

MANIPULATION OF SELF-DESTRUCTION IN THREE RETARDED CHILDREN¹

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The study attempted to isolate some of the environmental conditions that controlled the self-destructive behavior of three severely retarded and psychotic children. In the extinction study subjects were placed in a room where they were allowed to hurt themselves, isolated from interpersonal contact. They eventually ceased to hurt themselves in that situation, the rate of self-destruction falling gradually over successive days. In the punishment study, subjects were administered painful electric shock contingent on the self-destructive behavior. (1) The self-destructive behavior was immediately suppressed. (2) The behavior recurred when shock was removed. (3) The suppression was selective, both across physical locales and interpersonal situations, as a function of the presence of shock. (4) Generalized effects on other, non-shock behaviors, appeared in a clinically desirable direction. Finally, a study was reported where self-destructive behavior increased when certain social attentions were given contingent upon that behavior.

A significant number of children, who are diagnosed as psychotic or severely retarded, manifest, at one time or another in their lives, self-destructive behavior. This behavior consists primarily of "head-banging" (against walls and furniture), "arm-banging" (against sharp corners), beating themselves on their heads or in their faces with their fists or knees, and biting themselves on wrists, arms, and shoulders. In some children, the self-destructive behavior can be severe enough to pose a major problem for the child's safety. Thus, one can frequently see that such children have removed large quantities of flesh from their bodies, torn out their nails, opened wounds in their heads, broken their noses, *etc.* Such severe forms of self-destruction often require

restraints, either in the form of camisoles ("straitjackets") or by tying the child's feet and arms to his bed. Sometimes the self-destructive behavior may be sporadic, at other times it is long-lasting, necessitating such prolonged use of restraints that one can observe structural changes, such as demineralization, and shortening of tendons, and arrested motor development, secondary to disuse of limbs.

Such children pose major problems for both their parents and the personnel who care for them. First of all, there is the immediate threat to the child, either directly through tissue damage or indirectly through infections. There are secondary problems associated with self-destructive behavior which center on the curtailment of growth, psychological and otherwise, in the child who has to be restrained. Finally, the self-destructive child poses major psychological problems for those who take care of him, in the form of anxiety, demoralization, and hopelessness. The authors know of no treatment that effectively alleviates self-destructive behavior. The most common form of treatment consists of some combination of drugs and supportive, interpersonal therapy, and occasional electro-convulsive therapy. There is no evidence to demonstrate that any of these forms of treatment are effective. Conceivably, some treatments could make the child worse. There are no systematic studies that would support either outcome.

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Finally, clinically speaking, such violent self-destruction forms an expression of a most severe psychotic state. If self-destruction is an expression of a psychosis, then an understanding of the events that effect self-destruction should throw some light on the psychosis itself.

An earlier paper (Lovaas, Freitag, Gold, and Kassorla, 1965a) reported an attempt to study self-destructive behavior in a systematic manner. Data were presented which indicated that the self-destructive behavior showed a great deal of lawfulness which could be accounted for by considering the self-destructive behavior as learned social behavior.

The present paper seeks to clarify further the variables that control self-destructive behavior. On the suggestion from the first study that such behavior is learned social behavior and is maintained by social reinforcement (e.g., attention), the following relationships could be expected to exist: (a) one should observe a decrease and eventual disappearance of self-destructive behavior if the social consequences were withheld (that is, self-destructive behavior should extinguish); (b) one should observe an increase in self-destructive behavior if that behavior resulted in social reinforcement; and (c) the delivery of aversive stimuli, contingent upon such behavior, should serve to suppress it.

Punishment by the use of aversive stimuli or extinction through withdrawal of effective reinforcers ("ignoring") involves purposefully exposing the child to pain and raises ethical problems of what to do. In addition to punishment and extinction procedures, we could have attempted to check the pathological behavior by establishing incompatible behavior. A previous study (Lovaas *et al.*, 1965a) found that self-destructive behavior could be suppressed by building incompatible behaviors. Perhaps this would be the most humane procedure, since it involves exposing the child to minimal pain. However, the children to be treated here came from, and were to be returned to, state hospitals where maintaining incompatible behaviors was judged unfeasible. The wards were understaffed (a particular nurse having to deal with as many as 20 children) and were staffed by personnel unfamiliar with reinforcement procedures. In fact, the failure of the ward environment to provide reinforcement for alternative behaviors (coupled with the attention paid to the self-destruc-

tion) may have originally created, maintained, and increased the self-destruction. The viable alternatives, then, center on extinction by "ignoring" versus suppression with severe aversive stimulation. The potential therapeutic value of this intervention, once the children were returned from our clinic to the state hospitals, will be discussed after the data on aversive stimulation has been presented.

METHOD

The three children reported here were obtained by requesting that two of the state hospitals in Southern California point out their worst cases of self-destructive children. We then requested transfer of the first three children referred to the Neuropsychiatric Institute at UCLA. These children were all known, in their respective hospitals, from among thousands of children for the severity of their self-destructive behavior. The children were hospitalized at UCLA for the explicit and limited purpose of investigating their self-destructive behavior.

The three children, John, Linda, and Gregg, can be described as follows. John was an 8-yr-old boy with a diagnosis of severe mental retardation (IQ = 24). There was no known organic basis for his retardation. He had no speech and showed only a very limited understanding of language, such as simple commands. He would visually attend to adults, but in general had minimal social behavior. He did not imitate, was not toilet trained, and did not dress himself. At various times in his life he had evidenced severe psychotic behaviors, such as smearing and eating of feces, drinking from the toilet bowl, mouthing of objects, rocking, etc. He had no play behavior. His self-destructive behavior started when he was 2 yr old. A medical examination at the time he was three noted that "his fists and knuckles were used to bang the temple and forehead area to a degree in which bruising and contusions are resulted". Apparently his parents were initially partly successful in suppressing self-destructive behavior by teaching incompatible behaviors. For example, during one of his psychological examinations, at age five, his mother had him hold a cup in each hand to prevent him from hitting himself. The self-destructive behavior worsened over time and caused the parents to hospitalize him

at the age of seven. For six months before this study he had been in continuous restraints on both legs and arms. He would become extremely disturbed and refuse food if the restraints were removed. At this point in his development he needed complete care in feeding, hygiene, and all other aspects of his functioning. He had been on a combination of tranquilizers during his prior hospitalization with no visible effect on his self-abusive behavior. When admitted to UCLA, he had multiple scars all over his head and face. He was extremely agitated, kicked and screamed, and in general appeared extremely frightened and out of control, with a heart rate exceeding 200. Two days after hospitalization, he had settled down to the hospital routine, and the agitation and fear were seemingly gone but would reappear as soon as he was taken out of restraints.

Linda was 8 yr old at the time of hospitalization at UCLA. She had an IQ of 33 and was diagnosed as mentally retarded, etiology unknown. She evidenced some psychotic features, primarily in the form of self-stimulatory behavior. She had no speech and her understanding of speech was limited to correct responses to primitive commands. She had a viral infection at the age of two, at which point she stopped walking for three months and subsequently evidenced a bizarre gait. She was not toilet trained, could not feed herself, and in general needed complete nursing care. Unlike John, she resisted affectionate contact. She had bilateral cataracts, thought to be congenital, and was effectively blind. Her self-destructive behavior went back to her seventeenth month, and had become so severe that she had been kept in continuous restraints for 1.5 yr before her admission to UCLA. When she came to UCLA her left ear was bleeding, she had multiple scabs on both ears, and multiple bruises on both legs. Unlike John, she did not seem apprehensive upon admission, and her heart rate was within normal range, although she laughed excessively and inappropriately. She wore wrist restraints, tied around her thighs in such a fashion as to prevent her from hitting her ears. To prevent her knees from reaching her head, and thereby damaging herself, she had been placed on her abdomen while in bed, where she would lie quietly for most of the day, flopping her foot up and down rhythmically.

The third child, Gregg, was 11 yr old. He was diagnosed as having craniostenosis with motoric impairment and severe retardation (IQ = 13). He had been hospitalized since the age of 3.5 yr. As a child he was described as hyperactive and irritable. He was not toilet trained and could not dress himself. His self-destructive behavior started when he was 2 yr old. He had spent most of the two preceding years in restraints, tied on legs and arms to the four corners of his bed. He appeared unable to walk and was confined to a wheelchair. He had shortened Achilles tendons and some demineralization secondary to disuse. When placed on the floor he would stand still on his toes, hunched over, with his back bent, but it was judged physically possible for him to walk. He did not talk, but evidenced considerable delayed echolalia, particularly when upset. His social development was as limited as his intellectual, although he enjoyed physical contact, such as tickling and stroking. Upon admission to UCLA, he had about the same amount of scar tissue on his face and scalp as had Linda and John. Our informal probes revealed that none of the children responded appropriately to the word "no". It is important to note that these children came from, and would return to, settings where available treatments had failed and probably would continue to do so. Unless an effective technique was discovered, in all likelihood these children would remain self-destructive.

All experiments were conducted in sparsely furnished wardrooms that contained a bed, chest of drawers, a chair, and an occasional table. Some of these rooms had adjoining observation rooms connected by one-way mirrors and sound equipment, permitting observation and recording of the child's behavior. Recordings were made on a button panel, where each button corresponded to a particular behavior, the panel being wired into an Esterline Angus multiple pen recorder. A more detailed account of this observation technique has been given in a previous paper (Lovaas *et al.*, 1965*b*). The observers were instructed to depress the button corresponding to a particular behavior and keep it depressed for the duration of that behavior. Three observers were randomly assigned to record at various times throughout the study, so as to rule out changes in the recordings being associated with peculiarities in any one observer.

The observers met with experimenters, who defined the behaviors in the presence of the child. If the observers did not exceed 90% agreement on any one behavior before the actual recordings, they were trained to do so. In no instance did the training exceed 1 hr. If agreement was not achieved in that time, the response was redefined.

The following behaviors were recorded (although all behaviors were not recorded in any one study): *Self-destructive behavior* was particularly unambiguous in its occurrence. The child would strike his head with his fists or hit his head against the side of the bed, the blows generating considerable noise; the observers agreed that this would have caused considerable pain to them had they done likewise. Their agreement in recording this behavior exceeded 95%, without training. Two additional behaviors were recorded, in an attempt to measure more generalized changes which might help determine whether a particular form of intervention, such as aversive stimulation, should be employed. In particular, changes were recorded in withdrawal from attending adults. The adult would attempt to maintain close physical proximity to the child (less than 1 ft) and re-establish that contact as soon as the child moved away. *Withdrawal* was scored when the child was in the process of moving away from the adult [certain instances of this behavior were quite unambiguous, such as the child struggling to get off the adult's lap (*cf.* John on lap), or to withdraw a hand (*cf.* Linda during walk)]. An instance of emotional behavior, *whining*, was also recorded. The child would emit an annoying, screeching sound, without tears, and without communicating sadness or apprehension, but rather anger.

The three studies performed on these children, extinction through removal of interpersonal consequences, suppression by the use of painful shock, and increasing self-destruction through attention, are presented separately.

Extinction Study

If the self-destructive behavior had been originally shaped by its effect on the social environment and if the maintenance of the behavior was dependent upon its producing social effects or consequences, then the removal of such consequences should weaken, and eventually stop, the self-destruction. That is,

the behavior should extinguish. We had previously attempted extinction, in an informal manner, on another self-destructive boy, Rick (attending personnel were instructed not to give him attention when he hit himself, and to leave his room if he started self-destruction while they were present). Rick eventually did stop hitting himself under this arrangement, but the reduction in self-destruction was not immediate, and even took a turn for the worse when the extinction was first initiated, causing considerable bleeding and apparent physical discomfort. We feared, therefore, for the children's safety, and decided not to expose Linda to this treatment (her ears were already badly damaged), limiting the extinction to John and Gregg.

Extinction was carried out in a small, 12 by 12-ft experimental room with a bed and occasional furniture. The experimental room was connected to an adjoining observation room by one-way screens and sound equipment. The extinction sessions were conducted in the morning, on consecutive days. Each session lasted for 1.5 hr. The child was placed on the bed and his restraints removed; then the attending adults left the child alone. An observer in the observation room recorded each act of self-destructive behavior.

Figure 1 shows the extinction data on John and Gregg in terms of total frequency over days of extinction. The abscissa gives successive days of extinction and the ordinate gives the total number of self-destructive acts on any one day. John started with a high rate of 2750 self-destructive acts in the first 1.5 hr of extinction, declining to zero by the tenth session. John hit himself almost 9000 times before he quit. The data on Gregg are consistent with those of John: from a high of more than 900 self-destructive acts during the early part of extinction, his rate fell gradually to a low of 30 acts during the last part of extinction. It was different from John's in two respects: Gregg took more sessions for extinction and showed more irregularity. Actually, only the first 17 days of extinction represented "true" extinction, since certain experimental manipulations were superimposed upon the extinction from Session 18 on. These are discussed more fully in the subsequent section.

We have replicated the extinction operations on other institutionalized children, with similar, but not as intense, self-destructive be-

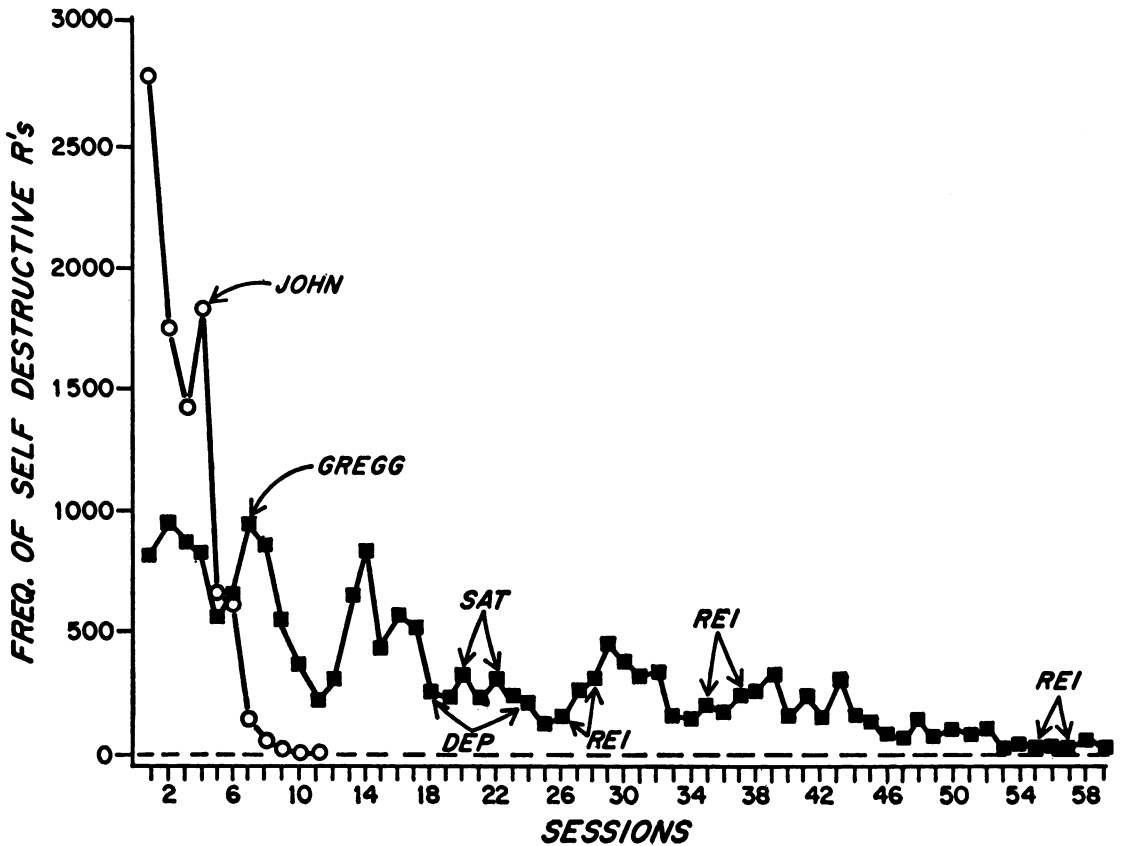


Fig. 1. Extinction of John's and Gregg's self-destructive behavior, over successive days of extinction, during 90-min sessions with total number of self-destructive acts on any one day given on the ordinate. SAT stands for satiation, DEP for deprivation, and REI for reinforcement.

haviors as those of John and Gregg. In each instance, the self-destructive behavior showed a very gradual drop over time, being particularly vicious in the early stages of extinction. Our data are consistent with those reported by others. For example, Wolf, Risley, and Mees (1964) observed a similar cessation of tantrumous and self-destructive behavior in an autistic child when the child was isolated from interpersonal contact contingent upon such behavior.

In summary, we can conclude that although extinction seemingly works, it is not an ideal form of treatment because the large amount of self-destructive behavior during the early stages of extinction subjects the child to much apparent discomfort. For some children extinction is ill-advised because the self-destructive behavior is severe enough to pose a high risk of severe or fatal damage, for example in children who bite themselves, tearing tissue.

Another disturbing feature of the extinction data pertains to the highly situational nature of effectiveness: while the self-destructive behavior fell to zero in the room used for extinction, it remained unaffected in other situations (these data are presented below). It is likely, therefore, that the child has to undergo extinction in a variety of situations. In view of these considerations, it was judged appropriate to investigate punishment (painful electric shock) as a way to suppress this behavior.

Punishment Study

While John received extinction for self-destructive behavior in the first situation, the bedroom, we recorded his self-destruction in two other situations, referred to as "John during lap" and "John during room". In the first situation, "John during lap", John's restraints were removed, and the attending nurse sat

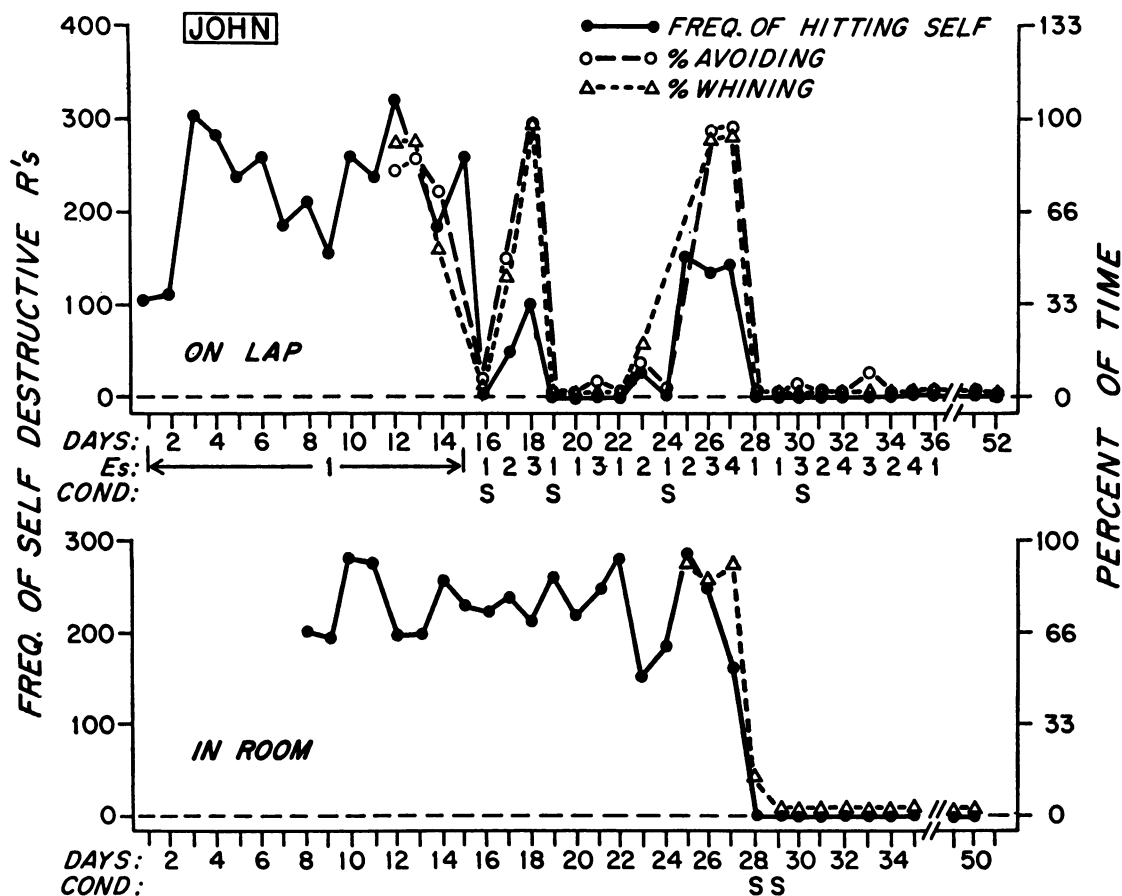


Fig. 2. Frequency of John's self-destructive behavior and the percentage of avoiding adults and whining, as a function of shock. Data are presented for two situations: daily 5-min sessions "on the lap" (upper half), and daily 10-min sessions "in the room" (lower half). The ordinate gives the particular experimenter (attending adult) present, condition (cond.) which shows when shock (S) was administered, and days, which are the same for the two situations, enabling comparison between the two situations. Shock was given by Experimenter 1 on Days 16, 19, and 24, and by Experimenter 3 on Day 30, in the lap situation. It was given on Days 28 and 29 in the room.

him sideways on her lap, placing one arm behind his back for support and the other on his knees. Although he was allowed as much freedom of movement as possible, he was not allowed to get off her lap. These observations took place in the same ward, but in a different room from that used during his extinction. They were made on a daily basis, each observation lasting 5 min. In addition to recording the frequency of his self-destructive behavior, a record was also kept of the amount of time that he attempted to avoid the nurse (defined as struggle to get off her lap) and the amount of time whining.

The data on John during the lap sessions are presented in the upper half of Fig. 2. The

abscissa gives the days, the kind of experimenter (one of four adults) present during that particular session, and condition: [S (shock)]. The ordinate gives either frequency of self-destructive behavior or per cent of time that John was avoiding and whining during the session. (Because of mechanical failures in the apparatus, some data are missing for some sessions.) The first 15 days were used to obtain his base rates. As can be observed, his rates stayed about the same over these 15 days, neither improving nor getting worse. It is important to note that the extinction of John's self-destructive behavior in the experimental room, as presented in Fig. 1, was going on during this time, and while he had reached

Session 10 in the lap situation, he was effectively extinguished in the experimental room. The extinction, then, did not generalize to this situation. Punishment, in the form of a 1-sec electric shock, was delivered by a hand-held inductorium ("Hot-shot", by Hot-shot Products Company, Inc., Savage, Minnesota). The inductorium was a 1-ft long rod, with two electrodes, 0.75 in. apart, protruding from its end. The shock, delivered from five 1.5-v flashlight batteries, had spikes as high as 1400 v at 50,000 ohms resistance. It was definitely painful to the experimenter, like a dentist drilling on an unanesthetized tooth, but the pain terminated when shock ended. As soon as (within 1 sec) the child hit himself, the experimenter, holding the inductorium, reached over and applied it to the child's leg. The punishment (S in the figure) was introduced in Session 16 with dramatic results. John received a total of 12 shocks distributed over Sessions 16, 19, 24, and 30. There was a two-week span between Sessions 36 and 51, and it can be observed that his rate was low, even without shock, after that time period.

Two additional observations are of interest. The first pertains to the generalization of the suppression effect across experimenters. Up to Session 29, he was punished only by Experimenter 1. The suppression effected by Experimenter 1 generalized only partly to the other experimenters. By Sessions 25, 26, and 27 it can be observed that his rate of self-destructive behavior with the non-punishing adults was climbing alarmingly. In other words, he started to form a discrimination between the adult who punished him for self-destruction, and those who did not. In Session 30, Experimenter 3 also punished John for self-destruction, with the effect of producing generalization across other experimenters.

The second observation of interest pertained to the generalization of the shock effects to behaviors that were not punished. As self-destructive behavior was brought down by shock, John avoided the attending adult less and also whined less. Apparently, avoiding, whining, and self-destructive behavior fell within the same response class. These data indicated that the side effects of punishment were desirable. Informal clinical observations further confirmed the finding (John was observed by some 20 staff members), the nurse's notes reporting less distance and less fussing.

Perhaps the most significant changes that took place in John after he was freed from restraints were the ones we were unable to quantify. He was removed from restraints and shocked at 9 A.M. He appeared extremely frightened and agitated (apparently not by the shock, but from the absence of restraints). He sat slumped on the floor, close to the wall and underneath the washbasin in a corner of his room. At 9:25 he moved out from the wall, peeked into a cupboard in the room, and then darted back to his original place of departure. He repeated this behavior at 9:40 and 9:50. At 10:00 and 10:30 he moved, in very gradual steps, from his room into the corridor and adjoining room. He became very rambunctious, running up and down the hallway, seemingly insatiable. Freedom from restraint also permitted him many other apparently reinforcing discoveries: that first afternoon he allowed himself a full hour of scratching himself, a luxury he had not been allowed while his hands were tied behind his back. He had been so self-destructive that it had been almost impossible to give him a bath in a tub. Freed of self-destructive behavior, he behaved much like a seal when he was placed in a tub, screaming in happiness and scooting underneath the water with his face up and eyes open.

The hallway and the bath were immediately adjacent to the location in which he was shocked, and maintained the suppression. The effect of shock did not generalize to rooms some distance away (*e.g.*, in another part of the ward) from the punishment situation. For example, it did not generalize to the other situation where we kept a record of his self-destruction, called "John during room". In this situation, he was left free to wander around a small dormitory room, in the company of two or three adults. The sessions lasted for 10 min each, and were conducted once each day; during this time the rates of his self-destructive behavior and his whining were recorded.

Data from this study are presented in the lower half of Fig. 2. The days along the abscissa in the lower half correspond to those in the upper half, so that his behaviors in the two situations can be readily compared. Twenty days (Days 8 through 27) of pre-experimental measurements were obtained. They show that his self-destruction was es-

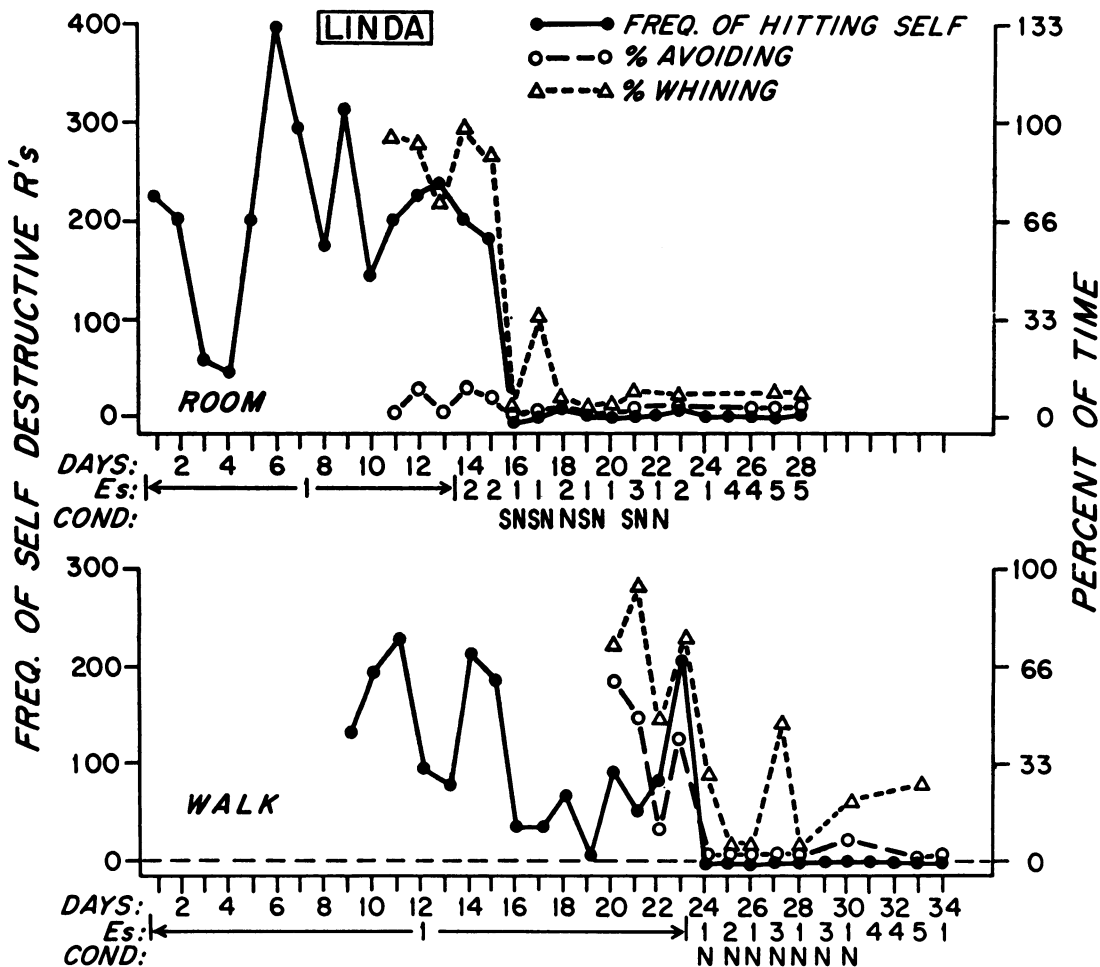


Fig. 3. Frequency of Linda's self-destructive behavior and the percentage of avoiding adults and whining, as a function of shock (S) and of "No" (N). Data are from two situations: daily 5-min sessions "in the room" (upper half), and daily 5-min sessions "on the walk" (lower half). The days in the two situations are the same, enabling comparison between situations.

entially unaffected by what occurred in the lap situation, where his self-destruction had been essentially eliminated by Day 16. (It should be pointed out that the pre-experimental sessions in Fig. 2, as in Fig. 3 and 4, approximate extinction sessions, since self-destruction was left unattended. Apparently, 10-min sessions were too short for extinction, probably reflecting the thinness of the schedule of reinforcement, less than VI 10-min, which had supported the self-destruction in the past.)

He was given two 1-sec shocks on Days 28 and 29. This brought his self-destructive behavior down to zero and retained it at that level until the end of the experiment, some 18 days later. At the same time as his self-destructive

behavior was decreasing, whining also disappeared. In general, these data are identical to those observed during the first shock session, except that fewer shocks were necessary to suppress the behavior.

At the end of this last experiment, shock was introduced in all other situations. It is notable that John was effectively freed from self-destructive behavior after five shocks in other (on the ward and on the street) situations. In other words, it was possible to achieve suppression of his self-destructive behavior in a large variety of situations using only a few shocks.

We attempted to study the effect of shock on Linda's self-destructive behavior in the same manner as John had been studied. The

effect of shock on Linda was observed in two situations. The first situation, "Linda during room", consisted of 5-min sessions, one session per day. The data from this experiment are presented in the upper half of Fig. 3. The abscissa gives number of days, kind of experimenter (one of five) present during that session, and conditions. The first 15 days served as base-rate measures. There was considerable variability in these sessions, but they showed neither a worsening nor an improvement in her self-destruction. Experimenter 1 administered a 1-sec shock (S) to her while at the same time she gave the patient a loud "no" (denoted by the letter N on the abscissa). She received one shock on each of Days 16, 17, 19, and 21, and it is apparent that her rate fell to zero or near-zero immediately, with the shock effects generalizing across experimenters. During Days 18 and 22, she received merely the word "no". "No" had been tested for suppressing properties for Linda before its pairing with shock (on Days 14 and 15) and was demonstrated to be neutral (*i.e.*, ineffective).

One can observe the same change in non-punished behaviors with Linda as was the case with John: there was a substantial decrease in both avoiding of the attending adults and whining after shock was administered.

The other situation in which Linda was studied is referred to as "Linda during walk". In these sessions the experimenter and Linda walked together up and down a corridor for a 5-min period. The experimenter held Linda's hand; if Linda pulled away, which was scored as avoiding, the experimenter would let her go and then reestablish hand-to-hand contact. We were particularly interested in whether the word "no", which had been paired with shock during the room sessions, had acquired suppressing properties.

The data are presented in the lower half of Fig. 3. The abscissa shows which experimenter was attending to her. The days correspond to those in the upper half of the figure (Room sessions) so that her behaviors in the two situations can be readily compared. In addition to keeping track of her self-destructive behavior and her whining, avoiding behavior, defined as pulling away from the experimenter's hand, was recorded. The first 15 days (9 through 23) served as baseline. As we had already observed with John, there was no effective generalization from shock in the room (Day 16 on) to

the walk situation. On Days 16 through 21, a loud "no" was given contingent upon self-destructive behavior, and it served to bring that behavior to zero level. The effects generalized across experimenters (4 and 5). The correlated behavior changes were the same as in the other studies reported: a concurrent suppression of whining and avoiding behavior.

Gregg was the last child with whom we observed the effect of shock under these controlled conditions. He was studied during one situation referred to as "Gregg during wheelchair". These sessions took place one week after extinction and the accompanying seven sessions of reinforcement for self-destruction (to be discussed later) had been completed. The sessions lasted for 2.5 min. He was placed in a standard wheelchair on one side of the experimental room (he was placed in a wheelchair because he did not walk). His self-destruction was so violent that the arms of the chair had to be padded. An attending adult sat directly in front of and facing him.

The data on Gregg in the wheelchair are presented in Fig. 4. The first 11 sessions served to establish the base rate, and produced no apparent change in his behavior. He was given shock by Experimenter 1 in each of Sessions 12, 13, and 14. His self-destruction was almost immediately suppressed during these sessions. Experimenter 2 and Experimenter 3 did not punish him at this time and it can be observed that his self-destructive behavior increased in their presence over the next several sessions (Sessions 22 through 38). In other words, he formed a discrimination between Experimenter 1 and other experimenters, as had John (Fig. 2). He was punished with shock by the other experimenters starting at Session 39 and the result shows an unambiguous drop in self-destruction. It was consistent with the data obtained on Linda and John, *i.e.*, as self-destructive behavior was brought down by the use of shock, there was a concomitant drop in whining. In the case of Gregg, we also recorded his physical contact with the attending adults and his vocalizations, but these were not systematically related to the experimental operations or correlated with the other behaviors.

In the case of both Gregg and John (Fig. 4 and 2 respectively) we replicated the effect of the noxious stimulus in a single subject design. Considering also the replication across

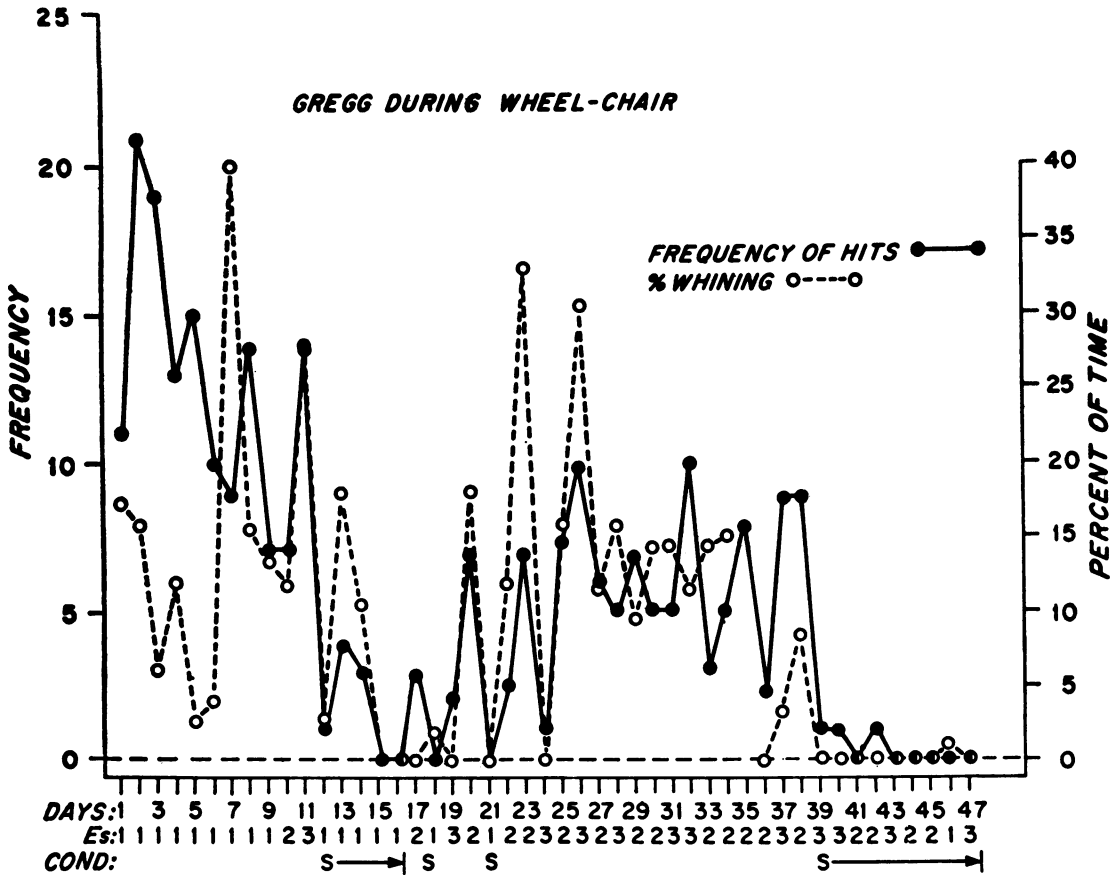


Fig. 4. Gregg's self-destructions and whining, during wheelchair sessions, as a function of shock (S) and the attending adult (E) who delivered shock. Each session ran 2.5 min.

subjects and situations, we no doubt are dealing with a reliable phenomenon.

Additional data on self-destruction, from more casual recording procedures, support the data on John, Linda, and Gregg. One of the most severe cases seen was Marilyn.² She was a 16-yr-old child diagnosed as retarded (moderate range) with psychotic features. She had been hospitalized for the previous 2 yr, and had been self-injurious since she was 2 yr old. The referring complaint centered on the parents' inability to control her self-destructive behavior. During her 2 yr of hospitalization she had been kept in a camisole in an attempt to prevent this behavior. When removed from the camisole, or when she removed the cami-

sole herself by using her teeth, she would bite her hands so severely that at one time the little finger on her right hand had to be amputated to the first joint. She would similarly, with her teeth, remove her nails by their roots. She was also a head-banger; her scalp was covered with scar tissue. She would fall to the ground without apparent reason, scream, and occasionally aggress toward others by biting them.

Her base rate of "spontaneous" injury was very low, and in that way different from the other children's. That is, self-destructive acts were highly discriminated: she would mutilate herself only whenever the experimenter gave her affection, such as comforting her or praising her (33 self-injurious behaviors out of the 36 such interactions with her before shock). The first session lasted for about 2 hr; half way into the session she was given shock for self-destructive behavior. A total of five shocks

²Thomas Ball, Ph.D., Chief Psychologist at Pacific State Hospital in Pomona, California, and Lawrence Dameron, Ph.D., formerly on the staff at Pacific State, had the major responsibility for the research with Marilyn.

(on the first, fourth, fifth, and fifteenth presentation of the affectionate interaction) brought her biting and head-banging to zero, and it remained at zero-level for the rest of the session. The suppression data on Marilyn were virtually identical to the others.

Because of the extreme severity of her self-injurious behavior, Marilyn demonstrated why it is impossible to place such a child on extinction. Marilyn could have inflicted serious self-injury or even killed herself during the extinction run.

While the immediate generalized behavior change due to shock was very favorable, there is some reason to believe that her aggression toward other children on the ward increased at a later time. Apparently, the reinforcers that maintained the self-destructive behavior were still operative, and since she did not develop a more acceptable behavior form, which seems to be the case in most children, and was not explicitly trained to behave otherwise, she returned to a form of behavior which also yielded large quantities of attention.

The data on shock can be summarized as follows. First, the use of shock, given contingent upon self-destructive behavior, brings about an immediate cessation of that behavior. Second, the effect of shock appears specific to the situations in which it is administered. If a child is shocked in one room and not in another, or by one person and not another, he sometimes will form a discrimination between these situations. Finally, both in the changes that we were able to record objectively and in the clinical observations, there was every evidence that the side effects of punishment, instead of being undesirable, were judged to be therapeutically desirable.

Worsening the Self-Destructive Behavior

It is apparent from the data presented above that considerable changes can be effected in destructive behavior, either by extinction or punishment. That there must be other variables that control self-destructive behavior is apparent on inspection of the great amount of variability present in all our baselines. Consider, as an example, the variability in the extinction data on Gregg, which was presented in Fig. 1. Within a matter of three or four days, his rate of self-destruction fell from more than 900 (Session 7) to less than 300 (Session 11) and then increased to more than 800 hits

per session. Such large shifts in amount of self-destructive behavior surely must be related to powerful variables and it is, therefore, appropriate to search for them.

We had some reason to suspect that these fluctuations in self-destructive behavior were caused by changes in the kinds of nursing care received on any one day. In particular, the early peaks in self-destruction occurred on Mondays, and we knew that the nursing personnel who cared for him over the weekend approached him differently from those who cared for him during the week. The nature of this difference was unknown, however, and could be a function of deprivation of interpersonal relationships, satiation of such relationships, or an undue amount of attention being paid to his self-destruction. Of course, a large number of other dimensions in interpersonal relationships could be responsible for the rise and fall in his self-destructive behavior.

In an attempt to identify some of the sources responsible for the magnitude of his self-destructive behavior, certain probes were initiated. First, we considered that deprivation of attention was responsible for a rise in self-destruction. Therefore, he was placed on a 24-hr period of social deprivation before Sessions 18 and 24 (DEP in Fig. 1). Essentially, Gregg was left alone in his room except for being changed and fed. He would lie the entire day on his bed in restraints, much as a typical day in a state hospital. The rate of self-destructive behavior after these deprivation operations was not different, however, from other days. To check further on the effectiveness of such operations of availability of social stimulation, we instigated two days of social satiation. During the 24-hr periods before Sessions 20 and 22 (SAT also in Fig. 1), Gregg was given continual attention during his waking hours, such as being talked to, touched, tickled, hugged and kissed, walked, and generally stimulated an excessive amount. However, there was no significant change in his self-destructive behavior accompanying such periods of social stimulation. We concluded, therefore, that the availability of interpersonal stimulation (*per se*) had no appreciable effect upon his self-destruction.

One form of nursing intervention of particular interest to us centered on the nurse's reaction to the child when he was self-destructive.

tive. We observed that the great majority of nursing personnel would be particularly likely to interact with him contingent upon his self-destruction. Anyone who has been around self-destructive children has experienced an urge to attend to such children when they hurt themselves, in an attempt to nurse their suffering. In fact, nursing personnel, as well as parents, are typically given explicit directions by the doctors and nurses in charge of the case to respond to self-destructive behavior with warmth and "understanding", attempting to reassure the child that they are in attendance, that he need not be afraid, and other words and gestures to that effect.

We tested the effects of this kind of intervention during Sessions 26 and 28 (REI in Fig. 1). Half an hour into the session, an adult would enter the room contingent upon Gregg's self-destructive behavior, hold Gregg's hands and say in a pleading voice, "don't do that, Gregg, everything is OK", and other comments to that effect. This contact lasted for approximately 30 sec, at the end of which the attending person would again leave. The adult would appear on the average of every third time Gregg hit himself. If one considers Sessions 25 through 34, it looked as if his self-destructive behavior temporarily worsened (acquisition followed by extinction). We replicated these operations (REI) in Sessions 35 and 37. Again, there seemed to be some worsening of his self-destructive behavior following these operations. However, when these operations were reintroduced a third time during Sessions 55 and 57, we did not replicate the observations.

On the basis of these data, we entertained the possibility that his self-destructive behavior was under the control of the attention paid to that behavior, but that the attention he did receive was a rather weak consequence which lost its reinforcing properties over time: that is, it lost its reinforcing properties as its S^D properties extinguished. This led us to investigate whether there were other consequences that would lead to greater control over his self-destruction.

The day after the last extinction day (Session 59 in Fig. 1), we obtained a new base rate of Gregg's self-destructive behavior in the same situation where he had undergone extinction. The new base rate data are presented in Fig. 5 as cumulative curves. Numbers 1 and

2 refer to the first and second 10-min sessions that formed the base rate of self-destruction: he was left to hit himself and no one did anything about it. The number 3 refers to the third 10-min session where approach was changed as follows. On an average of every fifth time that Gregg hit himself, we would

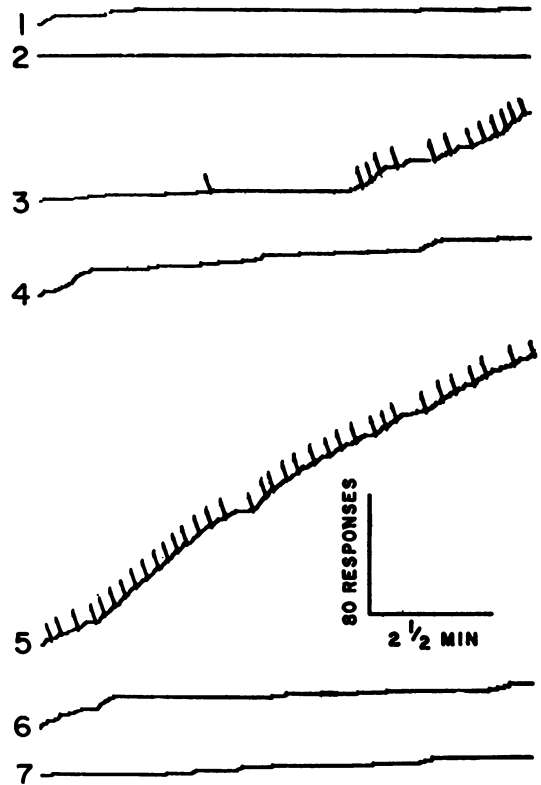


Fig. 5. Gregg's self-destruction, as cumulative response curves, over successive sessions (1 through 7). The upward moving hatchmarks in Sessions 3 and 5 mark delivery of sympathetic comments, play, etc., contingent on self-destruction.

take him out of the crib for about 30 to 60 sec and, in addition to comforting him, would allow him to play with some drawers, closet doors, and wooden blocks, which we knew that he liked to play with. On the average of every fifth reinforcement, we would take him for a 5-min walk (with the experimenter's physical assistance) from his bedroom to the day room. Again, Gregg very much enjoyed to be taken for a walk. This 10-min reinforcement period (referred to as number 3 in Fig. 5) was followed by a 10-min extinction session (number 4 in Fig. 5). This extinction session was similar to the pre-experimental operation denoted

with number 1 and 2. The next day, we again gave attention and play contingent upon self-destructive behavior (number 5 in Fig. 5). Finally, we ended with 2 hr of extinction with the first 10 min and the last 10 min presented as 6 and 7, respectively.

It is apparent that this approach, trying, in a sense, to "understand" what Gregg wanted and to give it to him when he was self-destructive, is a very dangerous form of treatment. His rate went up the first time we did this (number 3) and climbed alarmingly the second time (number 5). In fact, the attending adults agreed that if we had continued to attend to his self-destruction, we could have hurt him badly. This could have been true particularly if we had given attention contingent upon larger and larger amounts of self-destruction, as might happen when a parent or attendant becomes "used to", or adapted to, a particular level of self-destructive behavior.

This finding was consistent with one reported earlier (Lovaas *et al.*, 1965a) where a child's self-destructive behavior worsened when we attempted to communicate sympathy and reassurance contingent upon such behavior. Such therapy is typically prescribed for such children when the therapist attempts to address himself to the alleviation of some internal pathology, such as anxiety, for which the self-destruction is seen as an expression. Reinforcing attention is also likely to be given spontaneously by adults, since it is extremely difficult to withhold expressions of concern when a child appears to hurt himself. If our data are reliable, then it is such expressions which keep the child in restraints. Said differently, in this instance the expression of "love" contingent upon self-destructive behavior benefits only the giver.

The great majority of studies on treatment attempt to isolate the conditions under which a particular problem can be alleviated. There is also some value in attempting to assess whether aspects of current treatments do in fact worsen the patient's condition. Ideally, such studies help change old treatments.

DISCUSSION

Our data can be summarized as follows. Two procedures effectively terminated the self-destructive behavior. The first procedure,

carried out with two of the children, involved an extinction paradigm, whereby the child was allowed to hurt himself, isolated from personal contact. In both these instances, the self-destructive behavior was terminated. Our data are consistent with those obtained by Risley *et al.* (1964), who used extinction procedures to reduce the self-destructive behavior of a 3.5-yr-old boy. Additional data which support this kind of intervention have been reviewed by Gardner (1967).

This procedure of withdrawing or making potential reinforcers unavailable has an undesirable attribute, in that it is not immediately effective and temporarily exposes the child to the danger of severe damage from his own self-destruction, which is particularly intense during the early stages of the extinction run. In some cases of severe self-destruction, it is ill-advised to place the child on extinction. Marilyn (reviewed above), for example, could have inflicted serious self-injury of possibly even killed herself during an extinction run.

We reported five studies, carried out on three children, in which we observed an immediate suppression of self-destructive behavior when aversive stimuli were given contingent upon that behavior. This finding is consistent with data from previous work with aversive stimuli (Lovaas, Schaeffer, and Simmons, 1965) which reported the suppression of tantrums and self-destruction in two 5-yr-old autistic boys. Risley (1968), Tate and Baroff (1967), and others (as reviewed by Bucher and Lovaas, 1967) have reported similar findings.

The effects of shock appear to be specific to the situation in which shock is used, with respect to both physical locales and attending adults. This implies that if punishment to suppress self-destruction is to be maximally therapeutic (*i.e.*, durable and general) it has to be administered by more than one person, in more than one setting. Our data amply suggest that each child would revert to self-destruction as soon as he returned to the treatment settings from which he came, unless his treatment under those conditions was made consistent with our procedures. The children, in other words, formed discriminations. Figure 2 illustrates how quickly such discriminations can come about. Again, our previous work and the work of others (*e.g.*, Risley, 1968;

Hamilton and Standahl, 1967) is consistent on the highly discriminated stimulus control of shock. We observed also that the children did not become generally fearful of the adults who administer the punishment, but showed fear of the adult only when the adult gave signs of disapproval (looking angry and verbalizing anger, as he does when he administers punishment) or when they are in the act of self-destruction. That observation also supports the specificity of the shock-effects. Most likely, such discriminations come about because of the adults' differential treatment. Should the adult administer only punishment, then it seems likely that the child would become generally fearful of him. However, the adult who administered punishment for self-destruction was associated with the child in a number of situations, as a caretaking and parental person, administering love when the child acted appropriately. Watson (1967) made this point explicitly in discussing punishment effects.

One of the surprising findings on the use of shock pertains to the immediate increase in socially directed behavior, such as eye-to-eye contact and physical contact, as well as the simultaneous decrease in a large variety of inappropriate behaviors, such as whining, fussing, and facial grimacing. Such response generalization has also been reported by others: Risley (1968) made specific efforts to record some of these. Hamilton, Stevens, and Allen (1967) described their children, after punishment, ". . . to be more socially outgoing, happier, and better adjusted in the ward setting . . ." (p. 856). White and Taylor (1967) reported, as a consequence of shock, that their patients ". . . appeared to be more aware of and interact more with the examiner . . ." (p. 32). We reported similar findings in an earlier study (Lovaas *et al.*, 1965c). We have a filmed record that quite dramatically portrays the changes in John.

Some of these behavioral changes might occur for rather "mechanical" reasons: that is, it is difficult for a child who whines to smile simultaneously. It is easier for a child, removed from the restraints of his bed, to come into contact with more rewarding aspects of his environment, *etc.* Some of the beneficial changes will be specific to certain children. For example, the suppression of self-destruction (largely head-banging) in Linda permit-

ted surgery for her cataracts, with resultant alleviation of her restricted vision. Some of the behavioral changes accompanying shock probably occur because reinforcements have been given to the child for behaving appropriately when faced with aversive stimuli in the past. Finally, certain behaviors may be elicited by shock as an unconditioned stimulus: that is, certain kinds of stress, fears, or pains may call forth socially oriented behavior at a purely biological level. A number of interesting questions await research in that area.

Although the immediate "side-effects" of punishment point in a desirable direction, one should be less optimistic about long-term behavioral change under certain conditions. We can supply few data which exceed a couple of months follow-up, and in the case of only two children have we had the opportunity to conduct follow-ups for as much as 1 yr, while the suppression of self-destruction was being maintained. It seems reasonable that if social reinforcement controlled the self-destructive behavior in the first place, then that reinforcement, being unaltered in strength through punishment operations, should retain the power to build other, equally undesirable, behaviors. If the child had to go to such extremes as self-destruction to gain some attention from his attending adults, then it seems but reasonable that these adults, unless they were taught to respond to more appropriate behavior, would repeat themselves and begin shaping some similarly alarming behavior, such as feces smearing or eating, aggression toward other children, *etc.* Within reinforcement theory terms, the suppression of one behavior may be discriminative for a large number of other behaviors, some more and some less desirable than the suppressed one.

These children have demonstrated, through their self-destruction, that they will apparently withstand considerable pain to get attention, and that they may have considerable experience with pain adaptation. To avoid selecting a neutral shock, or a weak one to which the children could adapt quickly, we have used a strong shock which guaranteed quick suppression. By a strong shock is meant a shock which the experimenters experienced as definitely painful (smarted like a whip, or a dentist drilling on an unanesthetized tooth), and to which the subjects gave every sign of

fear and apprehension. The question is sometimes raised as to how, in view of the much more severe pain associated with self-destruction (e.g., pulling own nails out with teeth), the shock works in the first place. We can offer two guesses in this regard: the child has not had an opportunity to adapt to shock, nor has the shock been associated with positive reinforcement, both of which may have occurred with the painful stimuli generated by the self-destruction.

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