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Behavioral Suppression of Seriously Disruptive Behavior in Psychotic and Retarded Patients: A Review of Punishment and Its Alternatives

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The use of punishment procedures to suppress seriously disruptive behavior has generated considerable controversy. Differential reinforcement of behaviors incompatible with disruptive behavior is attractive to many because it does not involve aversive procedures. Unfortunately, differential reinforcement has shown mixed results and may be effective only when combined with other procedures. Contingent removal of reinforcement (time-out) has been found moderately effective for dealing with self-stimulation and aggression but is of more limited value in treating severe self-injury. Overcorrection also has a beneficial effect on a variety of serious management problems. Electric shock, the most controversial procedure reviewed here, has been the focus of considerable debate but may have value under certain conditions. Research on generalization, maintenance, and side effects attached to these various procedures is reviewed, and ethical issues are examined.

Few people, lay or professional, are without an opinion on whether punishment ought to be used to change behavior. Differing views on this question have generated an extensive literature on the theory and ethics of punishment of humans (e.g., Alderton, 1967; Buddenhagen, 1971; Church, 1963; Johnston, 1972; Maurer, 1974; Miller, 1967; Solomon, 1964). Although this debate continues, a substantial body of research has accumulated on the application of punishment for behavior modification. The present review surveys a portion of this research, focusing on nonverbal, essentially physical, procedures used in the attempt to alter self-injurious behavior (SIB), aggression, temper tantrums, self-stimulation, and other seriously disruptive behaviors of psychotic and retarded people. Treatments based primarily on verbal interactions—for example, token economies or contingency contracting—are excluded because they merit individual reviews. The subjects of the research under review are mainly autistic-type children and severely and profoundly retarded children and adults. Work with preverbal infants, moderately retarded adults, and in a few instances, psychotic adults of normal intelligence, is included to insure adequate coverage of some problems. We also excluded research on classroom management, treatment of delinquent, antisocial, or neurotic behavior, and most research with adults.

The treatment procedures reviewed here are surveyed in rough order of potential aversiveness; they include differential reinforcement of other behavior (DRO), time-out and extinction, overcorrection, electric shock, and other less known or less used procedures. In reviewing these techniques we asked if they were based on sound research and had demonstrated efficacy. We also explored issues of generalization to novel settings and people,

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maintenance of suppression, side effects, and potential risk to the subject.

Differential Reinforcement of Other Behavior

Differential reinforcement of other behavior is often seen as the first choice for treating inappropriate behaviors (Corte, Wolf, & Locke, 1971; G. L. Martin, MacDonald, & Omichinski, 1971). For example, a retarded child may be reinforced for playing with toys and other behaviors incompatible with hand self-stimulation. This emphasis on positive reinforcement, as opposed to aversive techniques, enhances its appeal to parents, teachers, ward staff, and psychologists (J. J. Myers & Deibert, 1971; Peterson & Peterson, 1968). It is also attractive because of its ready application in the home (e.g., Allen & Harris, 1966; Nordquist & Wahler, 1973). As a result, variations of DRO have been used to modify SIB, self-stimulation, aggression, and a variety of other troublesome behaviors.

The efficacy of DRO to reduce SIB has been equivocal. Several case reports and one laboratory study suggest that DRO reduced SIB during treatment sessions with retarded adults (Lane & Dormath, 1970; Weiher & Harman, 1975), geriatric patients (Mishara, Robertson, & Kastenbaum, 1973), and preschool (Allen & Harris, 1966) and autistic children (Lovaas, Freitag, Gold, & Kassorla, 1965), but other studies reported that DRO increased SIB and aggression in four retarded children and only moderately decreased these behaviors in another child (Herbert, Pinkston, Hayden, Sajwaj, Pinkston, Cordua, & Jackson, 1973). Still other research indicated that DRO alone did not influence SIB, but, when combined with procedures such as overcorrection (Measel & Alfieri, 1976), electric shock (Young & Wincze, 1974), and contingent removal of reinforcement and shock (Risley, 1968) it increased the effectiveness of these techniques.

Studies that evaluated DRO combined with another technique support the clinical value of DRO as part of a treatment package. For example, the use of DRO and contingent removal of reinforcement reduced head banging in a retarded, blind child (J. J. Myers & Deibert, 1971), SIB and aggression in four retarded children (Repp & Deitz, 1974), and SIB in an autistic child (Brawley, Harris, Allen, Fleming, & Peterson, 1969). DRO, electric shock, and contingent removal of reinforcement successfully reduced head banging in a retarded girl (Tate, 1972), whereas contingent removal of reinforcement and DRO were less effective than differential reinforcement of incompatible behavior (DRI) in confronting a retarded child's SIB (Peterson & Peterson, 1968). Corte et al. (1971) reported mixed data in treating SIB. For one girl, contingent removal of reinforcement and DRO were effective only when she was food deprived, whereas for another child this combination of treatments had little effect regardless of food deprivation.

DRO has also been used to modify self-stimulatory behavior. In fact, several studies suggest that rate of self-stimulation varies inversely with reinforcement of other behavior (Flavell, 1973; Lovaas, Litrownik, & Mann, 1971; Repp, Deitz, & Speir, 1974). However, the majority of this research concluded that DRO is of minimal value in reducing self-stimulation by itself (Azrin, Kaplan, & Foxx, 1973; Foxx & Azrin, 1973), although DRO combined with other techniques has proved more successful (Azrin et al., 1973; Barkely & Zupnick, 1976).

The potency of DRO vis-à-vis a variety of other problem behaviors is similarly equivocal. DRO increased sitting in a hyperactive boy (Twardosz & Sajwaj, 1972), improved a retarded child's interaction with other youngsters (Wiesen & Watson, 1967), and decreased ward disruption by four retarded people (Mulhern & Baumeister, 1969). Moreover, DRO and contingent removal of reinforcement successfully reduced aggressive behavior in retarded children and adults (Bostow & Bailey, 1969; Vukelich & Hake, 1971) and increased the imitative skills of autistic children (Nordquist & Wahler, 1973; Weisberg, Passman, & Russell, 1973). By contrast, DRO alone did not facilitate the teaching of appropriate eating skills to retarded subjects (G. L. Martin et al., 1971).

In light of the variable effects of DRO both alone and in combination with other techniques, as well as a lack of appropriate experimental designs, it is difficult to isolate the contributions of DRO. Part of the dif-

ficulty resides in the variations of DRO that have been employed. Young and Wincze (1974) point out that the "other reinforced behaviors" can either be compatible or incompatible with the target behavior. To emphasize this difference, Weiher and Harman (1975) use the term "omission training" to signify reinforcement of behavior other than the target behavior. However, the differential effects of reinforcing only incompatible acts (DRI) or all acts other than the target behavior (DRO or omission training) have not yet been systematically evaluated.

To what extent does the frequency or intensity of a target behavior influence the effects of DRO? Both theory and data vary regarding which target behaviors require the use of punishment along with DRO. Some research indicates that DRO alone effectively reduces the target behavior. For example, Lovaas and his colleagues found that SIB (Lovaas et al., 1965) and self-stimulation (Lovaas et al., 1971) declined as DRO increased other behavior. Peterson and Peterson (1968) argued that going one step further and using DRI may be more effective than using DRO to suppress SIB. In contrast, other researchers maintain that effective suppression requires additional punishment prior to DRO. Hobbs and Goswick (1977) pointed out that in many cases the high frequency of self-stimulation, in relation to other behaviors in a person's repertoire, may preclude the opportunity to reinforce positive behavior. Consistent with Young and Wincze's (1974) proposal that the elimination of deviant behaviors may be a prerequisite to the establishment of new behavior, Risley (1968) found that DRO was effective in increasing incompatible behavior only when the target behavior was prevented. In general, DRO appears to be more potent when used in combination with other techniques than when used alone.

The schedule for the delivery of reinforcement, varied across DRO studies, may also have contributed to these mixed results. Although it has been noted that there is a gradual reoccurrence of the target behavior as the length of time between reinforcements increases (Mulhern & Baumeister, 1969; Repp & Deitz, 1974), there are no other guidelines for scheduling reinforcement.

DRO poses particular problems in relation to side effects because one is directly reinforcing a variety of other behaviors. Zeiler (1970) hypothesized that by reinforcing nonresponding of the target behavior, other inappropriate behaviors may be reinforced adventitiously. In spite of this potential risk, only a handful of studies have examined the possible side effects of DRO. Among them are five that described negative side effects, including an increase in grabbing (Vukelich & Hake, 1971), self-stimulation (Foxx & Azrin, 1972), SIB (Herbert et al., 1973; Repp & Deitz, 1974), and aggression (Herbert et al., 1973). Further, Mulhern and Baumeister (1969) indicated that two retarded adults they treated adopted peculiar postures in order to refrain from rocking when receiving DRO.

Most studies reporting positive side effects offer only anecdotal evidence. These benefits have included increased ward activity (Lane & Dormath, 1970) and improved vocal and social skills (Repp & Deitz, 1974; Weiher & Harman, 1975). Peterson and Peterson (1968) found that their subject spent more time with other children after treatment with DRO and contingent removal of reinforcement. Both positive and negative side effects were noted when a combination of contingent removal of reinforcement, shock, and DRO was used to treat head banging in a retarded woman (Tate, 1972). Although the woman exhibited better self-help skills, there were sporadic reports of increased hand self-stimulation and self-injurious masturbation. Because Tate (1972) and Peterson and Peterson (1968) used DRO in combination with other procedures, it is impossible to attribute these side effects to DRO alone. Twardosz and Sajwaj (1972) described greater toy play by a hyperactive boy as a side effect of DRO treatment for appropriate sitting but added that the teacher deliberately reinforced this play.

Most positive side effects of DRO may actually be secondary target behaviors, that is, "other reinforced behaviors." What are these behaviors? Although few studies have actually measured them, Repp and Deitz

(1974) obtained a slight increase over baseline in unspecified behaviors of one child when using DRO and contingent removal of reinforcement for aggression, and Lovaas et al. (1965) found that DRO increased appropriate music behavior and decreased SIB. Brawley et al. (1969) reported that reinforced appropriate behaviors varied inversely with multiple self-stimulatory behaviors in an autistic child. By contrast, Risley (1968) and Young and Wincze (1974) found that although DRO increased specific appropriate behaviors, it did not affect the target behavior. Young and Wincze (1974) indicated that differential reinforcement of a behavior compatible with SIB increased that behavior (eye contact) but did not alter SIB, whereas reinforcement of incompatible behavior proved more successful in reducing one type of SIB but not another. Other than these few studies directly measuring the "side effects" of DRO, the general lack of systematic observation makes it difficult to reach conclusions about side effects.

Most of the DRO studies examining generalization and follow-up are case reports, several of which employed DRO along with other techniques. It is, therefore, impossible to discriminate DRO's contribution to generalization and maintenance of responding. Among those reports that examined generalization, success was found most often when treatment programs were instituted across settings or persons (Brawley et al., 1969; Measel & Alfieri, 1976; J. J. Myers & Deibert, 1971). Barkley and Zupnick (1976) found that treatment generalized across settings within the school when the teacher was present but not to the home of a retarded child. Weiher and Harman (1975) reported a reduction of SIB in a retarded adolescent when observed in settings similar to the experimental conditions. In contrast, Mulhern and Baumeister (1969) found no generalization of treatment effects with retarded subjects from experimental room to ward.

Successful maintenance following the use of DRO has been reported for periods ranging from 2 weeks to 1 year (Lane & Dormath, 1970; Measel & Alfieri, 1976; J. J. Myers & Deibert, 1971; Weiher & Harman, 1975). Less successful outcome data were reported by Sewell, McCoy, and Sewell (1973), who indicated that although a decline in aggressive behavior was maintained over 8 weeks, the frequency of this behavior among their retarded subjects was still substantial. Tate (1972), employing DRO, contingent removal of reinforcement, and shock for SIB, observed successful maintenance at 7 months but a drastic relapse at 3 years.

The value of DRO should not be minimized. Combined with other techniques it may offer a strategy to enhance maintenance of suppression by insuring that the patient has suitable behavioral alternatives available. However, when offered in isolation, DRO may prove cumbersome or ineffective. Although ethical considerations support the initial use of the least aversive means of punishment, the equivocal results of the effects of DRO raise other ethical concerns. This is especially true when treating SIB or aggression. Even when DRO is effective, there remain such problems as long-term food deprivation to heighten incentive and the practical matter of sufficient staff to maintain a high-frequency schedule of reinforcement.

Time-Out and Extinction Procedures

An examination of research using time-out and extinction procedures to treat seriously disruptive behaviors of the psychotic and the retarded reveals considerable variation in terminology. There is, for example, controversy about whether time-out requires contingent or noncontingent removal of reinforcement (Forehand & MacDonough, 1975; Johnston, 1972; MacDonough & Forehand, 1973). For that matter, there is little agreement about the essential elements of time-out (Leitenberg, 1965) and the words "time-out" and "extinction" are used interchangeably and inconsistently. To reduce this considerable ambiguity, the following definitions are employed in the present review:

1. Extinction—withholding of previously given positive reinforcement following the emission of the target behavior. No discriminative cues, such as environmental changes or verbal warnings, are given. For example, in using an extinction procedure to treat tantrums, the therapist simply ignores

the tantrum behavior and proceeds as though nothing has happened.

2. Contingent removal of reinforcement—removing attention or another reinforcing event upon emission of the target behavior. This removal is marked clearly by such events as removing the subject from the room, physical withdrawal of the therapist, or other discrete acts that signal the withdrawal of reinforcement. Return of access to reinforcement may be contingent upon cessation of the target behavior. This procedure is often called time-out but is more actively punishing than most definitions of time-out permit.

3. Noncontingent social isolation—placing the subject in social isolation independent of the emission of the target behavior and allowing free responding during this isolation. The isolation is imposed at a specified time, not on the basis of the subject's behavior and is similarly terminated independent of the subject's behavior. An alternative term for this procedure is noncontingent time-out.

Contingent Removal of Reinforcement

Contingent removal of reinforcement is regarded as a preferred punishment procedure by many clinicians because a physically painful stimulus is not required (Johnston, 1972) and the techniques are readily taught to paraprofessionals (Davison, 1964, 1965; Laws, Brown, Epstein, & Hocking, 1971) and parents (Barrett, 1969; Nordquist & Wahler, 1973; Wahler, 1969). As a result of its ease of administration and low aversiveness, contingent removal of reinforcement alone or in combination with DRO has been applied to a wide range of problem behaviors including self-stimulation (Greene, Hoats, & Hornick, 1970; Hamilton & Stephens, 1967; Pendergrass, 1972), SIB (Adams, Klinge, & Keiser, 1973; Anderson, Herrman, Alpert, & Dancis, 1975; Brawley et al., 1969, Hamilton, Stephens, & Allen, 1967; Harmatz & Rasmussen, 1969; Husted, Hall, & Agin, 1971; J. J. Myers & Deibert, 1971; Wolf, Risley, Johnston, Harris, & Allen, 1967), and aggressive behaviors (Bostow & Bailey, 1969; Drabman & Spitalnik, 1973; Hamilton et al., 1967; Hawkins, Peterson, Schweid, & Bijou, 1966; Husted et al., 1971; Sachs, 1973; Vukelich & Hake, 1971). In general, contingent removal of reinforcement has proved moderately effective in treating self-stimulation and aggression but has been of more limited value in dealing with severe SIB.

Contingent removal of reinforcement has also been used effectively with retarded or autistic patients to reduce inapprorpiate eating (Barton, Guess, Garcia, & Baer, 1970; Edwards & Lilly, 1966; G. L. Martin et al., 1971; O'Brien & Azrin, 1972), tantrums, sleeping and eating problems (Wolf, Risley, & Mees, 1964), escape from living quarters (Husted et al., 1971), out-of-seat behavior on a bus (Ritschl, Mongrella, & Presbie, 1972), verbal jargon (McReynolds, 1969), obscene speech (Lahey, McNees, & McNees, 1973), crying (Stark, Meisel, & Wright, 1969; Zimmerman & Zimmerman, 1962), bowel control (Barrett, 1969), and inappropriate attention seeking (Wiesen & Watson, 1967).

The efficacy of contingent withdrawal of reinforcement in most of the preceding studies must be viewed with caution. The majority are either case reports or are methodologically flawed. Fortunately, the value of a number of other studies is enhanced by their use of either multiple-baseline (Barton et al., 1970; Clark, Rowbury, Baer, & Baer, 1973; G. Martin, 1975), withdrawal (Bostow & Bailey, 1969; Hawkins et al., 1966; Lahey et al., 1973; G. L. Martin et al., 1971; Ritschl et al., 1972; Zegiob, Jenkins, Becker, & Bristow, 1976), or reversal designs (Pendergrass, 1972).

An assumption underlying contingent withdrawal of reinforcement is that the individual is functioning in a rewarding environment in which the termination of reinforcement will have an aversive impact (Drabman & Spitalnik, 1973; Kanfer & Phillips, 1970). In spite of this widespread assumption, most research has failed to determine that the items withdrawn from the subject are actually reinforcing. Moreover, as Gottwald (1975) pointed out, it is difficult to remove all reinforcement from any environment. Even alone in a barren room a person may generate self-reinforcement through self-stimulatory behaviors, as well as internal verbal or cognitively mediated processes. Especially for

higher functioning subjects the reinforcing value of cognitions must be anticipated when removal of externally controlled reinforcement fails.

Two studies manipulating token-economy ratios failed to show that a richer schedule enhanced the effect of contingent removal of reinforcement (Husted et al., 1971; G. Martin, 1975). The alteration of token ratios does not exhaust all environmental variables. One way to enhance the potency of the environment may be to combine contingent removal of reinforcement with DRO. Most studies doing this have combined the two techniques without attempting to evaluate their differential impact. However, Zegiob et al. (1976) found that although removal of access to reinforcement by means of facial screening reduced hand clapping, this self-stimulatory behavior was further reduced when DRO was applied to increase appropriate verbalizations.

For some subjects, what is intended to be punishing may actually prove reinforcing. According to Murray (1975), some brain-damaged and autistic children put themselves into isolation when they become upset. His anecdotal report was corrobrated by Steeves, Martin, and Pear's (1970) finding that one of their autistic subjects would bar press to earn 30 sec of being ignored by the experimenter. A second autistic child did not follow this pattern. The different reactions of these children suggest that contingent removal of reinforcement should not be assumed to be aversive for every subject in all contexts. Instead, a thorough assessment of the factors that maintain the target behavior is indicated prior to the imposition of punishment.

There may be a tendency for some clinicians to redefine a target behavior as improvement is observed. For example, Wolf et al. (1964) noted that data suggesting no change in frequency of tantrums in a $3\frac{1}{2}$-year-old boy may have been an artifact of the ward staff's changing criteria as the boy improved. This observation also highlights the measurement problem inherent in recording number of punishments as opposed to frequency of behavior. Drabman and Spitalnik (1973) pointed out that measuring frequency of punishment assesses the technician's behavior and only indirectly assesses that of the subject. Fortunately, a majority of studies report data in terms of the target behavior.

MacDonough and Forehand (1973) listed eight procedural variations typical of contingent removal of reinforcement studies. These parameters included duration, schedule, and location of punishment, type of reinforcement withdrawn, use of warning, offered verbal explanation, and signals to indicate onset of punishment and presence or absence of contingent release from punishment. There are very few data to specify how each of these parameters may affect individual subjects.

The duration of removal from access to reinforcement varies from a few seconds to several hours. Guidelines for establishing these limits are scant. G. D. White, Nielsen, and Johnson (1972) argued that using a longer period than necessary is ethically questionable because it is excessively aversive, removes the subject from opportunities to learn desirable behaviors, and runs a risk of increasing the rate of deviant behaviors.

Barton et al. (1970) reported a 15-sec removal from access to food to be as effective as 15 min of teaching appropriate eating. Pendergrass (1971), comparing 5 versus 20 min of social isolation for aggressive behavior of a brain-damaged child, found the schedule of punishment more important than the duration: Consistent application of either duration was more effective than intermittent application.

There are some data, however, to suggest that longer punishment is more effective than shorter. Burchard and Barrera (1972), comparing 5- and 30-minute contingent isolation, demonstrated that the longer period was more effective than the shorter in reducing aggressive behaviors among five of six retarded adolescents. The sixth youngster showed equally strong effects in the opposite direction. Similarly, G. D. White et al. (1972), evaluating the effect of 1-, 15- and 30-minute isolation periods for three groups of retarded residents, found both of the longer periods to be more effective than the shorter in reducing aggressive behavior. There was, however, considerable variability among the subjects. G. D. White et al. (1972) indicated that 1 minute was more effective when im-

plemented prior to longer intervals and advocated the use of a shorter duration of isolation initially, increasing it only if necessary. By contrast, research with nonretarded adolescents has produced data favoring shorter, rather than longer, periods of isolation (Kendall, Nay, & Jeffers, 1975), though the differences in subject population limit the generality of these data to the kinds of subjects under review.

The nature of the target behavior may also be important in predicting the effect of different lengths of isolation. In contrast with the preceding studies, all of which dealt with aggressive behavior, G. Martin (1975) explored reduction of error rate in a learning task with two retarded and three autistic children. He concluded that increased exposure to a learning task may be at least as efficient, if not more, than the use of extended isolation to reduce error rates. However, G. Martin (1975), like G. D. White et al. (1972) and Burchard and Barrera (1972), failed to examine the influence of duration on either generalization or maintenance of suppression. These additional data would be valuable in fully assessing the impact of duration on behavior. G. Martin's (1975) data do provide further support for G. D. White et al.'s (1972) view that prolonged isolation removes the subject from opportunities to learn appropriate behaviors.

Only two studies, in addition to Pendergrass's (1971), examined schedules of contingent removal of reinforcement. Both used intermittent schedules to facilitate maintenance of already established reductions in a target behavior. Greene et al. (1970) reported that reduced rocking behavior by retarded people was maintained on an intermittent schedule of punishment. Similarly, Clark et al. (1973), using four different variable-ratio schedules of isolation for a retarded child's aggressive behavior, found that any schedule with a greater than .23 probability of punishment was effective for maintenance once initial suppression was achieved. On the basis of these limited data it appears that a continuous schedule is preferable for attaining initial suppression, though a leaner schedule may be used for maintenance.

The most frequently used forms of contingent removal of reinforcement require removing the subject from an activity to either an isolated or nonisolated area. Procedures that eliminate a specific source of reinforcement without removing the person from an activity have also been explored, however. These have included music distortion (Greene et al., 1970), television distortion (Greene & Hoats, 1969), removal of music (Hauck & Martin, 1970; Ritschl et al., 1972), withholding food (Barton et al., 1970; G. L. Martin et al., 1971; O'Brien & Azrin, 1972), turning away from the child (Brawley et al., 1969; G. Martin, 1975; McReynolds, 1969; Sachs, 1973), covering the child's face with a bib (Zegiob et al., 1976), and placing a woman who could not walk on the floor (Bostow & Bailey, 1969). The only evaluation of the effects of the punishment setting was a laboratory study with normal children and their mothers (Scarboro & Forehand, 1975). They found more rapid effects when a mother picked up the toys and left the room than when she remained in the room but did not play with her child.

Only a handful of studies reported that a verbal warning was given before the contingent removal of reinforcement (Adams et al., 1973; Hawkins et al., 1966; Kendall et al., 1975; Ritschl et al., 1972; Wiesen & Watson, 1967). Likewise, few authors indicated that the subject was given an explanation for the punishment (Pendergrass, 1971; Sachs, 1973). Different devices that have been used to signal the onset and termination of the contingent removal of reinforcement include a tone generator (G. Martin, 1975), a signal by an observer (Clark et al., 1973), a bell (Hamilton & Stephens, 1967; Pendergrass, 1971), and counting aloud (J. J. Myers & Deibert, 1971).

Typically, when removal from the situation is used, the subject is placed in isolation by a staff member. However, Burchard and Barrera (1972) reported the successful use of instructions backed up with response cost in teaching their subjects to enter isolation on their own.

A number of experiments have imposed behavioral requirements on the subject to achieve release from contingent removal of

reinforcement (Bostow & Bailey, 1969; Brawley et al., 1969; Clark et al., 1973; Hawkins et al., 1966; Lahey et al., 1973; G. L. Martin et al., 1971; McReynolds, 1969; Ritschl et al., 1972; Sachs, 1973; Wiesen & Watson, 1967; Zegiob et al., 1976). Most specified an amount of time, ranging from 5 sec to 5 min, during which the person must be quiet or refrain from engaging in a specified behavior. The rationale behind such a requirement is that if release from removal of reinforcement is reinforcing, then whatever the person is doing at the time of release may be reinforced.

If release from isolation is reinforcing, one might hypothesize that noncontingent release would result in undesirable side effects. A review of those studies in which contingent removal of reinforcement was effective reveals only two that mentioned negative side effects; in both, noncontingent release from isolation was permitted (Pendergrass, 1971, 1972). In one study subjects exhibited new aggressive behavior toward the therapist (Pendergrass, 1972); it was suppressed when the definition of punishable behavior was expanded to include it. Pendergrass (1971) reported far more serious side effects for one girl who trembled and crouched when anyone said "No, don't hit." She consistently urinated in the isolation room and spent long periods of time facedown when not in the 20-minute isolation period. The findings suggest that the relationship between noncontingent release and negative side effects merits further exploration.

There have also been a few reports of positive side effects when contingent removal of reinforcement is required. These behaviors include greater participation in ward activities and personal interaction (Barrett, 1969; Bostow & Bailey, 1969; Brawley et al., 1969; Hamilton et al., 1967; Sachs, 1973) and the development of self-feeding in a person who had been spoon-fed for 23 years (Edwards & Lilly, 1966). G. L. Martin et al. (1971) reported mixed side effects during a program to decrease messiness while eating. One retarded subject exhibited a decrease in eating with hands and yelling; a second played with utensils less but yelled more; and a third ate more often with her hands. These unwanted increases were eliminated by expanding the definition of the target behavior to encompass them in the punishment process.

Successful generalization of the effects of contingent removal of reinforcement has occurred reliably only when the program was instituted in the new settings (Bostow & Bailey, 1969; Brawley et al., 1969; Hamilton & Stephens, 1967; Harmatz & Rasmussen, 1969; J. J. Myers & Deibert, 1971; Wolf, Risley, & Mees, 1964; Wolf, Risley, Johnston, Harris, & Allen, 1967). Mixed results were found in studies in which the procedures were not applied in the novel settings. Hauck and Martin (1970), using removal of music, reported that control of finger flicking generalized to a new setting when the same music was played. Pendergrass (1971) stated that control over a retarded child's hitting of people by a social-isolation procedure did not generalize to control over hitting objects. Edwards and Lilly (1966) found that appropriately quiet dining-room behavior did not extend to other parts of the day. Moreover, their patients tended to revert to their disorganized behaviors with any change of ward staff. Husted et al. (1971) tried to promote generalization of control of SIB and aggression in four retarded girls. Although they used a variable-interval schedule of reinforcement, moved treatment from an isolated room to the ward, increased the size of the group with four more girls, and spaced the sessions through the day, they were unable to achieve generalization. This failure may have been due to the absence of punishment in the girls' living quarters when the experimenters were absent.

Successful maintenance of suppression when contingent removal of reinforcement remained in effect has been reported for periods ranging from 1 to 11 months (Brawley et al., 1969; Hamilton & Stephens, 1967; Hamilton et al., 1967; Hawkins et al., 1966; G. L. Martin et al., 1971; O'Brien & Azrin, 1972; Wolf, Risley, & Mees, 1964; Wolf, Risley, Johnston, Harris, & Allen, 1967). Two studies reported unsuccessful maintenance when punishment contingencies were discontinued (Lahey et al., 1973; Ritschl et al., 1972). By contrast, three studies demonstrated maintenance of reduction of the target behavior to the point that punishment was no longer necessary. These

ranged from 2 months (Adams et al., 1973) and 4 months (Barrett, 1969) to 6 months (Zegiob et al., 1976).

Extinction

Related to—and sometimes confused with—time-out, extinction has been found of relatively little use in the suppression of severely disruptive behaviors. This may be because it is not easy to ignore the kinds of problems we are reviewing here. Two categories of behavior on which extinction has been tried are temper tantrums and SIB. Williams (1959) instructed the parents of a healthy 21-month-old boy to ignore his tantrums after he was put to bed, and a rapid decline in tantrums was reported. In a more difficult case, J. A. Martin and Iagulli (1974) used extinction for middle-of-the-night tantrums in a 4-year-old retarded child but reported no significant decrease.

The results of extinction procedures with SIB have been mixed. Ignoring self-biting and other disruptive behaviors led to a decline in biting but not head banging in a retarded boy with Lesch-Nyhan syndrome (Duker, 1975). However, D. V. Myers (1975) observed no change in SIB of a 12-year-old retarded boy when his teacher ignored all hand or finger biting. A response-cost procedure with tokens proved more effective. Ross, Meichenbaum, and Humphrey (1971) treated nocturnal head banging in a 16-year-old juvenile offender with extinction. The removal of staff attention decreased but did not eliminate the behavior. Ignoring a retarded child's vomiting in class, rather than returning her to her room as had previously been done, led to a marked decline in this troublesome behavior (Wolf, Birnbrauer, Williams, & Lawler, 1965). Sajwaj, Twardosz, and Burke (1972) found that ignoring a retarded preschooler's excessive speech to his teacher led to its rapid decline and a concurrent increase in speech to other children.

P. L. Martin and Foxx (1973) demonstrated the experimental feasibility of using extinction to reduce aggressive behavior in a retarded woman. A "victim" sat passively in the presence of the subject and allowed her to strike him without comment or retaliation. Using a reversal design, they were able to show a significant decrement in the frequency of aggression during extinction. Nonetheless, as the authors noted, this procedure would be difficult to implement on a clinical basis because it is not easy for staff to sustain physical assault from patients without a protective response.

Noncontingent Social Isolation

Noncontigent social isolation has been used very rarely to treat severely disruptive behaviors at least in part because of danger to the patient. In their evaluation of different techniques for suppressing SIB, Lovaas and Simmons (1969) used noncontingent social isolation with two retarded youngsters. Each child was left alone, unrestrained, for $1\frac{1}{2}$-hour sessions. Although SIB declined over time, there was no evidence of generalization to other settings. The authors expressed reservations about using this treatment with a behavior of the severity of SIB because the process is prolonged and the child may do real harm—or at least experience considerable discomfort—before the behavior ceases. In addition, as Gardner (1969) noted, the frequency of the target behavior may increase before it decreases.

Corte et al. (1971), using an hour-a-day isolation procedure for 12 days, reported no decrease in SIB in two retarded adolescents. They noted that the total time spent in isolation was considerably less than that used in the Lovaas and Simmons (1969) study. Both Corte et al. (1971) and Lovaas and Simmons (1969) used electric shock after noncontingent social isolation failed.

In contrast with studies using noncontingent isolation as a first choice, two case reports are also available in which it was used as an alternative procedure for SIB after electric shock had lost its potency. In the first of these, Jones, Simmons, and Frankel (1974) described a 9-year-old retarded autistic girl whose SIB had been treated successfully with shock at age 5 years but who had to be rehospitalized after 9 months because of increased SIB. As a consequence, an isolation procedure was implemented. The child was left alone and unrestrained in a room for

two 2-hour sessions a day. Self-injury declined over time; after 25 weeks, time spent in isolation was decreased while time in other activities was increased. For reasons that were not evident there was an increase in SIB after 72 weeks. When noncontingent social isolation was reinstituted, SIB once again declined. We found it interesting that the girl showed generalization of suppression to the ward even though it had not been programmed systematically. The report recounts no extended follow-up.

Romanczyk and Goren (1975) turned to noncontingent social isolation after shock lost its suppressive effect for a 6½-year-old boy. They used 12-hour isolation sessions in a well-padded chamber with the boy dressed in protective clothing. In contrast with Jones et al. (1974), these authors failed to find significant suppression. It is of interest to note that their subject, unlike the subjects in studies by Lovaas and Simmons (1969), Corte et al. (1971), and Jones et al. (1974), was dressed in considerable protective clothing. He may not have been as free to respond as subjects in earlier studies. However, the severity of his behavior clearly demanded such precautions.

In addition to the obvious physical risk associated with noncontingent social isolation, there is a problem of generalization. With the exception of the report by Jones et al. (1974), the literature has been consistently negative regarding generalization of learning from an isolation procedure. Noncontingent social isolation is also costly of the patient's time and carries little insurance that it will be effective.

In general, procedures involving isolation or removal of reinforcement appear more suitable for tantrums, aggression, or mild behavior problems than for SIB. Their application for SIB is especially hazardous because isolation permits serious physical harm to occur. Although contingent removal of reinforcement is potentially effective with self-stimulation, a careful behavioral analysis is necessary before putting a subject in a setting that might simply facilitate self-stimulation. In using isolation one must also consider the problem of removing the subject from the learning environment. The person who is isolated may cease the unwanted behavior but will not learn other, more adaptive behaviors until back in the teaching situation. Thus, data as well as ethics argue for as brief an isolation as possible and for the use of isolation primarily with subjects who do not harm themselves.

Overcorrection

Foxx and Azrin introduced overcorrection in 1972 as a way to minimize the negative aspects of traditional forms of punishment. In their 1972 paper, they pointed to the risk of increasing aggression when using punishment (Bandura, 1969; Berkowitz, 1970; Holt, 1970) and suggested that punishment is not educative because it neither teaches appropriate behavior nor corrects the immediate damage of the offending act. Overcorrection is viewed as an educative process composed of two main components, restitution and positive practice. Restitution requires the disruptor to repair the surroundings so that they are better than prior to the disturbance. Positive practice requires repeated practice of a relevant behavior. When the inappropriate behavior does not change the environment, only positive practice is used. Graduated guidance from the therapist can accompany both procedures. It is hypothesized that the patient will choose to do the restitutional overcorrection and positive practice voluntarily rather than be guided through the behavior. Thus, overcorrection combines punishment and negative reinforcement (Foxx & Azrin, 1973).

Whereas the bulk of overcorrection studies have been of retarded adults (e.g., Azrin, Kaplan, & Foxx, 1973; Azrin, Sneed, & Foxx, 1973; Foxx & Azrin, 1972; Rollings, Baumeister, & Baumeister, 1977), others have employed retarded children (e.g., Doke & Epstein, 1975), emotionally disturbed boys, and chronic adult psychiatric patients (e.g., Foxx & Azrin, 1972; Sumner, Mueser, Hsu, & Morales, 1974).

Overcorrection has been markedly effective in reducing such aggressive behaviors as hitting, biting, and throwing of objects (Foxx & Azrin, 1972; Matson & Stephens, 1977; Sumner et al., 1974). Its value for self-

stimulation (e.g., Azrin, Gottlieb, Hughart, Wesolowski, & Rahn, 1975; J. Martin, Weller, & Matson, 1977; Rush, Close, Hops, & Agosta, 1976) and SIB (e.g., Azrin et al., 1975) has been less broadly effective. Overcorrection procedures have also been used effectively in the treatment of enuresis (Azrin, Sneed, & Foxx, 1973), recurrent vomiting (Azrin & Wesolowski, 1975; Duker & Seys, 1977), nocturnal head banging (Wooden, 1974), persistent floor sprawling (Azrin & Wesolowski, 1974), public disrobing (Foxx, 1976), disruptive behavior (Azrin & Powers, 1975), and noncompliance (Doleys, Wells, Hobbs, Roberts, & Cartelli, 1976).

The use of a complex treatment package in the majority of overcorrection studies makes it difficult to identify the essential ingredients in overcorrection (Ollendick & Matson, 1976). These dimensions include duration and topography of the procedure, degree of graduated guidance, and presence or absence of restoration or positive practice. To further complicate the picture, DRO and removal of reinforcement are often incorporated into the overcorrection package (Azrin et al., 1975; Azrin & Powers, 1975).

The duration of overcorrection episodes varies widely across studies. Durations have included 40 sec (Doleys et al., 1976), 2.5 min (Epstein, Doke, Sajwaj, Sorrell, & Rimmer, 1974), 5 min (Foxx & Azrin, 1973; Matson & Stephens, 1977), 20 min (Foxx & Azrin, 1972), and 30 min (Foxx & Azrin, 1972). The effect of varying durations is unknown.

The topography of overcorrection is typically tailored for a specific purpose. For example, an oral-hygiene procedure has been used for biting (Foxx & Azrin, 1972), mouthing of objects (Foxx & Azrin, 1973), and coprophagy (Foxx & Martin, 1975). Aggressive behavior has been treated by having the disruptor apologize and restore the environment (Foxx & Azrin, 1972). In one approach to SIB, Azrin et al. (1975) used a combination of reinforced alternative activities, required relaxation, and practice of hand movement to suppress self-scratching and self-biting. Head banging has been treated with a series of arm and head exercises (Harris & Romanczyk, 1976). Must there be a relationship between the target behavior and the form of overcorrection? Not always (Doke & Epstein, 1975; Epstein et al., 1974). For example, Epstein et al. (1974) successfully applied a hand overcorrection to both foot and hand self-stimulation in one schizophrenic child and to hand and vocal self-stimulation in another.

The degree of graduated guidance in carrying out overcorrection procedures has varied from gentle guidance (Azrin et al., 1975; Foxx & Azrin, 1972) to forcing the person through activities (Azrin et al., 1975; Harris & Romanczyk, 1976).

Setting aside the question of active ingredients, it is clear that overcorrection works and in many instances may be superior to other treatments. Although early overcorrection studies were of limited value because they were case reports, recent, more sophisticated studies incorporating withdrawal designs (Doke & Epstein, 1975; Kelly & Drabman, 1977; Matson & Stephens, 1977) or multiple baselines (Duker & Seys, 1977; Epstein et al., 1974; Foxx & Martin, 1975) have added empirical support to demonstrate the value of these procedures. Two of these studies showed an awareness of an important measurement problem in this area—that the frequency of the target behavior may be influenced by whether recordings of the target behavior include or exclude the duration of the overcorrection (Doke & Epstein, 1975; Epstein et al., 1974).

Overcorrection has generally been shown to be more effective than alternative modes of treatment. Several studies comparing simple correction (such as returning stolen food or getting up from the floor) with overcorrection showed the latter to be superior (Azrin & Wesolowski, 1974, 1975). A comparison of verbal warnings and loss of recess with overcorrection showed the overcorrection to be more effective in reducing disruptive behavior in emotionally disturbed boys (Azrin & Powers, 1975). Azrin, Sneed, and Foxx (1973) found overcorrection superior to simple awakening to an alarm to treat enuresis in retarded adults. An evaluation of contingent social isolation, physical restraint, and overcorrection to reduce public disrobing by two retarded women showed overcorrection to be the most effective intervention (Foxx, 1976). Overcorrection has also been shown to be

more effective than DRO with retarded subjects for treating SIB and more effective than DRO and a slap for reducing self-stimulation (Foxx & Azrin, 1973). By contrast, Doleys et al. (1976) found overcorrection less effective than verbal scolding but slightly more effective than contingent withdrawal of reinforcement in reducing noncompliance in retarded children. Although the bulk of these studies favor overcorrection, they failed to adequately evaluate the differential effects of various treatments. Two studies that used appropriate design found overcorrection to be superior to DRO for the reduction of vomiting in a retarded female (Duker & Seys, 1977) and superior to DRI in treating the throwing of small objects by a psychotic adult (Matson & Stephens, 1977). Thus, with the exception of Doleys et al.'s (1976) work, research has consistently demonstrated the superiority of overcorrection to other treatment approaches with roughly the same degree of aversiveness.

Since overcorrection was introduced at least in part to reduce unwanted side effects, it is interesting to examine its effect in this regard. Studies using overcorrection to treat aggression reported only beneficial side effects, including increased socialization (Foxx & Azrin, 1972; Matson & Stephens, 1977; Sumner et al., 1974). Foxx and Martin (1975) indicated that their retarded subjects learned how to brush their teeth as a consequence of the oral-hygiene overcorrection. They also noted improved hand washing for those subjects in the personal-hygiene overcorrection. Epstein et al. (1974) observed that an increase in appropriate play accompanied the decrease of inappropriate hand self-stimulation in a schizophrenic child. Not all the reports were positive, however. Several studies using overcorrection to treat self-stimulation noted negative side effects such as development of, or an increase in, self-stimulatory behaviors (Doke & Epstein, 1975; Epstein et al., 1974; Rollings et al., 1977) and a rapid increase in new self-injurious behaviors (Doke & Epstein, 1975; Measel & Alfieri, 1976; Rollings et al., 1977). However, Doke and Epstein (1975) stated that this increased SIB and self-stimulation was suppressed as soon as overcorrection was applied to them.

Research examining the generalization of the effects of overcorrection to novel settings and people has shown little evidence of generalization without specific training (Foxx & Azrin, 1972, 1973; Harris & Romanczyk, 1976; Measel & Alfieri, 1976; Rollings et al., 1977). Only two studies reported limited generalization without specific programming. In one, reduction in eye poking by a visually handicapped boy generalized from a chair to the floor of the playroom (Kelly & Drabman, 1977). Since the two situations were very similar, these results may not reflect what would actually occur in the natural environment. In another study, J. Martin et al. (1977) reported anecdotal evidence indicating that reduction in self-stimulation generalized beyond the therapy sessions.

Of those overcorrection studies reporting follow-up, only one stated that suppression was not maintained (Rollings et al., 1977), but most of the successful follow-ups were 4 months or less (Azrin, Sneed, & Foxx, 1973; Doke & Epstein, 1975; Foxx & Azrin, 1972, 1973; Matson & Stephens, 1977; Measel & Alfieri, 1976; Rusch et al., 1976). Two studies reported successful maintenance at 6 months and 9 months, respectively (Azrin & Wesolowski, 1975; Harris & Romanczyk, 1976). Among the studies with follow-up data, five reported maintenance of suppression through verbal warnings without the use of overcorrection (Azrin & Wesolowski, 1975; Doke & Epstein, 1975; Foxx & Azrin, 1972, 1973; Rusch et al., 1976). Doke and Epstein (1975) qualified the effective use of verbal warning to be limited to those behaviors to which overcorrection had been applied previously.

The evidence to date suggests that overcorrection is an important and innovative contribution to the management of severely disruptive behavior. The impressive level of success in early studies demands a careful analysis of the essential components of this process and the development of guidelines for optimally efficient use of the procedures.

Electric Shock

The use of electric shock for the suppression of psychotic behavior enjoyed a brief but controversial popularity in the late 1960s and

early 1970s. Its use is presently more conservative than at its inception. In 1964, Lovaas, Freitag, Kinder, Rubenstein, Schaeffer, and Simmons (Note 1) described the application of shock to treat psychotic behavior in children. This set the stage for a series of studies using shock to treat SIB (Browning, 1971; Bucher & Lovaas, 1968; Corte et al., 1971; Duker, 1976; Griffin, Locke, & Landers, 1975; Kohlenberg, Levin, & Belcher, 1973; Lovaas & Simmons, 1969; McFarlain, Andy, Scott, & Wheatley, 1975; Merbaum, 1973; Prochaska, Smith, Marzilli, Colby, & Donavan, 1974; Romanczyk & Goren, 1975; Tate & Baroff, 1966; Whaley & Tough, 1970; Young & Wincze, 1974). Electric shock was also used to modify such varied and hazardous behaviors as stereotyped screaming (Hamilton & Standahl, 1969), chronic ruminative vomiting (Cunningham & Linscheid, 1976; Kohlenberg, 1970; Lang & Melamed, 1969; Luckey, Watson, & Musick, 1968; Toister, Colin, Worley, & Arthur, 1975; Watkins, 1972; J. C. White & Taylor, 1967), assaultive behavior (Birnbrauer, 1968; Brandsma & Stein, 1973; Browning, 1971; Ludwig, Marx, Hill, & Browning, 1969), and dangerous climbing (Risley, 1968). Other behaviors treated with shock include body rocking (Baumeister & Forehand, 1972), playing with electrical equipment (Bucher & King, 1971), incorrect picture identification (Kircher, Pear, & Martin, 1971), failure to come when called (Lovaas, Schaeffer, & Simmons, 1974), self-induced seizures (Wright, 1973), window breaking (Hamilton & Standahl, 1969), and paper eating (Hamilton & Standahl, 1969). Shock was applied primarily with retarded people whose cognitive abilities limited their ability to benefit from verbal instruction. It was also used effectively with infants of apparently normal intellectual potential who engaged in ruminative vomiting. Probably because they respond to less drastic alternatives and because few of them would tolerate it, there have been few reports of shock given to adults of normal intelligence (e.g., Ludwig et al., 1969).

In spite of its initial promise, electric shock has been found to have limitations. Problems of generalization, maintenance, potential side effects, method of delivery, and schedules of punishment, as well as lay and professional resistance to the use of such a painful modality, demanded a careful examination of this approach. While Bachman (1972) was rather enthusiastic in his support of shock as a treatment for SIB, a few years later Griffin and Locke (1974) wrote that "although favorable results were generally reported with aversion techniques for SIB suppression, the most recent consensus seems to favor a near exclusive reliance on positive approaches" (p. 18). They argued that this shift away from shock was based not only on ethical but on procedural considerations as well.

Although most authors report immediate suppression of the target behavior in response to the application of shock, the problems of obtaining generalization and maintenance of this suppression pose major obstacles. Thus, Birnbrauer (1968), in one of the early commentaries on these difficulties, noted that appropriate behavior in the laboratory did not automatically generalize to the living unit. Even after suppression was obtained on the ward, it was not maintained over a prolonged period. Birnbrauer (1968) urged that punishment not be discontinued until there was complete and prolonged suppression of the target behavior. Romanczyk and Goren (1975) commented that "it appears that the *experimental* control of self-injurious behavior has been extrapolated to lead to the conclusion that *clinical* control is possible. Within the clinical setting it is not sufficient to reduce severe self-injurious behavior to 'very low levels.' Complete suppression for extended periods is the only acceptable criterion" (p. 738).

Lovaas and Simmons (1969) noted that although there was no automatic generalization to new settings, suppression followed after only a few punishments in the novel environment. They cautioned that shock was specific to the people to whom and places in which it was administered. Corte et al. (1971), examining generalization across clinical settings and experiments, found that after their subject received shock from three different experimenters, there was immediate generalization to a fourth. Nevertheless, suppression did not automatically transfer to situations in which no experimenter was present. In addition,

their data regarding maintenance were mixed, with one of the four subjects no longer showing suppression of SIB after 2 months. Duker's (1976) report that an escape-avoidance paradigm was superior to punishment in obtaining sustained suppression of SIB argued for additional evaluation of this approach.

The issue of who is to administer shock is important for effective treatment. In those settings where personnel have extensive clinical responsibilities it is often difficult to insure that shock will be administered consistently. Thus, even if suppression is obtained in the laboratory and transferred to the living unit, maintenance may be difficult because of inconsistent treatment (Birnbrauer, 1968). One alternative to the institution is a home-based program. Merbaum (1973), working on an outpatient basis, taught a mother and a teacher to use shock to suppress SIB. He reported generalization to home and school with both mother and teacher acting as effective agents. A 1-year follow-up indicated continued maintenance of suppression. In another study, Prochaska et al. (1974) reported that parents could be successfully trained to use a remote-control shock device to bring SIB to a zero rate with good follow-up after 7 months. Unfortunately, not all home-based programs are this effective. Romanczyk and Goren (1975) described a case of excellent initial suppression in the lab, home, and school followed by loss of control in all settings and eventual institutionalization. In discussing this clinical failure they point to the discriminative nature of the equipment and the difficulty of maintaining control in an increasingly complex environment.

A major methodological problem in the evaluation of the literature on the use of shock has been the lack of a suitable experimental design. The majority of articles are case reports. Some of these are well-thought-out case reports with baseline data and reliable measures of the occurrence of the target behavior; others are much more limited in value because they are anecdotal summaries of clinical contacts.

Reversal designs are difficult and, indeed, of debatable ethical quality when used with behaviors of the severity that might warrant shock. However, multiple-baseline designs can be applied readily (Johnston, 1972). The lack of generalization across settings and therapists actually facilitates this form of design. Two studies that took advantage of this approach were Corte et al. (1971) and Duker (1976).

In those studies examining maintenance the period of follow-up has been relatively limited. Although many have no follow-up, others have followed subjects for periods ranging from 3 to 10 months (e.g., Baumeister & Forehand, 1972; Birnbrauer, 1968; Corte et al., 1971), and in a few cases there has been a full year or more of follow-up (e.g., Griffin et al., 1975; Hamilton & Standahl, 1969; Lang & Melamed, 1969; Merbaum, 1973). In light of the central importance of maintenance in evaluating the efficacy of shock, long-term follow-up data are essential.

One important concern in the use of shock has been whether or not unwanted side effects follow from its use. Do subjects become aggressive, withdrawn, or fearful? Most articles dealing with this question have described favorable side effects including seeking more attention from the therapist, better eye contact, and improved socialization (e.g., Bucher & King, 1971; Bucher & Lovaas, 1968; Hamilton & Standahl, 1969; Lovaas et al., 1974; Lovaas & Simmons, 1969; Merbaum, 1973). However, there have been exceptions, such as Brandsma and Stein's (1973) report that a retarded adult patient, shocked to treat aggressive behavior, exhibited some transient SIB during treatment. Bucher & Lovaas (1968) described one child who became more aggressive toward other children after shock was implemented for SIB. They suggested that this was due to a failure to train suitable alternative behaviors. Ludwig et al. (1969) reported that their adult schizophrenic patient showed some adverse behaviors including "pseudocatatonic sitdown," mild aggression, and SIB. None of these proved an enduring problem. The retarded child treated by Prochaska et al. (1974) began to exhibit a head-snapping response 3 months after remote-control shock was instituted for head banging. This new behavior was suppressed after the definition of SIB was expanded to encompass it. Similarly, Risley (1968) identified an increase in chair climbing

when he punished book-case climbing in an autistic girl. This too was suppressed by the use of shock. Young and Wincze (1974) described an increase in fist-to-head SIB while head-to-bed-rail SIB was declining with shock. Several authors have reported negative emotional reactions to shock including fear of the apparatus (Baroff & Tate, 1968; Bucher & King, 1971; Merbaum, 1973; Simmons & Lovaas, 1969), crying (Bucher & Lovaas, 1968; Duker, 1976), sullenness (Bucher & King, 1971), and decreased happiness (Lovaas et al., 1974).

In a preponderance of cases in which side effects of shock were reported, they were described as favorable. In their review of shock with autistic children, Lichtenstein and Schreibman (1976) reported a 5:1 ratio of positive to negative side effects. Those few reports that detailed unfavorable effects usually noted, at the same time, that they were temporary. Of course, data on side effects are only as good as the ability of the researcher to identify them. Nonetheless, it seems reasonable to assume that really serious side effects would be detected. In the absence of such negative data, the generally favorable comments about improved responsiveness on the part of many subjects are encouraging.

The equipment used to deliver shock is important both in terms of safety and effectiveness. The most commonly used piece of equipment has been a battery-operated shock prod delivering a peak shock of 1,400 V at 0.4 mA (Birnbrauer, 1968; Brandsma & Stein, 1973; Bucher & King, 1971; Corte et al., 1971; Hamilton & Standahl, 1969; Kohlenberg, 1970; Kohlenberg et al., 1973; Lovaas & Simmons, 1969; Ludwig et al., 1969; Merbaum, 1973). Romanczyk and Goren (1975) used the basic prod but connected long wires to electrodes attached to the subject. This allowed greater physical mobility for the boy and insured an instant response by the therapist. An even more desirable solution to the problem of permitting subject mobility and simultaneously rapid therapist response may be the use of remote-control shock. This approach may well facilitate generalization, since the discriminative cue of the prod is removed from the subject's view (Duker, 1976; Hamilton & Standahl, 1969; Luckey et al., 1968; Prochaska et al., 1974; Simmons & Lovaas, 1969; Wilbur, Chandler, & Carpenter, 1974; Young & Wincze, 1974). However, Johnson, Williams, and Landrum (1965) cautioned that some remote-control devices could be activated accidently by external sources, such as a CB radio. Whaley and Tough (1970) and Yeakel, Salisbury, Greer, and Marcus (1970) reported the development of equipment that delivers a shock automatically when the subject engages in SIB, and Wilbur et al. (1974) offered considerable detail about the design of such apparatus.

In addition to the more obvious problems of insuring that shocks are delivered consistently according to schedule and that the subject is unable to escape from punishment, shock involves safety problems that are not often mentioned in the literature. Butterfield (1975), in a systematic examination of the safety factors that must be considered when delivering shock to human subjects, pointed to (a) hazards, such as failure to recognize that current, not voltage, is the important variable in assessing how lethal a shock may be, (b) consideration of the path followed by current as it passes through the body (it must never go through the trunk), and (c) possible risks to a subject who might touch the metal case of a shock prod while being shocked. Noting that "any device that is used for aversive conditioning is potentially lethal" (p. 107), he urged that researchers report the type of device; its output characteristics, such as voltage and amplitude; the electrode material, design, area, and placement; and the type and amount of electrode paste. Published compliance with these standards is rare. The more careful studies have detailed the type of device, location of electrodes, and voltage and amplitude of the device output. In light of these technical complexities many clinicians untrained in the principles of electricity ought to read Butterfield's (1975) article and have suitable consultation available when instituting shock.

In sum, electric shock often works to create initial suppression of SIB but poses major problems of generalization and maintenance. The use of prolonged treatment, application within an escape avoidance para-

digm, remote-control equipment, and systematic programming for generalization may all contribute to clinically meaningful suppression. The negative side effects of shock appear outweighed by the positive ones, although this decision must obviously be made on a case-by-case basis. There are sufficient data to allow the clinician to consider shock when milder treatment modalities fail.

Other Techniques

Clinicians have tried many strategies in the name of treatment. Some of these (e.g., overcorrection) have proved to be major contributions to the field; others have remained obscure because of limited efficacy, highly specific effect, potential risk, or lack of publicity.

One technique long abused but recently used more rationally is restraint. Restraint used to mean simply tying a person to a bed or placing someone in a straitjacket for a prolonged period. Restraint as behavior modification is very different. For example, O'Brien, Azrin and Bugle (1972) decreased crawling and increased walking in profoundly retarded children by holding them around the waist for 5 sec when they crawled, at the same time prompting walking. Similarly, in teaching eating behaviors, O'Brien, Bugle, and Azrin (1972) and Henricksen and Doughty (1967) briefly held the child's arm to prevent inappropriate eating and then shaped appropriate eating skills. Dealing with a more serious problem, Saposnek and Watson (1974) significantly decreased SIB in a young boy by holding him while he hit and encouraging him to strike the therapist's hand. Giles and Wolf (1966) successfully toilet trained institutionalized retarded people using a combination of reward for appropriate toileting and restraint for inappropriate behavior.

The broad application of restraint as a punishment deserves closer attention. Although apparently effective when used in conjunction with procedures to teach and reinforce appropriate behaviors, it may be contraindicated in some cases. For example, Forehand and Baumeister (1970) reported temporary increases in rocking behavior when retarded men were restrained for 18 minutes prior to observation.

Another form of punishment in the response repertoire of many adults, but only recently used systematically by behavior modifiers, is the slap. Lovaas, Berberich, Perloff, and Schaeffer (1966) described slapping as a technique for suppressing disruptive behavior prior to language training for mute children. A light tap on the hand of an 8-year-old retarded girl reduced her head banging (Morrison, 1972). However, the data in this study were too sketchy to allow evaluation of treatment effects. G. R. Marshall (1966) used a slap on the buttocks as a component of a toilet-training package for a retarded, autistic boy. In two studies a slap was used to suppress self-stimulation (Koegel & Covert, 1972; Koegel, Firestone, Kramme, & Dunlap, 1974). In both studies behavior was enhanced by this suppression. Romanczyk (1977) compared two schedules of punishment when using a slap to suppress self-stimulation in two retarded children. He reported a variable schedule to be as effective as continuous punishment in obtaining suppression. The data also suggested that the variable schedule produced greater resistance to extinction than the continuous one.

Other forms of physical punishment include shaking (Risley, 1968; Stark et al., 1969) and aversive tickling (Greene & Hoats, 1971). The latter decreased but did not eliminate SIB. In slapping or shaking a patient the therapist must be aware of the intensity of the stimulus, the consistency with which it is given, and the site to which it is delivered. The physical condition of the patient must also be considered—a young or delicate child might be injured by a shake that would only be unpleasant to a larger person. Further, it requires training to use a slap effectively.

Liquids that taste or smell unpleasant have rarely been used to suppress unwanted behavior. Conway and Bucher (1974) used a shot of shaving cream in the mouth to control tantrums in a profoundly impaired girl. Sajwaj, Libet, and Agras (1974) used a 5- to 10-cc squirt of lemon juice in the mouth to effectively treat life-threatening vomiting in a 6-month-old infant. Tanner and Zeiler (1975) reported crushing a capsule of aromatic ammonia near the nose of a 20-year-old autistic woman to suppress SIB. These three

studies employed substances that were relatively mild in terms of risk. Nevertheless, one must anticipate problems of physical injury in administering an aversive liquid or gas. As Tanner and Zeiler (1975) pointed out, there is potential danger of destruction of nasal mucosa in using aromatic ammonia. Although shaving cream and lemon juice have low toxicity ratings (Gleason, Gosselin, Hodge, & Smith, 1969), even mild substances can produce unpleasant or lethal side effects in sufficient quantities. The nonmedical practitioner who uses such things as mouthwash, tabasco sauce, or other bad-tasting liquids to suppress behavior would do well to consult a physician and be alert to physical side effects.

General Conclusions

The questions raised about the use of punishment may be classified in two broad categories—methodological and ethical. We will discuss each in turn.

Methodological Issues

A blanket prescription for treating seriously disruptive behavior does not make good behavioral sense. For example, Carr (1977) has illustrated the importance of identifying antecedent and consequent events prior to treating SIB. Treating SIB that is (a) organically based, (b) maintained by positive reinforcement, (c) maintained by negative reinforcement, or (d) maintained by need for stimulation calls for different strategies. There is no isomorphic relationship between a particular behavior and a specific treatment. Effective intervention demands a thoughtful behavioral analysis.

If one uses an aversive procedure it is necessary to insure that there are sufficient resources to sustain the progress gained in treatment. It would be of little value to suppress temper tantrums in a therapy room if the patient returned to a ward or home that was unable to offer appropriate support for maintenance. Generalization and maintenance cannot be left to chance: If not programmed, they likely will not occur. Related to these concerns is the problem of training caretakers to administer aversive treatments. Beyond Loeber's (1971) examination of monetary reward as an incentive for performance and Koegel, Russo, and Rincover's (1977) exploration of techniques for training teachers, little has been done to evaluate training techniques for treating serious behavior problems in an institutional setting.

The client must be taught alternative responses to replace the undesirable behavior (H. H. Marshall, 1965; Smolev, 1971). The lack of such alternatives may account for a number of failures to sustain suppression of undesirable behavior.

There are a variety of methodological problems underlying research on punishment. These issues have been identified above. The following list, posed as a series of questions, summarizes major concerns in evaluating research in this area.

1. Does the procedure achieve complete suppression of the target behavior?
2. Does suppression generalize to other settings and other caretakers?
3. Is suppression sustained over time?
4. Are there side effects, positive or negative?
5. Is there physical risk to the subject?
6. Can the suppression procedures be consistently implemented by caretakers?
7. What level of training is required to use the procedure?
8. Are less drastic alternatives available?
9. Is provision made to teach the patient alternative responses?
10. What kinds of people benefit from the procedure?
11. Is an intermittent or continuous schedule of delivery more effective?
12. Where in the chain of responses can this procedure be most effectively imposed?
13. How intense must the punishment be to obtain suppression?

Above, we have tried, to the extent possible, to answer these questions. Our inability to do so in many cases reflects the need for continuing research on punishment and its alternatives. Comparisons of procedures, schedules and durations of punishment, evaluation of side effects, and techniques for facilitating generalization and maintenance remain com-

pelling issues that cut across the various techniques.

Ethical Issues

Beyond the technological problems in the application of punishment there remains the issue of the ethics of its use. May we legitimately impose pain or discomfort on other people to alter their behavior? More specifically, may we impose such procedures on people who are too young or intellectually damaged to give their informed consent to such procedures? These questions have been hotly debated (Miron, 1968; Senate Subcommittee on Constitutional Rights, 1974) and, in some instances, have become the object of legal intervention (Friedman, 1975; R. Martin, 1975). The use of electric shock, in particular, has generated extensive controversy (Akerley, 1976; Creedon, 1976; Oppenheim, 1976; Schreibman, 1977; Shea & Shea, 1976; Webster, 1977). It is clear that it is not possible for the behavior modifier simply to impose punishment without consulting the patient, legal guardian, or, in some instances, the court. Nonetheless, there is a substantial body of literature that recognizes that under appropriate conditions one may use painful or unpleasant procedures to benefit the patient (Buddenhagen, 1971; MacMillan, Forness, & Trumbull, 1973; R. Martin, 1975; Mayer, Sulzer, & Cody, 1968; Smolev, 1971; Warren, 1971).

Physicians freely use uncomfortable treatments, such as surgery or radiation, to treat physical disorders. We do not inquire about the morality of postoperative discomfort. Perhaps the objective evaluation of aversive behavioral procedures has become obscured because it is behavior and not disease that is being treated and because of the multiple meanings of the word punishment. To the lay public, punishment is a form of retribution or payment for wrongdoing. Criminals (and naughty children) deserve to be punished for their misdeeds. This retribution view argues, for example, that people ought to go to prison regardless of the lack of rehabilitation that takes place during incarceration. Punishment as used in a behavioral sense has a different meaning. Adhering to the concepts of learning theory, the behavior modifier simply defines punishment as any technique that decreases the probability of the future occurrence of a behavior. Removing the concept of moral justification from punishment does not make its application value free. Instead, it shifts the level at which the decisions are made. One must raise the question of whether a particular behavior is serious enough to warrant the pain of a specific treatment, just as we need to insure that a given physical disorder is serious enough to justify the risks of surgery. Such decisions lend themselves more readily to empirical inquiry than do those of morality. Even if smearing food were unattractive, one would hardly think electric shock an appropriate response to it. Painful procedures such as shock, slaps, or unpleasant liquids should be reserved for those situations in which the behavior offers a significant threat to the patient's life or welfare. These procedures are not appropriate for behaviors that are simply cosmetically undesirable or annoying. Along with all of the concern about imposing limits upon the practice of punishment, we must consider the other side of the ethical coin—the patient's right to treatment. When we have procedures of demonstrated efficacy and patients whose lives are disrupted by unwanted behaviors, there exists a compelling argument for the use of aversive procedures. As Romanczyk (1977) noted, the difficulties, legal and ethical, involved in punishment should not lead to automatic rejection of these procedures without considering the needs of the patient.

Summary

Punishment, for all the controversy that surrounds it, sometimes works for some problems. Its milder varieties including overcorrection and contingent removal of reinforcement, have produced moderate bodies of literature demonstrating their worth. Temper tantrums and some kinds of SIB and self-stimulation respond to DRO and contingent removal of reinforcement. Overcorrection has been effective in the treatment of aggression, self-stimulation, and some forms of SIB. The more intrusive punishments, specifically, elec-

tric shock, likewise have utility, although empirical support is weaker for them than for the milder treatment modalities. Shock has worked quite well to suppress chronic rumination in infants and has been of benefit for some cases of SIB.

It is not surprising that the best and most extensive research has focused on the less severe forms of intervention. One has fewer ethical qualms about imposing research requirements when studying the use of contingent removal of reinforcement for tantrums than when studying shock for SIB. Nonetheless, the painful nature of shock stands as a blunt argument for research in this area. Shock has not yet fulfilled the clinician's early hopes for its value in treatment. A close look reveals serious problems in generalization and maintenance of suppression with shock. Do we conclude that it ought to be abandoned? The answer to the question is a qualified *no*. Confronted by problems of the severity of SIB, one is reluctant to surrender any option. Nevertheless, the available data do demand that (a) less drastic alternatives be tried before shock is applied and (b) every case in which it is applied become a testing ground to expand our procedures for insuring generalization and maintenance. In the case of electric shock, more than any other punishment, there remains a serious discrepancy between what we see in the laboratory and in clinical practice.

The acknowledged limitations on the efficacy of punishment lend considerable support to the concept of a human-rights committee (Friedman, 1975) or other legally constituted group to pass judgment on the implementation of intrusive or experimental forms of punishment.

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