all, that although punishment can eliminate unwanted behavior almost immediately, its very effectiveness reinforces the punishing agent (such as parents, teachers, jailors, psychotherapists) thus escalating the use of aversive control within a social system. A culture which primarily sanctions aversive control methods would probably foster suppression, lethargy, withdrawal, and apprehension, characteristics which lead to that culture's demise, says Skinner.

As an alternative, Skinner proposes influencing behavior by positive reinforcement. Positive reinforcement can be used to develop rich and diverse modes of behaving within a culture or individual, thus ensuring that individuals have many choices open to them, all of which are things a person more or less wants to do. Such a culture would be characterized by spontaneity, openness, and expressiveness of its members, and by positive liberty (having many desirable alternatives to choose from) instead of negative liberty (freedom achieved by escaping aversive methods of control). Skinner warns, however, that there is a real danger in the use of positive control, namely that it lacks built-in countercontrol measures. Some of Skinner's critics recognize this and conjure up images of Brave New World in which benevolent despots rule by invisible, insidious positive reinforcement.

Regardless of whether there is a need to be concerned about the future ushering in 1984, Clockwork Orange, or Brave New World, operant behavioral scientists are playing a key role in deciding which behavioral control techniques are to be incorporated in the design of

contingencies operating in current psychiatric, educational, and industrial experiments, and recently there has been an expansion at the civic level to what Comfort (1973) calls semimacro experiments such as in antilittering campaigns, commuter travelling habits, and traffic control.

Since a characteristic of the followers of Skinner is their rejection of the use of punishment and other aversive control techniques, it is an area which is sparsely researched relative to its social implications, but, ironically, is fairly well reviewed (Azrin & Holz, 1966; Brush, 1971; Campbell & Church, 1969; Gardner, 1969; Johnston, 1972; Solomon, 1964).

Addressing himself to the current assumption that aversive methods of control should be excluded from social experiments, Wheeler (1973) comments that, "... the choice for or against the practice (applications of positive reinforcement and punishment techniques) would always be one in which the possible deferred aversive effects of positive reinforcement would have to be measured against the possibly amplified deferred reinforcements of immediate aversive means (p. 16)." It is important, therefore, that decisions to accept or reject punishment methods be based on empirical evidence and not pre-scientific opinions.

Within the broad concern for the problems of whether punishment should be an approved social practice, and the more narrow concern of how to modify objectionable behaviors of the severely and profoundly retarded, the present study seeks to add to the body of

empirical evidence addressed to the questions, "Under what conditions is punishment effective?" and "Are the effects of punishment deleterious?"

CHAPTER II

REVIEW OF THE LITERATURE

A Functional Analysis of Punishment

The belief that punishment is a procedure to be avoided altogether because it suppresses behavior only temporarily and produces the undesirable side effects of generating unpleasant emotional states such as anxiety and guilt, aggressiveness, behavioral suppression, and attempts to escape arose out of the early work by Estes (1944), Skinner (1938), and Thorndike (1932). Following Thorndike's finding that verbal "annoyers" were ineffective in decelerating responding, he claimed that punishment did not work, because it simply suppressed responding just as physical restraint does. Skinner (1938) found temporary suppression as well with his bar-slap experiment, and from more extensive experimentation, Estes (1944) concluded that non-contingent aversive stimulation is as effective in suppressing behavior as contingent stimulation.

Definitions of punishment have varied. Included are statements referring to subjective states, as in the "annoying after effect" of Thorndike (1911). Other types of definitions designate punishment as a drive variable (Dollard & Miller, 1950) or in terms of a procedural definition of presenting a noxious stimulus. In the latter category, one definition of punishment is an aversive stimulus following a response (Dinsmoor, 1954; Keller & Schoenfeld, 1950; Skinner, 1953). Skinner (1953) then defines an aversive stimulus in

terms of "... any stimulus the withdrawal of which strengthens behavior (p. 185)."

On the other hand, rather than making inferences about inner states or the nature of the punishing stimulus, Azrin & Holz (1966) prefer to look at behavior itself for a definition of punishment. Hence, their definition is "... a reduction of the future probability of a specific response as a result of the immediate delivery of a stimulus for that response (p. 381)." One reason why these authors prefer this definition is that it permits the response reduction by punishment to be considered as a primary process. Another important characteristic of Azrin & Holz's (1966) definition is that it makes no reference to subjective pleasant or unpleasant aftereffects from presentation of the punishing stimulus. This approach to defining punishment, which is favoured by most researchers (e.g. Church, 1963; Deese, 1958), has been described as functional (Fowler, 1969) since in addition to not being concerned about the noxiousness of the punishing stimulus, it is not necessary to record "hypothesized - but thus far unrecorded - escape responses that are presumed to produce the response reduction" (Azrin & Holz, 1966, p. 382).

Since current findings (Azrin & Holz, 1966; Hoffman & Fleshler, 1959; Meyer, Cho, & Wesemann, 1960) favour a primary process interpretation of punishment, the position of this paper will be that of Azrin & Holz (1966).

The following discussion of the variables of which response reduction is a function, will be presented according to the categories

established by Azrin & Holz (1966). For the purposes of research, the authors address themselves to parameters of the ideal punishing stimulus, variables related to the administration of punishment, reinforcement variables influencing punishment effects, and characteristic effects of the punishment process. They discuss, in addition, typical emotional and behavioral side effects of the punishment procedure.

Variables Related to the Punishing Stimulus

Ideally, the punishing stimulus should be capable of being precisely measured. In addition, the duration of application of the punishing stimulus with the subject should be constant in order to prevent undetected escape by the subject which would render the data meaningless. The third requirement is that no unauthorized means of escape by the subject be possible. For example, a rat learned to press a response lever with its foot while lying on its back on an electrified grid floor, thus eliminating the possibility of being shocked. When a specified escape response was provided, the overall reductive effects were nullified (Azrin, Hake, Holz, & Hutchinson, 1965). Johnston (1972) provides an analogy in the applied situation. When time-out from positive reinforcement, defined here as a period of time following a response in which no reinforcement is delivered for that response, is the punisher, all possible reinforcing objects in the time-out room should be removed and no unauthorized means of terminating time-out should be available.

Another requirement of the ideal punishing stimulus for

the purpose of research is that there be few skeletal reactions to the stimulus. Thus, if gross skeletal reactions are elicited which are incompatible with the punished response, response decrement will be due to the elicited response and not a direct result of the punisher. Finally, the punishing stimulus should be capable of being varied over a wide range of values.

In animal research, the first and second most frequently used stimuli are electric shock and noise. Other primary aversive stimuli reported have been (1) a blast of air (used with cats), (2) a toy snake (used with monkeys) (Masserman, 1946), and (3) a bar-slap (used with rats) (Skinner, 1938). In applied research (Johnston, 1972), a variety of stimuli have been shown to be effective punishers: slaps (Birnbrauer, 1968), noise (Barrett, 1962; Flanagan, Goldiamond, & Azrin, 1958; Goldiamond, 1967), hair pulls (Banks & Locke, 1966), and shock (Birnbrauer, 1968; Kircher, Pear, & Martin, 1971; Liversedge & Sylvester, 1960; Lovaas & Simmons, 1969; Powell & Azrin, 1968; Risley, 1968; Tate & Baroff, 1966).

Electric shock and noise most nearly meet the above criteria of the ideal punishing stimulus, but shock, in particular, has the disadvantage of allowing unauthorized escape and permitting variability in the actual stimulation reaching the subject. The importance of controlling the intensity of shock appears not to be as important in avoidance conditioning where beyond a minimal intensity, no change in rate of avoidance response is observed (Boren, Sidman, & Herrnstein, 1959). However, punished responses have been shown very

sensitive to shock intensity where a 20 percent increase in intensity has produced a 50 percent reduction in rate of the punished responses (Hake & Azrin, 1963). Noise has proven effective and does not have the disadvantages of shock, but noise is effective only within a narrow range (Azrin & Holz, 1966).

Conditioned punishing stimuli are the most frequently used punishers in natural social settings and acquire their aversive properties through associations with other conditioned or primary aversive stimuli. They are, however, seldom used in research to obtain a punishing effect since they must continue to be paired with a primary aversive stimulus to maintain their suppressive effect (Hake & Azrin, 1965).

In the applied setting a frequently used technique to produce deceleration of responding is time-out whereby the individual is either removed from the social context to another barren physical environment or some aspect of the social context assumed to be reinforcing the response is removed from the individual. Azrin & Holz (1966) refer to time-out as a punisher; Johnston (1972), however, refers to time-out as an extinction period. When signalled time-out was made contingent upon key-pecking it failed to produce a response decrement (Azrin & Holz, 1966). Ferster (1958), however, found time-out suppressed responding, provided it was preceded by a pre-time-out stimulus, and then responding decelerated only during the pre-time-out stimulus. Nonresponding during the pre-time-out stimulus resulted in nonpresentation of time-out thus allowing the organism an

alternative mode of behavior. This finding was later supported by Holz, Azrin, & Ayllon (1963).

Another means whereby a response decrement can be achieved in human settings is by response cost (Weiner, 1962), whereby a conditioned reinforcer is removed contingent upon a specified response. Conditioned reinforcers are usually in the form of tokens or points.

Variables Related to the Administration of Punishment

Several variables relating to the manner in which the punishing stimulus is administered have been found to affect the degree of response decrement obtained.

Manner of introduction. Masserman (1946), Azrin, Holz, & Hake (1963), and Brethover & Reynolds (1962) have reported gradual increments in intensity of the punishing stimulus to be less effective than if punishment is introduced at the onset at the highest feasible intensity. Apparently, adaptation to painful stimuli occurs with initial low intensities which are slowly increased over a period of time.

Immediacy of introduction. As in the case with positive reinforcement, punishment appears to be most effective if delivered immediately following the specified response (Azrin & Holz, 1966) and, preferably, at the onset rather than offset of the response (Birnbauer, 1968).

Intensity of punishing stimulus. Response reduction has been shown to be greatly affected by the intensity of the punishing stimulus: the greater the intensity of the punishing stimulus, the

greater the reduction of punished responses. When high intensities of electric shock are used, suppression is virtually complete (Azrin, 1959). Air blasts (Masserman, 1946) have completely eliminated responding, but no variations in the intensity of the air blast was attempted. High intensity of noise (138 decibels), however, achieved only an 80 percent suppression in pigeons (Holz & Azrin, 1962), and bar-slaps (Skinner, 1938) failed to effect complete suppression, but no experimental manipulations were made of the intensity of the bar-slap.

Schedule of punishment. Studies of intermittent punishment have shown response decrement to be a function of the proportion of punished responses: the greater the number of punished responses the greater the reduction in responding (Azrin, Holz, & Hake, 1963; Estes, 1944; Filby & Appel, 1966; Kircher, Martin, & Pear, 1971; McMillan, 1967; Thomas, 1968; Zimmerman & Baydan, 1963; Zimmerman & Ferster, 1963). Kircher, Pear, & Martin (1971) found a fixed-ratio 1 schedule more effective than a fixed-ratio 2 or a fixed-ratio 4 schedule in reducing errors on a picture naming task with retarded children. In fixed-ratio laboratory studies, the response pattern remained the same although an overall response decrement occurred (Azrin, Holz, & Hake, 1963).

In fixed-interval schedules of punishment the response pattern produced is a negative acceleration through the interval with the overall rate related inversely to the frequency of punishment (Azrin, 1956; Hunt & Brady, 1955).

One study comparing the effects of variable-interval punishment and fixed-interval punishment found the former to be more effective (Azrin, 1956).

In the applied setting, Clark, Rowbury, Baer, & Baer (1973) investigated the effectiveness of a fixed-ratio 1 schedule of time-out contingent upon 10-second intervals in which disruptive behavior occurred. The fixed-ratio 1 schedule was compared to three variable-ratio schedules (VR3, VR4, and VR8) and a schedule of differential punishment of high rates. The results of this study indicated that the variable-ratio 3 and 4 schedules and the differential punishment of high rates to be as effective as the fixed-ratio 1 schedule in reducing 10-second intervals of disruptive behavior. The variable-ratio 8 schedule, however, did not produce a substantial decrement. These findings led the authors to conclude that possibly a non-linear relationship exists between the probability of punishment and response frequency and that low rates of disruptive behavior could be maintained by intermittent schedules of time-out which involve a probability of time-out of 0.23 or greater.

The importance of the effects of schedules of punishment cannot be over emphasized. Recent findings have shown that schedule effects can override the effect of the punishing stimulus. Byrd (1969), Kelleher & Morse (1968), McKearney (1969), and Morse & Kelleher (1966) have demonstrated that responding can be maintained by contingent delivery of electric shock alone. Kelleher & Morse (1968) showed that electric shock on a fixed-interval schedule

controlled responding in the same way as positive reinforcement: increases and decreases in shock intensity produced increases and decreases, respectively, in responding and the pattern of responding was positively accelerated through the interval.

Discontinuous periods of punishment. The ongoing punishment process has been interrupted in two ways: (1) the experimental animal was removed from experimental sessions for extended periods of time (Azrin, 1959, 1960; Masserman, 1946), and (2) punishment was temporarily discontinued while positive reinforcement was continued. In both cases, reintroduction of the punishment paradigm produced as great (Brethower & Reynolds, 1962; Masserman, 1946), or greater (Azrin, 1959; 1960) reduction in responding.

Reinforcement Variables Influencing Punishment Effects

Since a response which is not reinforced will extinguish, the punishment of an existing response implies that the response is being reinforced on some schedule (Dinsmoor, 1952) or is in the process of being extinguished. When a response is both reinforced and punished, the effects tend to counteract each other (Johnston, 1972).

When a fixed-ratio 1 schedule of punishment is superimposed on a fixed-ratio schedule of reinforcement, the effect is to extend the post-reinforcement pause and slightly decrease the rate of the ratio run (Azrin, 1959).

A fixed-ratio 1 schedule of punishment on responding maintained by fixed-interval reinforcement results in a reduction of the overall number of responses, but no disturbance in the characteristic

positively accelerated "scalloped" interval (Azrin & Holz, 1961).

Fixed-ratio 1 punishment on responding maintained on a variable-interval schedule also produces a general response decrement with no disturbance of the constant response rate (Azrin, 1960).

There have been no studies investigating the effects of fixed-ratio 1 punishment on variable-ratio maintained responding, but presumably the effects would be similar to punishing variable-interval behavior (Johnston, 1972).

Reinforcement frequency. Fixed-ratio 1 punishment affects the number of reinforcements which accrue to the subject in the following manner: (1) decrease of reinforcement frequency under ratio schedules, (2) increase of reinforcement frequency under differential reinforcement of low rates, and (3) little change under interval reinforcement (Azrin & Holz, 1966).

Motivation to respond. Findings from the animal studies would indicate that increased food deprivation weakens the effectiveness of the punishing stimulus (Azrin & Holz, 1966). One study (Lovaas & Simmons, 1969), however, in the applied area did not support this finding.

Alternative responses available. In order to obtain the greatest effect from a punishment procedure, an alternative response which earns the same reinforcement as the punished response has been shown to dramatically decelerate the punished response (Azrin & Holz, 1966; Herman & Azrin, 1964; Holz, et al., 1963). The finding has important implications for maximizing effects of punishment in natural social settings.

Escape from a punishing stimulus. A similar procedure to providing an alternative response which earns reinforcement is to provide an available opportunity to emit the response without punishment (Azrin & Holz, 1966). Such an alternative escape has been shown to greatly facilitate suppression of the punished response in the situation in which punishment occurs (Azrin et al., 1965).

Characteristic Effects of the Punishment Process

Duration of effect. Findings from the animal literature (Azrin & Holz, 1966) indicate complete irreversibility of response reduction provided that responding has been completely eliminated. Total suppression is a function of stimulus intensity and once zero responding is achieved, the organism never has the opportunity to detect the absence of the punishment contingency. Rapidity of response decrement is a function as well of stimulus intensity. Most animal studies report immediate reduction. Recovery of punishment while the punishment paradigm is in effect typically follows mild punisher intensities (Azrin, 1960). If the punished response increases following removal of the punishment procedure, typically, responding accelerates above base rates before returning to the baseline. Azrin & Holz (1966) refer to this as punishment contrast. Fixed-ratio 1 punishment, although producing greater response suppression, typically results in more rapid recovery following removal of the punishment procedure than does intermittent punishment. Johnston (1972) in his review of the literature concluded that postpunishment recovery is probably the result of specific, experimenter controlled variables

since applied studies with humans have not always found this phenomenon. Johnston attributes the greater duration of effect with humans to uncontrolled variables (e.g. attention from others when the undesirable behavior is eliminated) operating in the natural social setting.

Generality of effects. Responses punished in the presence of one set of stimuli and not in the presence of another result in response decrement to the former (Azrin & Holz, 1966; Terrace, 1966). The animal literature indicates that initially there is a generalization of suppression to the safe period which disappears in time (Azrin, 1956). The clinical implications are clear: if a reduction in responding is desired across settings, then punishment must be programmed to occur in the presence of stimuli common to all settings (Baer, Wolf, & Risley, 1968).

Punishment as a discriminative stimulus. The punishing stimulus can acquire discriminative properties which signal further punishment, reinforcement for the next response, or that a period of extinction is in progress (Azrin & Holz, 1966). If the punisher signals that reinforcement is forthcoming or that the following response will go unpunished, the effects of the punishment paradigm can be negated. Ideally, the punisher should signal a period of extinction or further punishment.

Undesirable side effects. A frequently cited problem associated with the use of punishment is that it generates attempts to escape the punishing stimulus (Azrin & Holz, 1966; Skinner, 1953; 1968) and disrupts ongoing social relationships (Azrin & Holz, 1966).

Of the studies reviewed by Johnston, only one (Powell & Azrin, 1968) reported this problem.

Another problem is that of elicited and operant aggression (Azrin & Holz, 1966). Although this effect has been reported in the animal literature (Azrin & Holz, 1966), no applied studies reported elicited aggression (Johnston, 1972). On the contrary, many report unplanned improvements in the subjects' behavior (Gardner, 1969; Lovaas & Simmons, 1969; Risley, 1968). In the applied literature, the lack of undesirable emotionality and aggressiveness might be a function of the opportunity for an alternative response to earn reinforcement as well as the relatively mild intensities of the punishing stimuli and stimulus control.

One closed social system which has been the locus for extensive research into the effectiveness of operant conditioning principles is in institutions for the mentally retarded. In some respects institutions for the retarded which have widespread and highly developed token economies approximate the contingencies which many fear will characterize the social system of the future: its members have no means of countercontrol, positive reinforcement is the dominant method of teaching and influencing behavior, and physically administered punishment is banned altogether except in the most dire cases such as with self-abusive behavior and, in these cases, a severely painful punishing stimulus like electric shock typically is used.

The available alternatives to punishment, however, for decreasing undesirable behavior of severely and profoundly retarded persons are not always suitable. One frequently employed alternative for treating behavior problems with this population is the reinforcement of desirable behavior incompatible with the problem behavior, but for some persons, in particular those who are unresponsive, their deficient behavioral history has resulted in few, if any, powerful reinforcers which can be used to generate and maintain desirable behavior. Conversely, there is the difficulty of identifying the reinforcers currently maintaining unwanted behavior for the purpose of removing them and thus extinguishing the behavior. Time-out from positive reinforcement is frequently ineffective, and when the available reinforcers are weak, their removal in a punishment paradigm will produce no results.

Unfortunately, since many objectionable behaviors common to severely and profoundly retarded persons are not sufficiently injurious to the self and others to demand the use of intense punishing stimuli, and are resistant to positive forms of control, they are likely to persist. This problem works to the retarded persons' disadvantage because the less deviant and obnoxious a retarded individual can be made to behave, the more likely he is to receive favourable attention from staff and friends.

It is conceivable that finding and controlling powerful reinforcers would pose similar difficulties for influencing the behavior of individuals in the broader social context if positive

reinforcement was the only sanctioned method of modifying behavior.

The evidence reviewed would suggest that relative to other procedures for effecting response decrement (stimulus change, extinction, satiation, physical restraint, and reinforcing an incompatible response), none are as effective in terms of immediacy, endurance, and generality as the proper use of punishment (Azrin & Holz, 1966; Holz & Azrin, 1963). Nevertheless, Gardner (1969) noted the lack of investigation into the effectiveness of punishment procedures on clinically important behavioral problems, and Johnston (1972) re-emphasized this deficit delineating, in particular, a total absence of systematic studies of the effectiveness of the variable-ratio schedule of punishment in spite of the fact that, in complex social settings, most human behavior is punished on a variable-ratio schedule.

CHAPTER III

STATEMENT OF THE PROBLEM

The purpose of this study was to evaluate the effectiveness of a variable-ratio 6 schedule of punishment in eliminating a variety of undesirable behaviors occurring at a high rate in profoundly retarded institutionalized females. The evaluation involved comparing conditions of no punishment to conditions where the punisher was delivered on a variable-ratio schedule and to a subsequent condition in which the punisher was delivered on a fixed-ratio 1 schedule during posture training classes.

Additional purposes were to assess the effects of the punishment procedure delivered during classroom sessions on the punished behavior in another setting where no contingencies existed; the effects of punishment on other undesirable responses occurring during posture training classes, but which were not punished; whether punishment would enhance or hinder the performance of the subjects on the correct sitting posture being trained even though delivery of punishment was independent of the posture training task.

CHAPTER IV

METHOD

A. Subjects

Four adult females, residents of Cedar Cottage, a self-contained unit of the Manitoba School for the Retarded, served as subjects. Chronological ages, I.Q.'s (Stanford Binet), social ages, diagnoses, and years of institutionalization are summarized for each subject in Table 1. All were profoundly retarded according to the A.A.M.D. classification of retardation.

Each subject had a three year history of participation in a variety of behavior modification programs for training self care and academic skills such as grooming, toileting, dressing, and object identification. In particular, the subjects had six months of prior training in a class to teach appropriate posture. It was on the basis of the experimenter's prior experience with the subjects during posture training that they were selected for this study from eight students in the class. The criteria for their selection was that they had to emit at least two undesirable behaviors each of which was objectionable due to the high rate of the behavior, had interfered with their learning appropriate sitting posture, or was considered offensive by social normative standards.

Kathy had some speech and understood instructions. Brenda had minimal speech although it was inappropriate to the situation and

TABLE 1

A Summary of the Institutional History of Retarded Females
Participating in Study

Subject	Chronological Age	Diagnosis	Social Age	I.Q.	Yrs. in Institution
Kathy	20 years	encephalopathy	3.7 years	14	6 yrs.
Brenda	20 years	phenylketonuria	2 years	-	8 yrs.
Eleanor	24 years	cultural familial retardation	4.5 years	-	3 yrs.
Mary	24 years	cultural familial retardation	1.5 years	-	14 yrs.

she seldom responded to instructions. Mary appeared to be partially deaf and had no speech. Eleanor had little speech, but appeared to understand most instructions.

B. Setting and Apparatus

The classroom in which sessions were held measured approximately 20 ft. by 15 ft. Sessions were conducted with two subjects at a time and the two chairs in which the subjects sat were placed against one wall. Each chair was fitted with a peg board attached to the right side of the seat of the chair. The experimenter's chair was placed in front of and between the subjects' chairs at a distance of three feet. An additional chair placed to the experimenter's left held a red stimulus light. A flat, thin board holding data sheets was attached to the right side of the experimenter's chair. A reinforcer sampling tray with five compartments, one for multi-coloured pegs and four for candies and cookies, was placed on a small stool located between the subjects' chairs. The wall facing the subjects was equipped with an observation window and a cupboard housing the experimental apparatus. A clock was mounted on the wall facing the teacher for purposes of timing the subjects' duration of correct sitting posture. Also on this wall was a list of rules of the posture training procedure. An observation room with a one-way mirror overlooked the classroom. Mounted on the one-way window in the observation room was a walkie-talkie within reach of the observers. During the punishment conditions, the experimenter wore a belt from which hung

a walkie-talkie with an ear plug and the punishing stimulus. The punisher was a rolled newspaper inserted into a cardboard tube around which was wrapped more newspaper. The tightly rolled newspaper measured 15 in. in length and $2\frac{1}{2}$ in. in diameter. The observers behind the one-way window had clip boards holding data sheets indicating which responses were to be punished.

The television dayroom in which generalization sessions were conducted, measured 40 ft. by 15 ft. and was furnished with three vinyl covered sofas, two vinyl covered easy chairs, a variety of straight back chairs, four coffee tables, two tables located in the center of the room, a television set, and a hi-fi system.

C. General Procedures

Sessions

Four, 20-minute daily classroom sessions were run Tuesday to Friday, two subjects per session (Kathy and Brenda; Mary and Eleanor). In addition, subjects were observed daily, Tuesday to Friday, during an eight-minute pre-session period and an eight-minute post-session period in the television dayroom where they spent their free time mingling with other residents of the cottage.

Correct Sitting Posture

Correct sitting was defined as sitting with (a) one leg crossed over the other at the knees, (b) with one foot flat on the floor pointed forward, (c) the hands in the lap either clasped or with one hand placed on the other, (d) the shoulders back with the shoulder

blades touching the chair back, and (e) the head held straight with the jawline angled slightly less than the horizontal plane. The head position proved a difficult discrimination for some subjects and thus a shaping procedure was used with the first step being that the back of the head touched the wall. The subjects then were required to relax this position until the jawline conformed to (e) above.

Posture Training Procedure

The posture training procedures were largely those which had been standardized during the posture training class which had been in operation during the prior six months. The exception was that in the present study, duration of correct sitting was an added requirement. At the conclusion of the six month class, the level of the performance of the subjects used in this investigation was evaluated. Mary and Brenda had failed to respond to the modelled correct sitting posture as well as the criterion command, "Sit up straight." Kathy and Eleanor imitated the modelled behavior and responded to the verbal instruction, but required additional verbal prompts such as, "Hold your head up."

Prior to the two morning sessions and the two afternoon sessions, the experimenter rehearsed the posture training procedures to control for keeping procedures as constant as possible. The classroom observers brought two subjects per session into the classroom, seated them in their chairs, and left the room closing the door behind them. The observers then signalled the experimenter to enter the room at the onset of a session. Seated in front of the subjects, the

experimenter presented trials alternating between individuals. One trial consisted of saying the subject's name, then modelling the correct posture followed by the verbal instruction, "Sit up straight." If a subject failed to respond to the initial command, "Sit up straight," or only partially responded, the experimenter verbally prompted the subject to correct the body part in question; for example, "Put your hands in your lap. Cross your legs." If a subject still failed to respond, the verbal prompt(s) was repeated and physical guidance was used to achieve the correct posture. When the subject was sitting appropriately, the experimenter switched on the red stimulus light and timed the subject to criterion duration. While timing the subject and modelling correct sitting posture, the experimenter smiled at the subject with the mouth closed. If the subject maintained the correct posture for the criterion time, the experimenter switched off the light, smiled broadly, and said, "Good girl, (subject's name), take a peg." If a subject failed to achieve the correct posture or to maintain the correct posture to criterion duration, the stimulus light was switched off, the experimenter looked away from the subject and presented a trial to the next subject. Subjects exchanged pegs for a choice of candies and cookies on a 5:1 pegs/edible reinforcer ratio. Since it was possible that some of the undesirable behaviors under study were respondent in nature (e.g. grunting) and could be a function of reinforcement and subject-experimenter interaction, the experimenter never handed a peg or edible to the subject, but required that she take her peg or candy

from the reinforcer tray located on a small stool placed between the subjects. Additionally, care was taken to never give tactile reinforcement to subjects.

At the outset of the study, the first step in shaping duration of correct sitting was two seconds. When a subject had successfully maintained criterion duration for three consecutive trials, the criterion was raised by two seconds. If a subject failed to meet the new criterion, it was lowered to the last completed step. If a subject met the raised criterion duration on the next trial, but failed to meet it on the second or third trials, three successive failures to meet criterion were required before moving back to the last completed step. These procedures remained constant throughout all conditions.

A procedural modification had to be introduced for two subjects after introduction of the first punishment condition. Eleanor and Brenda would not take pegs for correct responding at the beginning of the punishment phase when they came into frequent contact with the punishing stimulus. As a result, a limited hold of 5 seconds was imposed for peg taking following the instruction, "Good girl, take a peg."

Observation and Recording Procedures

During practice sessions prior to the onset of the study, six observers recorded the undesirable behaviors which would be punished until inter-observer agreement of 85% or better was reached.

Session observers. During posture training sessions in the

classroom, from the adjacent observation room, two observers recorded undesirable behaviors continuously on a 1:1 observer/subject ratio and alternated observing subjects over sessions.

Generalization test observers. The other four observers were assigned to television dayroom pre-test and post-test observation periods. During these generalization sessions, two observers recorded the undesirable behaviors of four subjects during an observation period. Each observer was assigned two subjects and recorded on one subject for eight minutes and then switched to another subject and recorded for eight minutes. The onset and offset of observation periods were signalled by means of a tape. Earplugs were used to ensure that the observers remained as unobtrusive as possible. As a further precaution, each observer positioned herself in a corner of the room and had no knowledge of the subjects and no previous history of interacting with them.

Posture training observation. During posture training sessions in the classroom, the experimenter recorded responses to the first verbal instruction, additional verbal prompts required to correct a specific body part, whether physical guidance was required, and duration of maintaining correct sitting posture.

Behavioral definitions. Since each subject had participated in a posture training program for six months prior to the present study, the experimenter had become well acquainted with the subjects' bizarre, idiosyncratic behaviors which facilitated operationally defining them for purposes of investigation. For all

subjects, the most frequently occurring response was chosen to be punished. A second response for each subject was also selected in order to evaluate the response generalization of punishment. In the following definitions, the behaviors which were punished will be referred to as the punished behaviors. The behaviors which were recorded to evaluate generalization effects of the punishment contingency, but which were not punished, will be referred to as the generalization behaviors.

Kathy: Head bobbing and hand twisting. The punished behavior was called "head bobbing" which was any instance of tossing the head back with the chin thrust out. The generalization behavior was "hand twisting" which was any instance of extremely twisting the palm of either hand toward the wrist whether her hands were in her lap, under her chin, or across her chest.

Brenda: Hand twiddling and inappropriate verbalizations. The punished behavior was "hand twiddling." One instance of hand twiddling involved an episode of patting one hand against the leg, against the palm of the other hand, pulling at the fingers of the other hand, or tapping one finger between the fingers of the other hand. If the subject switched hands, this terminated an episode and marked the beginning of another episode. The generalization behavior was "inappropriate verbalizations" which included any instance of yelling, "Cut that out," "Shut up, Shirley," "Eeee-ow," or whispering "I want to go outside."

Mary: Hand on face and hand in underpants. Mary's punished

behavior was placing a hand on the face or in the mouth. If the hand was placed in the hair beyond the hairline, it was not counted. Any instance of touching and removing the hand from the face was scored as one response. The generalization behavior was any instance of pulling at the underpants, slipping the fingertips under the waistband of the underpants, or putting the hand in the underpants.

Eleanor: Grunting and playing with shoes and socks. The punished behavior was any instance of grunting regardless of the volume. The generalization response was any instance of touching any part of her shoe or sock.

Interobserver reliability. One hundred and seventy interobserver reliability checks were made during posture training sessions and television dayroom pre-test and post-test observation periods. Agreement was calculated by dividing the number of agreements by the number of disagreements plus agreements and multiplying by 100 to yield percentage of agreements.

D. Experimental Phases

Baseline

Posture training was conducted during baseline, and remained constant throughout all sessions. No punishment contingency was in effect and the experimenter did not wear the punishment apparatus. Twenty-five sessions were conducted.

VR6 Schedule of Punishment

During the VR 6 punishment conditions, the first response for each subject was punished revolving around a mean of six

responses. A VR6 was selected since Birnbrauer (1968) found this schedule effective with shock as the punisher in decreasing the number of incorrect button responses. The responses to be punished were selected from a table of random numbers with the condition that no two consecutive responses could be punished in order to control for the possible powerful effect of an FR1 schedule of punishment. Each 2nd, 14th, 17th, and 19th response in a 24 response sequence was punished. Thus, the number of responses that could occur without being punished ranged from 1 to 11 and the program recycled after a sequence of 24 responses were emitted. Within each 24 response cycle, four responses were punished averaging around a mean of six. To control for the subjects learning the sequence, the VR6 schedule was programmed over all sessions. This method of programming insured that occasionally each subject was punished after the first response was emitted in a session. The VR6 schedule began immediately upon the experimenter's opening the classroom door and terminated upon closing the door when leaving. Thus, responses which did not enter into the schedule were not emitted in the presence of the experimenter.

Prior to each session, the observers circled on their data sheets which responses were to be punished by continuing the schedule from the previous session.

By means of the walkie-talkie, the observers signalled the experimenter who wore an ear plug when a response should be punished. Upon receiving a signal to punish, the experimenter grasped the

subject's right wrist and slapped the back of the hand as hard as possible with the newspaper. No verbal reprimands were given. If a subject emitted a punishable response during a trial, that trial was terminated by switching off the stimulus light and passing on to the next subject.

Reversal to Baseline

Baseline procedures were reinstated for 20 sessions.

VR6 Schedule of Punishment

Procedures for delivering punishment on a VR6 schedule as previously described were reinstated for six sessions.

FR1 Schedule of Punishment

Punishment was delivered after every undesirable response for five sessions.

Reversal to Baseline

A return to baseline conditions was reinstated for eight sessions.

CHAPTER V

RESULTS

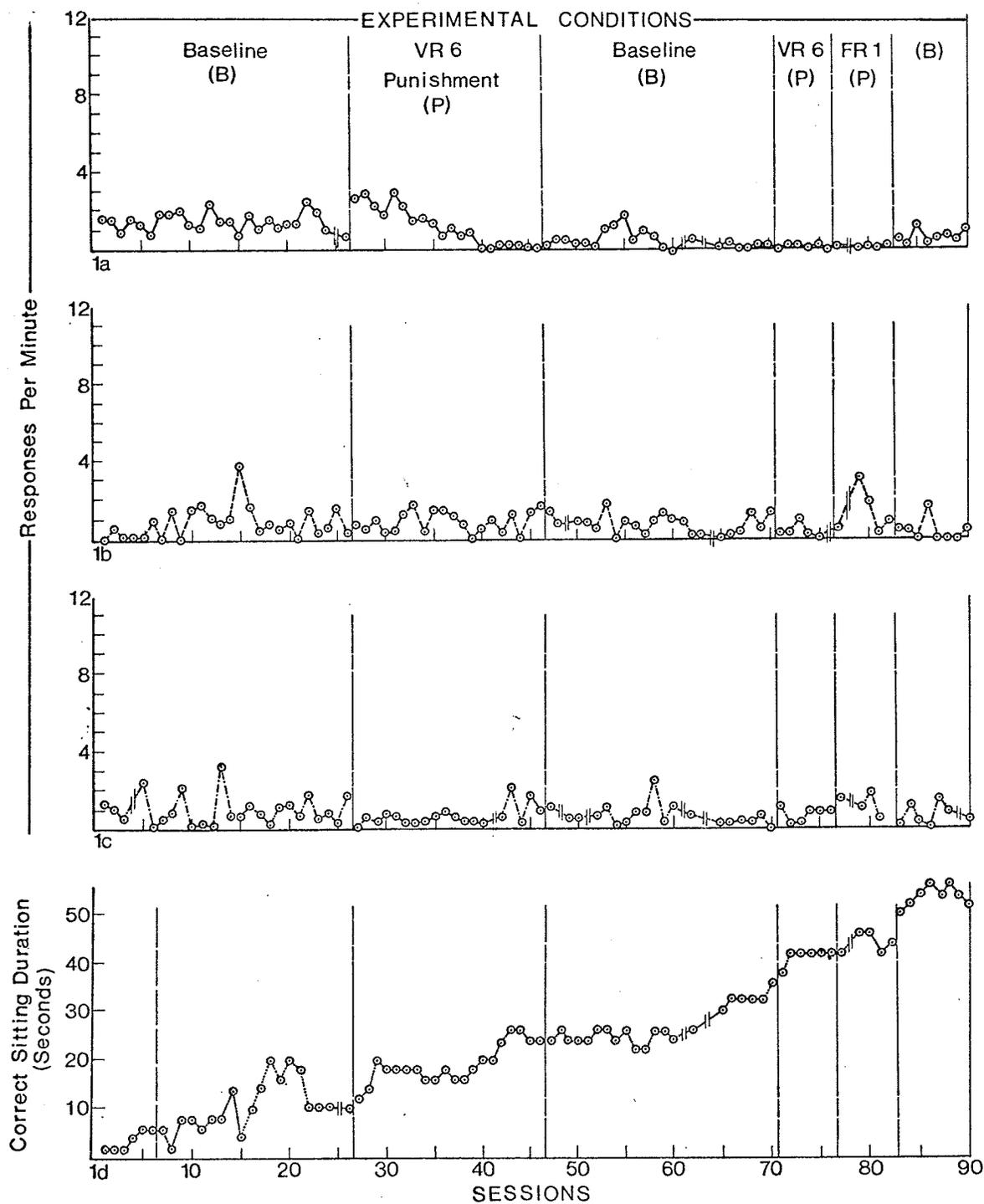
Table 2 presents interobserver reliability estimates as percentages which were made on 170 occasions of observing individual subjects during posture training classes and television dayroom pre-test and post-test observation periods. During classroom posture training sessions, 50 reliability estimates yielded average agreement of 91.71%. During television dayroom pre-test and post-test observation periods, 120 reliability estimates averaged agreement of 89.32%. Very low agreements such as 0% and 40% represent periods when very few responses were made. For example, in the observation period which yielded agreement of 0%, one observer recorded one instance of the behavior and the other observer recorded no instances of the behavior resulting in agreement of 0%. Another difficulty associated with interobserver reliability agreement was that because a variety of outside observers were used to do interobserver checks, they did not have the benefit of pre-study practice recording sessions in which consensus was reached about what constituted an instance of a response. Consequently, the first one or two reliability estimates between a new outside observer and one of the six regular observers typically yielded low agreement.

Figures 1abc, 2abc, 3abc, and 4abc present the responses per minute of the punished response for each subject during classroom posture training and generalization pre-tests and post-tests in

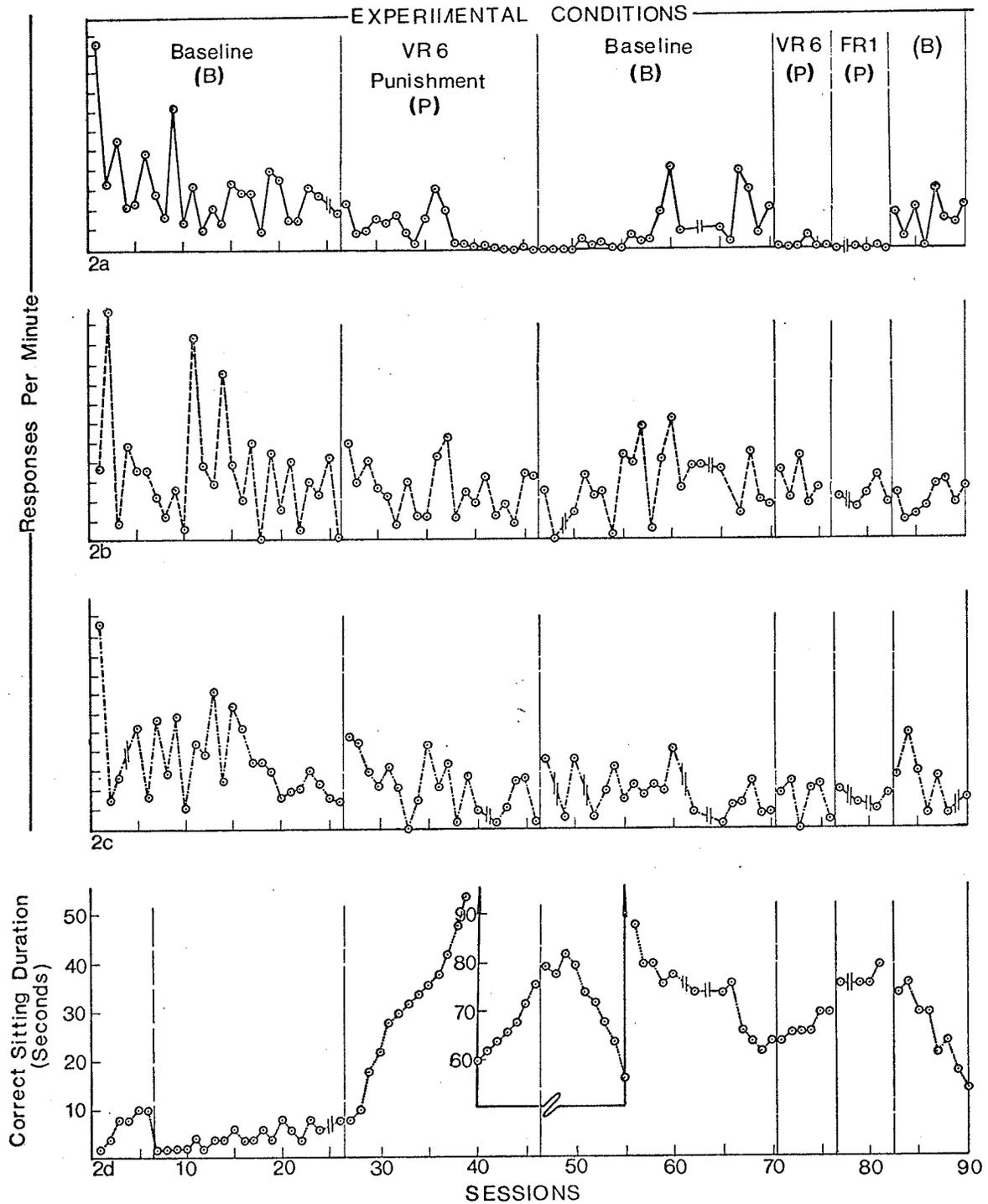
* TABLE 2

Interobserver Reliability Estimate Percentages During Posture
Training and Generalization Sessions

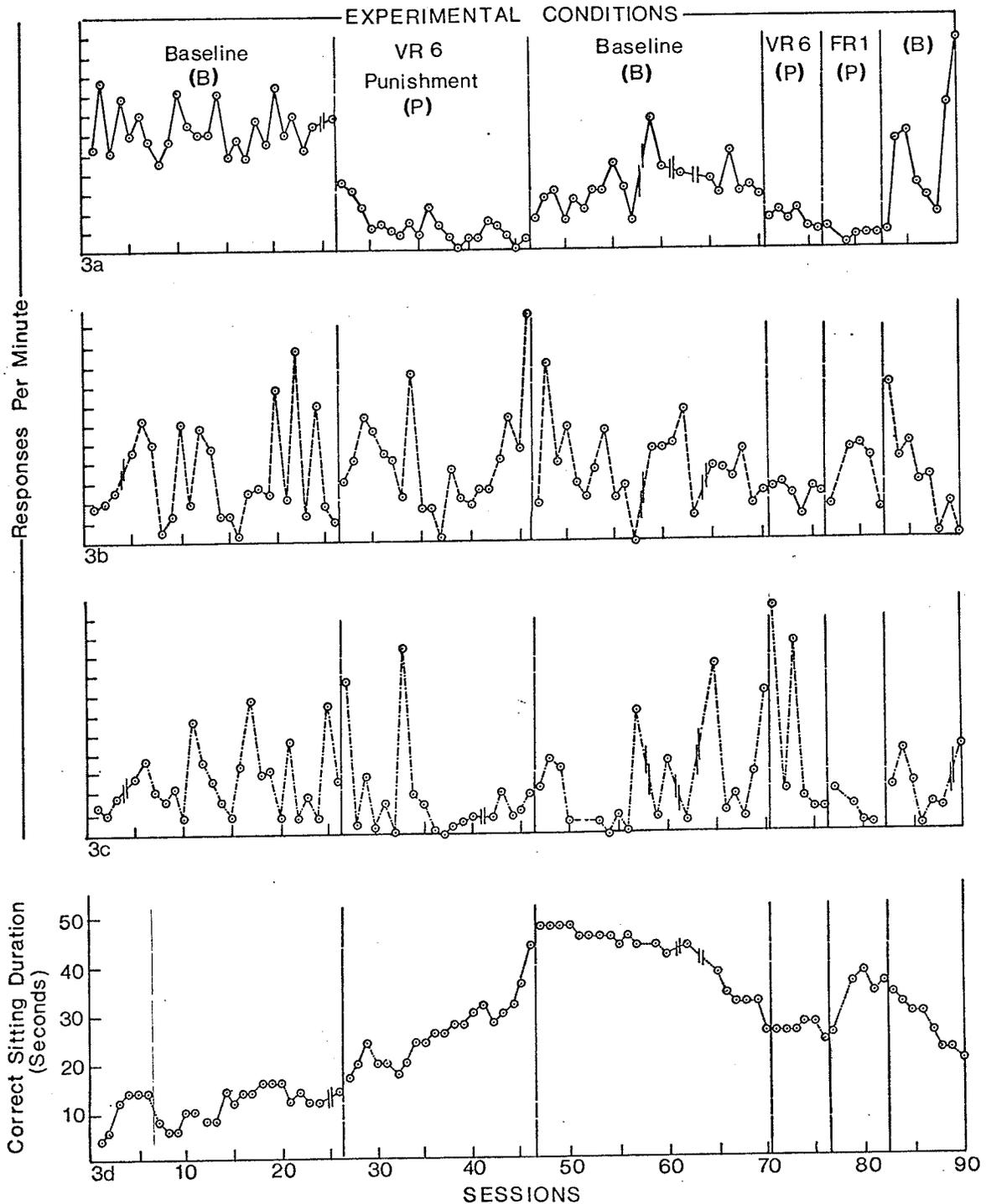
EXPERIMENTAL CONDITIONS							
Baseline		VR 6 Schedule of Punishment		Return to Baseline		VR 6 Schedule of Punishment	
Posture Training Sessions	General- ization Sessions	Posture Training Sessions	General- ization Sessions	Posture Training Sessions	General- ization Sessions	Posture Training Sessions	General- ization Sessions
94.1	95.2	100	80	100	100		94.1
40	76.9	100	100	100	94.2		100
100	100	100	87.5	100	100		100
100	88.9	100	93.7	100	100		100
94.1	100	100	70.2	66.7	89.4		97.2
100	100	100	62.5	100	96		100
98.2	100	100	100	100	100		100
100	100	100	86.3	100	100		100
50	20	75	95.6	100	86.9		
100	61.6	100	97.4	100	90.9		
68.1	97.8	100	100	100	60		
55.5	95	100	100	100	100		
100	100	93	92.3	91.6	97.8		
100	100	100	85.7	100	66.6		
92.3	88.5	100	50	97.5	77.7		
100	100	100	91.6	100	36.3		
	88.2		27.2	90.09	100		
	80		85.7	100	100		
	95.4		50		100		
	64.5		91.6		100		
	100		27.2		70		
	100		85.7		100		
	96.5		100		94.1		
	60		63.6		100		
	100		100		100		
	88.2		25		100		
	95		100		100		
	84.2		100		100		
	33				81.8		
	100				100		
	74				88.8		
	0.0				100		
	96.8				93.3		
	71.4				88.2		
	87.5				100		
	50				100		
	80.9				100		
	90.4				100		
	97				50		
	84.6				100		
	96				82.6		
	85.7				95.6		
	59				100		
	77.7				100		
	100						
	100						



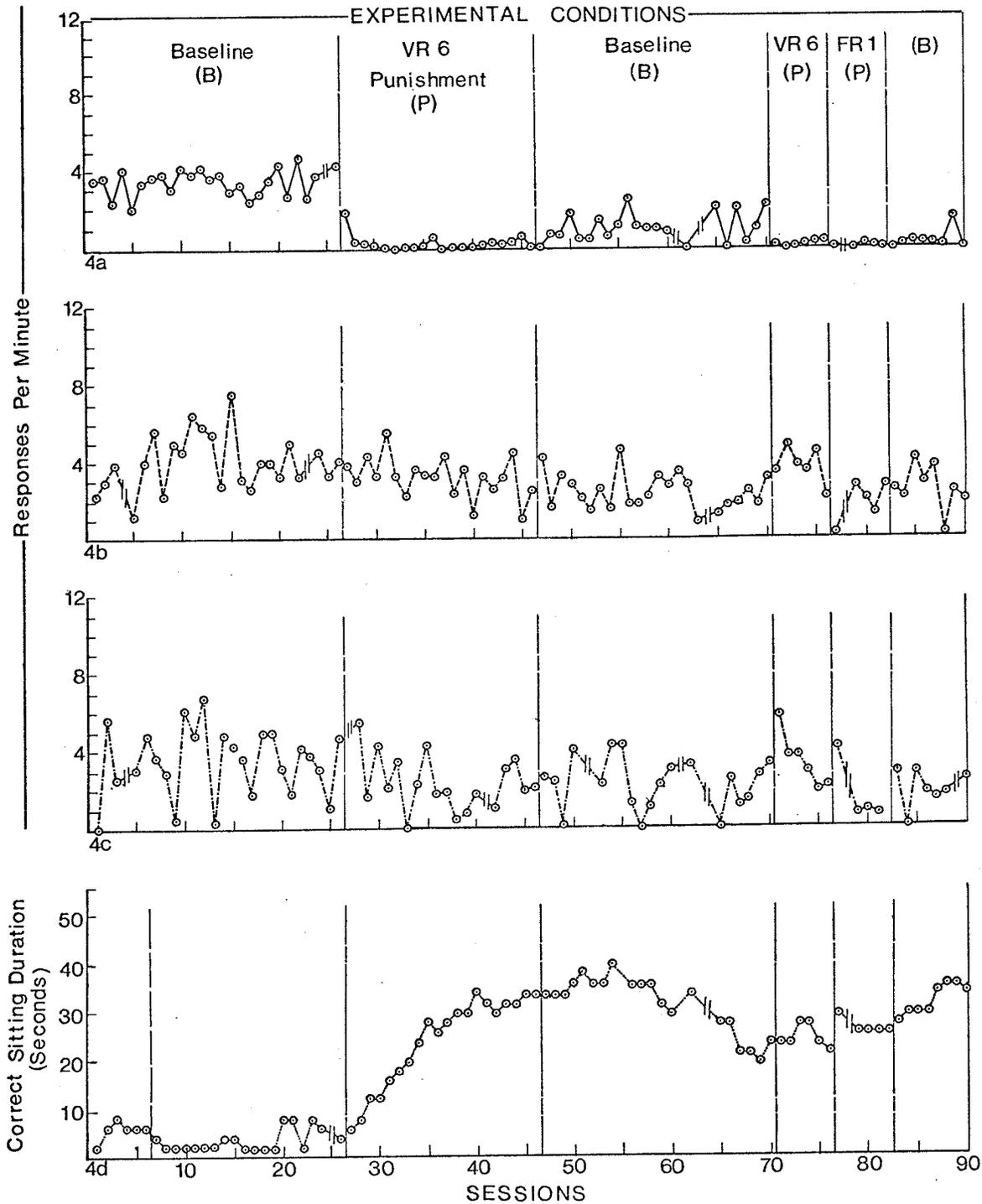
- Fig. 1a. Kathy's head bobbing responses per minute during posture training sessions.
- Fig. 1b. Kathy's head bobbing responses per minute during television dayroom generalization pre-tests.
- Fig. 1c. Kathy's head bobbing responses per minute during television dayroom generalization post-tests.
- Fig. 1d. Kathy's duration of correct sitting posture during posture training.



- Fig. 2a. Brenda's hand twiddling responses per minute during posture training sessions.
- Fig. 2b. Brenda's hand twiddling responses per minute during television dayroom generalization pre-tests.
- Fig. 2c. Brenda's hand twiddling responses per minute during television dayroom generalization post-tests.
- Fig. 2d. Brenda's duration of correct sitting posture during posture training.



- Fig. 3a. Eleanor's grunting responses per minute during posture training sessions.
- Fig. 3b. Eleanor's grunting responses per minute during television dayroom generalization pre-tests.
- Fig. 3c. Eleanor's grunting responses per minute during television dayroom generalization post-tests.
- Fig. 3d. Eleanor's duration of correct sitting posture during posture training.



- Fig. 4a. Mary's hand-on-face responses per minute during posture training sessions.
- Fig. 4b. Mary's hand-on-face responses per minute during television dayroom generalization pre-tests.
- Fig. 4c. Mary's hand-on-face responses per minute during television dayroom generalization post-tests.
- Fig. 4d. Mary's duration of correct sitting posture during posture training.

the television dayroom.

VR6 Schedule of Punishment Effects

As indicated in Figures 1a, 2a, 3a, and 4a the VR6(P) schedule resulted in an effective decrease in rate of punished responses for all four subjects during classroom posture training sessions. Only one subject, Eleanor (Figure 3a), did not show a decrease to a near zero level of responding during the first punishment phase. Three of the four subjects showed a recovery during the reversal. As evident in Figures 2a and 4a, the reinstatement of the VR6 schedule (Condition IV) produced a rapid decrease in rate to a near zero level for Brenda and Mary. Kathy's (Figure 1a) rate of responding remained at a near zero level ($X. = .156$). For Eleanor (Figure 3a), a low mean rate of 1.55 responses per minute was established.

FR1 Schedule of Punishment Effects

Responses per minute remained at near zero levels for three subjects while Figure 3a shows that Eleanor's mean rate was reduced further to .75 under the FR1 schedule from 1.55 under the VR6 schedule.

Generalization Effects

In another setting. Figures 1bc, 2bc, 3bc, and 4bc indicate that no significant generalization of the punishment contingency to the same behaviors in the television dayroom is evident.

On the unpunished, undesirable behavior. Figure 5 presents the responses per minute of the second undesirable, but unpunished

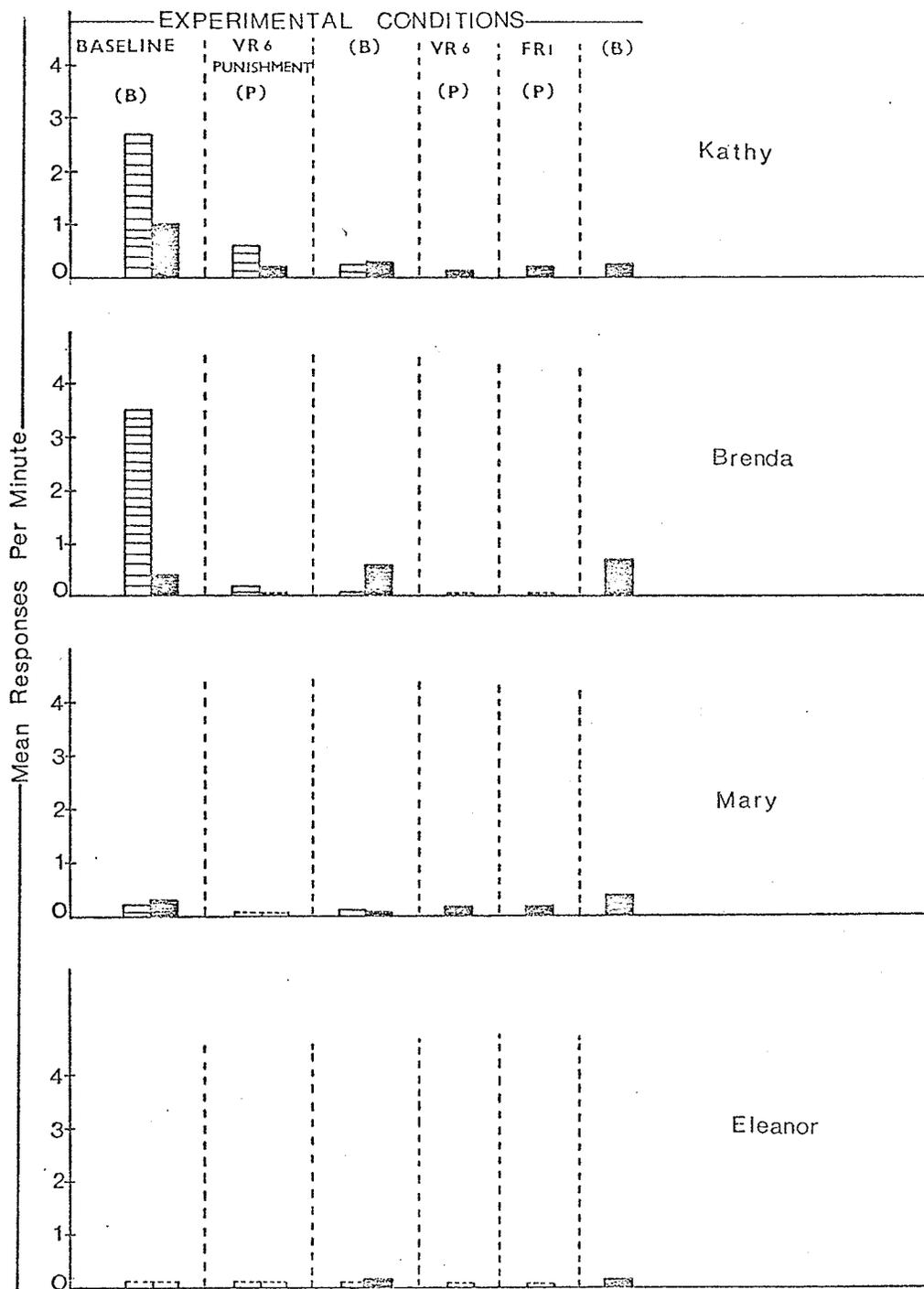


Fig. 5. Mean number of unpunished, undesirable responses per minute under six Experimental Conditions for each subject. In each of the first 3 Conditions, the first bar represents the mean responses per minute of the first five sessions and the second bar represents the mean responses per minute of the last five sessions of those Conditions. The bars in the last three Conditions represent the mean responses per minute of each Condition.

response for each subject. With the onset of the first VR6 schedule of punishment contingent on the first response, a decrease in the rate of the second response occurred for all subjects. In the cases of Kathy and Mary, the rates remain low after the first introduction of punishment. Brenda's responding, however, clearly decelerates and accelerates under the punishment and no-punishment conditions respectively. Eleanor's rate of responding was too low during the baseline to evaluate subsequent effects.

Punishment side-effects. In all four subjects, the first introduction of the punishment contingency coincided with a marked increase in duration of correct sitting posture (see Figures 1d, 2d, 3d, and 4d). In the cases of Brenda, Eleanor, and Mary (Figures 2d, 3d, and 4d), this effect tended to accelerate and decelerate with the introduction and withdrawal of punishment respectively. The exceptions are Kathy (Figure 1d) and Mary (Figure 4d, last condition). Kathy's duration of sitting showed a consistent upward trend even when no punishment contingency was in effect. This might have been a function of her opportunity for positive reinforcement for correct sitting since during posture training, as the subjects' duration of sitting increased, the time available for trials decreased, thus reducing the number of opportunities for reinforcement. For example, examination of Figures 1d and 2d reveals that Brenda's duration of sitting dramatically increased under the punishment conditions, and since Kathy and Brenda were paired during posture training sessions, Kathy's opportunity for reinforcement was decreased; however as

Brenda's duration of sitting fell off when punishment was subsequently withdrawn, Kathy's opportunity for reinforcement increased as did her duration of correct sitting.

Another example of duration of sitting being a possible function of opportunity for reinforcement is demonstrated in Figures 3d and 4d under Conditions FR1(P) and the final baseline (B). Eleanor's increase in duration of sitting during Condition FR1(P) correlated with a small decrease for Mary, and, conversely, when punishment was withdrawn under Condition (B), a distinct decrease in duration for Eleanor correlated with an increase for Mary.

Experimental control was demonstrated by increases in responding during two return-to-baseline conditions. In only one instance did a subject's rate not show an increase during a reversal (see Figure 4a, the final Condition (B). In this case, the behavior being punished was Mary's "Hands on Face" which was incompatible with the alternative correct sitting posture being reinforced which included having "Hands in the Lap" as part of the definition of correct sitting. Since during this final reversal, duration of Mary's appropriate sitting (Figure 4d, Condition VI) continued to increase, the rate of having "Hands on Face" would have to decrease as a function of being mutually exclusive with "Hands in Lap."

CHAPTER VI

DISCUSSION

A variable-ratio (VR) schedule of punishment (VR6 of hand slapping with a newspaper as the punishing stimulus) in conjunction with positive reinforcement for desirable behavior effectively reduced a variety of persistent, undesirable behaviors exhibited by four profoundly retarded females, and effected an increase in desirable behavior (appropriate sitting posture) where the positive reinforcement contingency alone had failed to do so during the baseline. An FRI schedule of punishment further reduced responding in one subject whose undesirable behavior was not completely eliminated under the VR conditions. This might be interpreted as support for earlier findings of an inverse relationship between the probability of punishment and the rate of responding (Azrin et al., 1963; Kircher et al., 1971). Had the punishable behaviors been first punished on an FRI schedule, a more valid comparison of the two schedules would be possible.

Because the VR6 schedule decelerated responding to near zero levels in the case of three subjects (Figures 1a, 2a, and 4a), in order to be more effective, the FRI schedule would have had to completely eliminate responding. Since it did not, this might lend some support to the results reported by Clark et al. (1973). In that study, VR3 and VR4 schedules of time-out (T.O.) reduced disruptive behaviors in a preschool child as effectively as an FRI

schedule of T.O., although a VR8 schedule of T.O. did not. The authors concluded that "an inverse nonlinear relationship existed between the probability of a disruptive behavior being timed out and the resultant rate of that behavior." In the Clark et al. study, T.O. was contingent upon 10-second intervals in which occurred any one of three behavioral categories (Chokes and Armwraps, Other Attacks Toward People, Attacks Toward Materials). Thus, it was possible that more than one instance of the three behavioral categories occurred in one interval. In spite of the fact that T.O. was not contingent upon instances of a specific response, it is nevertheless significant that the VR was effective in decelerating responding.

The difficulty associated with assessing the effects of a punishment paradigm when the schedule of reinforcement for the punished response is unknown has been noted by others (Gardner, 1969; Johnston, 1972). This problem is exemplified in the performance of Kathy (Figure 1a), who showed an initial increase in responding over the baseline level with the first introduction of VR punishment. This pattern of increased responding following the introduction of an aversive stimulus resembles the findings of Rescorla and LoLordo (1965). In this study, dogs on a Sidman avoidance schedule showed an initial increase in rate following presentation of a warning signal predicting shock superimposed on the Sidman avoidance paradigm. With repeated presentations of the warning, however, responding decreased to baseline rate. Conversely, a superimposed warning

predicting no shock resulted in an initial decrease in response rate followed by an increase. The difference between the paradigm in the Rescorla and LoLordo study and the present study is that the aversive stimulus was presented non-contingently in the former and contingently in the latter. Perhaps Kathy's initial burst of responding in the first punishment condition was a function of an interaction between a response maintained by an avoidance schedule and the presentation of an aversive stimulus. This interpretation supports the author's subjective observations of Kathy's head bobbing. In unstructured situations such as the television dayroom, if another resident of the cottage annoyed Kathy, she would gesture frantically at the other resident with her hand while looking at a staff member and bobbing her head. Possibly, this response is frequently successful for Kathy in ridding herself of the bothersome resident since staff members frequently scold Kathy's antagonists, thus reinforcing her head bobbing. In punishment paradigms, such as this one, where it is not possible to identify the schedule of reinforcement maintaining a response to be punished, better understanding of the behavior under investigation might be gained by recording responses by means of a cumulative recorder. This procedure of recording would reveal cyclicity, if any, of responding and could lead to identification of antecedent and consequent events as well as schedule effects of which the behavior is a function.

The lack of generalization to the television dayroom of the effects of the punishment contingency administered in the classroom

during posture training supports previous findings that punishment effects tend to be situation specific (Risley, 1968; Terrace, 1966). On the other hand, the concurrent deceleration of the unpunished, undesirable response with the punished response under the punishment conditions does not support general findings that the effects of punishment are highly specific to a single response (Birnbrauer, 1968; Bucher & Lovaas, 1968; Risley, 1968). This is not to be necessarily interpreted as a generalization of the punishment effect to the unpunished response since three of the four unpunished, undesirable responses (Kathy's "Twisted Hands", Mary's "Hands in Pants" and Eleanor's "Playing with Shoes and Socks") were incompatible with the alternative, desirable behavior ("Correct Sitting Posture"). Because the duration of correct sitting increased for all subjects under punishment conditions, it follows that these undesirable behaviors would decrease. This explanation does not account, however, for continued suppression of the undesirable second response during no-punishment conditions. Nor does it account for suppression and subsequent recovery of Brenda's "Inappropriate Verbalizations" during the punishment and no-punishment conditions since "Inappropriate Verbalizations" were not incompatible with correct sitting posture. It might be that Brenda's "Hand Twiddling" and "Inappropriate Verbalizations" were a function of the same variables and thus punishing "Hand Twiddling" resulted in a decrease of "Inappropriate Verbalizations" as well.

Table 3 presents ratios of punished responses to the total

TABLE 3

Ratios of Punished Responses to the Total Number of Responses
for Each Subject in Each Experimental Punishment Condition.

Subject	Experimental Punishment Conditions			Total
	First Application of VR6 Schedule	Second Application of VR6 Schedule	FRI Schedule	
Kathy	67/405	2/16	13/13	82/434
Brenda	40/238	5/19	2/2	47/259
Mary	15/79	2/14	5/5	22/98
Eleanor	64/385	24/140	75/75	163/600

number of responses under each experimental punishment condition for each subject and demonstrates that relatively low values of VR schedules, such as VR6, permit quite a few unpunished responses (e.g. 11) while maintaining low rates of responding. If this finding proves reliable, it seems reasonable to suggest that intermittent punishment could be used for clinically important behavioral problems, where positive forms of control have proved ineffective.

An important variable which probably would influence the effectiveness of a variable-ratio schedule is the discriminative property of punishment. Azrin & Holz (1966) have demonstrated that punishment can acquire discriminative properties indicating that the response following a punished response will result in reinforcement, absence of punishment, or further punishment. Ideally, of course, for punishment to be effective it should signal further punishment, but this is possible only when the schedule is an FR1. Birnbrauer (1968) found that under a VR6 schedule of shock, his subject learned that it was safe to emit one undesirable response at the beginning of each session. In the present study, although all subjects occasionally emitted punishable responses, it is difficult to evaluate whether they learned that following a response which was punished, it was safe to emit one undesirable response. Had the FR1 schedule completely eliminated responding, this conclusion would be more valid. On the other hand, it is probably not reasonable to conclude that the subjects failed to make this discrimination since the FR1 schedule of punishment might have completely eliminated responding had it been

of greater duration.

In institutions for the retarded, we protect the residents as we do children by banning punishment because we do not want to inflict pain on those who are unable to exert countercontrol over punishing contingencies. Further, sanctions against punishment are a tacit acknowledgement that all staff members cannot be trusted to administer punishment judiciously and within the established limits. There is also the problem of not being able to use punishment according to the rules which maximize its effectiveness (Azrin & Holz, 1966). We are also concerned, however, about the residents' quality of life; how much opportunity do they have to develop more varied means of gaining positively reinforcing events? Retarded persons who exhibit bizarre behavioral patterns are more likely to be shunned by those who control the reinforcers in the institutional environment. The most effective means for a retarded institutionalized resident to gain access to the reinforcers is to possess a behavioral repertoire which is reinforcing to the staff. The question is how to eliminate highly persistent unwanted modes of behavior without being unduly cruel when the available reinforcers are not sufficient to teach incompatible and desirable behavior. Use of VR schedules of punishment partly solve the problem by reducing the instances that a painful stimulus is administered. They also have the advantage of requiring that the punishable responses be recorded thus reducing the possibility that the punishing agent can be negatively reinforced by immediately punishing a resident after any occurrence of the response.

Another technique which would further reduce the instances of primary punishment and which, as yet, has not been investigated is the use of negative tokens. Negative tokens are akin to positive tokens in that they would be exchanged for primary punishment rather than primary positive reinforcement such as an edible. Negative tokens thus could be dispensed on a continuous schedule and exchanged on a variety of VR or FR schedules. This procedure is analagous to the use of demerit points in the broader social context for certain driving offences. After a fixed number of demerit points have been accrued, a driver's licence is suspended.

Evolving social sanctions about the use of physically administered punishment will probably be based on empirical evidence of the efficacy of punishment and the extent to which it tends to create painful private experiences and generates undesirable, disruptive behavior. In the present study, none of the subjects attempted to escape from the classroom or aggress against the experimenter. Needless to say, extrapolation of this finding to semi-controlled environments such as in classrooms of high school students is risky. Because the contingency histories of residents in institutions for the retarded would include lack of opportunities to escape, the subjects acceptance of punishment is not surprising. As previously mentioned, only one subject, Kathy, demonstrated any form of escape behavior (head bobbing) following initial introduction of punishment. This decreased over time, however, and remained suppressed. Contrary to the experimenter's expectations, evidence

of emotionality indicating pain or unhappiness was generally minimal. After the initial introduction of punishment, Brenda's eyes filled with tears and her mouth turned down considerably. She assumed the correct sitting posture and usually maintained this position throughout a session. At first, the experimenter's subjective evaluation of her behavior was that she was displaying behavioral suppression due to being "frightened." On Day 3, however, while maintaining correct sitting posture, Brenda fell asleep. Apparently, heightened emotionality did not account for her increased duration of appropriate sitting posture under the punishment conditions. Apart from initial increased head bobbing which was interpreted by the experimenter as anger, Kathy did not show other signs of emotionality. Eleanor let out a sort of wail after the first slap, but did not cry. She held her slapped hand up to her face, looked at it, and, thereafter, when the experimenter was about to punish her, Eleanor held out her hand to be slapped and looked away while she was punished. Mary's initial reaction could best be described as puzzlement. She frowned, looked the experimenter in the eyes and from then on, paid close attention. Previously, Mary had been completely inattentive and showed no emotional affect like smiling. As time passed and her sitting performance improved, she smiled frequently when trials were presented to her. In addition, she became very skilled at responding to subtle eye signals from the experimenter (Mary appeared deaf) to correct a body position, take a peg, or exchange her pegs for edibles. Summarily, then, emotionality

was moderate and short lived.

Decisions to use punishment with populations like the severely and profoundly retarded will partly be based on individuals' sensitivity to reinforcement. Those persons who do not respond for reinforcement might benefit from punishment, and of course, decisions should be made only on an individual basis. Possibly, tests for sensitivity to reinforcement and punishment will become established practices in institutions for the retarded permitting accurate judgements about whether mild punishment would enhance positive reinforcer effectiveness in individual cases. For example, although Mary did not appear to enjoy receiving pegs and "cashing them in" for candies and cookies during the baseline, after the punishment contingency was established, she appeared to like reinforcement as evidenced by her smiling and frequently looking at her pegs and the candies and cookies.

Whether aversive control practices should be permitted in environments where individuals have no means of countercontrol is of real concern. Needless to say, if punishment measures are used, they should be closely monitored by supervisory staff as should an institutions' formal policy about the use of aversive control be closely monitored by appropriate governmental agencies and by professional associations whose members work in these environments.

This study has demonstrated that it is possible to greatly reduce highly persistent behaviors in the profoundly retarded without resorting to use of an extremely painful stimulus like electric

shock and without punishing every instance of a response. Further, the punishment effects proved to be specific to the situation and to the presence of the punishing stimulus but not to the punished response. A concurrent deceleration which occurred in another undesirable, unpunished response with deceleration of the punished response is not, however, necessarily interpreted as generalization of the punishment contingency. Also, with punishment of the undesirable response, concurrent acceleration occurred in a desirable response where positive reinforcement alone had failed to increase the desirable behavior. This phenomenon is difficult to interpret but generally supports findings in the human literature (Johnston, 1972).

The finding in the present study that a mild punisher can significantly reduce high frequency undesirable behaviors in the profoundly retarded has implications for punishment policies in institutions for the retarded. Should further research bear out the present results, it raises the question of whether it is just and ethical to permit offensive behaviors to persist if those behaviors contribute to an individual's institutionalization and restrict his access to reinforcing events. Another implication of the results of the present study is whether systematic investigation and application of punishment will lead to a de-emphasis of the use of positive control methods. Presently, many social contingency planners (notably, B. F. Skinner, 1971) favour the use of positive reinforcement only for teaching and altering behavior, but others warn that elimination of aversive control might prove maladaptive to the survival of

cultures (Wheeler, 1973) as well as providing the opportunity for tyrannical rule by despotic individuals or groups (Comfort, 1973).

Whether it is desirable to design a culture in which behavior likely to be punished seldom or never occurs is a problem for those involved in planning social contingencies and will have to be answered on the basis of what non-punitive practices would contribute to a culture's survival as well as taking into account ethical and philosophical considerations. Alexander Comfort (1973) has forecast such a society in 25 to 50 years. Whether such a world is possible, however, is a problem for behavioral scientists.

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