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THE EFFECTS AND SIDE EFFECTS OF PUNISHING THE AUTISTIC BEHAVIORS OF A DEVIANT CHILD[1]

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Timeout procedures in the home and extinction and reinforcement of incompatible behaviors in the laboratory failed to eliminate the disruptive and dangerous climbing behavior of a deviant child. Punishment with electric shock was used to eliminate this behavior in the laboratory and then in the home. The effects were reversible and were restricted to specific stimulus conditions. A less severe form of punishment was used to eliminate the child's autistic rocking. Other behaviors of the subject were continuously measured in the laboratory to determine the side effects of punishment. No suppression of other behaviors correlated with punishment was noted. However, the rate of some behaviors increased when punishment was used to eliminate deviant behaviors, but these increases were, primarily, desirable.

A prime argument against punishment has been that it allegedly produces undesirable side effects. Traditionally, the evidence supporting this argument has been based on clinical anecdotes describing cases of "symptom substitution". More recently, the results of experimental research have similarly suggested that punishment procedures are likely to produce undesirable side effects.

For example, the conditioned suppression literature suggests that aversive stimulation may suppress other behaviors, including desired behaviors, in addition to suppressing the behavior being punished. The negative reinforcement literature suggests that aversive stimuli may produce and maintain escape and avoidance behaviors which may be undesirable, such as leaving, avoiding, or removing the punishing situation, or the person dispensing the punishment. The literature on pain-elicited aggression (or "reflexive fighting") suggests that aversive stimuli may elicit aggression toward the person dispensing punishment and toward other organisms and objects as well. A corollary is that punishment procedures may, in fact, increase rather than eliminate aggressive behaviors. And finally, the stimulus properties of the person dispensing punishment may become altered by being paired with aversive stimulation such that his presence and attention become more aversive and less reinforcing. Virtually every summary account of punishment research in recent literature (excepting Solomon, 1964) has appended a warning statement to the effect that, for these reasons, the use of punishment is contraindicated when dealing with applied problems of human behavior. (*Cf.* Azrin and Holz, 1966 for a recent example, as well as for a thorough and clear review of punishment research.)

The present study describes the application of a series of procedures designed to reduce the highly dangerous and disruptive climbing behavior of a severely deviant child. After other methods had failed, electric shock punishment was applied under several conditions. Another punishing stimulus, shouting at, and shaking the child, was applied to the child's autistic rocking. Other behaviors of the child were recorded to assess possible side effects of these punishment procedures.

Antecedent to this study in both time and function was the initial work on the use of shock punishment with autistic children by

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Lovaas, Schaeffer, and Simmons (1965). A verbal report of that work provided the instigation and some of the techniques to investigate further the effects of punishment.

METHOD

Subject

The subject, *S*, was a 6-yr-old girl who was hyperactive and exhibited bizarre behaviors. She had been consistently diagnosed as having diffuse brain damage caused by pneumococcal meningitis at age seven months, although recent diagnoses included an 'overlay' of emotional disturbance and autism. She had occasional seizures and was taking anticonvulsant medication. She exhibited no verbal behavior but almost continuously emitted howls, moans, and clicks. These vocalizations did not correspond in length, inflection or topography to normal speech. She exhibited no imitative behavior, either verbal or non-verbal. Her predominant behaviors in all situations were climbing in high places (on furniture, window sills, trees, houses, *etc.*), alternating with sitting and rocking rhythmically. Her climbing was a constant source of concern to her parents due to the threat to her life and limb (her body bore multiple scars from past falls; her front teeth were missing, having been left imbedded in a 2 by 4-in. molding from which she had fallen while climbing outside the second story of her house), and the attendant destruction of furniture in the house. She had attended several schools for special children but had been dropped from each because of these disruptive behaviors and her lack of progress.

S's parents, who both possessed advanced academic degrees, had resisted placing her in an institution, as they predicted that her climbing would result in her being kept in continuous physical restraint on a custodial ward. However, as she had become larger and more skillful, her climbing and her aggression toward her younger brother at home were causing them to consider institutionalization seriously.

Reinforcer

S was brought to the laboratory four times a week around noon after having had only 3 oz of milk at breakfast time. Milk, which was the only food she would reliably consume, was used as a reinforcer. Even under this amount of food deprivation, she exhibited long latencies of drinking the milk when it was presented. Each reinforcer was about one tablespoon of milk in a paper cup placed on the table in front of *S*, accompanied by the statement, "Good girl!"

Setting

The experimental sessions were either 20 or 30 min long, and were conducted in an 8 by 12-ft experimental room with an 11-ft ceiling. At one end of the room, next to the door, a ventilator frame formed a 5-in. deep ledge, 6 ft above the floor. Directly across from the door a large one-way mirror permitted observation from an adjacent room. The experimenter and the child sat in chairs, facing each other across a small table in the center of the room (*cf.* Risley and Wolf, 1967). Initially the room also contained several extra chairs and a canvas cot. At the experimenter's request, *S*'s mother observed all sessions through the one-way mirror.

Recording

Frequency and duration of the child's behaviors were recorded on a six-pen event recorder located in an adjacent room, via a bank of microswitches placed on the table. On occasional sessions an observer behind a one-way mirror would independently record those behaviors for which reliability was considered to be a problem. However, most of the behaviors were so highly distinctive that reliability checks were not considered necessary.

The data presented on *S*'s behaviors at home were collected by the mother throughout each day. Periodically, the experimenter would observe in the home for several hours. During these periods there was always complete agreement between the experimenter's and the mother's recording. Since there were no systematic differences in the mother's data on those days, as compared to the prior and succeeding days, the mother's data were considered to be reliable.

PROCEDURES AND RESULTS

Timeout for climbing in the home. The mother's response to *S*'s climbing was originally considered to be the most likely variable maintaining that climbing. Since the climb-

ing usually endangered the child and/or destroyed the home furnishings, the mother's contingent attention and interaction was consistent and predictable. A simple extinction procedure (ignoring the behavior) did not appear feasible. Therefore, physical isolation (timeout) from social interaction was made contingent upon climbing behavior. Accordingly, her mother was instructed to say "No!", lift *S* to the floor, and lead her to her bedroom (with minimal physical contact and no further verbalization) contingent upon each instance of inappropriate climbing. The bedroom door was reopened after 10 min (timed on a kitchen timer). The mother was also instructed to attend to and to interact with her as frequently as possible when *S* was not climbing. Inappropriate climbing was defined

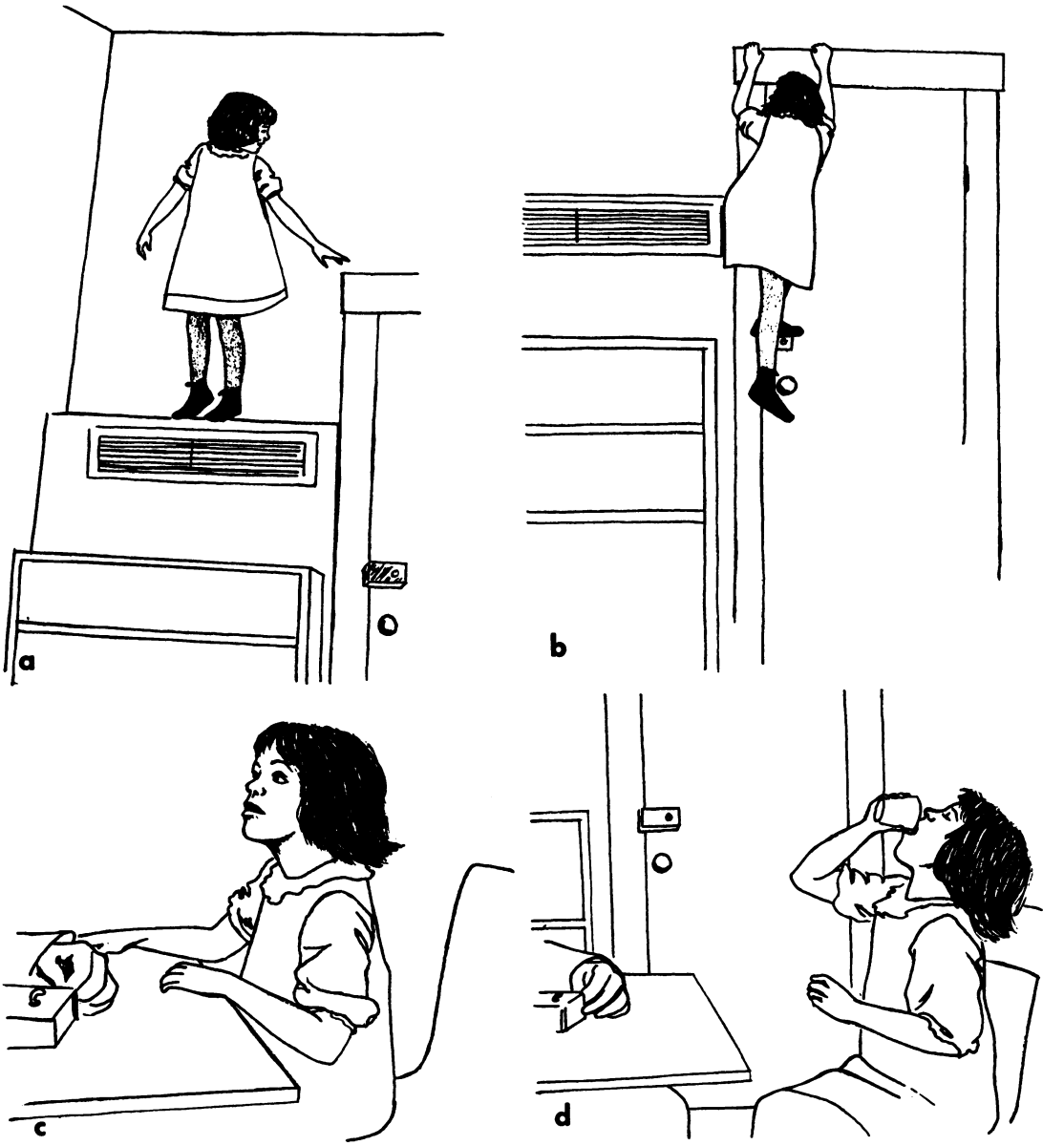

Fig. 1. Tracings from photographs showing the subject's climbing behavior (a and b), eye contact topography (c), and consummatory response (d). Note the bookcase, door, and ventilator frame in a and b and the microswitch recording panel beside the experimenter's hand in c and d. Original photographs were taken through the one-way observation window.

as standing, sitting or hanging on anything not specifically designed for such, with neither foot touching the floor.

After 17 days, no reduction in the rate of climbing was observed. The timeout contingency was then applied to climbing in only one location (the bathroom) and the mother was instructed to do whatever she had previously been doing for all other climbing. It seemed likely that a concurrent schedule of social interaction for climbing in other places and the timeout procedure for climbing in the bathroom would provide a more sensitive measure of the effects of the timeout procedure. However, no reduction in the rate of climbing in the bathroom was obtained during 46 days of this procedure (average daily rate of climbing was 5.5 per day over the first 23 days and 5.7 over the last 23). The timeout procedure was therefore discontinued.

Reinforcement for incompatible behaviors and extinction for climbing in the laboratory. Concurrent with these attempts to eliminate climbing at home, procedures for establishing imitative behaviors were initiated in the laboratory.

In a preliminary session, *S* moved about the room almost continually standing on the chairs and table, moving furniture to the door and climbing from it to the door knob, then to the ventilator frame next to the door, and then to the door lintel (a and b, Fig. 1). Alternately she would sit on the floor or in the chair, rhythmically rocking and humming with closed eyes. Throughout this period she frequently struck the side of her head with her palm or fist, sometimes resoundingly. She occasionally would approach and grab for the food reinforcer, but she never looked directly at the experimenter, and actively averted her gaze whenever the experimenter stood in front of her.

In order to establish attending to the experimenter's face, which was a necessary prerequisite for vocal imitation training, systematic shaping of eye contacts (*S*'s gaze focusing on the experimenter's eyes) was begun. During the preliminary session, the experimenter periodically said "Sit down" and patted the chair. Initially, standing by the chair, and then only sitting in the chair was reinforced.

The original plan was to work with the mother to control climbing behavior at home, while concentrating on developing imitative behavior in the laboratory. Therefore, climbing was eliminated in the laboratory by removing the opportunity to climb. Between Sessions 2 and 3 (point A, Fig. 2) all furniture was removed from the room except a table and two chairs which were fastened to the floor in the middle of the room. After several unsuccessful attempts to step up onto the doorknob without a chair in the next two sessions, all climbing activity ceased. Time spent out of the chair decreased from 38% of Sessions 1 and 2, to less than 2% of Sessions 5 through 12.

Once *S* was sitting in the chair during most of the session, reinforcers were delivered only

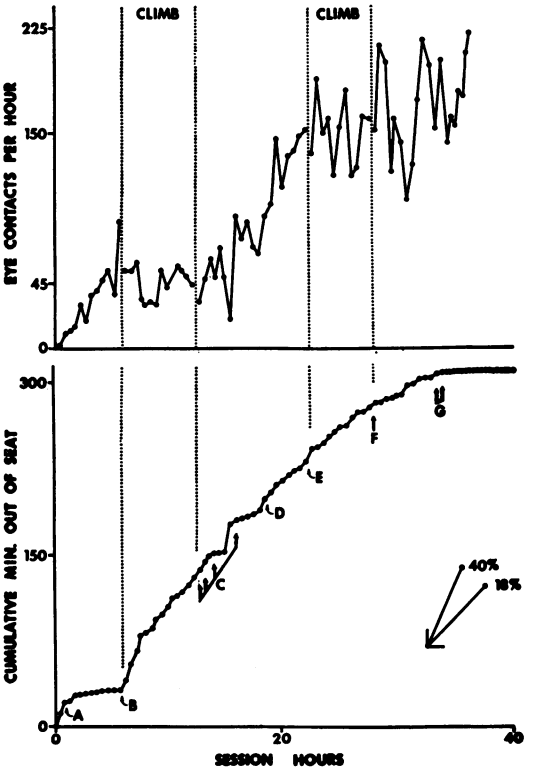

Fig. 2. Graphs showing the relationship between the rate of eye contacts and the amount of time *S* spent out of her chair. Each dot represents one session. The portions of the graphs between the dotted lines labeled "CLIMB" indicate blocks of sessions during which *S* was climbing on the bookcase. At A all furniture was removed from the room, precluding climbing. At B the bookcase was placed in the room. At C climbing on the bookcase was punished with electric shock. Beginning at D the shock device was not brought into the experimental room. At E a footstool was placed in the room in front of the bookcase and climbing resumed. At F climbing on the bookcase was again punished with shock. At G standing on the chair was punished with shock.

when she looked at the milk cup. As looking at the cup became more frequent, the experimenter gradually moved the cup toward his face, thereby increasing the probability of eye contacts. A few fleeting glances at the experimenter's face occurred and were reinforced. These gradually became more frequent. After eye contacts had reached a rate of 6 per min, reinforcement for looking at the cup was discontinued. At this point *S* was first looking at the cup and then looking at the experimenter; successively longer eye contacts were reinforced until the topography of this behavior was a focussed stare at the experimenter's eyes of 1 sec or longer (see C, Fig. 1). Concurrently, the experimenter gradually moved the cup away from his face, finally holding the cup out of sight under the table. The frequency of eye contacts systematically increased during these procedures from 0 per min in the first session to 1.5 per min in Session 12 (point B, Fig. 2).

Meanwhile, the timeout procedure had failed to reduce the climbing behavior at home. Now that sitting in the chair and looking at the experimenter (behaviors incompatible with climbing) had been established in the laboratory it was decided to see if climbing would re-occur there if the opportunity were again presented. A small bookcase was placed under the ventilator next to the door (see a and b, Fig. 1) before Session 13. As can be seen in Fig. 2 at point B, time out of the chair immediately increased from less than 2% of the previous eight sessions to 42% of the first four sessions with the bookcase present, as *S* again began to climb. In the 14 sessions (totaling 6.4 hr) after the bookcase was introduced, *S* climbed on the bookcase, and the ventilator and door above the bookcase, an average of 6.7 times per hr (from point B to first arrow, Fig. 3), occupying 18% of the time in the sessions. During these sessions the experimenter did not look at her or respond in any way when she was out of the chair, but sat staring down at the table. When *S* resumed her seat, the experimenter would look up and wait for *S* to meet his gaze. Eye contacts of 1 sec or longer were reinforced with milk.

Thus it did not appear that the climbing behavior was maintained by consequences which the experimenter could manipulate. Attempts to supplant climbing by establishing competing behaviors, coupled with the removal of all experimenter-controlled consequences for this behavior had had no apparent effect in reducing its frequency or duration. Therefore, it was decided to attempt to eliminate the climbing behavior by the contingent application of shock.

Punishment with shock for climbing in the laboratory. A hand-held inductorium was constructed which operated on a series of seven 1.5-v flashlight batteries. When a button was pressed this device delivered shock across two contacts ¾ in. apart. The coil, interrupter, and shock contacts were obtained from a commercially available device for shocking livestock (Hot Shot Products, Minneapolis 16, Minnesota). From oscilloscope readings it was estimated that the average voltage output was in the range of 300 to 400 v, with occasional spikes exceeding 1000 v. Subjectively, the shock produced a sharp, extremely painful sting, localized in the area of the body to which the contacts were touched, much like being struck with a vigorously applied willow switch. The pain terminated with the removal of the shock, with no after-effects such as redness, swelling of the skin, tingling, or aching. (Observers of the sessions in which shock was applied reported that, on the basis of observable autonomic responses such as flushing, trembling, *etc.*, the subject recovered from the shock episodes much faster than the experimenter.)

In the twenty-seventh experimental session (first and second arrows, Fig. 3) when the bookcase had been present for 14 sessions (6.4 session-hr), shock was applied contingent upon climbing. When the child climbed on the bookcase, the experimenter would shout "No!", run to her, take hold of one leg, touch the shock contacts to the calf or lower thigh and depress the switch for approximately 1 sec. The experimenter then returned to his chair, looked down at the table until *S* returned to her chair, and then looked up and resumed reinforcing eye contacts.

In Session 27, *S* climbed nine times, but only two shocks were delivered. On the first four climbing episodes the experimenter began the punishment sequence (shouting "No!" *etc.*) immediately contingent upon the initial stages of climbing, when *S* was still on the lower shelf of the bookcase. On these occasions, when the experimenter shouted

"No!" and approached, *S* stepped down from the bookcase to the floor. As the shock was to be made immediately contingent only upon climbing, no shocks were delivered. On the fifth climbing episode, the experimenter waited until *S* had climbed from the top of the bookcase to the ventilator frame; he then shouted "No!" and approached, *S* stepped down to the top of the bookcase, where she was standing when the shock was applied (first arrow, Fig. 3). When shocked, *S* abruptly sat down on the top of the bookcase. The experimenter took her arm and assisted her down to the floor, then returned to his chair. *S* returned to her chair 23 sec after the shock, looked at the experimenter and consumed the consequent milk reinforcer within 70 sec after the shock. On the sixth, seventh, and eighth climbing episodes, when "No!" was shouted, *S* jumped to the floor before the experimenter reached her, and no shock was delivered. On the ninth climbing episode in Session 27, *S* was still climbing when reached and the shock was applied.

In Session 28 (third and fourth arrows, Fig. 3), the first climbing episode was terminated without shock when, upon the shouted "No!", *S* jumped 6 ft from the ventilator frame to the floor. It was apparent that although the procedure had not eliminated the climbing, it had quickly produced behaviors which avoided the shock. Therefore, on succeeding climbing episodes the experimenter shouted "No!" and then, irrespective of *S*'s behavior when reached, shock was applied. On the second climbing episode, *S* had jumped to the floor when shock was applied (third arrow, Fig. 3). On the next climbing episode *S* got up from her chair, pushed the bookcase across the room to the other side of the door and climbed there. Shock was again applied after *S* had jumped to the floor (fourth arrow, Fig. 3). Approximately 5 min later *S* got up, pushed the bookcase back to its original

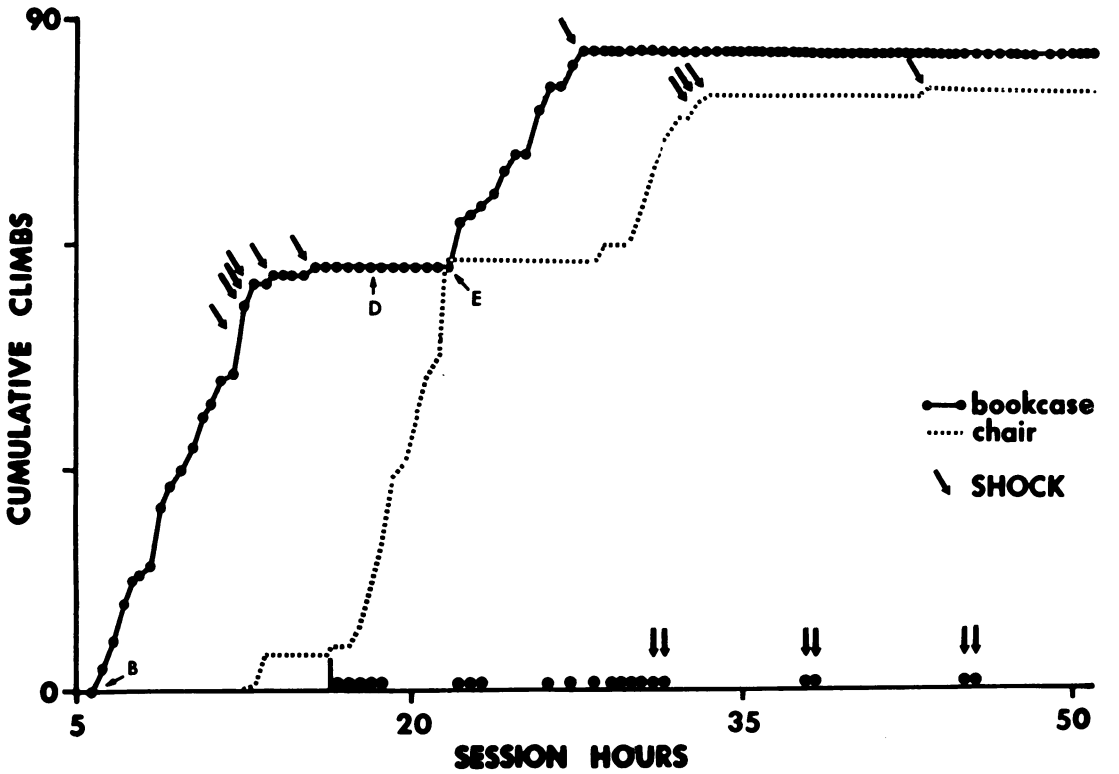

Fig. 3. A cumulative graph of the rates of *S*'s climbing on the bookcase and standing on her chair. Each dot on the top line represents one session. Heavy arrows indicate where each behavior was punished with electric shock. At B the bookcase was placed in the experimental room. Beginning at D the shock device was not brought into the experimental room. At E a small stool was placed in front of the bookcase. Beginning at the short vertical line above the X-axis *S* was placed in the room alone for 5 min before each session. The dots above the X-axis indicate instances of climbing on the bookcase in these periods.

position, looked at the experimenter, and then returned to her chair. No further climbing occurred in the remainder of Session 28 or in Session 29. One climbing episode, followed by shock, occurred in Session 30 (fifth arrow, Fig. 3). Four sessions (1.5 hr) later (Session 34) one additional climbing episode occurred and was followed by shock (sixth arrow, Fig. 3). No further climbing occurred in the subsequent 12 sessions (6.5 hr).

When climbing had been eliminated, correlated with the contingent application of shock, the generality and reversibility of the effect were investigated.

The mother reported no noticeable decrease in climbing at home correlated with the elimination of climbing in the laboratory. Thus, the effects of the shock punishment appeared to be specific to the laboratory situation. From Session 36, *S* was placed in the experimental room alone for 5 min before the session started to see if climbing would occur when the experimenter was absent. Climbing occurred during each of the first five pre-session periods and during intermittent periods thereafter (dots above X-axis, Fig. 3) but did not occur in the regular sessions when the experimenter was present with the shock apparatus. From Session 40 (point D, Fig. 3) the shock apparatus was not present during the regular sessions, with no recurrence of climbing. Clearly, the reduction in climbing was primarily under the discriminative control of the presence of the experimenter.

Before Session 47, after no climbing had occurred in the experimenter's presence for 12 sessions (6 hr), a 1-ft high metal stool was placed in front of the bookcase (point E, Fig. 3). During this session, *S* approached the stool, placed one foot on it, looked at the experimenter, and then returned to her chair. A few minutes later she again approached the stood, stood on it, and again looked at the experimenter. She then placed one foot on the bookcase, looked back, paused, and climbed on the bookcase. The experimenter did not respond. After this, climbing occurred at an average of 4.9 times per hr during the subsequent 11 sessions (5.5 hr) (point *E* to seventh arrow, Fig. 3), occupying 12% of the time in the sessions. At Session 50, the shock apparatus was again brought to the sessions, with no discernible effect on the frequency of climbing. Clearly, the effects of the shock punishment were reversible (not permanent).

In Session 58 one shock was applied contingent upon the second instance of climbing in the session. No further climbing occurred during the next 59 sessions (23 hr). However, climbing still occurred during the pre-session periods when the experimenter was not in the room. From the period preceding Session 65, whenever *S* climbed, the experimenter would enter the room shouting "No", apply the shock, and leave again. This procedure reduced the proportion of pre-session periods in which climbing occurred from 52% to 10% (dots above X-axis, Fig. 3).

The side effects of punishing climbing with shock. As climbing on the bookcase decreased, another, topographically similar, behavior increased. *S* began to stand and climb on the seat and back of her chair. She would sit on the back of the chair, stand on the chair seat, and often stand on the back of the chair with her hands braced against the wall. Climbing on the chair was defined as *S* being on the chair with neither foot on the floor except when she was either sitting or kneeling on the chair seat. This behavior first occurred in Session 28, when climbing on the bookcase was nearly eliminated. During Sessions 35 to 46, when climbing on the bookcase had been reduced to zero, climbing on the chair occurred at an average rate of 8.8 per hr occupying 8.4% of the session time (dotted line, Fig. 3). When the foot stool was introduced (point *E*, Fig. 3) and climbing on the bookcase again occurred at its previous high rate, climbing on the chair immediately ceased. When climbing on the bookcase was again eliminated by contingent shock (seventh arrow, Fig. 3), climbing on the chair again occurred, at a rate of 4 per hr occupying 3.1% of the session time. After 10 sessions, during which the frequency of climbing on the chair was relatively stable, shock was then applied contingent upon this behavior. After three applications of shock contingent upon each instance of climbing on the chair during two sessions, no chair climbing occurred during the subsequent 28 sessions (9.6 hr). During Session 99 another instance of chair climbing occurred, shock was applied, and no further chair climbing occurred in the subsequent 18 sessions (7.7 hr).

Another side effect was observed in a second, topographically dissimilar behavior, eye contact. Throughout the procedures to eliminate climbing, sitting in the chair and meeting the experimenter's gaze for 1 sec had been continuously reinforced with milk. During Sessions 3 to 12 (4.7 hr), when climbing was made physically impossible by the absence of furniture, the frequency of eye contacts had steadily increased from 5.5 to a peak of 88 per hr (A to B, Fig. 2). During Sessions 13 to 26 (6.4 hr) when the bookcase was introduced and climbing reoccurred, the frequency of eye contacts remained relatively stable at an average of 42 per hr (B to C, Fig. 2). During Sessions 27 to 46 (9.7 hr) when climbing was eliminated by the contingent application of shock, the frequency of eye contacts steadily increased from 42 to a peak of 152 per hr (C to E, Fig. 2). During Sessions 47 to 57 (5.5 hr), when climbing again occurred, the frequency of eye contacts remained relatively stable at an average of 151 per hr (E to F, Fig. 2). During Sessions 58 to 77 (8.8 hr), after climbing was again eliminated by the contingent application of shock, the frequency of eye contacts, though variable, again slowly increased to a peak of 222 per hr (F to end, Fig. 2).

From behind the one-way mirror, another observer recorded the duration of *S* looking at the experimenter's face during six sessions between Sessions 13 to 26 and six sessions between Sessions 27 to 46. During these sessions the observer started a stopwatch whenever *S* looked at the experimenter's face (when *S* was sitting in her chair) and stopped it whenever *S* looked away. Although this measure included other instances of *S* looking at the experimenter, in addition to the eye contacts recorded (*S* often looked at the experimenter when he was pouring the milk, looking at the microswitch recording panel, *etc.;* or during the reinforcement 'cycles' while *S* was holding the cup), the changes in magnitude of both were closely correlated. The close correspondence between the relative levels of this measure and the relative levels of eye contacts recorded during both of the experimental conditions, as shown in Table 1, substantiates the magnitude of the changes in eye contacts between these two conditions recorded by the experimenter.

Eye contacts could occur only when *S* was seated in her chair: the experimenter did not look at her when she was out of her chair. Eliminating climbing with contingent shock did not noticeably affect the amount of time *S* spent sitting in her chair. Except when climbing was physically impossible, due to the absence of furniture, the amount of time *S* spent out of her chair gradually declined across all conditions, from 42% during Sessions 13 to 16 (when the bookcase was first introduced) to 0% during Sessions 107 to 117. The periods in which eye contacts remained constant or systematically increased were not correlated with the amount of time *S* was in or out of her chair. The systematic increases in eye contacts during periods when climbing was not occurring were not due to *S* spending a greater proportion of time in the chair, but to *S* looking at the experimenter more frequently when she was in her chair.

Table 1

	Session	*Eye Contacts Per Hr (Experimenter's Record)*	*Min of Looking at Experimenter Per Hr (Observer Record)*
S Climbing	14	54	3.1
	16	34	2.6
	17	30	1.9
	18	32	2.1
	20	54	3.0
	25	50	2.7
S Not Climbing	36	88	4.5
	37	70	3.7
	39	92	4.6
	41	140	7.6
	44	138	7.8
	46	152	8.1

Punishment with shock for climbing in the home. After these effects and side effects of shock were evaluated in the laboratory, climbing in the home was punished with shock. The mother was again instructed to record each instance of inappropriate climbing in the home. After 16 days of recording, during which inappropriate climbing occurred on the average of 29 times per day, the mother began to punish climbing with shock. On the seventeenth day, when the shock was first applied, the experimenter was present in the home instructing the mother in the use of the shock apparatus. The mother carried the

shock apparatus in the pocket of her apron. When the child climbed, the mother was instructed to shout "No!", and to continue to scold the child in a loud voice while approaching, apply the shock, and then, with no further interaction, resume her previous activity. The mother continued to attend to, and interact with the child intermittently when she was not climbing. Shock reduced the inappropriate climbing from an average of 29 per day to 2 per day within four days (Fig. 4). The mother reported that the shock device had been malfunctioning on Day 29 through Day 32, delivering shock only on intermittent trials (dotted lines, Fig. 4). On Day 33 the shock device was repaired (arrow, Fig. 4). Subsequently, inappropriate climbing decreased quickly to zero (from arrow to Day 50, Fig. 4).

Another problem of long standing had been that *S* would occasionally strike her three-year-old brother with an object, push him down the stairs, *etc.* As the mother was extremely concerned for the safety of the young child, shock was also applied contingent upon aggressive behavior toward her brother. Although no baseline was taken on the frequency of this behavior before shock was applied, the mother had estimated that the behavior occurred three or four times a day. *S* was shocked contingent upon 17 instances of hitting her brother over 20 days. During this time the behavior decreased from 2.3 per day on the first three days of shock contingencies to zero (upper graph, Fig. 4) with no further instances of this behavior reported during the subsequent 70 days.

On the fifty-first day, when no climbing had occurred on 14 of the last 15 days, the shock device was removed from the home. The mother was instructed to try to control the climbing by spanking the child whenever she climbed. During 25 days of this, the climbing averaged 2.0 per day, and showed a slightly increasing trend (Fig. 4). Furthermore, the mother complained that spanking the child was more unpleasant and "brutalizing" for both herself and the child than the shock had been. Therefore, further procedures were sought to maintain a low, tolerable frequency of climbing without the direct use of shock.

After the daily sessions in the laboratory, the child was taken to a large nursery school playroom. A chair was placed in the middle of the room. As *S* was wandering around the room, periodically she would be told to sit in

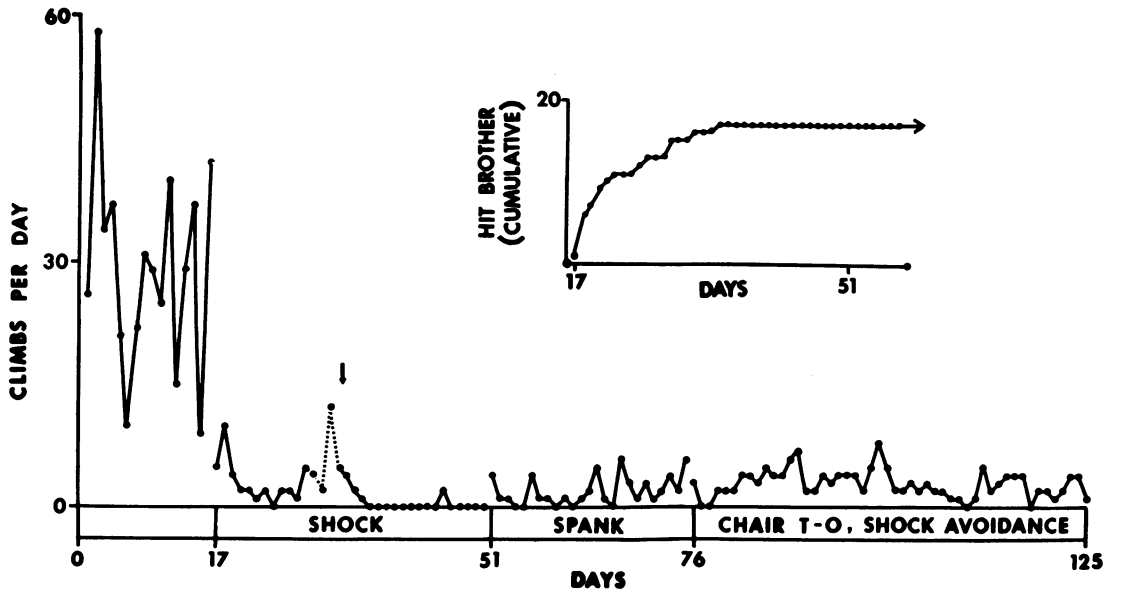

Fig. 4. Graphs of the frequencies of *S*'s climbing and aggressions against her little brother at home. Each dot represents one day. Beginning on Day 17 each occurrence of either behavior was punished with electric shock. The dotted lines during the shock condition represent days when the shock device was malfunctioning. The device was repaired at the arrow. Beginning on Day 51 the shock device was removed from the home and the mother was instructed to spank the child for climbing. Beginning on Day 76 the child was given a 10-min time-out in a chair for climbing. Sitting quietly in the chair avoided shock.

the chair. The experimenter would point to the chair and say loudly, "(Name), go sit in the chair." If the child moved in any direction but toward the chair or did not move at all for 5 sec the experimenter would slowly approach the child with the shock device until she sat in the chair. After *S* had been sitting in the chair for a variable length of time, she would be helped up from the chair, and told, "O.K., you can go now". If *S* attempted to get up before this occurred, the experimenter would shout "No!" and approach her with the shock apparatus. Under these conditions, *S*'s compliance with the instructions to sit in the chair improved only slightly. Her first move was never in the direction of the chair. Her latency of getting to the chair remained long (averaging 26 sec) and it was necessary to approach her with the shock apparatus on 63% of the first 30 trials. On the thirty-first trial the child was shocked when she had to be approached with the shock apparatus. On the next six trials the child went directly to the chair, arriving there within 6 to 15 sec without being approached with the shock device. During the next 44 trials shock was applied five times. By trials 84 to 101, *S* was going directly to the chair when instructed, arriving within 7 to 12 sec, with the shock apparatus never being presented. After the first shock, *S*, once seated, never attempted to get up until instructed to do so.

This procedure was then used as a basis for controlling climbing behavior in the home. From Day 76 (Fig. 4) the mother no longer spanked *S*, instead, *S* was made to sit in a chair for a 10-min timeout contingent upon each instance of climbing. If *S* did not go to the chair when instructed, got up from the chair before the mother instructed her to leave, or did not sit quietly in the chair, shock was applied. Under this procedure inappropriate climbing in the home occurred at an average rate of 2.9 times per day during the next 50 days (Days 76-125, Fig. 4). Sitting in the chair was "backed up" with shock on 19% of the occasions when *S* was sent to the chair for climbing (approximately one shock every other day), although the mother's records indicate that "shockable offenses" occurred on 36% of the occasions.

This procedure was not as effective as the direct use of shock punishment in controlling climbing and, in fact, resulted in a greater frequency of shocks. However, this timeout procedure was continued because it approximated normal child-rearing procedures and, as such, was also used by the mother to control *S*'s less severe disruptive behaviors, such as opening the refrigerator, pulling clothes off of the closet hangers, throwing the pots and pans out of the kitchen cupboards, *etc.*

Imitation training in the laboratory. After the effects and side effects of shock in eliminating disruptive climbing were analyzed, the original program of establishing imitative behavior was resumed.

S had occasionally exhibited two discrete responses in the previous sessions, clapping her hands, and pounding on the table with the palms of one or both hands. Whenever *S* looked at (made eye contact with) the experimenter, he would model one of these two behaviors for *S* to imitate. Whenever *S* emitted these behaviors within 5 sec after the model behavior had been presented, a reinforcer was delivered. Initially, models for both clapping and pounding were alternated randomly. When no improvement in the frequency of imitation was noted after eight sessions, only one of the models, clapping, was presented. The experimenter began clapping his hands repeatedly and reinforcing *S*'s clapping behavior. *S* exhibited such a low rate of clapping (two or three per session) that no discernible progress was made in two sessions. The experimenter then began holding *S*'s arms and bringing her hands together. Reinforcers were first delivered contingent upon not struggling and then contingent upon slight cooperative movements while the experimenter was moving her hands. Successively greater force produced by *S* was then reinforced while fading out the force supplied by the experimenter in bringing her hands together, until the experimenter would clap his hands and then just touch *S*'s arms and *S* would clap her hands. The experimenter then faded out touching *S*'s arms, first to a gesture which was made smaller and finally eliminated until, after two sessions *S* would respond to the model stimulus of the clap alone. (These procedures are modifications of those developed by Sherman (1965) to reinstate verbal behavior in adult psychotics and further developed by Metz (1965) and Baer, Peterson, and Sherman (1965) to establish verbal behavior in autistic and re-

tarded children.) While the rate of clapping systematically increased from an average of two to an average of 25 per 10-min period, no improvement in imitative clapping occurred over five sessions. Imitative claps occurred at an average frequency of 5.3 per 10-min period, (first fourteen 10-min periods, bottom graph, Fig. 5) and to only 12% of the models presented.

Punishment for autistic rocking. Two other deviant behaviors were recorded. *S* would frequently strike the side of her head with the palm of her hand, sometimes resoundingly, and she spent a significant portion of the time in the sessions engaged in autistic rocking behavior. No contingencies were applied to the self-striking behavior, but their frequency was recorded. A contact of a hand with the side of her head which resulted in an audible sound was the criterion for recording a self-hit. The frequency of self-hitting gradually declined from an average of 77 per hr in the first 15 sessions to 13 per hr in Sessions 105 through 117.

Rhythmic twisting of the head was the criterion for recording a period of autistic rocking. This rocking usually included movement of the shoulders and upper trunk and was always accompanied by a monotonic humming. *S*'s eyes were either closed or focused on her hand, which was held out in front of her face. Autistic rocking occupied an average of 25% of the time in the session and did not systematically change over 107, 20- to 30-min sessions.

Midway through Session 108 (arrow, Fig. 5) the following procedure was introduced. The experimenter shouted "Stop that!", seized *S* by the upper arms, and shook her whenever she began rocking. He would wait until her eyes were closed or fixed on her hand before abruptly shouting and shaking her. This event invariably produced a "startle reflex" and flushing in *S*. This contingency, which terminated each rocking episode, of course, decreased the time spent rocking from 25% to less than 1% of the session (top graph, Fig. 5). More important, the frequency of rocking episodes also decreased steadily from 0.94 per min in the first session where this contingency was applied, to 0.03 per min in the tenth session. This indicated that shouting and shaking *S* was a punishing stimulus which decreased the probability of the behaviors, in addition to terminating each occurrence of the behavior.

The side effects of punishing autistic rocking. When autistic rocking was eliminated by this punishment procedure imitative claps immediately increased to 64% of the models presented and to an average rate of 16 per 10-min period in the first session (fifteenth to seventeenth 10-min periods, Fig. 5), and continued to increase to 76% of the models presented and to a rate of 25 per 10-min period by the fourth session of this procedure (twenty-second and twenty-third 10-min periods, Fig. 5).

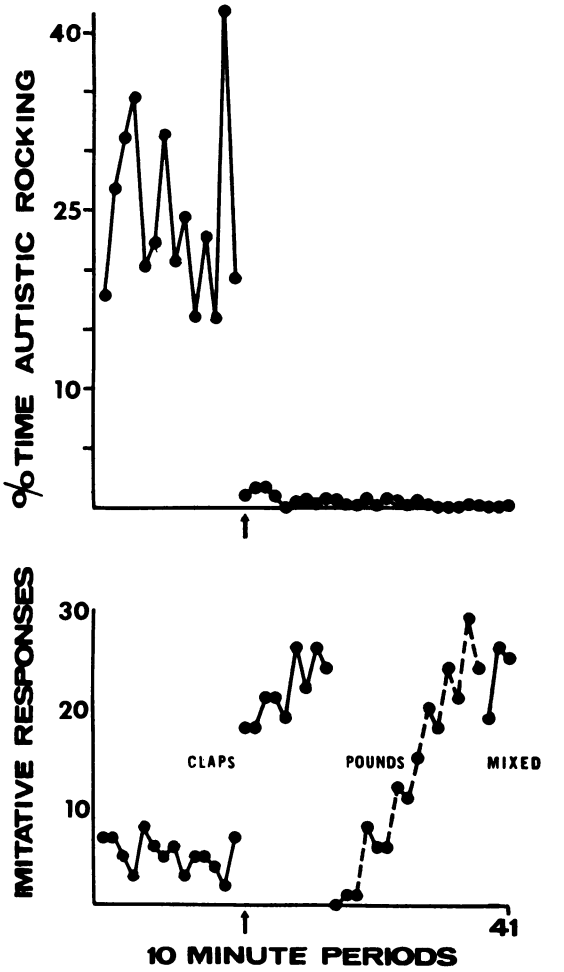

Fig. 5. Graphs showing the relationship between autistic rocking and frequency of imitative responses. At the arrows, autistic rocking was punished by the experimenter shouting at and shaking *S*. Following the increase in frequency of imitative clapping, imitative pounding was trained, and then clapping and pounding were both randomly presented.

In the fifth session after autistic rocking had been eliminated, the experimenter began to establish imitative pounding of the table. He pounded on the table contingent upon eye contact and reinforced any pounds which occurred within approximately 5 sec after this model. Imitative pounds systematically increased from an average of 13% of the models presented and a rate of three per 10-min period to 93% of the models presented and a rate of 26 per 10-min period in five sessions (twenty-fourth to thirty-eighth 10-min periods, Fig. 5). Models for both pounds and claps were presented in a random order in the final session. Accurate imitation of pounds and claps occurred to 87% of the models presented and at a rate of 23 per 10-min period in this session (thirty-ninth to forty-first 10-min period, Fig. 5). Thus, punishing autistic rocking not only immediately increased imitative clapping but also permitted the rapid establishment of a new imitative response.

Imitation training in the home. After the procedures to control *S*'s disruptive behaviors had been developed and employed in the home, the mother was able to devote her time to the training of appropriate behaviors.

The mother had observed the establishment of the two imitative behaviors in the laboratory. After one session in which the mother worked with *S* under the experimenter's supervision, the mother began conducting imitation training sessions at home. Due to extra-experimental factors, the experimenter no longer worked with *S*, and communicated with *S*'s mother via letter and telephone. The mother reported that in 115 sessions (a total of 41 hr) she had established five new imitative responses (pounding on wall, stamping feet, standing up, raising arms, and placing a hat on head) in addition to the two already established, and all seven imitative responses would reliably occur when their models were presented in random order. From data sheets which the mother kept, it appeared that the last of these five imitative responses was established in less than 1.5 hr of session time. At last report the mother was working on imitative mouth movements in a mirror and imitative behaviors which produce noises (blowing a whistle and a harmonica, squeezing a horn, *etc.*) as a step toward establishing verbal imitation.

DISCUSSION

The failure of the initial attempts to eliminate climbing (in the home with contingent timeout from social interaction and in the laboratory with extinction procedures coupled with the establishment of incompatible behaviors) obviates even a tentative statement about the variables which maintained this behavior. It appears that social interaction was not functional in maintaining this behavior (although even this statement must be tentative, since the initial procedures were applied for a short period of time, relative to the lengthy history of the behavior).

Although the electric shock was applied contingent upon several behaviors, it was seldom applied concurrent with those behaviors. The actual behavior ongoing when the shock was applied was usually vigorous struggling. Nevertheless, the shock (preceded by "No!") functioned as a punishing stimulus, decreasing the future probability of the behaviors. Climbing on the bookcase and standing on her chair in the laboratory, and hitting her brother and climbing at home were all quickly eliminated by the contingent application of shock. Shouting and shaking *S* contingent upon and concurrent with autistic rocking also functioned as a punishing stimulus for that behavior. (However, this consequence was apparently not a punishing stimulus for climbing behavior, as the parents reportedly had been applying it for several years without success.)

The original direct effect of the punishment was restricted to the specific stimulus conditions of the presence of the experimenter in the laboratory room. After punishment, climbing occurred in the laboratory when the experimenter was absent, at home when he was present, but not in the laboratory in his presence, even when the shock device was absent. Identical stimulus control was noted, but not measured, following punishment of autistic rocking. In light of the continued climbing at home and in the laboratory in the absence of the experimenter, the stimulus control exerted by his presence in the laboratory room was remarkable. Only by evoking approximations to climbing by placing a new piece of furniture in front of the bookcase, did climbing recur in the experimenter's presence. The continued, inter-

mittent occurrences of climbing when *S* was alone in the room during the pre-session periods, even when this climbing was punished, was perhaps due to the specificity of the punishment effect to the experimenter's presence.

A prime argument against the use of punishment procedures is that these procedures will generate undesirable side effects. Most of the behaviors of *S* were continuously recorded in the laboratory sessions to evaluate the side effects of punishment on other behaviors. Several marked side effects were, in fact, observed.

When climbing on the bookcase was punished *S* began to stand and climb on the seat and back of her chair. This behavior subsequently varied inversely with climbing on the bookcase. When the punished behavior was allowed to recover, standing on the chair immediately ceased. When climbing was again punished, standing on the chair again resumed. This side effect corresponds to the clinical model of "symptom substitution" in that the substituted behavior was topographically similar and similarly undesirable to the punished behavior. This "contrast effect" may have been related specifically to the punishment procedure since standing on the chair did not increase during the nine sessions when climbing was eliminated by removing the furniture. However, when this "symptom" was also punished, no other undesirable behaviors appeared.

No suppression of other behaviors was noted, either through generalization of the punishment effect or through conditioned "emotional" suppression, correlated with the punishment of the target behaviors. On the contrary, all changes noted in other behaviors were increases. The brevity of the general suppression directly produced by the shock, if any, is indicated by *S* obtaining and consuming food within 70 sec after the first shock.

S quickly learned to jump down from the bookcase in the laboratory, and to sit in the timeout chair at home, to avoid shock. Although strong escape and avoidance behaviors were produced with the shock, both intentionally and inadvertently, no general avoidance of or attempts to escape from the room or the experimenter were seen.

No aggressive behavior toward any person or object occurred in the laboratory. When the aggressive behavior toward her little brother (which antedated this study) was punished with shock, no evidence of pain-elicited aggression was noted, only a systematic decrease in the behavior.

The experimenter was closely paired with the shock presentations in the laboratory. The effects of the punishment were specific to his presence in the laboratory, attesting to the fact that he was discriminative for shock. However, the only observed alteration in *S*'s behavior toward the experimenter following punishment was an increased frequency of attending to (making eye contact with) him. This increase in frequency of eye contacts after a behavior was eliminated by shock is in marked contrast to the theoretical discussion by Hutt and Ounsted (1966) predicting that increasing the level of arousal and anxiety of a child would result in a decrease in eye contacts.

The most significant side effect was the fact that eliminating climbing and autistic rocking with punishment facilitated the acquisition of new desirable behaviors. When climbing was occurring, the reinforcement procedures were ineffective in increasing the rate of eye contacts. When climbing was punished the reinforcement procedures produced a steady increase in the rate of eye contacts, which ceased when climbing resumed. Whereas the absolute level of the rate of eye contacts could be maintained when climbing was occurring, systematic increases in rate were produced only when climbing was suppressed. An almost identical relationship was observed between autistic rocking and rate of imitation.

This effect did not appear to be related to the punishment procedures *per se*, but only to the presence or absence of the climbing behavior, as a systematic increase in the rate of eye contacts also occurred when climbing was simply precluded by the absence of furniture. However, the relationship between climbing and eye contacts, or autistic rocking and imitation, was not simply a function of the physical incompatibility between the behaviors. Subtracting the total time spent climbing or rocking from each session and recomputing the rate of eye contacts or imitations does not alter the relationships depicted in Fig. 2 and 5. The physical incompatibility does not account for those relationships. However, the

necessity of eliminating climbing or rocking before increases could be obtained in eye contacts or imitations demonstrates a relationship between the behaviors. This relationship might be termed "functional incompatibility". The possibility that the stereotyped behaviors of deviant children are functionally incompatible with the establishment of new, socially productive behaviors certainly warrants further investigation. It may be that punishment of stereotyped behaviors could play an important role in remediating the deficits of deviant children.

In summary, this study found that when punishment was used to eliminate a child's deviant behavior, side effects in the form of behavioral contrast or "symptom substitution" did occur, but that these side effects were primarily desirable. Some deviant behaviors, maintained by unknown variables, interfered with the establishment of new behaviors. This interference was not primarily due to a physical incompatibility between the behaviors. This interference, which might be termed "functional incompatibility", suggests that the elimination of such deviant behaviors may be a necessary prerequisite to the establishment of new behaviors.

This paper should not be interpreted as a blanket endorsement of punishment with children. In the opinion of the author, the punishment procedures were therapeutically justified for this child. Shock punishment was employed only after other procedures to control disruptive and dangerous behaviors had been extensively but unsuccessfully employed. The possibility of deleterious effects and side effects were thoroughly considered before shock was used. The effects and side effects were carefully assessed in the laboratory before shock was employed in the home. The benefits to the child, in fact, far exceeded the author's expectations. Of course, no statement about the generality of these findings to other children can yet be made. However, these findings do serve to limit the generality of extrapolations from past research which contraindicates the use of punishment.

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