Generalization Effects of a Spray Mist to Reduce Self-Injurious Behaviors in Two Profoundly Retarded Female Adults

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GENERALIZATION EFFECTS OF A SPRAY MIST TO REDUCE SELF-INJURIOUS BEHAVIORS IN TWO PROFONDLY RETARDED FEMALE ADULTS

by

Pamela A. Ong

A Thesis
Submitted to the Faculty of The Graduate College in partial fulfillment of the Degree of Master of Arts

Western Michigan University
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Family and friends too numerous to mention here were also directly responsible for the completion of this paper. Special thanks to my mother and to Paul Kuczora for their extraordinary patience and understanding during the writing of this paper.

Pamela A. Ong
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INTRODUCTION

A common behavior found in residential institutions for the severely and profoundly mentally retarded is that of self-injurious behavior (SIB). Examples include "head-banging", "arm-banging", beating oneself with fists or knee, and biting oneself on the arms or hands (Lovaas and Simmons, 1969).

Drugs and Restraints

Drugs are used in an attempt to control self-injurious behavior but research indicates that this method appears to be relatively ineffective (Berkson, 1965; Rudy, Himwich, and Rinaldi, 1958). Severe forms of self-injurious behavior require restraints in order to protect the health of the child. The main advantages of these methods used individually or in combination are that they are inexpensive and do not require a great amount of staff time to administer. However, these methods used individually or in combination may interfere with the training of more desirable behaviors (Koegel and Covert, 1972) but are often the only available method of control in institutions where a high resident-to-staff ratio precludes any interaction with the residents beyond custodial care. Use of physical restraint such as tying the resident's arms or feet to the bed can lead to permanent physical damage such as structural changes, demineralization, shortening of the tendons, and arrested motor development, secondary to disuse of limbs (Lovaas and Simmons, 1969).

Behavioral methods based on learning theory derived from experimental animal studies have been studied extensively in an attempt
to eliminate self-injurious behaviors and include: differential reinforcement of other behavior (DRO), reinforcement of specific competing behaviors, extinction, time-out from positive reinforcement (TO), punishment, overcorrection and comparative methods of treatment studies.

**Differential Reinforcement of Other Behavior**

The use of positive reinforcement as in differential reinforcement of other behavior is the preferred method of treatment because it is generally more acceptable to staff persons in the institutional or school setting. In the typical DRO schedule, the subject is reinforced only if he has not engaged in an undesirable behavior for a previously specified amount of time. Unlike other schedules of reinforcement, DRO does not specify what responses will be reinforced but rather it specifies the response(s) which will preclude reinforcement. Ragain and Anson (1976) demonstrated very brief (three minutes) suppression of head-banging by using DRO alone. Repp and Deitz (1974) found that DRO was most effective when used in conjunction with other methods such as brief time-out, mild verbal reprimand and response cost. Ferster's (1961) theory states that many autistic behaviors are learned. According to this premise, for subjects who have a relatively short history of self-injurious behavior, positive reinforcement will probably be more effective than subjects whose self-injurious behavior is more long-standing, e.g. the older client with a long history of institutionalization. More appropriate behaviors can be taught to the class of subjects who respond to this schedule of reinforcement. Most studies investigating the effects of DRO have
used relatively young subjects (cf. Frankel, Moss, Schofield and Simmons (1976): CA=6; Peterson and Peterson (1968): CA=8; Ragain and Anson (1976): CA=12; Repp and Deitz (1974): CA=12, CA=8; Repp, Deitz and Deitz (1976): CA=14). However, subjects who do not respond to the usual reinforcers such as edible or social reinforcement are unlikely to benefit from the effects of a DRO schedule. Another disadvantage of the use of a DRO schedule is that because the subject is reinforced for any behavior other than the self-injurious behavior, the risk of conditioning superstitious behavior is taken (Skinner, 1948).

Reinforcement of Competing Responses

A second method of decelerating self-injurious behavior utilizing a reinforcement procedure is to reinforce a specific behavior that is incompatible with the self-injurious response. An incompatible or competing response is one that is physically impossible to carry out while engaged in a self-injurious response. For example, if the targeted self-injurious behavior were hand-biting, a possible incompatible response to be reinforced would be whenever the subject places or holds his hands on the chair arms or at his side for a specific duration of time. Lovaas, Frietag, Gold and Kassorla (1965) reduced the self-injurious behavior of a schizophrenic subject by reinforcing the specific incompatible behavior of lever pressing and singing. In order to gain instructional control over two severely retarded subjects' undesirable behavior of stereotypic gestures, Weisberg, Passman and Russell (1973) reinforced the subjects' imitative response to the verbal prompt of "do this". The experimenter then modeled the response
that was incompatible with the targeted gesture. The authors reported suppression of gesturing responses when this procedure was initiated. However, Young and Wincze (1974) were only partially successful in decreasing head-banging of a profoundly retarded adult subject by training an incompatible response. The authors reinforced the subject whenever he had his hands on the bed rail, a behavior incompatible with the targeted response. Fist-to-head response rates did decrease in frequency but head-to-rail responses actually increased as a result of this procedure.

The advantages of reinforcement of competing responses are like the advantages of all other reinforcement procedures in that reinforcement may be more palatable to staff and more effective with the subject who is "reinforceable", i.e., one who will respond to traditional reinforcement methods such as food, praise, tactile and social reinforcement. Another advantage of this procedure is that the subject is taught to follow verbal instructions as in the Weisberg et al. (1973) study. The main disadvantage of this method is that often, the incompatible behavior that is taught may not be functional, relevant or available to the subject's natural environment, e.g., lever pressing. A more functional incompatible behavior that could be taught might be the reinforcement of appropriate toy manipulation.

Extinction

The removal of a potential reinforcer that may be maintaining an undesirable behavior is defined as extinction. Used as a decelerator of self-injurious behavior, this procedure is based on the premise that if the self-injurious behavior had been originally shaped and
maintained by the social effects it produced on the social environment, then the contingent removal of such consequences should weaken and eventually eliminate the self-injurious response. Extinction has been studied as a method to reduce self-injurious behavior rates by many experimenters (Adams, Klinge and Keiser, 1973; Baumeister and Forehand, 1971; Williams, 1959; Wolf, Birnbauer, Lawler and Williams, 1970).

Adams, Klinge and Keiser (1973) demonstrated control of a 14 year old severely retarded and epileptic female's falling behavior by use of extinction. Shortly after admission to a clinic for seizure control, the subject developed a pattern of falling from her chair while sitting alone and not receiving the attention from staff or clients. The clinic staff determined that these episodes were not epileptic in nature since the subject's eyelids moved while seemingly unconscious. Before treatment by the authors, staff and patients nearby would offer assistance to the chair and concern for the subject's safety. Treatment consisted of enriching the subject's environment by offering her access to the most reinforcing events contingent upon her not falling. Secondly, the staff and patients were instructed to ignore the subject's non-epileptic falls. After five days of the extinction procedure, the rate of non-epileptic falls decreased from a baseline rate of ten per day to zero. Extinction seems to be the safest method of treatment when the history of the self-injurious response is short (cf. Adams et al., 1973). Lovaas and Simmons (1969) also used extinction to eliminate self-hitting with two severely retarded children. The authors concluded that although extinction was "seemingly effective", it is not the ideal form of treatment because: (1) initial self-injurious
behavior rates are typically high after extinction procedures are introduced and therefore, (2) exposes the subject to apparent discomfort and (3) possibly endangers his life. These considerations are certainly true for the subject with a longstanding history of self-injury. An example to consider is the older subject with a long history of self-injurious behavior and who resides in an institution with a high client-to-staff ratio. Not only is there little social reinforcement readily available but often it is the case that this type of subject does not respond to social reinforcement because of a deficit in learning history. Therefore, the withdrawal of social reinforcement may have little or no effect on this segment of the institutional population. In fact, the subject might even learn to avoid demands made by the educational staff and extinction might in fact reward the subject (cf. Solnick, Rincover and Peterson, 1977).

**Time Out from Positive Reinforcement**

Time out from positive reinforcement (TO) entails the physical removal of the subject from an area where reinforcement is available to a setting void of reinforcement for a specified period of time (Leitenberg, 1965). The effectiveness of time out has been demonstrated not only with self-injurious behaviors (Myers and Deihart, 1971; Lucero, Frieman, Spoering and Fehrenbacher, 1976) but with a variety of other undesirable behaviors such as aggression (Hamilton, Stephens and Allen, 1967; Sachs, 1973) and non-compliance (Sachs, 1973). The use of time out from positive reinforcement is advantageous because the subject cannot be reinforced for inappropriate responses due to the absence of possible reinforcing stimuli. Conversely, appropriate
behaviors are not reinforced during the time-out period. Care must be taken by the experimenter to observe the subject in the time out area and to remove the subject from time out after the subject has not emitted the undesirable behavior for a specified period of time.

Hamilton, Stephens and Allen (1967) demonstrated the effectiveness of time out in reducing the rates of inappropriate behaviors in five institutionalized subjects. The subjects were removed to time out areas contingent upon the target behaviors for predetermined periods of time which ranged from thirty minutes to two hours. The various targeted behaviors were: head banging, undressing, breaking windows with the head, physical aggression and verbal aggression. The results of this study indicated that time out was effective in reducing the targeted behaviors.

Sachs (1973) attempted to reduce aggression, self-stimulation and non-compliance with contingent time out as the aversive stimulus. Non-compliance and aggression responses were eliminated but the rate of self-stimulation actually increased as a result of time out. Prochaska, Smith, Marzilli, Colby, and Donovan (1974) found similar results in attempting to reduce the rates of head banging with a nine year old subject. Solnick, Rincover, and Peterson (1977) investigated the determinants of the reinforcing and punishing properties of time out. In the first experiment, the results demonstrated that the opportunity for a six year old subject to engage in self-stimulatory behavior during time out was responsible for an increase in tantrums, the undesirable behavior. When time out failed to reduce spitting and self-injurious behavior of a 16 year old retarded male subject, the

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nature of the "time in" environment was demonstrated to be an important determinant of the effects of time out. When the "time in" environment was enriched, i.e., new toys and increased social reinforcement for approximations to appropriate toy play, time out became an effective punisher.

The problems in using time out as an effective decelerator in the institutional setting can be examined in light of the Solnick et al. (1977) findings. Typically, much of the institutionalized client's waking hours are spent void of social or tactile stimulation. Again, due to the high resident-to-staff ratio, only the clients' basic needs are met such as feeding, dressing, bathing and diapering. In the absence of any other stimulation, the resident is left to create his own stimulation such as rubbing his clothing, wheelchair or any other available object. Therefore, if the severely retarded subject is put back into isolation, he will probably return to his already-established and reinforcing repertoire of self-stimulation. In the severe instance, the subject will return to self-injurious behavior while in time out. The use of time out with such subjects may only serve to reinforce the subject if self-injurious behavior or self-stimulation is in fact reinforcing since the subject usually chooses to engage in that behavior most often.

Aversive Control

The contingent use of aversive stimuli to control undesirable behavior has been studied extensively (Birnbauer, 1968; Butcher and Lovaas, 1968; Lovaas, Schaeffer and Simmons, 1965; Risley, 1968; Sajwaj, Libet and Agras, 1974; Tanner and Zeiler, 1975; Tate and Barhoff,
The aversive stimuli that have been studied are: slaps, ammonia, loud noise, lemon juice, and shock. The main advantage of each procedure using aversive stimuli is the immediate and almost total response suppression. Although aversive techniques bring about the most immediate results, controversy over the ethical and legal ramifications of its use abounds (Stolz, Wienckowski and Brown 1975; Wexler, 1974). In the clinical setting, the use of aversive stimuli is restricted by administrative and nursing staff due to the pain and possible physical damage to the subject. Only in life threatening instances and when all other methods have been exhausted such as the previously described reinforcement procedures, is the use of aversive stimuli usually considered ethically sound (Stolz et al., 1975).

The disadvantage of slaps (Koegel, Firestone, Kramme and Dunlop, 1974; Romanczyk, 1977) as an aversive consequence is that the intensity of a slap can vary greatly from each use as well as from person to person. Auxiliary staff may also misuse such methods to control the residents' behavior which could lead to serious abuse.

The inhalation of aromatic ammonia capsules served as the aversive stimulus in a study by Tanner and Zeiler (1975). Although the calibration of each presentation of the punisher is consistent, extended or repeated use or contact with the aromatic ammonia fumes can cause damage to the nasal mucosa. Contact of the liquid with the skin can also lead to physical damage. Therefore, ammonia is limited to use with responsible and well-trained staff thereby restricting its usage throughout the agency or institution.
Extended exposure to loud noise (Azrin, 1958) risks permanent hearing loss and the subject can eventually attenuate to the effects of very loud verbal reprimands.

The high acidity of lemon juice (Sajwaj et al., 1974) may not only cause damage to the teeth but also causes excessive salivation. Some subjects have been observed to "finger" the excessive saliva as a form of self-stimulation (as evidenced by Subject One in the present study) or when used with subjects who ruminate, the use of lemon juice tends to exacerbate the problem.

The most extensively reported aversive stimulus is electric shock (Birnbauer, 1968; Butcher and Lovaas, 1968; Lovaas et al., 1965; Prochaska et al., 1974; Risley, 1968; Tate and Barhoff, 1966; Whaley and Tough, 1970; and White and Taylor, 1967). The confusion between electroconvulsive therapy and contingent electric shock may serve to make the latter's use unpopular to the general population. Although the mild electric shock quickly suppresses the targeted behavior, and the effect can be easily generalized with the use of remote control devices (cf. Prochaska et al., 1974), this method is not often used in institutions in even life threatening situations because it is perceived to be "cruel and unusual punishment".

Overcorrection

An alternative decelerator of self-injurious behavior to traditional painful punishment procedures is the application of "overcorrection" contingent upon a self-injurious response. This method was initially described by Foxx and Azrin (1973). A variety of "positive practice overcorrection" procedures were described in which the subjects were
required to perform a predetermined series of appropriate behaviors that were topographically incompatible with the self-stimulation responses. The rationale behind overcorrection is "...to teach and motivate the (subject) to hold his (body) in a sustained orientation (not moving) and to move only for functional reasons, i.e., when told to do so." (page seven). Therefore, Foxx and Azrin reason that "Overcorrective Functional Movement Training" is educative because the subjects eventually learn to follow specific directions. For example, if the subject were to engage in head banging, the subject would be required to randomly position his head in each of four positions: up, down, right and left. After a self-injurious response, the subject's head would be restrained by the experimenter. Then, a verbal cue would be given such as, "Tricia, head up." If the subject did not respond immediately, the experimenter would then manually guide the subject's head in the appropriate direction and hold it in that position for fifteen seconds. Foxx and Azrin state that the subject will eventually respond to the verbal cue alone to avoid the experimenter's physical guidance as in conditioned avoidance (Azrin, Holtz, and Hake, 1962). Epstein, Doke, Sajwaj, Sorrell and Rimmer (1974) reported that the effects of positive practice overcorrection on inappropriate movements to be consistent with those of Foxx and Azrin (1973). They found that overcorrection was not only effective for the targeted response (inappropriate hand movements), but also weakened topographically different behaviors (inappropriate foot movements). However, Epstein et al. reported an increase in other undesirable behaviors (inappropriate vocalizations) as a result of the overcorrection procedure. The authors concluded that the application
of a single treatment to various behaviors could save staff time and increase the appeal of overcorrection as an alternative to the more dangerous and painful punishment procedures.

Like the Epstein et al. findings of increases in undesirable behaviors, Rollings, Baumeister and Baumeister (1977) were forced to terminate the study when more severe self-injurious behaviors were demonstrated. Rollings et al. applied overcorrection procedures to a stereotyped behavior, head-weaving. However, the subject then began to exhibit several previously unobserved behaviors such as self-pinching, self-scratching and screaming. The study was terminated when the subject began the self-injurious behavior of head banging because of potentially serious injury. A second study was conducted to suppress body rocking with overcorrection. Increases in intensity and frequency of self-hits and head nodding were recorded when overcorrection was introduced. Lastly, the suppression of the targeted behaviors did not generalize to new settings.

Matson and Stephens (in press) assessed the effects of overcorrection on a number of stereotyped behaviors in two adult retardates. The stereotyped behaviors (wall-patting, face patting, face rubbing and hair flipping) were reduced but these reductions did not generalize across settings. However, in contrast to the Epstein et al. data, no negative side effects were observed but rather, increased social responsiveness and positive affect responses (smiles and comments) were recorded. The authors concluded that generalization did not occur because the experimenter had become a conditioned stimulus for the presentation of overcorrection.
While overcorrection is more acceptable as a means of deceleration and it serves to "educate" the subject, its use is disadvantageous in many ways in the institutional setting. Effective administration of this procedure is time-consuming. Since there is typically a high resident-to-staff ratio, widespread use of this procedure is limited. Also, Rollings et al. (1977) reported that this procedure did not have immediate effects as Foxx and Azrin (1973) had previously stated.

Although overcorrection is less repugnant, its effects are less adaptative. Overcorrection is intended to teach the subject a functional behavior such as following a one-step direction to place a body part up or down. However, the question should be asked as to how really "functional", or adaptative the newly learned behavior will be to the subject outside of the experimental setting. Perhaps the experimenter should consider long term goals or objectives and teach a skill more practical and beneficial in the subject's naturally-occurring environment. For example, the subject could be taught to visually track an object in a random pattern contingently upon head banging. A second alternative could be to teach the subject to either point at an object in the room with an extended index finger or to pick up a small object in front of him contingently upon a hand biting response. These new behaviors would teach the subject to move his body parts in a manner that would be more beneficial to future educational skills such as in a program to teach stimulus discrimination.

A second consideration of overcorrection's utility is the fact that the mere verbal, social (e.g., eye contact with the experimenter) and physical interaction required by the experimenter to carry out
positive practice contingently upon the self-injurious response may in fact, serve to increase the rate of the targeted behavior. Measel and Alfieri (1976) reported data from an overcorrection study to support this hypothesis. Considering the typical deprived social environment of an institution, such attention that is required by overcorrection might serve as a strong reinforcer.

Lastly, if overcorrection is not well-supervised or if the experimenter is required to hold a recalcitrant subject in position for long periods of time, the experimenter could become abusive to the subject. (cf. In re Department of Mental Health vs. Bliss, Calvert, Chambers and Congdon, 1976) Also, the subject may be inadvertently reinforced if he escapes the experimenter's grasp and the experimenter must chase the subject.

Comparative Treatment Studies

Several studies have been made comparing the effectiveness of the various treatment methods of self-injurious behavior. Lovaas and Simmons (1969) compared extinction with punishment and briefly examined the effects of social reinforcement upon the rates of self-injurious behavior. As previously stated, the authors found that extinction was effective in terminating the self-injurious behavior. However, due to the fact that extinction is not immediately effective, this procedure exposes some subjects to severe injury and possible death particularly during the initial extinction sessions when response rates usually increase. Punishment or the contingent application of an aversive stimulus, i.e., brief electric shock, was found to be the most effective and desirable treatment because of the immediate response suppression.
When the experimenters administered social reinforcement contingent upon the fifth self-injurious response (Fixed Ratio Five), the rate of the self-injurious response increased. The authors concluded that the traditional approach of trying to "understand" what the subject wants can in fact, worsen the problem of self-injurious behavior.

Corte, Wolf and Locke (1971) compared the effects of extinction, differential reinforcement of other behavior, and punishment. Extinction was not shown to be an effective treatment for two subjects. Using the same subjects, differential reinforcement of other behavior was effective in reducing the self-injurious response rate of one subject only when mildly food deprived but the procedure was ineffective with the other subject. Punishment was the only treatment that produced immediate response suppression in all four subjects' rate of self-injurious behavior. Both Corte et al. and Lovaas and Simmons found that the effects of punishment were highly specific and easily discriminated by the subjects. Lovaas and Simmons' subjects discriminated the physical locales and experimenters where punishment was administrated. Corte et al. found that punishment effects spontaneously generalized to a fourth experimenter in the case of one subject. Other studies have supported the Corte et al. and Lovaas and Simmons findings (Rollings et al., 1977; Matson and Stephens, in press).

Based on experimental animal studies data, Bachman (1972) compared the effectiveness of differential reinforcement of other behavior, reinforcement of competing behaviors, extinction, time out, and punishment in the treatment of self-injurious behavior. Punishment was found to be the most effective method in eliminating a behavior in
animal subjects. Bachman concluded that punishment of a self-injurious behavior in combination with some schedule of reinforcement for a competing behavior has been consistently proven to be the treatment of choice in the reduction of self-injurious response rates in humans. Like Lovaas et al. (1965), Bachman notes that the pain and harm of the punishing stimulus is insignificant when compared to the accumulative long term effects of severe self-injurious behavior.

Rationale of the Study

The literature on treatment methods for the reduction of self-injurious behavior yields little data on the older institutionalized subject with a relatively long history of self-injurious behavior. Several factors inherent in the institutional setting preclude the effectiveness of reinforcement procedures (differential reinforcement of other behavior, reinforcement of competing responses). Foremost is the typical high resident-to-staff ratio that limits staff interaction to only the essential needs of the client. The staff will more readily attend to imminently harmful situations rather than reinforce more desirable behaviors. The staff may also inadvertently reinforce the subject by trying to "understand" what the subject wants (cf. Lovaas and Simmons, 1969).

Secondly, the long term institutionalized client is less apt to be "reinforceable" by normal standards. Due to the lack of appropriate social interactions, some institutionalized clients do not respond to traditional types of social reinforcement such as smiles, praise, or tactile stimulation. Often, the same client does not respond to the usually effective edible reinforcers such as candy, cereal, pudding or
juice. In the case of the present study, the institution did not allow the use of food deprivation in treatment programs.

Due to the fact that the institutionalized client spends most of his or her waking hours devoid of appropriate social interaction, extinction and time out are also less likely to be effective due to the paucity of existing reinforcing stimuli. Also, the length of time needed for extinction may actually endanger the subject's life when a severe self-injurious behavior such as head banging is the targeted behavior.

Because of the state of social deprivation in the institutional setting, overcorrection in some cases may actually increase the self-injurious response rate due to the almost constant physical contact of the experimenter required to implement the procedure. There have also been cases of broken bones of clients who received overcorrection from over zealous staff (Congdon, Personal Communication).

Most of the aversive control measures have many properties that make these procedures unsuitable for use in the institutional setting. The use of ammonia, loud noise, slaps and shock all result in pain to the subject. Physical damage can result from the use of lemon juice and aromatic ammonia. These aversive control measures also can be misused by staff and result in the abuse of the subject.

Finally, although punishment will decelerate a self-injurious response rate, the effects are not longstanding, i.e., they do not generalize easily outside of the experimental setting, unless some other stimulus associated with the experimental setting is present outside of that experimental setting. Lovaas and Simmons (1969)
demonstrated that the word "no" paired with the aversive stimulus, shock, became a conditioned punisher, i.e., it served to suppress the self-injurious behavior alone, for one subject. The punishing effects generalized across experimenters and settings in only one of the two subjects. The other subject discriminated the "punishing" experimenter and "no" alone did not generalize until shock was paired with the different experimenters. Two variables confound Lovaas and Simmons' results. Before "no" was paired with the shock, it was tested for its suppressive effects for two sessions. The authors stated that the subject "...merely received the word 'no'...and (the word) was demonstrated to be neutral, i.e., ineffective." (page 151). However, when "no" alone was presented after being paired with shock, the authors stated that "...a loud 'no' was given contingent upon self-destructive behavior and it served to bring that behavior to zero level." (page 151). The intensity of the word "no" could account for the suppression of self-injurious behavior if it startled or punished the subject.

Lovaas and Simmons do not clearly state if the pre-treatment intensity level of "no" was identical to the post treatment "no". The second confounding variable that may have accounted for the other subject's discrimination of the "punishing" experimenter is the presence of the shock inductorium. Lovaas and Simmons do not state whether or not the shock device was present at all times with all experimenters and not just the "punishing" experimenters. The absence of the shock inductorium may have signaled the absence of shock.

In order for a decelerating method to be maximally therapeutic, its suppressive effects must generalize outside of the experimental setting.
Ideally, these effects should be easily replicable by other people and in the different settings of the subject's naturally occurring environment. Birnbauer (1968) investigated the generalization effects of response contingent shock. Shock paired with the word "don't" was administered contingent upon a variety of incorrect responses (picture tearing, bottle breaking, incorrect button pressing, and clock breaking). After several pairings of shock and "don't" contingent upon incorrect button pressing, novel objects were placed in the experimental area. The initial verbal warnings alone were insufficient in suppressing the subject's destructive behaviors upon the novel objects. Shock had to be paired with the warning in order to be effective in decreasing the destructive behaviors with the novel stimuli. Later when a second experimenter used "don't" alone as a conditioned punisher, this had no effect on the targeted behavior. Again, it was only when the second experimenter administered shock with the word "don't" did the word alone stop destructive attempts. However, like Lovaas and Simmons, Birnbauer does not state whether or not the shock inductorium was present at all sessions with all experimenters.

Romanczyk (1977) paired a firm "no" with a slap but never reported any systematic pre-test of "no" alone as a conditioned punisher of the targeted self-injurious behavior.

The purpose of the present study was: (1) to investigate the effectiveness of a less harmful and noxious punishing stimulus to suppress a self-injurious response and (2) to develop a method to facilitate the generalization of the punishing effects of the aversive stimulus to a setting outside of the experimental area. The aversive
stimulus chosen was a fine spray mist of water directed at the subject's face. The self-injurious response was hand biting and served as the target behavior of the study. The second purpose of the study was designed into the procedure because the administrative staff of the institution would approve the study only if punishment conditions were restricted to one closed setting, i.e., not on the ward. This measure was taken as a precaution against the potential abuse by unsupervised nursing aides who might observe punishment by the experimenter. A multiple baseline across settings design (Kazdin and Kopel, 1975) was used in the present study to control for treatment effects in the experimental setting and as a precaution against abuse by auxiliary staff. The word, "no" spoken in a normal tone of voice was paired with the aversive stimulus during training sessions and was later tested alone in different settings and with different experimenters who were not associated with the water mist.
METHOD

Subjects

Two profoundly mentally retarded non-ambulatory and speechless females who resided in a privately owned residential care facility in Oshtemo, Michigan served as subjects in the present study.

Subject selection was based on several criteria besides the common high rate of self-injurious behavior, hand-biting or mouthing. The institutional staff expressed a desire for treatment of hand-biting because: (1) informal observation indicated that the subjects engaged in hand-biting almost continually (in the hallways, day room, classrooms, during feeding times, and in bed), (2) the use of contingent positive reinforcement (social or primary) or its withdrawal was reported to be unsuccessful in the past by other staff, (3) sporadic use of punishment (slaps, loud verbal reprimand) effects were transitory at best and did not generalize outside of treatment areas, (4) overcorrection had only served to increase other self-stimulatory behavior ("fingering" clothing had increased as a result for Subject One and "clapping" had increased as a result of overcorrection for Subject Two), (5) educational task training was precluded by the incompatible response of hand-biting, and (6) the possibility of infection by open wounds being exposed to saliva.

Subject One was 21 years of age and had been institutionalized since the age of four. Her diagnosis was profound mental retardation and severe quadriplegia due to Edward's Syndrome (partial trisomy 18). There was no indication of how long hand-biting had persisted but
large callouses and inflammation evidenced an extensive history.

Subject Two was 26 years old and had also been institutionalized since the age of four. Her diagnosis was profound mental retardation with encephalopathy at birth and cerebral palsy resulting in severe quadriplegia. The etiology of these congenital defects was unknown. Examination of her medical records revealed no indication of the onset of hand-biting. Again, large, thick callouses and inflammation evidenced a long history of hand-biting.

Subject Two served in a study conducted approximately 18 months prior to the present experiment in which water mist was used as an aversive stimulus. However, since the rates of the self-injurious behavior had returned to pre-treatment levels, Subject Two was included in the present study.

Settings

Classroom (Setting A). Sessions were conducted in this setting during the morning at 9:00 a.m. for Subject One and at 10:00 a.m. for Subject Two.

The physical dimensions of the classroom were sixteen feet long by eight feet wide. There were usually one to four other students and two teacher aides present at any given time throughout the study. There were no partitions to isolate the subjects from environmental distractions due to municipal fire guidelines that banned their use in the classrooms.

Each subject was seated in the manner they were worked with in other educational settings and also to comply with prescriptive guidelines set by the physical therapy staff. This was done in order
to facilitate generalization to their normal classroom environment.

Subject One was seated in a chair at a small cut-out table with blocks and various small toys, i.e., those which were available, placed in front of her in random order. The experimenter sat facing the subject at a distance of fifteen inches.

Subject Two sat in her wheelchair facing the experimenter who was seated twenty-four inches away.

**Hallways and Nurses' Station (Setting B).** Sessions were conducted in this setting during the afternoons. During baseline sessions, Subject One was observed at 1:00 p.m. but this time was changed to 3:00 p.m. and finally to noon due to staff scheduling conflicts. This factor is discussed in the final section of this paper. Subject Two was observed at 2:00 p.m. in this setting. These times and settings were chosen because both subjects spent the majority of their waking hours in these areas of the institution.

Subject One's afternoon treatment sessions were conducted at various locations around the nurses' station. Subject Two's afternoon sessions were conducted in the hallways near her bedroom. She was usually placed in the hallways away from the other residents and staff because she was loud, grabbed other residents and objects within reach, tipped over other residents in their wheelchairs, and was generally disruptive. Subject Two's wheelchair was always secured to the handrails along the walls with a sheet so she could not maneuver her wheelchair via the handrails. The experimenters sat at a distance of twenty-four inches from either side of the subject.

Pre-baseline observations indicated that the staff rarely attended
to either subject other than taking care of basic needs because Subject One was innocuous and Subject Two was disruptive but safely restrained. The staff reaction (or lack thereof) toward the subjects was typical because residents who receive extra staff attention usually respond in a more socially appropriate manner such as smile, babble or maintain eye contact.

Response Definition and Observation

The response definition of hand-biting or mouthing in the present experiment was: any contact of the subject's hand from the wrist up to her lips or in her mouth. Therefore, a brief touch, e.g., one second, of the subject's fingertips to lip was not differentiated from placing a fist in the mouth and biting. However, both subjects were observed prior to the study to almost always insert their fist or half of their hand (from the bottom joints at the palm to fingertips) in their mouths and repeatedly bite (up and down movement of the jaws) or lick (a repetitive movement of the hand in and out of the mouth while extending the tongue) during pre-treatment sessions.

The occurrences of mouthing were recorded during continuous ten second intervals using a partial interval scoring procedure (Powell, Martindale, and Kulp, 1973). A cassette tape with recorded auditory prompts indicated the beginning of each interval. Earphones were used by the experimenter and observers in listening to the auditory cues in order to prevent the intervals from becoming conditioned auditory stimuli for the subjects. The percent of intervals during which the self-injurious behavior occurred was obtained by dividing the positively scored intervals (range = 0 to 120) by the total number of intervals.
(120) and multiplying by 100. All sessions were conducted daily for twenty minutes. Exceptions were made when the subjects were ill and confined to bed or whenever staff scheduling conflicts occurred (see baseline observations in setting B for Subject One).

**Reliability**

Reliability was taken for each subject at least once per condition in both settings. During sessions in which reliability was assessed, data were taken by both experimenter and an independent observer. Reliabilities were calculated by dividing the number of agreements of mouthing on an interval-by-interval basis by the total number of agreements plus disagreements. Reliability scores ranged from 86% to 100% with a mean of 99.1% across all sessions.

**Procedures**

**Condition I: Baseline.** Target behaviors were recorded for each subject in the absence of contingencies. Baseline data were recorded for each subject until pressure from the experimenter's superior terminated this condition. Condition I lasted twelve sessions for Subject One and seven sessions for Subject Two.

**Condition II: "No" Alone.** Each time the subject emitted a self-injurious response, the experimenter said, "No" or "No, (subject's name)" in a normal tone of voice, i.e., not loudly in such a way that the volume would be considered aversive to the subject. If the subject's hand remained in contact with her mouth throughout the interval, "No" was again repeated at the beginning of the next interval. Therefore, the verbal reprimand was used both contingently upon insertion of the hand in mouth and whenever the hand was present in the mouth.
This condition was simultaneously in effect in both settings until data trends had somewhat stabilized. Again, this condition was terminated due to pressure from the experimenter's superior. Condition II lasted for eight sessions for Subject One and eleven sessions for Subject Two.

**Condition III: Water Mist Plus "No" Plus DRO-1 Minute/Return to Baseline.** The water mist stimulus was directed toward the subject's face contingent upon the occurrence of hand-biting. The water mist was dispensed from a standard plastic spray bottle that is normally used to mist plants or dampen clothes for ironing purposes. The spray bottle was always adjusted to ensure maximum misting effect, i.e., diffused spray of water as opposed to a direct stream of water, and held no closer than one foot from the subject's face. The spray bottle was placed within easy reach of the experimenter but was out of the subject's sight when not in use. This was done in order to prevent the presence of the spray bottle to become a discriminative stimulus. At the time the spray was administered, the experimenter said "No" in a normal tone of voice. The subject's hands and mouth were dried with a towel after each spray because it was soon found that their faces would be very wet after several mistings. This was done to prevent the chilling of the subject. This condition was in effect in the morning sessions in Setting A only and lasted until data trends stabilized. Due to administrative pressure to "do something more than just say 'No' and spray the clients in the face", a DRO one minute condition was instituted during this phase of the study. DRO one minute was begun in the classroom for Subject One on session 24 and for Subject Two on session
30. However, during some sessions, DRO was not used in order to act as "probe" sessions to see how much effect DRO had. Subject One was reinforced with tickling, smiling, praise (e.g., "Good girl!") and growling by the experimenter. Subject Two was reinforced by the experimenter clapping her hands, smiling and praise (e.g., "Good girl!"). Baseline data were recorded during afternoon sessions in Setting B until data trends stabilized in morning sessions ("No" + mist + DRO). Condition III lasted for 21 sessions for Subject One and 23 sessions for Subject Two.

**Condition IV: "No" Alone + DRO-1 Minute.** During these sessions, "No" was said to the subject in a normal tone of voice contingent upon mouthing responses in both settings. Subject One's hands and mouth were dried with a towel whenever she removed her hands because she usually rubbed saliva into her face. Again, due to administrative pressure to "do something more with them than just say 'No'", a DRO one minute had to be continued in the classroom sessions and instituted in the hallways and nurses' station (setting B) sessions despite the experimenter's efforts to retain experimental rigor. As in Condition III, DRO was not carried out consistently as can be seen on the graphic illustration of the data. The subjects were reinforced in the same manner as described in Condition III. This condition was terminated when the experimenter left the institution for another job in the intermediate school district. Condition IV lasted 14 sessions for Subject One and 12 sessions for Subject Two.
RESULTS

Mean percentage of hand-biting for each subject across experimental conditions and settings are presented in Table One.

Insert Table 1 About Here

Initial baseline rates for both subjects ranged from 90.84% to 55.37% in both settings. Subject One's self-injurious response rates were lower in the nurses' station setting (55.37%) due to the changes in experimental session times. This problem is discussed further in the last section of the paper.

When "No" was presented contingently upon a self-injurious response in both settings, there was little change in the average rates of the targeted behavior. When "No" was paired with an aversive stimulus (the spray mist) presented contingently upon the self-injurious response and DRO, the average rate of self-injurious behavior in the classroom setting was suppressed to an average of 5.10% for Subject One and 6.22% for Subject Two. In the sessions conducted outside of the classroom in the afternoons, baseline rates of self-injurious behavior were 78.53% for Subject One and 87.48% for Subject Two. When "No" was presented contingently upon a self-injurious response and DRO was used in the classroom (morning) sessions, the rate of the targeted behavior was reduced further in the classroom. This is illustrated in the 3.00% response rate for Subject One and a 2.10% response rate for Subject Two in this setting. When "No" was presented contingently upon the self-injurious response and DRO was used in the afternoon sessions
TABLE ONE
Mean Percentages of Self-Injurious Behavior Rates
In Two Settings as a Function of Conditions

<table>
<thead>
<tr>
<th></th>
<th>SETTINGs</th>
<th>Subject One</th>
<th>Subject Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDITION</td>
<td>Classroom</td>
<td>Nurses' Station</td>
<td>Classroom</td>
</tr>
<tr>
<td>Baseline</td>
<td>90.84</td>
<td>55.37</td>
<td>74.73</td>
</tr>
<tr>
<td>&quot;No&quot; Alone</td>
<td>88.38</td>
<td>94.20</td>
<td>92.00</td>
</tr>
<tr>
<td>&quot;No&quot; + Spray Mist + DRO</td>
<td>5.10</td>
<td>*</td>
<td>6.22</td>
</tr>
<tr>
<td>Baseline</td>
<td>*</td>
<td>78.53</td>
<td>*</td>
</tr>
<tr>
<td>&quot;No&quot; + DRO</td>
<td>3.00</td>
<td>2.08</td>
<td>2.10</td>
</tr>
</tbody>
</table>

* = Conditions not run
in the subjects' natural environment that was never associated with
the aversive stimulus, the rates of self-injurious behavior were reduced
to near zero levels.

Percentage of ten-second intervals in which the subjects engaged
in self-injurious behavior in both settings as a function of the differ­
ent experimental conditions are presented in Figure One for Subject
One and Figure Two for Subject Two.

Data are presented for classroom setting sessions in the upper por­
tions of each figure and the natural environment settings (i.e.,
hallways and nurses' station) data are depicted in the lower portions
of each figure. All classroom sessions are conducted in the morning
hours. All natural environment sessions were conducted in the after­
oons. Experimental conditions are presented at the top of each
graph. Session numbers and experimenters are designated along the
ordinate of each graph. Asterisks above data points indicate the
sessions when the subject was ill. Arrows designate probe sessions
in which DRO was not used.

The fluctuations in baseline rates for Subject One in the
nurses' station setting is more clearly illustrated in the graphic
representation of the data. The sessions with lower rates during
the return to baseline condition in the nurses' station setting
(Sessions 21, 35, 37, and 39) were run at 2:00 or 3:00 due to staff
conflict.

General trends as previously indicated can be seen in Figures
Subject One

Percentage of ten-second intervals in which Subject One engaged in self-injurious behavior in both settings as a function of different experimental conditions.

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Subject Two

Percentage of ten-second intervals in which Subject Two engaged in self-injurious behavior in both settings as a function of different experimental conditions.

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One and Two. There was little difference between baseline and the initial "No" alone conditions. When the aversive stimulus was presented in the classroom sessions along with DRO, response rates rapidly decreased to near zero levels. The return to baseline data from the afternoon sessions that were run on the same days with the morning mist + "No" + DRO sessions is similar to the initial baseline rates with some exceptions as previously discussed. Probe sessions conducted during Condition III ("No" + mist + DRO) where DRO was not used indicated response rates that were low as in sessions using DRO. When "No" + DRO was presented in both settings, self-injurious response rates remained near zero in the setting associated with the spray mist. The self-injurious response rates dropped immediately in the natural environment settings where the water mist was never used. Perusal of the experimenters on each figure indicates that experimenters who had never administered the water mist could suppress the self-injurious response with "No" + DRO in the afternoon sessions. Probe sessions during the last condition in which "No" was used alone demonstrated similar low response rates as in sessions using DRO.
The purpose of the present study was to suppress self-injurious behavior using water mist in one setting paired with a neutral stimulus, i.e., the word "No", and to study the suppressive effects of the word "No" alone in a setting not previously associated with the water mist. The study utilized a multiple baseline design across settings with two profoundly retarded female adults who exhibited high rates of hand-biting prior to the study. All other reinforcement procedures and overcorrection had proven to be ineffective in controlling the subjects' self-injurious response rates. Some forms of punishment such as a loud "No!" and slap had little effect on the subjects' behavior.

The use of aversive control can only be ethically used when all other reinforcement procedures have been demonstrated to be ineffective and the targeted behavior is endangering the subject's life or is impeding learning. The water mist had suppressed Subject Two's self-injurious behavior in a previous study (Dorsey, 1976) but the treatment effects had failed to generalize after the termination of the study as can be seen by the initial baseline data of the present study.

The present study was undertaken because the high hand-biting rates of the two subjects interfered with their educational programming. Since the administrative staff felt that hand-biting was obnoxious and served as an embarrassment when visitors took tours of the institution, they were cooperative initially in the support of
the study. However, one restriction on the study was made by the instructional supervisor. The use of water mist could only be used in the classroom and not used in front of the institutional attendants since it was felt that the mist could potentially be misused by the attendants. Therefore, a non-aversive suppressive method was necessary to control self-injurious response rates outside of the educational classroom. A multiple baseline design was chosen to facilitate and examine generalization effects. The design also served as a control within subjects as well as between subjects by conducting baseline sessions in the afternoons when the water mist was being used in the morning classroom sessions.

Experimentation in a natural setting such as in an institution does not offer an environment with rigid control such as in the experimental laboratory. For example, the occupational therapy staff was known to be using the mist as punishment for hand-biting for Subject One while the initial baseline sessions were being conducted. Despite many attempts, the author could not convince the staff of the necessity of experimental rigor. The baseline session times were also changed from 2:00 p.m. to 3:00 p.m. because of the conflicts with the same occupational therapy staff persons. Subject One was scheduled for occupational therapy sessions at 2:00 but until the study was well-underway, she was never worked with at that time period. Therefore, the session time was changed to noon on session ten. It seemed as if the subject's self-injurious behavior rates were lower later in the day. This can be possibly attributed to fatigue on the part of the subject.
Illness contributed to suppressed rates of the targeted behavior in several instances. This can be seen on sessions 15 (a.m.), 35 (p.m.) and 37 (p.m.) for Subject One and sessions 12 (p.m.), 13 (p.m.), and 32 (p.m.) for Subject Two.

Finally, a factor which may have had considerable impact on the treatment effects of "No" alone in the final condition was the use of differential reinforcement of other behavior. The experimenter was instructed to "do something else besides just sitting there saying 'No'". The experimenter was unable to convince the administrative staff how important it was not to confound the data since the effects of differential reinforcement of other behavior were not tested during baseline sessions. This problem arose from the occupational therapy staff conflicts mentioned earlier.

There were several sessions where differential reinforcement of other behavior was not used by the experimenter, i.e., when the administrative or occupational therapy staff were not present. However, there were few chances for this to occur since the administrative staff person frequently made surprise visits to the educational classroom. Arrows on the graphs indicate those sessions where differential reinforcement of other behavior was not used. These data do not differ from sessions when differential reinforcement of other behavior were used. Because there were no baseline data on the initial effects of differential reinforcement of other behavior, no firm conclusions can be drawn whether or not DRO contributed in suppressing the behavior during the "No" alone sessions. However, in light of Bachman's (1972) conclusions, this procedure incorporating an aversive stimulus (water
conditioned punisher and differential reinforcement of a competing response is the most effective and desirable treatment of choice for self-injurious behavior. Using the aforementioned procedure with a multiple baseline design across settings could be easily and safely replicated in the institutional setting with practical results.

One surprising result of the study was that when the last "No" + DRO condition was presented contingently upon a self-injurious response in the afternoon sessions of Subject Two, her response rate was quickly suppressed even though that experimenter had never administered the water mist. This suggests that the previously neutral stimulus, "No", had acquired suppressive effects on Subject Two's self-injurious response rate and these effects were not merely due to the conditioned stimulus of the experimenter who used the aversive stimulus, Experimenter One.

Because of the confounding variable of the added differential reinforcement of other behavior condition, it is difficult to ascertain which of the treatment effects suppressed the self-injurious behavior and facilitated the generalization to a new setting and in the case of Subject Two, generalization to new experimenters. The use of differential reinforcement of other behavior along with the spray mist could have reinforced a competing response which suppressed the self-injurious response rates. When "No" alone was used, it is unclear whether or not the "No" suppressed the self-injurious behavior or that the reinforcement of other behavior increased the probability of competing responses. A second study to test the actual treatment
effects is called for wherein the mist is paired with the "No" and differential reinforcement of other behavior, is not used at all.

The importance of teaching new, appropriate responses while eliminating undesirable behaviors in institutionalized severely retarded clients cannot be overlooked. Prior to the study, Subject One was not responsive to social or edible reinforcement. During the study, the subject improved in an eating program (she previously refused to open her mouth when fed), ate pudding (which she previously refused), placed blocks in a container upon request, and was generally more responsive to social and edible reinforcement. The positive behaviors that were present after the study were valuable to future instructional programming. Staff remarked how much more "likeable" Subject One was after hand-biting responses decreased and she was more reinforcing to the other staff persons to work with. As a result of the study, Subject One was much more likely to be reinforced for appropriate behaviors, rather than self-injurious behavior.

The use of aversive control methods such as the spray mist is advisable only with subjects who: (1) do not respond to reinforcement or the withdrawal of reinforcement such as time-out and extinction; and (2) engage in behaviors which are potentially harmful to the subject. As a result of the present study, self-injurious behavior was reduced. This reduction facilitated educational programming, reduced the danger of the subjects' hands becoming infected, and lessened the danger of contracting the prevalent infections of the institution. Less harmful behaviors such as stereotypic hand-weaving can be treated with other procedures such as differential
reinforcement of other behavior, extinction or time-out. Treatment effects may take longer to achieve but these procedures have been demonstrated to be effective.

Lastly, the experimental design lends itself well to use in the applied setting. Generalization effects can be studied in an institution where aversive stimuli might be misused by auxillary staff. If the cooperation of all staff persons can be attained, then the problems of experimental control that were found in the present study might be eliminated.
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