Self-Injurious Behavior: Evaluations of Controlling Variables and Interventions

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A nested multi-element within a multiple baseline design was used to evaluate potential controlling variables for the self-injurious behavior (SIB) of two severely retarded seventeen-year-old boys. Both subjects had extended histories of SIB which were somewhat unresponsive to prior behavioral programming. For each subject, four variables, attention, escape from a task, sensory stimulation, and mild punishment were evaluated. Results indicated that Subject 1's SIB was controlled by the response produced stimulation. A "package" intervention which included sensory attenuation and punishment procedures was evaluated with Subject 1 and shown to significantly suppress head hitting. A controlling variable was not identified for Subject 2's head hitting, however, contingent forced arm movements and contingent forced leg movements each caused a suppression of his SIB.
ACKNOWLEDGEMENTS

I would like to thank a number of people for their continuous support which led to the completion of this research. First, I would like to thank the Kalamazoo Valley Intermediate School District and, specifically Paul Wolham, Karol Peterson, and Margaret Cudihy-Sterzelecki, for their permission to conduct the research. I would also like to thank Jim Cowart, whose endorsement and critical eye improved the quality of this research numerous times. A great deal of appreciation is also extended to Rick Vanden Pol, Sheldon Stone, Al Poling, and Brian Iwata, all of whom were instrumental in the development of this project. Norm Schultz and JoAnn Walters provided their quality support and assistance at times when they were dearly needed. Without their many hours of committed help this project may have come to an early, unsuccessful completion. Jack Green, George Thompson, and Ted Apking were helpful resources for obtaining exceptional staff and I am indebted to them for their assistance. As a result of this project, my wife, Pat, has done as much work as I have. Without her understanding, tolerance, assistance, and support, my perspective of the magnitude of this project would have been very much increased. Finally, I would like to thank Wayne Fuqua for his ongoing support and invaluable constructive suggestions during the development, implementation, analysis, and writing of this study.

Scott Nelson Schrum
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CHAPTER I

INTRODUCTION

Self-injurious behavior (SIB) is a relatively common problem observed in the retarded and "schizophrenic" populations, with estimates that four to six percent of the institutionalized population exhibits some form of SIB (Bachman, 1972). Self-injurious behavior has also been observed to occur in the natural home (Peine, 1972) and in day schools (Luisselli, Helfen, Collozi, Donnellon and Pemberton, 1978). SIB has been defined as "measures carried out by the individual, upon himself, which tend to cut off, to maim, to destroy, to render imperfect, some part of the body" (Phillip and Mazaffer, 1961). Some of the topographies of SIB which have resulted in tissue damage include eye gouging, lip biting, hand and arm biting, head banging, head hitting, and hair pulling. The occurrence of self-injurious behavior in any environment is a perplexing problem since one would expect that the immediate and "painful" stimulation produced by the SIB would have more of an effect on its future occurrence than almost any environmental stimulus changes.

Unfortunately, it is usually not clear what stimulus changes maintain SIB in the natural environment; therefore, this is an important area which deserves study for a number of reasons. The most important need is to develop effective intervention programs which will provide clinicians with tools to decrease the occurrence of SIB. Many punishment procedures have been devised to control SIB
(Dorsey, Iwata, Ong and McSween, 1980; Tanner and Zeiler, 1978; Lutzker, 1978; Lovaas and Simmons, 1969) but these would undoubtedly benefit from an attempt to control for the stimulus changes which are responsible for the maintenance of the behavior. A second reason to identify the controlling variables for self-injurious behavior involves the maintenance of the reduction of SIB. Once the SIB has been reduced or eliminated, the likelihood of that reduction continuing would be enhanced if the reason for its occurrence was eliminated from the environment. A third reason to identify controlling variables is to help prevent the future development of SIB. Identifying different controlling variables and educating direct contact staff about those controlling variables would be needed steps for the prevention of self-injurious behavior.

Carr (1977) has reviewed the SIB literature and offers many insightful comments and suggestions regarding the causes of SIB. Many of the comments in this review are similar to Carr's and interested readers may find it helpful to refer to his article for a more thorough discussion. There are two possible causes of SIB which have been identified in the literature: physiological causes and environmental causes. The most common physiological causes are the Cornelia de Lange syndrome (Bryson, Sakati, Nyhan and Fish, 1971) and the Lesch-Nyhan syndrome (Anderson, Dancis and Alpert, 1978). With regard to environmental causes, self-injurious behavior has been classified as an escape response (Skinner, 1953), an attention-getting response (Lovaas, Freitag, Gold and Kassorla, 1965), and possibly a self-stimulatory response (Rincover, Cook, Peoples and Pickard, 1979).
Skinner (1953) first discussed SIB as a potential escape response when describing "aversive self-stimulation". He wrote, "Such self-stimulation is explained if it can be shown that the individual thus avoids an even more aversive consequence". For some individuals (e.g., students) being involved in an instructional task may be the "even more aversive consequence" which Skinner mentioned, and SIB just prior to, or during, the task could function as an escape/avoidance response. Carr, Newsom and Brinkoff (1980) demonstrated that aggression occurred more frequently in a high demand situation (an instructional task) than in a low demand situation and these results may be easily related to the potential explanation of SIB functioning as an escape/avoidance response. Carr et al.'s demonstration would probably have been a stronger evaluation of escape responding, however, if the termination of the high demand situation would have followed the aggressive response, and it could have been shown that the termination controlled the rate of responding.

Lovaas et al. (1965) demonstrated that attention and preferred activities functioned as a reinforcer for SIB by delivering them contingent upon SIB and observing an increase in the behavior's occurrence when compared to baseline. This, of course, was not a test indicating that the subject's SIB was initially caused by contingent attention and activities, only that SIB could be reinforced through the contingent presentation of attention and activities. Schaeffer (1970), however, demonstrated that contingent attention and edibles could be used to shape head-banging in rhesus monkeys. Schaeffer
first shaped head-banging, then suppressed its occurrence during an extinction condition, and then increased the frequency again by providing contingent attention and edibles. The results of this experiment, although useful, would have been of even greater value if only attention had been manipulated.

Self-stimulation (or response producer sensory stimulation) has not been directly linked to self-injurious behavior, however, some forms of response produced stimulation have been shown to control the occurrence of self-stimulatory behaviors. Rincover et al. (1979) provided data which suggested an important role for sensory stimulation in the control of seemingly non-functional object and hand manipulations. One subject spun plates on a wooden table, thus producing auditory and visual stimulation. By carpeting the table and thus attenuating the auditory stimulation, a reduction in the amount of plate spinning occurred. By turning out the room lights and thus reducing visual stimuli, a second subject's object waving was completely eliminated. Rincover et al. selected the type of sensory stimulation to manipulate by observing the subjects and identifying behaviors which seemed to indicate a preference for one type of stimulation over another type. If two or more types of sensory stimulation appeared to be potential reinforcers, each was systematically evaluated. This type of procedure could be used to analyze SIB by placing some type of insulating or attenuating clothing on the body part(s) which receives the stimulation and determining whether a decrease in the SIB occurs.

One weakness of the majority of the previously described studies
is that single variables were being evaluated as a potential controlling variable for the undesired behavior. Often, the same variable was evaluated across subjects. Although these experiments provided useful information, it would have been helpful to know what process the experimenters went through in deciding what variable to evaluate. In the two case studies reported in this study, it was not clear what variables controlled the SIB of the two subjects so each of the three variables (escape, attention, and sensory stimulation) was evaluated with each subject. The information to be learned would hopefully lead to the identification of the essential controlling variable, and hence, a reduction of the subject's SIB.

In addition to the procedures already identified, operant researchers have reported the successful suppression of SIB with a variety of techniques. This list includes punishment (Dorsey et al., 1980; Harris and Romanczyk, 1976; Lovaas and Simmons, 1969; Risley, 1968), extinction (Lovaas, Freitag, Gold and Kassorla, 1965; Tate and Baroff, 1966), differential reinforcement of other behavior (Corte, Wolfe and Locke, 1971), and differential reinforcement of incompatible behaviors (Tarplay and Schroeder, 1979). Punishment has been the most frequently used of these contingencies for SIB. Operant literature has identified the use of spray mist (Dorsey et al., 1980), aromatic ammonia (Tanner and Zeiler, 1978), overcorrection (de Cantanzaro and Baldwin, 1978), shock (Lovaas and Simmons, 1969), timeout (Solnick, Rincover and Peterson, 1977) and facial screening (Lutzker, 1978) as effective punishers for SIB.

Probably the most suppressive, and therefore successful, of
these punishment procedures has been contingent shock, or faradic punishment. Corte et al. (1971), Risley (1968) and Lovaas and Simmons (1969) have all described complete suppressions of SIB when contingent faradic punishment was used. One problem which has been typical of faradic punishment, however, has been the lack of generalization to settings in which the shock was not introduced. A procedure which has had initial results which are almost as successful as shock has been spray mist. Dorsey et al. (1980) described the complete suppression of SIB with seven out of nine profoundly retarded subjects when spraying a fine mist of room temperature water in the subjects' faces was made dependent on the occurrence of SIB. This seems to be especially important research since spray mist is a more socially acceptable punisher than shock. Overcorrection has been another punishment procedure used for the deceleration of self-injurious behaviors (de Cantanzaro and Baldwin, 1978; Kelly and Drabman, 1977; Harris and Romancyzk, 1976; Measel and Alfieri, 1976). Harris and Romancyzk (1976) demonstrated a complete suppression of SIB over a 145-day period by requiring five minutes of forced head movements contingent upon chin-banging. de Cantanzaro and Baldwin (1978) also showed a complete suppression of one subject's SIB and a significant suppression of a second subject's SIB by using contingent forced arm movements. Unfortunately, overcorrection procedures are often time-consuming, require a staff person who is strong when physical guidance is necessary, and may not produce rapid suppression. A more viable alternative may be the response dependent presentation of aromatic ammonia. Tanner and
Zeiler (1978), working with a twenty-year-old autistic woman, placed a crushed ammonia capsule under her nose when she began face-slapping, and kept it there until she stopped. The result was the complete suppression of slapping in the experimental setting, and the near elimination of face-slapping when the procedure was implemented in the natural environment (the ward of a hospital). Solnick, Rincover and Peterson (1977) used another punishment procedure - timeout - to decrease the head-hitting of a severely retarded teenage boy. They were also able to demonstrate that the time in condition played an important role in the effectiveness of the timeout condition. Wolf, Risley and Mees (1964) used timeout with a three-and-one-half-year-old boy who head banged, face slapped, and scratched, and eliminated his SIB in ten weeks. A typical problem which arises when evaluating timeout procedures is that there is almost always more involved in the procedure than the elimination of attention (Carr, 1977). For example, the subject is usually moved to another setting or is required to sit in a chair.

Aside from punishment, differential reinforcement of other behaviors (DRO) and differential reinforcement of incompatible behaviors (DRI) procedures may be the most widely used for suppressing SIB. Luisselli, Helfen, Colozzi, Donnellon and Pemberton (1978) used praise and edibles on a fixed-interval one minute schedule to eliminate the hand-biting of a ten-year-old moderately retarded boy, in three different settings. Tarplay and Schroeder (1979) compared DRO and DRI schedules to suppress head-banging and found the DRI schedule to cause a more rapid suppression. These findings suggest
that DRO and DRI procedures could be useful components of many clinical interventions for SIB.

Another area of research which may be of use to those interested in SIB is the use of vibration as a reinforcer. Since vibration is a form of tactile stimulation, it has a stimulus component similar to that of self-injurious behavior. Nunes, Murphy and Ruprecht (1971) evaluated the effects of vibration as a reinforcer by using a punishment and DRO procedure to decrease head-slapping with two severely retarded teenagers. Two experiments were conducted and each produced a rapid suppression of SIB. Bailey and Meyerson (1969), working with a profoundly retarded self-injurious child, were able to demonstrate that vibration functioned as a reinforcer. Whenever the child pressed a lever in his crib, the crib was vibrated by an industrial vibrator; however, no data were presented regarding any changes in the occurrence of the child's SIB.

The present research project was an attempt to identify the controlling variables for the SIB of two severely retarded teenage boys. Platt (1964) suggests that systematic lines of research, with simple, elegant experiments will lead to answers in the most expeditious manner, i.e., by systematically following a specific, logical line of research questioning, you will quickly answer the original question or be led to the correct question. This process is known as inductive inference. According to Platt, "In numerous areas that we call science, we have come to like our habitual ways, and our studies that can be continued indefinitely. We measure, we define, we analyze, but we do not exclude." It is the continuous work toward
excluding alternative hypotheses that will most quickly lead us to the correct answer. This research was an attempt to follow Platt's suggestions in attempting to identify the controlling variables for the self-injurious behavior of two severely retarded boys. This research strategy involved the following steps: (1) identify the potential reinforcers for self-injurious behavior, (2) design simple experiments which would allow us to isolate and evaluate the potential reinforcers, (3) conduct those experiments, eliminating those variables not functioning as reinforcers while identifying the variables which were functioning as reinforcers, and (4) recycling the process when the original procedure did not provide the answer. According to the operant literature, the potential reinforcers for SIB included attention, the opportunity to escape or avoid an aversive stimulus, and possibly sensory stimulation. An additional question was: If sensory stimulation is a reinforcer for SIB, could "artificial" stimulation from a vibrator also function as a reinforcer?
CHAPTER II

GENERAL METHODS

Subjects

Two subjects participated in these two case studies - one subject in each study. Both subjects attended the same day school and were selected because of long histories of self-injurious behavior which had proven somewhat unresponsive to behavioral programming during the two preceding years.

The experimenter sought and received the approval of university and day school research committees. Informed consents were obtained from the parents of both subjects and daily logs were kept of any external tissue damage produced during the experimental sessions.

Subject 1 was a seventeen-year-old ambulatory severely retarded boy who had an untestable I.Q. At school he was being taught to follow simple commands such as "Come here," "Stand up," "Sit down," and to engage in self-help skills such as walking up and down steps, independent eating and drinking, and pulling up his pants. His current receptive language repertoire consisted of sitting down when told "Sit" and coming when a person said "Come here." He had no expressive language and rarely emitted vocalizations except for a whining sound and some laughing. His SIB consisted only of head-hitting, usually using the back of his left hand. Although the topography of the behavior had remained stable for the past two
years, the intensity and frequency changed often. Tissue damage consisted of a large protrusion on the left side of his head and on the back of his left hand, and noticeable hair loss in the area of the protrusion on his head. The contingency for head hitting which was in effect at school involved a five-minute DRO (using edibles paired with attention) and a fixed-ratio one punishment schedule (spraying a fine mist of room temperature water from a hand-held plant mister in the subject's face). This contingency had been in effect during the two years prior to this research with the only change being the thinning of the DRO schedule (initially fifteen seconds). The initial effect of this program was a reduction of head-hitting from a baseline of 225 hits per hour to ten per hour. At the time of this research, the subject was averaging fifty head hits per hour.

Subject 2 was also a seventeen-year-old ambulatory severely retarded boy who had an untestable I.Q. At school he was being taught to feed himself, make eye contact with a tutor, and improve fine motor skills. His current receptive language repertoire involved inconsistent responding to stand up and sit down commands. He had no expressive language repertoire and his only vocalizations consisted of yelling during tantrums. Subject 2's SIB consisted of head-hitting with his open hands or fist. Tissue damage which the subject caused included minor face scratches, some hair loss, and bruised hands. Subject 2 had received special behavioral programming for two years prior to this research. The day-long contingencies in effect during this research project involved ignoring the
head-hitting, i.e., making no change in interactions with the sub-
ject when he hit his head. Subject 2 averaged thirty-eight head hits
per hour, with a range of zero to one hundred sixty-two hits per
hour. He wore a protective helmet during the entire day to decrease
potential tissue damage caused by head hitting and also as a pre-
caution because of poor gross motor skills associated with ambulation.

Experimental design

The design used for each of these case studies was a nested multi-
element within a multiple baseline. For each subject three baselines
were initiated, followed by interventions staggered in a multiple
baseline fashion. All interventions were introduced using a multi-
element design, with the exception of the final interventions of
Case Study 2.

Each of the three baselines and subsequent interventions were
designed to evaluate one potential reinforcer (either sensory stim-
ulation, the opportunity to escape an aversive stimulus, or attention)
for each subject's self-injurious behavior. In general, each of
the three baseline conditions was designed to consequte (on a fixed-
ratio one schedule) the occurrence of SIB with one of the potential
reinforcers, and the interventions were designed to eliminate or
attenuate that potential reinforcer. The sequence of conditions for
each of the case studies varied depending on the results of prior
conditions.
Settings

The setting for this research was the day school which both subjects attended five days per week. Individual settings within the school varied from classroom settings to individual tutorial booths. Because each evaluation involved a multi-element design, two settings were used for each evaluation. Those settings were always designed to be as visually discriminable as possible.

Staff training

Staff for this project were psychology graduate and undergraduate students and social work undergraduate students who worked at the school.

Observers were required to pass a written quiz and a videotape quiz in order to participate in the study. The written quiz involved writing definitions and examples of topographies for the behaviors on which they were collecting data. After passing the written quiz, the observers were taught the scoring rules and practiced using those rules by scoring a videotape of Subject 2, which they had to pass with a 90% interobserver agreement score (using occurrence reliability) or better.

Tutors received the same training as observers in order to ensure that all staff could identify head hits with similar accuracy. Additionally, tutors were given written descriptions and role play practice on the procedures they would be implementing during the study.
Response definition

The same definition was used with both subjects; it was written to include their current topographies, but also to allow for potential changes in topographies. A head hit was defined as any contact between an object (inanimate objects or a body part of the subject) and the subject's head, except for head contact with the shoulders or chest.

Data collection

Data were collected on the occurrence of the dependent variable (head-hitting) and the accuracy of implementation of the independent variables.

A ten-second partial interval system was used to collect data, with the first seven seconds for observing the behaviors of the tutor and subject, and the last three seconds of the interval for recording. The observers switched between observing and recording based on prompts from an audio cassette. Since all sessions were fifteen minutes in duration, there were ninety intervals. When a single condition was in effect, it continued for those ninety intervals, and when two conditions were in effect during the multi-element design, each condition was in effect for forty-five intervals.

The percentage of intervals in which head-hitting occurred was calculated as follows: the number of intervals in which head hits were scored was divided by the total number of intervals in which there was an opportunity for head hits to occur, and that number was
multiplied by 100. For example, if a subject head hit and was consequently restrained for three whole intervals, those intervals would not be included in the total number of intervals since the restraint eliminated the opportunity for head hitting to occur. Therefore, calculations of the percentage of intervals in which head-hitting occurred would be based on forty-two intervals instead of forty-five.

Overall, occurrence, and nonoccurrence interobserver agreement percentages were calculated for head hitting. The overall interobserver agreement calculation was: the number of agreements on the occurrence and nonoccurrence of head hitting was divided by the total number of intervals, and then multiplied by 100. Occurrence interobserver agreement percentages were calculated as the number of agreements on the occurrence of head hitting divided by the number of agreements plus disagreements on the occurrence of head hitting, and then multiplied by 100. Nonoccurrence interobserver agreement percentages were calculated as the number of agreements on the nonoccurrence of the head hitting divided by the number of agreements and disagreements on the nonoccurrence of head hitting, and then multiplied by 100. In Case Study 1, interobserver agreement was collected during 18.5% of the daily sessions. However, during the Head Hits Ignored versus Contingent Spray Mist comparison of the Escape/Avoidance Evaluation, no interobserver agreement was collected. For head-hitting in Case Study 1 the mean overall interobserver agreement was 96.9%, the mean occurrence interobserver agreement was 87.4%, and the mean nonoccurrence interobserver
agreement was 91.8%. In Case Study 2 interobserver agreement was collected in 22.2% of the daily sessions. For head hitting in Case Study 2, the mean overall interobserver agreement was 96.4%, the mean occurrence interobserver agreement was 88.8%, and the mean non-occurrence interobserver agreement was 92.3%.

Tables 1 and 2 are representations of the correctness (accuracy) with which independent variables were presented dependent upon a head hit. Whenever a head hit was scored as having occurred, an independent variable had to be scored in the same or next interval in order for the implementation to be considered correct (i.e., accurate). The calculation for accuracy of implementation: the number of times a head hit was consequated correctly was divided by the total number of times a head hit was scored as having occurred, and then multiplied by 100. Some conditions did not involve the response dependent presentation of stimuli by a tutor so no data are presented for those conditions. The Contingent Vibratory Stimulation condition of the Sensory Stimulation Evaluations was not arranged so that accuracy of implementation data could be retrieved. As can be seen in Table 1 (for Case Study 1), the range of means for the accuracy of implementation was 84.5% to 98.3%. For Case Study 2, Table 2 shows that the range of means for the accuracy of implementation was 93.8% to 100%. Overall interobserver agreement was collected for the occurrence of the independent variables in both case studies. This interobserver agreement was for whether or not the observers scored the occurrence of the independent variable in the same interval. It was not a direct measure for whether or not the
Table I: Mean percent accuracy of implementation of independent variables for each condition of Case Study 1.
<table>
<thead>
<tr>
<th>Sensory Stimulation Evaluation</th>
<th>Escape/Avoidance Evaluation</th>
<th>Attention Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Condition</td>
<td>Condition</td>
</tr>
<tr>
<td>Alone in Booth</td>
<td>Contingent Tutor Withdrawal</td>
<td>Task plus Contingent Attention</td>
</tr>
<tr>
<td>Alone in Booth versus---</td>
<td>Contingent Tutor Withdrawal</td>
<td>Task plus Contingent Attention</td>
</tr>
<tr>
<td>Sensory Insulation Equipment On in Booth</td>
<td>Contingent Tutor Withdrawal versus--- Head Hits Ignored</td>
<td>NRDP</td>
</tr>
<tr>
<td>Alone in Booth versus---</td>
<td>Contingent Tutor Withdrawal</td>
<td>Task plus Contingent Attention</td>
</tr>
<tr>
<td>Contingent Sensory Insulation Equipment</td>
<td>Contingent Thirty-Second Restraint</td>
<td>No Task plus Contingent Attention</td>
</tr>
<tr>
<td>Alone in Booth versus---</td>
<td>Contingent Sensory Insulation Equipment</td>
<td>No Task plus Contingent Attention</td>
</tr>
<tr>
<td>Contingent Vibratory Stimulation</td>
<td>Contingent Spray Mist</td>
<td>No Task plus Package Intervention</td>
</tr>
<tr>
<td>Alone in Booth versus---</td>
<td>Contingent Spray Mist</td>
<td>No Task plus Package Intervention</td>
</tr>
<tr>
<td>Sensory Insulation Equipment On in Booth</td>
<td>Package Intervention</td>
<td>$x = 100%$ (100%-100%)</td>
</tr>
</tbody>
</table>

$^a$NRDP indicates that No Response Dependent Presentation of Stimuli by Tutor occurred.
Table II. Mean percent accuracy of implementation of independent variables for each condition of Case Study 2.
### TABLE IX

**Mean Percent Accuracy of Implementation of Independent Variables for Each Condition - Case Study 2**

<table>
<thead>
<tr>
<th>Sensory Stimulation Evaluation</th>
<th>Escape/Avoidance Evaluation</th>
<th>Attention Evaluation</th>
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<tbody>
<tr>
<td><strong>Condition</strong></td>
<td><strong>Mean Percent Accuracy of Implementation (and Range)</strong></td>
<td><strong>Condition</strong></td>
</tr>
<tr>
<td>Alone in Booth</td>
<td>NRDP&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Contingent Tutor Withdrawal</td>
</tr>
<tr>
<td>Alone in Booth versus Contingent Vibratory Stimulation</td>
<td>NRDP</td>
<td>Contingent Tutor Withdrawal</td>
</tr>
<tr>
<td>Alone in Booth versus Sensory Insulation Equipment On in Booth</td>
<td>NRDP</td>
<td>Head Hits Ignored</td>
</tr>
<tr>
<td>Alone in Booth versus Contingent Sensory Insulation Equipment</td>
<td>NRDP</td>
<td>No Task plus Contingent Forced Leg Movements</td>
</tr>
<tr>
<td>Task with Physical Contact Eliminated</td>
<td>NRDP</td>
<td>Contingent Forced Arm Movements</td>
</tr>
<tr>
<td>Task with Physical Contact Eliminated plus Contingent Forced Arm Movements</td>
<td></td>
<td>No Task plus Contingent Forced Arm Movements</td>
</tr>
<tr>
<td><strong>Note:</strong> NRDP indicates that No Response Dependent Presentation of Stimuli by Tutor occurred.</td>
<td></td>
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</tr>
</tbody>
</table>

<sup>a</sup>NRDP indicates that No Response Dependent Presentation of Stimuli by Tutor occurred.
independent variables were implemented accurately. The calculation for overall interobserver agreement was the number of intervals in which there was agreement on the occurrence or nonoccurrence of the independent variable divided by the total number of intervals, and then multiplied by 100. For the independent variables of Case Study 1, the mean overall interobserver agreement was 98.4%. In Case Study 2, the mean overall interobserver agreement was 98.6%.
The purpose of this evaluation was to determine whether sensory stimulation was the essential controlling variable for head hitting. A secondary question was: Would vibration, applied to the head from a hand-held vibrator, function as a reinforcer in a DRO procedure to suppress the occurrence of head hitting?

The Sensory Stimulation Evaluation conditions took place in tutorial booths with no instructional task involved so that attention would not be inadvertently delivered following head hits and escape from aversive stimuli would also not follow head hitting. Daily sessions lasted fifteen minutes. If only one condition was in effect, it lasted the entire fifteen minutes; however, if two conditions were in effect, each lasted seven and one-half minutes.

Sensory stimulation evaluation procedures

Alone in booth (baseline). Subject 1 was placed alone in a tutorial booth in order to isolate sensory stimulation as a potential reinforcer for his SIB (head hitting). At the end of the condition he was taken out of the booth, but only after three consecutive seconds without a head hit occurring. Subject 1 never had to stay in the booth for more than one additional minute. A provision was set up that if Subject 1's SIB was causing further tissue damage, the
session was to be terminated. However, it was never necessary to implement this procedure. When the multi-element design was initiated, one-half of the fifteen minute session was devoted to the new condition, thus giving the baseline condition a seven and one-half minute duration for the remainder of the study.

**Sensory insulation equipment on in booth.** This condition was seven and one-half minutes in duration and was identical to the Alone in Booth condition except that the subject wore "sensory insulation equipment" for the entire duration of the condition. The sensory insulation equipment consisted of air-filled plastic gloves [manufactured by Skyline under the brand name of "Soccer Boppers" (model #340)]. The gloves had sleeves of oven mittens glued to the inside of the gloves and the sleeves had velcro straps attached to the wrists and forearms to ensure that the gloves would not come off during the condition. The helmet, made by Prestor (no model number could be found) was a leather hockey helmet which covered the subject's head, except at the top, where leather strips crossed. The helmet was completely covered with one inch of foam rubber. By continuously hitting the helmet in a particular spot, Subject 1 could move the helmet to a position which allowed for additional sensory stimulation to occur. When this happened the tutor would enter the booth and reposition the helmet, providing as little attention as possible (e.g., no vocalizations, no eye contact, no facial expression, and no physical contact except for repositioning of the helmet). The tutor then left the booth immediately.

**Contingent sensory insulation equipment.** This seven and one-half
minute condition was designed to determine if the contingent application and removal of sensory insulation equipment could suppress the occurrence of head hitting. The subject was placed alone in the booth and when a head hit occurred, the tutor would quickly enter the booth, walk behind the subject, put the sensory insulation equipment on the subject, and leave the booth. When putting the equipment on, the tutor always placed the helmet on first, followed by the placement of a glove on the preferred hitting hand, and then the placement of the other glove on the other hand. The equipment was left on for thirty seconds, with the additional requirement of no hitting during the last five seconds. At the end of the thirty seconds, or the additional time period because of head hitting, the tutor entered the booth, removed the equipment in the opposite order of its application, and left the booth. At all times attention was kept to a minimum. If another head hit occurred before the tutor was able to exit from the booth, he/she immediately began putting the equipment on the subject again. Putting the equipment on the subject took from twenty to sixty seconds, depending on whether the subject was resisting. Typically, a thirty-second period was required to put all of the equipment on Subject 1 and twenty seconds was required to remove the equipment.

**Contingent vibratory stimulation.** This procedure was designed to determine if vibratory stimulation, applied contingent upon not head hitting, would decrease the occurrence of head hitting. The vibrator was an Oster Scientific Massager, model #136-11A, and it was placed inside a hand puppet. This condition was different than
the other conditions of this evaluation in that the tutor had to be in the booth with the subject for the duration of the condition in order to implement the procedure. The procedure involved placing the vibrator on the back of the subject's head when he did not head hit for five consecutive seconds, and it was left on the back of his head for a maximum of ten seconds. If a head hit occurred while the vibrator was in contact with Subject 1's head (or if the subject touched or pulled at the vibrator), the contact was immediately terminated and the subject had to not head hit for another five seconds before contact with the vibrator was initiated. As in the other conditions, the tutor provided as little attention as possible.

Sensory insulation equipment on in booth. This condition was the same as the previous Sensory Insulation Equipment On in Booth condition. It was repeated to determine if the head hitting with equipment on would return to the level obtained the first time this condition was in effect.

Sensory stimulation evaluation results

The two questions being asked in this evaluation were: (1) Would sensory stimulation function as a controlling variable for Subject 1's SIB? and (2) Would vibratory stimulation function as a reinforcer when used in a DRO procedure designed to decrease the occurrence of Subject 1's SIB? Results (see Figure 1) showed substantially lower levels of head hitting during the Sensory Insulation Equipment On conditions than in its associated baseline or in other conditions. The Contingent Vibratory Stimulation condition, when
Figure 1. Case Study 1 - Sensory stimulation evaluation.
compared to the baseline condition (see Figure 1, third comparison), did not show a significant suppression of head hitting. A reduction in head hitting did occur in the Contingent Sensory Insulation Equipment condition (see Figure 1, second comparison), however, the reduction was not as significant as the reductions associated with the Sensory Insulation Equipment On conditions.

**Alone in booth versus sensory insulation equipment on in booth.**

As can be seen in Figure 1, when Alone in Booth was the only condition in effect (first eleven data points), head hits occurred in a mean of 73% of the intervals, with a range of 30% to 92%. During the first comparison (see Figure 1 again), head hitting in the Alone in Booth condition occurred in a mean of 74% of the intervals, with a range of 58% to 87%. During this comparison, in the Sensory Insulation Equipment On in Booth condition, head hitting occurred in a mean of 2%, with a range of 0% to 4%. Anecdotally, it was observed that no "hard" hits occurred in this condition. The only head hits observed involved the subject's helmet contacting a wall or gently contacting one of the gloves.

**Alone in booth versus contingent sensory insulation equipment.**

During the Alone in Booth condition (see Figure 1, second comparison), Subject 1 head hit in a mean of 73% of the intervals, with a range of 0% to 98%. Two sets of data are presented for the Contingent Sensory Insulation Equipment condition - the "with equipment on" data which reflect the level of SIB when the insulation equipment was on the subject, and the "contingent sensory insulation equipment" data which reflect the level of SIB during the experimental
condition but without the insulation equipment actually in place. During the "contingent sensory insulation equipment" situation, head hitting occurred in a mean of 31% of the intervals, with a range of 4% to 80%. Head hitting in the "with equipment on" situation occurred in a mean of 12% of the intervals, with a range of 0% to 68%. It is apparent from Figure 1 that there is a clear separation between the Alone in Booth data and the "contingent sensory insulation equipment" data. Anecdotally, it was noted that when Subject 1 had the sensory insulation equipment on, "hard" hits were occurring consistently, and this did not occur in the Sensory Insulation Equipment On in Booth condition.

*Alone in booth versus contingent vibratory stimulation.* In this comparison (see Figure 1, third comparison), head hitting in the Alone in Booth condition occurred in a mean of 55% of the intervals, with a range of 29% to 87%. For this comparison, two sets of data are presented for the Contingent Vibratory Stimulation condition - the "with equipment on" data which reflect the level of SIB when the vibrator was being applied, and the "contingent vibratory stimulation" data which reflect the level of SIB during the experimental condition but without the vibrator actually in place. In this comparison, head hitting occurred in a mean of 42% of the intervals (range of 3% to 72%) for the "contingent vibratory stimulation" situation. Head hitting represented by the "with equipment on" data occurred in a mean of 13% of the intervals, with a range of 0% to 33%. Although there was a thirteen percent difference between the means of the Alone in Booth condition and the "contingent
vibratory stimulation" situation, there was no clear separation of the two sets of data (never more than five consecutive days). There was a clear decrease of head hitting while the vibrator was placed on Subject 1's head but because of the contingency, Subject 1 had only one opportunity to head hit before the vibrator was removed.

**Alone in booth versus sensory insulation equipment on in booth.**

During this comparison (see Figure 1, fourth comparison), the Alone in Booth condition had head hitting in a mean of 64% of the intervals, with a range of 36% to 91%. The Sensory Insulation Equipment On in Booth condition had head hitting in a mean of 19% of the intervals, with a range of 0% to 64%. The separation of the two sets of data continued throughout the comparison.

**Sensory stimulation evaluation discussion**

The results of this evaluation provided strong evidence that head hitting was controlled by the response produced sensory stimulation. Two comparisons support this: (1) the Alone in Booth versus Contingent Sensory Insulation Equipment On in Booth comparison (see Figure 1, second comparison), and (2) the second comparison of Alone in Booth versus Sensory Insulation Equipment On in Booth (see Figure 1, fourth comparison). The first comparison of Alone in Booth versus Sensory Insulation Equipment On in Booth may not be representative since no "hard" hits occurred with the sensory insulation equipment on, and, therefore, Subject 1 did not contact the changed response produced stimulation. The Contingent Sensory Insulation Equipment
condition did cause a strong suppression of head hitting and could be compared to a timeout procedure in which the opportunity to contact a reinforcer is removed contingent upon the occurrence of an undesired response. In this condition though, the environment was changed contingent upon a head hit so that the subject did not contact the same sensory stimulation as he had previously. It should be noted, however, that this condition had a similar confound as do most timeout contingencies. While the sensory insulation equipment was being placed on Subject 1, he was being restrained, and this restraint could have been partially responsible for the suppression of head hitting. Perhaps a stronger test of sensory stimulation as a reinforcer for SIB occurred in the Sensory Insulation Equipment On in Booth condition, in which the reinforcer was attenuated during the entire condition and a significant reduction of head hitting occurred. Since there were no response dependent manipulations in this condition, the suppression must be attributed to the attenuation of the stimulation.

One of the most interesting behavior changes that occurred in this evaluation involved the anecdotal information from the first Sensory Insulation Equipment On in Booth condition. As previously mentioned, Subject 1 never emitted a "hard" hit during this condition and, therefore, never contacted the attenuated stimulation. Two possible explanations for the lack of "hard" hitting are based on the subject's history, but neither provides a convincing argument. First, the sensory insulation equipment may have functioned as a discriminative stimulus for head hitting not to occur because no, or little,
reinforcement was available. This explanation does not seem likely though, since Subject 1 had never worn the equipment before this condition and because "hard" hits occurred the first day in the next comparison when he wore the equipment. The second explanation for the lack of "hard" hits involves the equipment approximating a restraint procedure (because of the tactile stimulation produced by the straps around the wrists) which would remove the opportunity for head hitting to occur. This explanation also seems unlikely since school records do not indicate a history of restraint, which would be necessary for the restraint-like stimuli to acquire control over head hitting. Furthermore, the fact that the subject did emit behaviors topographically similar to head hitting suggests that the response decrement was not a product of that stimulus control.

Escape/Avoidance Evaluation

These procedures were designed to evaluate whether or not escaping and/or avoiding contact with aversive stimuli functioned as a reinforcer for the head hitting of Subject 1. In setting the occasion for escape/avoidance behavior to be reinforced, the subject was involved in an instructional task specially designed to require a high response effort and deliver minimal reinforcement. The task was a stand up/sit down procedure with correct (independent) responses being followed by the delivery of a piece of cereal or kernel of popcorn on a variable ratio three schedule. The instructional task was in effect for all conditions of this evaluation. The settings were the corners of the subject's classroom and an area of
an adjacent physical/occupation therapy room. Daily sessions were fifteen minutes. If only one condition was in effect, it lasted the entire duration, but if two conditions were in effect, each lasted seven and one-half minutes.

**Escape/avoidance evaluation procedures**

**Contingent tutor withdrawal (baseline).** This condition was designed to assess the role of escape and/or avoidance of instructional tasks as a factor in maintaining head hitting. Whenever the subject would hit, the tutor would walk away for thirty seconds (contingent tutor withdrawal) and thus, temporarily terminate the task. During the tutor withdrawal time, the only requirement on Subject 2 was that he remain in the experimental setting (which was divided from the remainder of the room by enclosing the area with tables).

**Head hits ignored.** The purpose of this condition was to remove the tutor withdrawal consequence for head hitting in order to determine the effect it was having on the occurrence of head hitting. This condition involved the same instructional task as previously described. The contingency in effect for head hitting was to ignore the hits, i.e., the tutor would continue with the task as though the head hit had not even occurred. Hence, instructions were sometimes presented immediately following head hits, physical prompts were sometimes delivered immediately following head hits, and edibles were sometimes delivered immediately following head hits; however, all of these were presented contingent upon behaviors directly involved in the instructional task.
**Contingent thirty-second restraint.** This restraint procedure was attempted because of anecdotal information obtained in the Contingent Tutor Withdrawal condition, which indicated that when the tutor withdrew, Subject 1 spent that "free time" head hitting and rubbing his fingers together. These behaviors were assumed to be reinforcers, thus increasing the reinforcement value of tutor withdrawal time. In an effort to increase the timeout characteristics of the tutor withdrawal, efforts were made to remove the opportunities to head hit and finger rub. The instructional task remained the same. When a head hit occurred, the tutor immediately stopped the task and held the subject's hands at his side for thirty seconds. The tutor would position his/her hands around the subject's fingers so that he could not finger rub, in addition to not head hitting. The tutor would avoid all eye contact with the subject, would say nothing, and would restrain the subject from moving around in the experimental setting.

**Contingent spray mist.** This condition was originally a portion of the subject's contingencies in the classroom for head hitting and was evaluated here in order to validate its effectiveness as a punisher for SIB. This condition involved the same instructional task as the other conditions. Whenever the subject head hit, the tutor would spray one mist of water from a hand-held lever action plant mister (manufactured by Thiokol, under the brand name of "Spray Pal") which was set on the finest mist possible and contained room temperature water. The nozzle of the mister was positioned approximately twelve inches from the subject's face and was aimed at the subject's
nose. If the subject continued to head hit after the first spray mist the tutor attempted to maintain a one-to-one ratio, but when the head hitting was too rapid, the sprays would be delivered as quickly as possible until Subject 1 stopped hitting, at which time the tutor would deliver one final spray and also stop. After the daily completion of this condition, Subject 1's face was dried with a soft towel.

**Helmet on plus contingent reprimand, spray mist, and restraint (package intervention).** This procedure was an attempt to combine the effective contingencies of previous conditions from all three evaluations into a "package" contingency which would control the occurrence of head hitting. This condition involved the same instructional task as all previous conditions. The subject was required to wear a helmet (from the Sensory Stimulation Evaluation) during the entire condition. Whenever Subject 1 head hit, the tutor would immediately deliver the reprimand "No hitting!" (using a harsh tone of voice and a louder-than-normal volume), deliver a single spray from the plant sprayer, and then use the same restraint procedure as previously described. The contingent reprimand was included in the package in hopes that it would become a conditioned punisher.

**Escape/avoidance evaluation results**

These data (see Figure 2) indicate that escaping from and/or avoiding a "high effort/low reinforcement" instructional task situation did not function as a controlling variable for Subject 1's SIB.
Figure 2. Case Study 1 – Escape/avoidance evaluation.
CASE STUDY 1

ESCAPE/AVOIDANCE EVALUATION

DATES
However, two separate consequences, response dependent spray mist and response dependent thirty-second restraint, each suppressed head hitting, as did the final Package Intervention.

**Contingent tutor withdrawal versus head hits ignored.** Comparing the two sets of data for these conditions (see Figure 2, first comparison) indicates that contingent tutor withdrawal did not reinforce Subject 1's head hitting. When the Contingent Tutor Withdrawal condition was the only one in effect (the first twenty-five sessions) head hits occurred in a mean of 44% of the intervals, with a range of 0% to 94%. When the multi-element design was introduced the mean percent of intervals in which head hits occurred for the Contingent Tutor Withdrawal condition increased slightly to 47%, with a range of 2% to 91%. During the same time period, in the Head Hits Ignored condition, head hits occurred in a mean of 61% of the intervals, with a range of 2% to 100%. Although there was a 14% difference between the two means, there was never more than four consecutive days in which the two sets of data remained separated.

**Head hits ignored versus contingent thirty-second restraint.** There was a significant reduction in head hitting in the Contingent Thirty-Second Restraint condition, in comparison to the Head Hits Ignored condition (see Figure 2, second comparison). During the Head Hits Ignored condition, hits occurred in a mean of 44% of the intervals, with a range of 0% to 89%. During the Contingent Thirty-Second Restraint condition head hits occurred in a mean of 13% of the intervals, with a range of 0% to 41%. The data remained separated throughout thirty-nine days of the forty-four day comparison, indicating that
the response dependent restraint functioned as an effective punisher.

Head hits ignored versus contingent spray mist. The Contingent Spray Mist condition was associated with a significant reduction in Subject 1's head hitting, in comparison to the Head Hits Ignored condition (see Figure 2, third comparison). In the Head Hits Ignored condition, head hits occurred in a mean of 66% of the intervals, with a range of 22% to 96%. During the same time period, head hits in the Contingent Spray Mist condition occurred in a mean of 28% of the intervals, with a range of 13% to 38%. Although upward trends were occurring in both sets of data when the final intervention was introduced, an increase in the separation was also occurring.

Head hits ignored versus helmet on plus contingent reprimand, spray mist, and restraint (package intervention). A comparison of these two sets of data (see Figure 2, fourth comparison) indicates that the Package Intervention significantly suppressed head hitting. Data for the Head Hits Ignored condition represent a mean of 54% of the intervals, with a range of 13% to 89%. Data for the Package Intervention represent a mean of 13%, with a range of 0% to 47%.

Escape/avoidance evaluation discussion

The first comparison of this evaluation, which shows only minor differences in the amount of head hitting that occurred when Subject 1 was allowed to escape from and avoid an instructional task (Contingent Tutor Withdrawal) versus when he was not allowed to escape/avoid the instructional task (Head Hits Ignored), suggests that escaping/avoiding the instructional task was not a controlling variable.
for his head hitting. Additional support for this conclusion can be found by reviewing the Contingent Thirty-Second Restraint data. The response dependent thirty-second restraint could be considered as an opportunity for the subject to escape (that is, if the task were more aversive than the restraint) since the restraint temporarily stopped the instructional task. However, the restraint caused a suppression of head hitting, again indicating that escaping from the task was not a controlling variable for head hitting.

The reason for suppression of head hitting during the restraint procedure may be apparent through anecdotal information from the Sensory Stimulation Evaluation and the Contingent Tutor Withdrawal condition. First, the Sensory Stimulation Evaluation results support the hypothesis that sensory stimulation functioned as the essential controlling variable for Subject 1's head hitting and second, it was anecdotally noted during the Contingent Tutor Withdrawal condition that Subject 1 consistently head hit and finger rubbed while the tutor was withdrawn. Thus, the tutor withdrawal period may have functioned as a free operant situation which allowed the subject to engage in reinforcing activities, while the restraint procedure may have functioned as a timeout procedure (taking advantage of the subject's self-stimulatory behaviors).

The final Package Intervention was probably effective for two reasons. First, by requiring the subject to wear a helmet the sensory stimulation was attenuated, thereby decreasing the reinforcing stimulus change produced by the head hitting. Second, the restraint and spray mist procedures had been shown to be effective
punishers and when paired, they may have functioned as a stronger punisher than either did individually. The reprimand was included in the package in hopes that it could be established as a conditioned punisher and also so that the package could be gradually removed and the verbal reprimand could maintain the suppression of the head hitting.

Attention Evaluation

This evaluation was designed to evaluate the function of "attention" for the head hitting of Subject 1. The attention was in the form of a mild reprimand, which included a combination of visual, auditory, and tactile elements. During the initial condition of this evaluation, the subject was involved in an instructional task designed to require little response effort and provide minimal reinforcement. The task was an object identification task ("Touch the cup") and the schedule of reinforcement was designed to be a variable ratio three for correct (independent) responses. However, during this task the subject never emitted the correct response and never contacted the edible reinforcers. All conditions of this evaluation were conducted in the subject's classroom. The Attention Evaluation session lasted fifteen minutes daily. When only one condition was in effect, its duration was fifteen minutes; however, if two conditions were in effect, each lasted seven and one-half minutes.

Attention evaluation procedures

Task plus contingent attention. This condition was designed to
assess the effects of response dependent attention, in the form of a mild reprimand, on head hitting. The subject was involved in the instructional task previously described. Whenever the subject head hit, the tutor would temporarily stop the task and deliver the reprimand, "That's bad (Name). You're not supposed to hit your head."

A slightly harsh tone of voice was used and eye contact and a "mad" facial expression also occurred with the reprimand. If head hitting continued following the reprimand, a second reprimand was delivered, and if head hitting continued after the second reprimand the subject's hands were prompted to his side (using as little force as necessary) and a third reprimand was delivered. The tutor would then let go of the subject's hands and return to the task or begin the reprimand sequence again, if necessary.

No task plus contingent attention. During the Task plus Contingent Attention condition attention was delivered contingent on head hits. Unfortunately, attention also occurred in presenting the instructional task. Therefore, it was decided to eliminate the task in order to enhance the stimulus change involved in the delivery of the reprimand. During this condition the subject was placed alone in a corner of the classroom and the area was divided from the remainder of the room by placing tables side-by-side. The tutor stood outside this area (approximately three meters away) and watched the subject, but always avoided eye contact. Whenever a head hit occurred, the tutor quickly walked toward the subject and simultaneously delivered the reprimand. The reprimand was the same as that used in the Task plus Contingent Attention condition, and if head hitting
continued, the same sequence of reprimands and the hand prompt was used.

No task and no attention. The setting for this condition was similar to that described in the No Task plus Contingent Attention condition's section. The tutor stood a short distance from the subject and remained there for the entire condition. The tutor never presented a trial and never delivered a reprimand or made eye contact with the subject during the entire duration of the condition.

No task and helmet on plus contingent reprimand, spray mist, and restraint (package intervention). This condition was the same as the Package Intervention implemented in the Escape/Avoidance Evaluation, except that no task was involved. The tutor stood approximately two meters from the subject (who always wore the sensory insulation helmet) and whenever the subject head hit, the tutor immediately delivered the reprimand, spray mist, and then the thirty-second restraint. This procedure is described in greater detail in the Escape/Avoidance Evaluation section.

Attention evaluation results

The data from this evaluation (see Figure 3) indicate that a response dependent reprimand did not function as a controlling variable for Subject 1's head hitting. The reprimand may have functioned as a mild punisher, however. The Package Intervention also suppressed head hitting, a reproduction of the effect observed when the Package Intervention was introduced in the Escape/Avoidance Evaluation.
Figure 3. Case Study 1 - Attention evaluation.
Task plus contingent attention versus no task plus contingent attention. When the Task plus Contingent Attention condition was the only one in effect (the first fifty-nine data points of Figure 3) head hits occurred in a mean of 45% of the intervals, with a range of 1% to 94%. In this same condition, when the multi-element design was introduced (see Figure 3, first comparison), the mean percent of intervals in which head hits occurred increased slightly to 50%, with a range of 0% to 98%. During this comparison head hits in the No Task plus Contingent Attention condition occurred in a mean of 34% of the intervals, with a range of 2% to 76%. Although there was a 16% difference between the means of these two conditions, there was no significant separation of the two sets of data. As can be seen in Figure 3, both sets followed similar upward and downward trends and the sets of data never separated for more than five consecutive days.

No task plus contingent attention versus no task and no attention. The data from this comparison (see Figure 3, second comparison) indicate that response dependent attention (in the form of a mild reprimand) probably functioned as a mild punisher because it caused a slight suppression of Subject 1's head hitting. When the No Task plus Contingent Attention condition was in effect, head hits occurred in a mean of 27% of the intervals, with a range of 2% to 82%. During the No Task and No Attention condition, head hits occurred in a mean of 49% of the intervals, with a range of 13% to 78%. By reviewing Figure 3, it can be seen that there was a slightly greater separation of the two sets of data at the beginning of the comparison than at the end, suggesting a possible weakening of the effects of the
response dependent attention.

No task and no attention versus no task and helmet on plus contingent reprimand, spray mist, and restraint (package intervention).

The Package Intervention significantly suppressed Subject 1's head hitting when compared to the No Task and No Attention condition (see Figure 3, third comparison). During the No Task and No Attention condition head hits occurred in a mean of 43% of the intervals, with a range of 19% to 69%. During the Package Intervention condition, head hits occurred in a mean of 10% of the intervals, with a range of 2% to 18%. The separation of the data was very clear, beginning on the first day of the comparison and continuing until the last day. The effects obtained in this comparison reproduced the effects obtained with the Package Intervention in the Escape/Avoidance Evaluation.

Attention evaluation discussion

Results from this evaluation clearly indicate that contingent attention from a tutor did not function as a variable that would increase the occurrence of head hitting. In fact, the data suggest that the response dependent attention may have functioned as a mild punishing stimulus in that responses were slightly decelerated under these conditions.

These results may be expected since the attention delivered was in the form of a mild reprimand. However, the experimenter had considered that almost any form of attention may have functioned as a reinforcer with Subject 1. It was quite obvious that pats on the
back and talking to him in a pleasant voice would function as reinforcers for many behaviors; however, it was not obvious that other interactions meant to be aversive actually functioned as aversive consequences. The reprimand was included in the final Package Intervention in order that its conditioned aversive properties would have the opportunity to increase in strength.

The results of the Package Intervention are of interest because it involved a combination of punishers and attenuated reinforcers, each of which was relatively weak when evaluated individually. This technique of combining mild punishers while attenuating the maintaining variable, is of value because it is a method the public should be receptive of, from an ethical point of view (since the intensity of any one punisher is not enough to cause any type of tissue damage or severe pain). Clinicians should also be interested in this type of procedure because of its effectiveness and ease of implementation.

A final interesting feature of this evaluation is the clear cyclic trend which occurred throughout the evaluation. It was also present in the other evaluations but was more pronounced here. Unfortunately, the experimenter was not able to identify the variable(s) controlling this trend and this indicates a need to identify and hold constant potential extraneous variables. Attempts to control those extraneous variables might necessitate controlling the subject's entire day - which was not an available option during this research. One possible explanation for the cyclic trend is that the subject head hit at high rates when under a state of deprivation for the sensory stimulation, and then after a period of time,
satiated on the stimulation, causing a reduction in the head hitting. This reduction could then lead to the development of another state of deprivation for sensory stimulation and cause more head hitting again.

It should be pointed out that, following the completion of this case study, the Package Intervention was combined with a DRO procedure and implemented across Subject 1's entire school day. At the time of this writing (six months after the completion of the case study), Subject 1 is averaging less than one head hit per school day. Efforts are now being made to implement a modified version of this package in the home setting in order to completely eliminate Subject 1's SIB.
CHAPTER IV

CASE STUDY 2

Sensory Stimulation Evaluation

The purpose of this evaluation was the same as the Sensory Stimulation Evaluation of Case Study 1. The two evaluation questions were: (1) Was sensory stimulation a reinforcer for the head hitting of Subject 2? and (2) Would vibration, applied to the back of the head, function as a reinforcer which could be used in a DRO procedure to suppress head hitting?

The settings for this evaluation were the same as those used for Case Study 1. As previously described, when only one condition was in effect, it was for a duration of fifteen minutes, but during the multi-element design comparisons, each condition lasted seven and one-half minutes.

Sensory stimulation evaluation procedures

Alone in booth (baseline). The contingencies in effect for this condition were the same as those in effect for the Alone in Booth condition in Case Study 1.

Contingent sensory stimulation. The contingencies in effect for this condition were the same as those described for the Contingent Sensory Stimulation condition in Case Study 1, except for the time constraints involved in the DRO procedure. Subject 2 was required
to not head hit for thirty seconds before the vibrator was placed on the back of his head (for a maximum of thirty seconds).

**Sensory insulation equipment on in booth.** The contingencies in effect for this condition were the same as those described for the Sensory Insulation Equipment On in Booth condition in Case Study 1.

**Contingent sensory insulation equipment.** The contingencies in effect for this condition were the same as those of the Contingent Sensory Insulation Equipment condition of Case Study 1. Because Subject 2 resisted more when the equipment was being put on him, it typically took fifty to sixty seconds to place all the equipment on him, with a range of thirty seconds to two minutes. Taking the equipment off took approximately twenty seconds.

**Sensory stimulation evaluation results**

The two questions being asked in this evaluation involved the reinforcing effects of response produced stimulation and the reinforcing effects of vibration applied to the head in a DRO procedure. Results were inconclusive regarding the reinforcing effects of the response produced stimulation. It appeared that vibration from a hand held vibrator may have functioned as a mild punisher.

**Alone in booth versus contingent vibratory stimulation.** When the Alone in Booth condition was the only one in effect (the first thirty-six sessions), hits occurred in a mean of 12% of the intervals, with a range of 0% to 40% (see Figure 4). When the multi-element design was introduced (see Figure 4, first comparison) head hits in the Alone in Booth condition occurred in a mean of 18% of
Figure 4. Case Study 2 - Sensory stimulation evaluation.
CASE STUDY 2
SENSORY STIMULATION EVALUATION
the intervals, with a range of 0% to 64%. Two sets of data are presented for the Contingent Vibratory Stimulation condition - the "with equipment on" data which reflect the level of SIB when the vibrator was being applied, and the "contingent vibratory stimulation" data which reflect the level of SIB during the experimental condition but without the vibrator actually in place. In the "contingent vibratory stimulation" situation, Subject 2 head hit in a mean of 20% of the intervals, with a range of 0% to 82%. In the "with equipment on" situation, head hits occurred in a mean of 41% of the intervals, with a range of 0% to 100%. There was no separation between the two sets of data for Alone in Booth and "contingent vibratory stimulation"; however, Subject 2 consistently head hit more when the vibrator was on his head ("with equipment on" data) than he did in either of the other two situations. This increase may be attributable to the vibration functioning as a mild punisher, rather than as a reinforcer as originally hypothesized. Since the vibrator was removed from the subject's head as soon as a head hit occurred, the head hits may have functioned as escape responses from the vibration.

**Alone in booth versus sensory insulation equipment on in booth.** During this comparison (see Figure 4, second comparison) head hits in the Alone in Booth condition occurred in a mean of 12% of the intervals, with a range of 4% to 33%. In the Sensory Insulation Equipment On in Booth condition head hits occurred in a mean of 1% of the intervals, with a range of 0% to 11%. It should be pointed out that no head hits occurred until the fourth day of this condition and it was anecdotally observed that the only "hard" hit that
occurred in this condition was in the second-to-last day of the condition.

**Alone in booth versus contingent sensory insulation equipment.** During this comparison (see Figure 4, third comparison) head hits in the Alone in Booth condition occurred in a mean of 14% of the intervals, with a range of 0% to 40%. The Contingent Sensory Insulation Equipment condition is represented by two sets of data - the "with equipment on" data which reflect the level of SIB when the insulation equipment was on the subject (on July 24, 25, and 30, there is no "with equipment on" data because no head hits occurred during those sessions and the equipment did not have to be applied), and the "contingent sensory insulation equipment" data which reflect the level of SIB during the experimental condition, but without the insulation equipment actually in place. In the "contingent sensory insulation equipment" situation, Subject 2 head hit in a mean of 13% of the intervals, with a range of 0% to 80%. The "with equipment on" situation had head hits in a mean of 1% of the intervals, with a range of 0% to 15%. As can be seen in Figure 4, there was no separation of the data between the Alone in Booth condition and the "contingent sensory insulation equipment" situation. As in the Sensory Insulation Equipment On in Booth condition, there was very little head hitting while Subject 2 had the equipment on.

**Sensory stimulation evaluation discussion**

The data from this evaluation were inconclusive in determining whether response produced sensory stimulation functioned as a
controlling variable for Subject 2's head hitting. The most significant test of this evaluation should have been the Alone in Booth versus Sensory Insulation Equipment On in Booth comparison (see Figure 4, second comparison). There was a significant separation of the two sets of data in this comparison, but the reason for the effect is not clear. Subject 2 did not have any hits until the fourth day of the Sensory Insulation Equipment On in Booth condition, and the only "hard" hit occurred in the second-to-last session. Similar results were obtained in Case Study 1 and the two possible explanations presented there also seem applicable for Subject 2.

A second condition which produced a significant change in the occurrence of head hitting was the Contingent Vibratory Stimulation condition (see Figure 4, first comparison) in which an increase in head hitting occurred in the "with equipment on" situation. Because a component of the contingency involved the vibrator being removed from the subject's head as soon as a head hit occurred, the most likely reason for the increase is that the vibration functioned as an aversive stimulus. This explanation is questionable though, because if the application of the vibrator was aversive an increase in head hitting should have occurred (in comparison to the Alone in Booth condition), as a form of avoidance behavior.

The inconclusive results of this evaluation could be attributed to a couple of procedural weaknesses. First, during the Contingent Vibratory Stimulation condition, the stimulus change produced by the placement of the vibrator on Subject 2's head may not have functioned as a reinforcer because the stimulation it produced did not closely
approximate the response produced stimulation of head hitting. The second procedural difficulty involved the contingent application of the vibrator and the sensory insulation equipment. Because of the need for tutors to present the consequences, it was not possible to completely eliminate attention from the contingencies.

**Escape/Avoidance Evaluation**

The evaluation was designed to answer the same question as the Escape/Avoidance Evaluation of Case Study 1: Did escaping and/or avoiding contact with a high response effort/minimal reinforcement situation function as a reinforcer for the self-injurious behavior of Subject 2? As in Case Study 1, an instructional task was specially designed to set the occasion for escape/avoidance behavior to be reinforced. The task required Subject 2 to pedal an exercise cycle and was chosen partly because Subject 2 already had a history of high rates of head hitting when required to perform this task. The task was used throughout the evaluation except in those conditions that state no task was involved, or that a variation of the task was involved. The target response for this task was one complete and independent rotation of the pedals; however, this response never occurred and reinforcers were never delivered. Instead a "correction trial" was implemented which required the tutor to physically prompt the desired topography. A single trial of the instructional task occurred as follows: The tutor would say, "(Name), pedal" and wait five seconds for an independent response to occur. When it did not occur, the tutor would repeat the instruction and then immediately
physically guide the subject's legs through a complete rotation of the exer-cycle pedals. The duration of a daily session was fifteen minutes; when only one condition was in effect it lasted for the entire duration of the session, but, when the multi-element design was in effect, the two conditions each lasted seven and one-half minutes.

**Escape/avoidance evaluation procedures**

**Contingent tutor withdrawal (baseline).** Except for the instructional task used, this condition was the same as the Contingent Tutor Withdrawal condition of Case Study 1.

**Head hits ignored.** Except for the instructional task used, this condition was the same as the Head Hits Ignored condition of Case Study 1.

**No task plus contingent forced leg movements.** During this condition, the subject was still required to sit on the exer-cycle, however, the instructional task was eliminated. Whenever Subject 2 head hit the tutor would immediately say, "(Name), pedal" and then physically guide the subject to pedal one complete rotation of the pedals. If a single head hit occurred, no other physical guiding occurred but, if the subject continued to head hit, the tutor would continue to physically guide the legs until the head hitting stopped.

This condition was implemented because of the temporal relationship between the physical guidance and the head hitting in the Contingent Tutor Withdrawal condition. In that condition, whenever Subject 2 did not head hit, he was physically guided to pedal the exer-cycle, and because it was believed that physical guidance, or
contact, may have been an aversive stimulus for Subject 2, he may have been punished for not head hitting. Because of this, it was decided to reverse the contingency and only present physical guidance contingent upon head hitting.

Task with physical contact eliminated. This condition was designed to further evaluate the effects of physical contact. It was possible that when physical contact was delivered noncontingently (as in the Head Hits Ignored condition), it evoked head hitting. Therefore, by eliminating physical contact from the instructional task, the rate of head hitting should be reduced significantly. The contingencies used in this condition were identical to those in the Head Hits Ignored condition, except that the tutor never touched the subject. All the tutor's vocalizations and physical movements remained exactly the same. The tutor would say, "(Name), pedal" and wait five seconds. When the response did not occur, the tutor would repeat the instruction and then pretend to physically guide the correct topography - except that the tutor would not actually touch Subject 2's legs.

Task with physical contact eliminated plus contingent forced arm movements. This condition was designed as a final test to determine whether physical contact functioned as an aversive stimulus for Subject 2. In the No Task Plus Contingent Forced Arm Movements condition of the Attention Evaluation, forced arm movements had been demonstrated to suppress Subject 2's head hits (which were mostly "face touches"); however, no stimulus changes which seemed to evoke head hitting (e.g., physical contact presented noncontingently) were
present in that condition. Since there was also no potential evoca-
tive stimulus in the Task with Physical Contact Eliminated condition,
it was decided to implement the contingent forced arm movements in
that situation as well. Because of the extreme length of the study
to date, the multi-element design was eliminated and one fifteen-
minute session was run in order to detect the effectiveness of the
contingency.

The task remained the same as in the Task with Physical Contact
Eliminated condition. However, when a head hit occurred the tutor
would immediately walk behind the subject, hold his wrists, and
then move his arms over his head, straight out (parallel to the
ground), and down to the subject's side. This was repeated a minimum
of three times and for a minimum of fifteen seconds. If Subject 2
resisted the arm movements, the movements still had to be repeated
three times, even if more than fifteen seconds was required to com-
plete the repetitions.

No task plus contingent forced arm movements. This task was
exactly the same as the Task with Physical Contact Eliminated plus
Contingent Forced Arm Movements condition, except that the task with
the no physical contact was eliminated. During the time between this
and the previous condition, Subject 2's daily dosage of phenobarbitol
was increased from thirty to sixty milligrams and he missed approxi-
mately two weeks of school because of a virus infection.

Escape/avoidance evaluation results

The data from this evaluation (see Figure 5) indicate that the
Figure 5. Case Study 2 - Escape/avoidance evaluation.
response dependent escaping from and/or avoiding of a high effort/minimal reinforcement situation did not function as a controlling variable for Subject 2's head hitting. However, the data do indicate that response dependent forced body (either legs or arms) movements consistently suppressed head hitting.

**Contingent tutor withdrawal versus head hits ignored.** When the Contingent Tutor Withdrawal condition was the only one in effect (the first twenty-one data points of Figure 5) head hits occurred in a mean of 50% of the intervals, with a range of 11% to 79%. During the comparison (see Figure 5, first comparison) with the Head Hits Ignored condition, head hits in the Contingent Tutor Withdrawal condition occurred in a mean of 46% of the intervals, with a range of 2% to 87%. During this time head hits in the Head Hits Ignored condition occurred in a mean of 59% of the intervals, with a range of 7% to 98%. At one point the two sets of data separated for ten consecutive days, but this separation did not maintain and it appeared that the two sets of contingencies were not strong enough to effect a consistent differentiation in Subject 2's head hitting.

**Head hits ignored versus no task plus contingent forced leg movements.** During this comparison (see Figure 5, second comparison) head hits in the Head Hits Ignored condition occurred in a mean of 49% of the intervals, with a range of 0% to 96%. In the No Task plus Contingent Forced Arm Movements condition head hits occurred in a mean of 18% of the intervals, with a range of 0% to 82%. Anecdotally, the proportion of intervals with "hard" hits was extremely low in the No Task plus Contingent Forced Leg Movements condition.
No task plus contingent forced leg movements versus task with physical contact eliminated. During this comparison (see Figure 5, third comparison), Subject 2's head hitting in the No Task plus Contingent Forced Leg Movements condition occurred in a mean of 24% of the intervals, with a range of 0% to 69%. In the Task with Physical Contact Eliminated condition, head hits occurred in a mean of 44% of the intervals, with a range of 7% to 80%. Toward the end of this comparison, the data separated for eight consecutive days, but this separation was not maintained.

Task with physical contact eliminated plus contingent forced arm movements. During this condition (see Figure 5) head hits occurred in a mean of 19% of the intervals, with a range of 1% to 40%. These data initially took a strong upward trend but then decreased substantially, possible indicating that Subject 2's hitting was coming under the control of the punishment contingency. Anecdotally, "hard" hits occurred on an infrequent basis.

No task plus contingent forced arm movements. During this final condition of the Escape/Avoidance Evaluation (see Figure 5) Subject 2 head hit in a mean of 8% of the intervals, with a range of 0% to 18%. At the end of this evaluation there was a slight upward trend in the data; however, the variability was substantially less than that of any other condition. Anecdotally, "hard" hits occurred in a very low percentage of the intervals in this condition.

Escape/avoidance evaluation discussion

The results of this evaluation suggest that escaping from a
high demand/low reinforcement situation did not reinforce Subject 2's head hitting. The test for this occurred in the first comparison of the evaluation, which was Head Hits Ignored versus Contingent Tutor Withdrawal. If the SIB had been an escape response, a suppression of head hitting in the Head Hits Ignored condition should have occurred, while head hitting in the Contingent Tutor Withdrawal condition should have maintained at a steady rate. As can be seen in Figure 5 though, the only result of this comparison was an increase of the data's variability under both conditions.

A suppression of head hitting did occur in this evaluation, but only when forced body movements were presented in a response dependent fashion. These suppressions occurred in the No Task plus Contingent Forced Leg Movements condition and the No Task plus Contingent Forced Arm Movements condition. It is interesting to note that it did not matter whether the body parts being guided were the arms or the legs. The consequences were not arranged exactly the same, however, and this may confound these results somewhat. Another potential confound is that Subject 2's daily phenobarbital dosage was increased just prior to the condition change to No Task plus Contingent Forced Arm Movements.

The physical contact involved in this evaluation is also of interest because during the Head Hits Ignored condition, physical contact was delivered independent of Subject 2's head hitting and it seemed plausible that these contact stimuli were evoking head hitting. This hypothesis was strengthened by the fact that when that same contact was delivered dependent upon a head hit, it
functioned as a punisher. Physical contact was eliminated in the next condition (Task with Physical Contact Eliminated) though, and head hitting continued to occur as frequently as it had before. Two possible explanations for this maintenance are: (1) the head hitting was automatically reinforced by the response produced stimulation, and (2) some stimulus other than the tactile stimulation was evoking the SIB. The first explanation seems unlikely since the data from the Sensory Stimulation Evaluation provides no strong evidence that the stimulation was the controlling variable. In the second explanation some stimulus change would need to be functioning as a reinforcer for the SIB since it was maintained over a two-month period, and no potential reinforcers were apparent to the experimenter.

Attention Evaluation

The purpose of this evaluation was to answer the same question as was asked in the Attention Evaluation of Case Study 1: Did attention, in the form of a "mild" reprimand, function as a reinforcer for Subject 2's head hitting? As in the Attention Evaluation of Case Study 1, the subject was initially involved in an instructional task that required minimal response effort and was designed to provide minimal reinforcement. Because Subject 2 did not emit a correct response during the evaluation, no edibles were delivered. A single trial of the task began with the tutor delivering the instruction, "Pick up the block." The tutor then waited five seconds for an independent response to occur, and when it did not, the tutor would repeat the instruction and physically guide the desired topography.
As in all the previous evaluations, all sessions lasted fifteen minutes and each condition was in effect for fifteen or seven and one-half minutes depending on whether one or two conditions were implemented during the session.

Attention evaluation procedures

Task plus contingent attention. Except for the instructional task, this condition was the same as the Task plus Contingent Attention condition in Case Study 1. The setting for this condition involved Subject 2 sitting in a chair, behind a desk.

No task plus contingent attention. This condition eliminated the task because it was a potential confound, as explained in the No Task plus Contingent Attention condition of Case Study 1. The response dependent attention for head hitting remained the same. The setting for this condition was changed from that of the Task plus Contingent Attention condition, and Subject 2 was required to sit on the floor. This caused a confound which is explained in the Results section.

No task and no attention. This condition was designed to determine if eliminating contingent attention would affect the amount of Subject 2's SIB. The contingencies were the same as explained in the No Task and No Attention condition in Case Study 1. Subject 2 was required to sit on the floor.

No task plus contingent attention with physical contact eliminated. This condition was the same as the No Task plus Contingent Attention condition, except that the physical contact (which accompanied the
third reprimand) was eliminated from this condition. This was done because during the No Task plus Contingent Attention condition Subject 2 was observed to continue making hand/head contact until just prior to the delivery of the third reprimand, which was always paired with physical contact (hands were prompted down). This physical contact was eliminated in order to determine if it was the physical contact component of the reprimands which caused the suppression of head hitting in the previous condition.

No task plus contingent forced arm movements. This condition was designed to evaluate whether response dependent physical contact could cause a suppression in Subject 2's head hitting. At the time that this condition was increased to fifteen minutes, a change in tutors also occurred because the first tutor was not strong enough to require Subject 2 to comply with the arm movements.

No task was involved in this condition. Whenever Subject 2 head hit, the tutor (who stood nearby) would quickly walk up to the subject and physically guide him through a series of arm movements. The movements involved the tutor holding the subject's wrist, moving the subject's arms over his head, then straight out at his sides (parallel to the ground), and then down to his sides. This series of movements was repeated a minimum of three times and for a minimum of fifteen seconds, i.e., if Subject 2 resisted the arm movements, they still had to be repeated three times, even if more than fifteen seconds was required to complete the repetitions. On October 24, the setting of this condition was changed so that the subject sat on the exercycle.
Attention evaluation results

The data in Figure 6 indicate that a mild reprimand which included auditory and visual stimulation probably functioned as a neutral stimulus for Subject 2. However, when those same stimuli were paired with tactile stimuli, the combination apparently functioned as a mild punisher. Response dependent forced arm movements, of fifteen seconds' duration, also decreased the occurrence of SIB.

Task plus contingent attention versus no task plus contingent attention. For the first sixty-one sessions of the Attention Evaluation the Task plus Contingent Attention was the only condition in effect (see Figure 6). Head hitting occurred in a mean of 19% of the intervals, with a range of 0% to 88%. Once the multi-element design was introduced (see Figure 6, first comparison), head hits in the Task plus Contingent Attention condition occurred in a mean of 6% of the intervals, with a range of 0% to 72%. In the No Task plus Contingent Attention condition head hits occurred in a mean of 36% of the intervals, with a range of 18% to 53%. A strong separation in the two sets of data occurred, but these data are confounded. In the Task plus Contingent Attention condition, Subject 2 sat in a chair and all the head hitting involved him bringing his hand up to his head and making contact. In the No Task plus Contingent Attention condition, Subject 2 was seated on the floor and the majority of his "hits" in this condition consisted of leaning forward and resting his chin on his hand. Because the two topographies probably had different controlling variables, the data are considered to be unrepresentative.
Figure 6. Case Study 2 - Attention evaluation.
CASE STUDY 2

ATTENTION EVALUATION

DATES
of the potential effects of the two contingencies.

No task plus contingent attention versus no task and no attention. During the No Task plus Contingent Attention condition (see Figure 6, second comparison), head hits occurred in a mean of 36% of the intervals, with a range of 18% to 80%. For the No Task and No Attention condition, head hits occurred in a mean of 51% of the intervals, with a range of 20% to 96%. Anecdotally, there was no difference observed between the "hard" hitting of the two conditions.

No task and no attention versus no task plus contingent attention with hand contact eliminated. In the No Task and No Attention condition (see Figure 6, third comparison), head hits occurred in a mean of 40% of the intervals, with a range of 16% to 67%. In the No Task plus Contingent Attention with Hand Contact Eliminated condition, head hits occurred in a mean of 32% of the intervals, with a range of 11% to 62%. Although a clear separation of the two sets of data was present at the beginning of this evaluation, that separation was not maintained over an extended period of time. Anecdotally, there was no clear separation of the "hard" hitting of the two conditions.

No task and no attention versus no task plus contingent forced arm movements. During the No Task and No Attention condition (see Figure 6, fourth comparison), head hits occurred in a mean of 47% of the intervals, with a range of 0% to 98%. In the No Task plus Contingent Forced Arm Movements condition, head hits occurred in a mean of 40% of the intervals, with a range of 9% to 100%. Anecdotally, there was no difference between the "hard" hitting of the two conditions.
No task plus contingent forced arm movements. For the last forty-one sessions of this evaluation (see Figure 6), the No Task plus Contingent Forced Arm Movements condition was the only one in effect. On November 10, Subject 2's daily dosage of phenobarbitol was increased from thirty milligrams to sixty milligrams. Also, immediately after the increase, he missed two weeks of school because of a virus infection. Throughout this evaluation, head hits occurred in a mean of 13% of the intervals, with a range of 0% to 79%. Anecdotally, hard hits occurred at a low rate, but increased in occurrence in a similar fashion as the head hitting data.

Attention evaluation discussion

In this evaluation there were two tests of whether attention functioned as a controlling variable for Subject 2's SIB. The first was the comparison of the No Task and No Attention condition and No Task plus Contingent Attention condition, and the second was the comparison of the No Task and No Attention condition and the No Task plus Contingent Attention with Hand Contact Eliminated condition; the only difference being that the first attention condition involved a tactile stimulation component. Neither comparison provided clear evidence that attention (with or without tactile stimulation) functioned as a reinforcer or punisher. The comparison involving the hand prompt suggests that that particular tactile stimulation may have functioned as a mild punisher. This conclusion is strengthened because anecdotal observations indicated that Subject 2 would consistently stop head hitting just prior to the delivery of the hand.
prompt, and this may have been an avoidance response.

Because Subject 2 appeared to be avoiding the physical contact in the No Task plus Contingent Attention condition the effects of the contingent forced arm movements were evaluated, but when this condition was evaluated with the multi-element design, there was a great deal of variability in the data, with no suppression of head hitting. However, when the No Task plus Contingent Forced Arm Movements condition was the only condition in effect, an immediate suppression of the head hitting occurred. Unfortunately, results of this final condition cannot be readily compared to the previous conditions because of a one-month period when this condition was not in effect, a change in tutors, an increase in the subject's phenobarbital, and the subject's illness.
CHAPTER V

GENERAL DISCUSSION

For Subject 1, different variables were related to varying degrees of suppression in head hitting. These variables included the contingent thirty-second restraint, the contingent spray mist, and the sensory insulation equipment being on. The reduced occurrence of head hitting while the sensory insulation equipment was on indicated that response produced sensory stimulation (especially the tactile stimulation) was a controlling variable for head hitting. After identifying the previously mentioned controlling variables, it was possible to develop the Package Intervention, which controlled the SIB without using any socially unacceptable punishers. It seems likely that by attenuating the essential controlling variable, the effectiveness of the package was greatly increased. This strategy has not typically been used when dealing with SIB, but because of the absence of socially unacceptable consequences (e.g., shock, lemon juice, ammonia capsules) this procedure should be of interest to the clinician and the public.

Anecdotal comments by Subject 1's classroom staff indicated that educational and social improvements in his behavior occurred following the implementation of the Package Intervention and the subsequent reduction of head hitting. Those improvements included an improved rate of acquiring new skills, as well as a significant increase in his initiation of social interactions with the staff.
These results suggest that the SIB may have been interfering with educational and social improvements.

The results of Case Study 2 were inconclusive, which could have been the result of any of a number of design problems. First, it was not possible to control many of the potentially powerful extra-session variables occurring across Subject 2's day. This will be discussed at greater length later. Second, the definition of a head hit included a continuum of hand/head contacts, ranging from very slight face touches to forceful hits with the fist. At the beginning of this case study, it was not clear whether this entire continuum was in the same response class, especially with respect to the Sensory Stimulation Evaluation. Even after this lengthy study, it is not clear whether more than one response class falls within this continuum (although one would not expect face touches to function as an escape response). A third potential problem was whether the use of the multi-element design precluded the development of response levels characteristic of the conditions in effect.

The forced body movement contingencies were of special interest, not only because they suppressed Subject 2's head hitting, but also because of the duration of the movements. The response dependent forced leg movements had a range of durations from three seconds to one minute, while the response dependent forced arm movements typically lasted fifteen seconds. Most overcorrection procedures which have been used with SIB have been of longer duration, lasting up to five to eight minutes (Harris and Romanczyk, 1976; Agosta,
Close, Hops and Rusch, 1980). Based on these results, further research of overcorrection procedures needs to occur, especially with respect to the duration necessary to significantly suppress the occurrence of an undesired response.

Subject 2 is currently involved in a series of evaluations to determine effective reinforcers and punishers, so that a package intervention similar to Subject 1's can be implemented across his school day.

In both case studies, patterns of head hitting occurred which were only partially controlled by the contingencies in the different conditions. Subject 1's head hitting occurred in a cyclic trend and Subject 2's was exceedingly variable from day to day. This high degree of variability suggests the need for better control of the extra-experiment variables - variables which could not be controlled during these case studies partially because the subjects attended a day school and lived at home with their families. Some of the variables it may have been helpful to control include: (1) the contingencies in effect at home and school for head hitting, (2) the contingencies in effect for responses which were consequated with attention or escape from a situation, (3) the subjects' daily activity level, (4) the subjects' daily amount of sleep, and (5) changes in medication dosages. Also, rather than evaluate contingencies for seven and one-half minutes or fifteen minutes, it may have been more beneficial and expedient to evaluate contingencies across the entire day, especially since minimal progress was being made toward the completion of educational goals and objectives.
As mentioned in the Introduction, Platt recommends that research be conducted using an inductive inference process and that simple, elegant experiments be designed so as to answer questions in the most efficient manner. The remainder of this discussion will focus on the redesign of these case studies in order to more efficiently determine the controlling variables of SIB for any individual. Each of the three types of evaluations will be discussed, as well as the experimental design.

In the Sensory Stimulation Evaluations it would have been ideal to implement the contingent application of the sensory insulation equipment and the vibrator without simultaneously introducing attention. Also, the use of a hard-shelled helmet (e.g., a plastic hockey helmet) with foam rubber padding on the outside would have improved the sensory insulation function of the helmet. Finally, better results may have been obtained in the Contingent Vibratory Stimulation conditions if the contingent stimulation had more closely approximated the response produced stimulation of the head hitting.

Two potential improvements in the Escape/Avoidance Evaluations are noteworthy. First, sensory stimulation was not controlled for in these evaluations. If this attempt to eliminate, or hold constant, the sensory stimulation had occurred, it might have allowed for the detection of any effects produced by other independent variables. Second, Carr et al. (1980) identified behaviors as escape responses partially by comparing the occurrence of a response in high demand and low demand situations, and also by looking at the occurrence of the response when some other behavior was reinforced as an escape

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response.

In the Attention Evaluations there are two concerns to be addressed. The first concern, the need to control for alternative sources of reinforcement, has been mentioned previously. The second concern involves the form of attention delivered. In these evaluations mild reprimands were used to evaluate the effectiveness of attention as a reinforcer, and the results indicated that attention did not function as a reinforcer. In past research which attempted to identify attention as a reinforcer for SIB, more pleasant forms of attention were evaluated (Lovaas et al., 1965; Lovaas and Simmons, 1969) and proven to function as reinforcers. Identifying the most likely form of attention to be delivered in the subject's setting and then evaluating that form of attention is a viable solution to determining which form to evaluate.

The results of these two case studies were very dissimilar; for Subject 1, a controlling variable was identified, while for Subject 2, no controlling variable was identified. It is possible that the success of Case Study 1 and the ineffectiveness of Case Study 2 could be partially attributed to the experimental design. One reason the multi-element design had been chosen for these evaluations was because of the variability of Subject 2's head hitting. It was considered an advantage to evaluate both conditions simultaneously. However, in reviewing Subject 2's data, it is clear that the only time consistent data were obtained there was only one condition in effect. Whether a multi-element design or a multiple baseline design is the most effective when dealing with the severely retarded population or
exceedingly variable data is of substantial interest to researchers.

Three final suggestions for utilizing this evaluation method are: (1) Develop a data collection system which is sensitive to changes in the intensity of the SIB. (2) Obtain the assistance of the biomedical profession. Determining the subject's ability to feel pain would be valuable information, especially if it were found that the "painful" stimuli elicited less emotional and aggressive responding when the stimuli were presented on portions of the body which typically received the self-injurious behavior. (3) Choose subjects carefully because of the potential length of this type of evaluation. Those with dangerous forms of SIB may benefit from this evaluation format but may inflict severe tissue damage upon themselves.

These two case studies attempted to identify what variables controlled the occurrence of SIB and the studies were necessitated because of the subjects' long histories of SIB which were resistant to change. This approach to behavior change seems advantageous since it forces the experimenter to conduct a functional analysis of the controlling variables under study. Certainly this strategy will not always be appropriate but it seems to be particularly useful in attempting to identify reinforcers for a behavior and for dealing with a behavior which is resistant to change.
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