The Effects of the Opportunity to Engage in Self-Stimulatory Behavior on Task Responding in Retarded Children

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THE EFFECTS OF THE OPPORTUNITY TO ENGAGE IN SELF-STIMULATORY BEHAVIOR ON TASK RESPONDING IN RETARDED CHILDREN

by

Paula Shilton

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Paula Shilton
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Mentally retarded individuals are characterized by their slow rate of acquisition of new skills. However, extensive research has shown that with the use of teaching techniques developed within the framework of applied behavior analysis (including task analysis, prompting, and differential reinforcement) retarded individuals can be taught a variety of skills, such as self-feeding, self-toileting, language, and vocational skills, to name only a few (Birnbrauer, 1976).

Such teaching techniques, as a rule, depend upon the use of effective positive reinforcers to shape and maintain targeted behaviors. Edibles and social praise are the most frequently used positive reinforcers, and research has indicated that both entities are powerful reinforcers for many retarded individuals (Risley & Wolf, 1967; Tramontana, 1972). Unfortunately, retarded children may satiate quickly on edible reinforcers, or show no interest in edibles that are offered. These same children may also lack the receptive language skills necessary for understanding the content of social praise. In the final analysis, the near-zero rate of learning among some members of this population suggests that other reinforcers need to be identified for those who are the most difficult to teach if they are to acquire important skills of daily living which will enrich their lives as well as decrease the burden on their caretakers.

One method of discovering reinforcers for a given person based on the Premack principal (Premack, 1959) is to observe what activity that person does frequently in a free operant situation. The researcher may then make the opportunity to engage in that high-rate behavior contingent on the performance of some specified amount of a low-rate behavior.
Several applied researchers have used this strategy for identifying reinforcers. They have found, for example, that sitting reinforces "industrial therapy" in inactive schizophrenics (Mitchell & Stoffelmayr, 1973) and that running and screaming reinforces short periods of sitting quietly and looking at the chalkboard by preschoolers (Homme, DeBaca, Deyine, Steinhorst & Rickert, 1963).

According to Premack (1959), any response will reinforce any other response if the independent rate of the former response is greater than that of the latter response. The absolute validity of this principle has been convincingly challenged (Knapp, 1976), but it probably remains a good assumption that a high-rate activity may function as a positive reinforcer. Only an empirical test can determine whether a particular activity has reinforcing properties, but a high-frequency activity would be a logical one to test.

The difficult-to-teach retarded students described earlier are often the students who engage in repetitive, stereotypic body movements at a very high rate. Since the cause of this behavior is not known and the movements appear to have no purpose other than providing some type of sensory stimulation to the performer, this class of behaviors is commonly referred to as "self-stimulatory" behavior. According to a 1962 survey, self-stimulatory behavior has been observed in approximately two-third's of the institutionized retarded population (Berkson & Davenport, 1962). The extremely high rate at which this behavior occurs in many of these students suggests that it could possibly be used as a reinforcer by being made contingent upon the performance of a low-rate academic response.
The operation of "sensory reinforcement"—that is, unconditioned sensory events increasing the probability of behaviors that they follow—was postulated a decade ago (Kish, 1966). In accordance with this theory, researchers have attempted to increase subjects' rates of responding by following responses with assorted kinds of stimulation including vibration (Rehagen & Thelan, 1972; Bailey & Meyerson, 1969); a combination of visual and auditory stimulation (Rheingold, Stanley & Doyle, 1964); a visual flickering stimulus (Frankel, Freeman, Ritvo, Chikami & Carr, 1976); and either music, visual flickering, or visual movement depending on the subject (Rincover, Newsom, Lovaas & Koegel, 1977).

That self-stimulatory behavior may be in itself a reinforcer has been suggested by several researchers (Lovaas, Litrownik & Mann, 1971; Koegel, Firestone, Kramme & Dunlap, 1974). However, since these researchers have also found an inverse relationship between self-stimulatory behavior and learning, their focus has been to suppress (punish) the self-stimulation to increase the appropriate behaviors with which it appears to be incompatible.

A third group of researchers has divided self-stimulatory behavior into two components and theorized that the actual behavior is reinforced by its sensory consequences. (For example, repetitive hand-waving in front of the eyes is reinforced by stimulation.) This theory is supported by research showing that if the sensory consequences for a particular self-stimulatory behavior are masked or removed (in the above example, a blindfold put on to decrease visual stimulation) the behavior will decrease. This phenomenon has been referred to as "sensory
extinction" (Rincover, 1978; Rincover, Cook, Peoples & Packard, 1978).

In attempting to discover whether the opportunity to engage in self-stimulatory behavior is a reinforcer, the present study differs from the three research areas described above in the following ways. It does not assume that externally produced types of stimulation are analogous to the stimulation provided by student-produced self-stimulatory behavior. Rather, this study offers the student the opportunity to perform a type of self-stimulation that he has actually been observed to perform in a free operant situation.

Additionally, the present study does not separate self-stimulatory behavior into two different components (the physical action itself and its sensory consequences, as proposed by Rincover [1978]) but attempts to discover if undifferentiated self-stimulatory behavior as traditionally defined has reinforcing properties.

Finally, the current study does not attempt to eliminate self-stimulatory behavior; but rather to use it in a constructive fashion (attempting to increase an academic response) while at the same time showing that this procedure will not increase the overall rate of what is generally considered to be a maladaptive, socially unacceptable behavior.

It should be noted that during the course of this study similar research was being carried out concurrently by Devany and Rincover (Note 1). Their study explored whether food reinforcers or self-stimulatory reinforcers would maintain greater amounts of responding and learning. An outstanding similarity between this study and that of Devany and Rincover is that they also used the contingent opportunity
to engage in a self-stimulatory activity already in the student's repertoire. A significant difference is that the above-mentioned researchers assumed that self-stimulatory activity was a reinforcer and compared its efficacy with that of an intervention already known to be reinforcing in many situations (contingent presentation of food). The present study uses a somewhat more traditional paradigm, attempting to establish whether or not self-stimulatory behavior actually is reinforcing by analyzing rates of responding when the opportunity to self-stimulate is presented contingently versus not being presented at all.

In summary, the present experiment attempted to: (1) discover if self-stimulatory behavior is a reinforcer and if it can be used to increase the rate of correct responses on a simple motor task; and (2) find out if offering the opportunity to engage in self-stimulation increases the overall rate of that behavior either within the therapy session or in extra therapy sessions.

Method

Subjects

The participants in the study were two boys who attend a day school for the retarded. At their most recent evaluation, both boys (Mike, age 13, and Steve, age 10) were described as "severely mentally impaired." Neither child had any intelligible verbal behavior or apparent receptive language. Both subjects had limited skills in daily living--they could feed themselves but could not dress or toilet themselves. They were selected for the study mainly because of their high rates of self-stimulatory behavior and their reputations for being difficult to teach. Additionally, they were observed to use particular objects during self-
stimulation and, based on casual observation, seemed to prefer the use of these objects over stimulating with body parts alone. Having a preferred object was an important prerequisite since presentation (or withdrawal) of the preferred object could be used to control self-stimulatory behavior during the experimental phase whereas instructions (e.g., "Okay, now you may self-stimulate.") could not.

Pilot work was carried out for both subjects to insure that objects were indeed "preferred." First, the child was placed in a corner of the classroom with a variety of objects with which he had been observed to self-stimulate at some previous time. Tallies were made of the number of times each item was chosen for use in self-stimulation during a 15-minute observation session. The three most frequently chosen objects were identified. (Steve only used two of approximately eight objects.) The subject's interaction with these most frequently used objects was then calculated by observing the subject for 10 minutes and noting whether body self-stimulation and/or object self-stimulation occurred during 40, 15-second intervals, using definitions of self-stimulation essentially the same as the ones used during later experimental procedures. Both subjects clearly preferred stimulating with the objects. Mike self-stimulated with an object in 40 out of 40 intervals; with his body during 14 of the 40 intervals. Steve self-stimulated with an object in 37 out of 40 intervals; with his body during 3 of the 40 intervals.

A consent form which included information on the procedure as well as assurance of rights to privacy, right not to consent, and right to withdraw from the study at any time was signed by the parents of each
subject.

**Experimenter/Personnel**

The author served as the experimenter (carrying out all procedures) and also as the primary observer. Three other people served as reliability observers: a school employee (social work aide); a social work undergraduate student; and a psychology undergraduate student. Two of the observers had had extensive previous contact with both subjects. All three knew that the study concerned the reinforcing aspects of self-stimulation, but they did not know the specifics of the research. Possible outcomes were not discussed.

**Setting and Materials**

All parts of the study were carried out within the school these subjects attended. It was planned that all training sessions would be held in a medium-sized conference room (14' by 16'). Because of changes within the school program, the study had to be moved to a second room approximately halfway through the study (at point "C" in all figures). This room was significantly larger than the first (approximately 18' by 25'), had an oval shape, and had seven overhead lights as opposed to four in the first room. It also had a supporting pillar in the middle of the room and a long conference table along one side (the first room was devoid of furniture). Later still in the study (point "D" in the figures), the oval room was altered for one subject (Steve) by standing a large gymnastic mat on its side to partially enclose a corner of the room. The mat was intended to decrease visual and auditory feedback for throwing objects, vocalizing, and staring at the lights in the large room. The mat was hinged, and the dimensions of
each half were 5' by 5'.

Training sessions were held once each day for 10 minutes during the early afternoon on four or five days a week. During training sessions, the subject sat at a small (2.5' high) horseshoe-shaped table, with the experimenter seated to one side. At point "B" in the study, Steve's table was padded to reduce auditory feedback he was receiving by banging the wooden ring on the table. All these sessions were videotaped so that a camera, adaptor, and video recorder were also present in the rooms for every session. The videotape equipment was placed approximately 15 feet in front of the subject.

Periodic probes of each subject's self-stimulatory behavior were taken two to three times during each experimental condition in the subject's classroom. For Steve, these 10-minute probes occurred during a regular one-to-one teaching session held in the morning in one corner of his large "open" classroom. Since Mike did not have regularly scheduled sessions during the period of the study, 10-minute probes of his self-stimulatory behavior occurred during the period while he was waiting to be put on the bus to go home. He was allowed to roam around the classroom area and do as he wished during this time.

The task materials used differed for each subject and were selected in the following manner. Each subject was tested on a variety of classroom table tasks (puzzles, ring trees, pegboards, etc.); and it was noted, for each task, whether the subject would perform the task upon being given an instruction alone; upon an instruction plus a demonstration; upon an instruction plus demonstration plus verbal prompt; and continuing in this same additive fashion, through gestural prompts.
and minimal, partial and full physical prompts. Since the purpose of this study was to analyze rates of responding under several different conditions rather than to shape and maintain (teach) a new response, a desirable task would be one which the subject was capable of performing without a lengthy shaping period, yet one which he would not perform consistently (since consistent performance would obviate the need for a reinforcement procedure).

A Fisher-Price Ring Tree (wooden doughnut-shaped rings which fit on a wooden pole with base) was the task selected for Steve. Mike used a specially constructed puzzle made of heavy cardboard which was 13" by 13" by 2.5". It had four openings in the top (square, circle, triangle, hexagon). Additionally, this subject used a 1 1/2" square flat wooden block which fit through the square hole. This puzzle was used since there were no table tasks available (not already being used in Mike's nonexperimental teaching sessions) which were of the correct degree of difficulty.

Preferred Objects

Preferred objects for Steve were:

1. Piece of clear heavy plastic, cut from a car floor mat, 6" by 8", with one-fourth inch nubs protruding in several places.

2. Piece of blue gel-like plastic (Dycem), 10" by 12".

Preferred objects for Mike were:

1. Rubber tube, 12" long, 1" in diameter.

2. Red cylindrical wooden stick, 8" long, 1/4" in diameter.

3. Broken toy car with only base and two wheels remaining, approximately 2" by 3".
Dependent Variables

Task response. A correct response for Steve was putting one ring on the post so that it slid to the bottom within 10 seconds of the instruction, "Steve, ring on post." For Mike, a correct response was putting the square wooden block into the square hole so that it fell to the table below within 10 seconds of the instruction, "Mike, put it in."

Response latency. The latency of the response was defined as the length of the period between the last word of the experimenter's instruction (e.g., "post") and the moment the correct response was completed, measured to the nearest half-second. If a correct response did not occur within 10 seconds, no latency measure was recorded.

Self-stimulation with preferred object. This measure was only applicable during the contingent presentation of preferred object phase and was included to verify that the student did indeed stimulate with the preferred object when it was presented to him. The student was considered to have self-stimulated with the object if he made a stereotypic movement of part of his body with or against the presented object two or more times within the 10 seconds in which he had possession of the object.

Self-stimulatory behavior (overall). Self-stimulatory behavior was defined generally as any stereotypic, repetitive movement occurring two or more times during a seven-second interval. During the observer training period, lists were compiled of the behavior of each child that would be considered self-stimulatory if it also met the frequency requirements. These lists were based on the definitions given by Koegel,
Firestone, Kramme & Dunlap (1974) and appear below:

Steve
1. Repetitive extension and flexion of fingers against object.
2. Rubbing hands or face against object.
3. Waving arms or hands in air.
5. Banging objects against table.
6. Repetitively rubbing ears with hands (ear flipping).
7. Waving head back and forth or from side to side.
8. Rocking (moving trunk forward and backward and side to side).
9. Swinging feet.

Mike
1. Rocking (moving trunk back and forth or from side to side).
2. Tapping or rubbing hands against body part or object.
3. Hands or arms waving or flapping in the air.
4. Tongue in and out.
5. Body rocking (shifting weight from foot to foot while standing).
6. Turning in circles while standing.
7. Finger manipulation (moving one or more fingers with continuous flexion and extension or rubbing two or more fingers against each other).
8. Flicking object between fingers.
9. Twirling objects (such as wheels on a toy car).
10. Rolling objects against body or along floor or table (unless this is the purpose of the toy, such as rolling a toy truck appropriately).
11. Flipping edge of object (e.g., a placemat).
12. Twirling or rubbing hair between fingers.
13. Waving or shaking head back and forth or side to side.

The above definitions describe all types of self-stimulation that were observed to occur during numerous informal observation sessions in the classroom. No differentiation is made in the definitions between stimulation with an object that was presented contingently upon a correct response (the preferred object) and stimulation with an object that is part of the task (e.g., a puzzle piece) since they are topographically and functionally similar. However, provisions were made in the data collection procedures and scoring rules to separate the occurrence of self-stimulation with the preferred object from the occurrence...
of self-stimulation with the task material or with the body alone. The rationale for this separation was that the preferred object is one that is extraneous to actual task performance and one that could presumably increase the rate of self-stimulation to a level higher than that which would normally occur with these students in a task performance situation. Separation affords the opportunity to determine not only if the overall rate of self-stimulation increases during the study but if that increase is due to an increase in self-stimulation with the preferred object alone or if the other types of self-stimulation increased as well.

**Data Collection Procedures**

All 76 training sessions were videotaped, and data were collected from the videotapes at a later time. The following measures were collected on a trial-by-trial basis: accurate completion of task response; latency of response; and self-stimulation with the preferred object. For these measures, either a "yes," "no," "not applicable," or time in seconds would be scored for each of the approximately 25 trials in a training session. A fourth measure (self-stimulatory behavior throughout the sessions) was collected for 51 of these 76 sessions (evenly spaced throughout the study) with the use of a partial-interval recording procedure. Sessions were divided into 10-second intervals; and within these intervals, 7 seconds were designated for observing and 3 seconds for recording. An observer recorded whether self-stimulatory behavior (as described in the definitions above) occurred either with the preferred object alone or with body and/or task material during the 7-second observation period. A tape recorder indicated when to
observe and when to record.

For trial-by-trial data, the primary observer viewed every session's videotape and collected data on the three trial-by-trial measures. Later, a reliability observer viewed tapes sampled from all experimental phases (approximately one-third of the total number of session tapes) and independently recorded the same measures. Partial-interval data were collected from approximately two-thirds of the total number of session videotapes (again sampled from all experimental phases). The primary observer independently collected data from one-half of this sample of tapes, and the remaining half of these tapes were scored by the primary and reliability observers simultaneously. To avoid observer bias during these data collection sessions, the observers were seated so that they could not view each other's data sheet. Additionally, they recorded a slash in some category (yes, no, or not applicable) for each interval so that one observer could not be influenced merely by hearing that a pencil mark had been made by the other observer.

**Scoring Rules**

The following scoring rules were used when recording data:

**Response (correct or incorrect)**

1. If the student makes a correct response as defined for each task in 10 seconds or less, check the "correct" column. For ring on post, one ring must fall to the base of the post. For puzzle, one block must be put into the square hole and fall to the table below.

2. If the student does not make a correct response within the allotted 10 seconds, check the "incorrect" column.

3. If the student makes an error (such as dropping the ring on the table) but corrects the error within the 10-second limit, check the "correct" column.
4. If the student makes a grossly inappropriate response (that is, one that could not be easily corrected within 10 seconds, such as throwing the ring across the room), check "incorrect" and prepare for the next trial.

Response latency (in seconds)

1. Begin the stopwatch to coincide with the last word of the instruction. ("Ring on post," "Put it in.")

2. Stop the stopwatch when the correct response is made (when the ring hits the base of the post or when the puzzle piece hits the table).

3. Record the response latency in the appropriate column to the nearest half-second. If the stopwatch hand falls halfway between two half-second values, write down the high value.

4. If the stopwarch registers more than 10 seconds after rounding off (that is, more than or equal to 10.5 seconds), put a minus (-) in the column.

5. If the trial ends before the 10 seconds are up (for example, because of student inappropriate behavior) and the experimenter begins to prepare for a new trial, stop the stopwatch, write a minus in the column, and prepare for the next trial.

Self-stimulation with the preferred object

1. Check "yes" if the student stimulates with the preferred object that is presented to him (stereotypic movement of the body with or against the preferred object two or more times) within the 10 seconds he is allowed to have it before the experimenter takes it away.

2. Check "no" if the student does not stimulate with the presented object (as defined above) within the time he is allowed to have it. The experimenter may have difficulty getting the object away from the student. Do not count any stimulating with the object that occurs after the experimenter touches the object (while attempting to reclaim it).

3. Stimulating with the body or any other object other than the preferred one that is presented does not count. Check "no."

4. Check "N.A." if the student is not given the object on a trial.

Self-stimulatory behavior

1. Check "yes" if the student is involved in any stereotypic,
repetitive (greater than or equal to two times) movement during a seven-second observation interval. This can be movement with body parts or with the body plus an object other than the presented preferred object (for example, task materials). The two or more movements must occur consecutively (that is, without a different movement of that same body part intervening). See individual lists of self-stimulatory behaviors for each subject.

2. Check "no" if the student is not doing any of the above movement during a seven-second observation period.

3. Check "N.A." if the student is stimulating only with the presented preferred object during the seven-second observation period. Body or body plus "other" object stimulation supersedes stimulation with the presented preferred object so if both types occur during an observation interval check "yes."

4. Do not count as self-stimulation movement that could be considered part of the normal person's repertoire of purposeful behavior (for example, scratching the head or flicking away a fly).

5. Stimulating with the presented preferred object must meet the same requirements as all other self-stimulation.

Classroom Data Collection

During the periodic classroom probes, data were collected on self-stimulatory behavior using the same data collection system and scoring rules detailed above. The observer would seat herself approximately 10 feet away from the subject so that she had a clear view of him but was not interfering with his activity. When reliability observation was taking place, the two observers would seat themselves so that they could not see each other's data sheets as well as following the above classroom data collection procedure. A tape recorder playing in the classroom signaled the beginning and end of observing and recording intervals for this self-stimulation measure.

Observer Training

The four observers were trained simultaneously by having them
collect data (and receive feedback) on a sample tape. The sample tapes showed each subject involved in a teaching session on a task similar to the experimental one. The observers were considered adequately trained when each observer had a reliability score of 90% or higher (using the agreement/disagreement method) with every other observer, on each of the four measures, for each subject. The scoring rules were reviewed during each training session and before all subsequent data collection sessions.

**Design**

A multiple baseline design across subjects with a reversal was used. Each subject was exposed to the baseline and intervention conditions in the same sequence. The conditions were: (a) Baseline I; (b) Contingent presentation of preferred object and opportunity to engage in self-stimulatory behavior; and (c) Baseline II. It was arranged that the two subjects would never begin or end the same condition on the same day but that their experimental conditions would temporarily overlap. Decisions concerning the appropriate time to change conditions were based upon visual inspection of the stability of the data, primarily the correct response measure. The number of sessions in each condition for Steve was baseline I (8), preferred object presentation (25), baseline II (9); and for Mike was baseline I (15), preferred object presentation (21), and baseline II (7).

**Procedures (General)**

In each condition, the subject received a daily 10-minute training session with as many trials as the time period allowed. Number of trials per session ranged from 21 to 35 with an average of 26. Teaching
techniques shown to be effective with difficult-to-teach children were followed as far as the experimental procedures would permit. For example, clear and distinct instructions were presented when the subject was looking at the task materials or at the experimenter and consequences were applied immediately.

The instruction at the start of the trial remained the same throughout the study. ("Steve, ring on post," "Mike, put it in." ) The subject had 10 seconds in which to make a response. After a correct response was made or after the 10 seconds allowed had passed with no response or with an uncorrected incorrect response, there was a 10-second period in which consequences were applied for the response. Following this was a three-second intertrial interval after which the experimenter began the next trial.

Procedures (Specific)

Baseline I. During baseline sessions, the experimenter attempted to get a correct response from the student on the motor task simply by presenting the instruction. No physical or verbal guidance of any kind was given. Both correct and incorrect responses received the same consequences from the experimenter--remaining expressionless and saying nothing (for 10 seconds).

Contingent presentation of preferred object and opportunity to engage in self-stimulatory behavior. During this period, the subjects received an instruction and did not receive physical or verbal guidance, as in baseline. If a correct response was made within the 10-second period after the presentation of the instruction, the experimenter immediately handed the subject one of his preferred objects without
saying anything. The subject was allowed to stimulate with the object for the duration of the 10-second consequation period. In the case of an uncorrected incorrect response or no response within the 10-second period allowed for responding, the experimenter took away the task materials and silently looked away from the subject for 10 seconds, as in baseline.

At the beginning of daily sessions during this condition, the subjects were given five warm-up trials in which they were physically prompted to perform the correct response after which they received the preferred object. The rationale for these warm-up trials was to bring the subjects into contact with the prevailing contingencies. With children possessing adequate receptive language, this could have been accomplished by simply making a statement of the contingencies in effect; but these children needed to be shown rather than told. Steve began receiving these warm-up trials on the fourth day he was in this condition (point "A" in the figures); Mike received them on all days of this condition. These correct responses were not included in the tally of correct responses for that session.

Before data collection began for preferred object presentation, each subject was required to perform at least one independent correct response. This requirement was imposed because each subject had dropped to a near-zero rate of responding at the end of baseline and analysis of the effects of the experimental consequences required at least some opportunity (i.e., correct responses) to deliver the consequence. Steve met this criterion after 42 trials (one session) in which gradually reduced physical prompting and consequation with the preferred
object were used. Mike met this criterion after 32 trials (one ses-
tion); but since no correct responses occurred on the first day of data
collection, it was decided to institute additional training trials.
This time it took him 269 trials (7 sessions) to meet the criterion.

Baseline II. The procedures used during this condition were the
same as those used in baseline I. Two unanticipated changes in the
procedure used with each subject were made at point "D" in the study
(see figures):

1. Increasing the intertrial interval from three to four seconds
to seven to eight seconds.

2. Physically holding the subjects' hands on the table to pre-
vent hand self-stimulation at the start of a trial.

Results

Reliability

For trial-by-trial measures, reliability was taken on 32 out of
the 76 sessions in the study, with at least 6 reliability checks in
each condition. For the interval measure (which the primary observer
had recorded for 51 of the study's 76 sessions), reliability was taken
on 26 out of those 51 sessions, with at least 4 in each condition.
Fourteen classroom probes were taken. Reliability measures were taken
on 8 out of the 14 sessions, with at least 2 in each condition. For
each of the four dependent measures, reliability was calculated by
dividing the number of agreements by the number of agreements plus dis-
agreements and multiplying by 100. For the response latency measure,
a difference in the latency measures recorded by two observers of
one-half second or less was considered an agreement. Thus, 8.0 and 8.5
were considered an agreement as were 8.0 and 8.0; however, 8.0 and 9.0
were not. Reliability calculations for the five measures in the study were:

1. Average correct response 99.6%, with a range from 96% to 100%.
2. Average response latency 96.8%, with a range from 50%* to 100%.
3. Average self-stimulation with preferred object 98.4%, with a range from 91% to 100%.
4. Average self-stimulation (overall) during training sessions 91.1%, with a range from 81% to 97%.
5. Average self-stimulation (overall) during classroom probes 92.3%, with a range from 81% to 97%.

Task Response Measures

Figure 1 shows the subjects' percent of correct task responses for each daily 10-minute training session, across conditions. During the baseline I period, the percent of correct responding was generally low, with a mean of 7% for Steve and 5% for Mike. Correct task responding increased for both subjects with the introduction of contingent presentation of the preferred object for self-stimulation. Steve increased to a mean of 67%; and Mike to a mean of 50%. Additionally, trend lines drawn using the "split middle" technique (Hersen & Barlow, 1976; White, 1977) show a definite upward trend in the data for each subject during the intervention condition. When the opportunity to self-stimulate was no longer available (during baseline II), Steve's rate of correct responding quickly decreased to a mean of 17%. Mike's

*Subject 2 made only two correct responses in Session 2. Primary and reliability observers agreed on one latency measure and disagreed on the other. To put this 50% score into perspective, it should be noted that the next lowest reliability score during the study for this measure was 86%.
mean actually increased during baseline II (65%), but there is a downward trend in his data.

Insert Figure 1 about here

Changes in materials and procedures used with Steve (beginning prompted trials at point "A" and padding the table at point "B") are both associated with generally higher rates of correct responding than that seen on other days near the beginning of the intervention condition for this subject. At point "C," the setting of the sessions was changed for both subjects. At this point, Steve's rate of correct responding began to decline and become more erratic than it had been during the first several weeks of the intervention condition. Since Mike had not had any training sessions during intervention prior to the room change, there is nothing with which to compare his post-room-change intervention data. At "D," two changes in the procedure used with both subjects occurred which were associated with high rates of correct responding: an increase in the length of intertrial intervals and a restraint procedure to prevent the subjects from self-stimulating at the start of a trial. At this point, Steve returned to a rate of correct responding similar to the level he attained before the room change (point "C"). Mike's correct responding reached its highest level after these two procedure changes.

The data for the average latency of correct responses is presented in Figure 2. The average latency of Steve's responding remained fairly constant across all three conditions, with means of 4.3 seconds (base-
line I), 4.2 seconds (preferred object presentation), and 4.6 seconds (baseline II). On the average, Mike responded more quickly during the preferred object presentation condition (mean of 3.1 seconds) than during baseline I (mean of 5.5 seconds). His mean latency increased slightly to 3.5 seconds in baseline II. (In other words, he responded to the instruction a bit more slowly.)

**Self-stimulation Measures**

Data indicating whether or not the subjects actually did stimulate with the preferred objects during the preferred object presentation condition showed the following: Steve stimulated with the objects on 373 of the 380 times they were presented (98%); whereas Mike stimulated with them on 116 of 158 presentation times (73%). (These data are not presented graphically).

Figure 3 presents data collected on the amount of self-stimulation that occurred during training sessions. The ordinate represents the percent of intervals during a session in which self-stimulation occurred. The abscissa, as in all other graphs for this study, represents the consecutive days on which sessions took place. The circular data points represent self-stimulation that occurred with the subject's body or with task material. Triangular data points (which appear only in the preferred object presentation condition) represent the amount of self-stimulation with the presented preferred object added to the amount of self-stimulation with body or task materials. Therefore, following the
top line all the way across the graphs for each subject (circles in baseline I and baseline II; triangles in preferred object presentation) will reveal the total percent of intervals in which any kind of self-stimulation occurred across conditions. Mean totals for Steve remained fairly constant across all three conditions with the following results: (a) baseline I, 69%; (b) preferred object presentation, 72%; and (c) baseline II, 73%. For Mike, mean totals were: (a) baseline I, 68%; (b) preferred object presentation, 63%; and (c) baseline II, 82%. In other words, it appears that the total amount of Mike's self-stimulation actually decreased somewhat with the introduction of the preferred object and then rose to its highest level when the preferred object was no longer available in baseline II.

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When amount of self-stimulation with body or task materials only is analyzed across conditions, it can be seen by comparing the levels of the connected circular data points that this type of self-stimulation occurred less frequently during the preferred object presentation condition than it did during both baseline conditions for each subject. A comparison of the mean percent of intervals in which body or task material self-stimulation occurred for each condition yields the following for Steve: (a) baseline I, 69%; (b) preferred object presentation, 44%; and (c) baseline II, 73%. The same comparison for Mike yields: (a) baseline I, 68%; (b) preferred object presentation, 46%; and (c) baseline II, 82%.

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Data recorded on the amount of self-stimulatory behavior during the classroom probes (not presented graphically) showed that the mean percent of intervals in which self-stimulation occurred was higher in both preferred object presentation and baseline II than in baseline I for each subject. Mike's means increased with each successive condition (61%, 68%, 80%) while Steve's baseline II mean declined nearly to his baseline I mean level of 45% (baseline I had been 37%) after a jump to 59% during the preferred object presentation condition. It should be noted that the classroom probe means given for each condition were calculated from only two to three data points. It is, therefore, possible that these means are not representative of the self-stimulatory behavior that actually occurred in the classroom during each phase of the study.

Discussion

The present study showed that the opportunity to engage in self-stimulatory behavior with a preferred object functioned as a reinforcer for correct task responding in two mentally retarded children. Evidence of the functional relationship between self-stimulatory behavior and correct responding can be seen in the increased mean percentages of correct responses and in the upward data trends which occurred when the opportunity to self-stimulate with the object was introduced for each subject. Lending additional credence to the conclusion that self-stimulatory behavior is a reinforcer is the strong reversal effect seen in Steve's performance. (When the opportunity to self-stimulate with the object was no longer available, his rate of responding quickly decreased.) Mike's performance also shows a reversal effect. Although
Mike's reversal is not as dramatic as Steve's, two factors suggest that his rate of correct responding was decreasing as a result of the unavailability of the previously dispensed reinforcer: (1) The downward trend of his data in the return to baseline I; and (2) The drop in mean response level during baseline II when contrasted with the high and stable percent of correct responding seen near the end of the intervention condition. It seems likely that Mike's correct responding would have declined still further if the study had been extended for several more days. Thus, while Rincover's (1978) separation of self-stimulation into two distinct parts (the behavior itself and its sensory consequences) may be a valuable conceptualization when elimination of self-stimulation is the primary objective, the present study shows that contingent presentations of opportunities to self-stimulate with preferred objects can serve to reinforce behavior of a different type. (In this case, a motor task response.)

The present data also show that the amount of self-stimulatory behavior that occurred during preferred object presentation sessions (in which the subjects were "encouraged" by presentation of a preferred self-stimulatory object on a contingent basis to self-stimulate) was about the same as the amounts that occurred during training sessions in which this opportunity was not presented. The significance of this result is that using the opportunity to engage in particular topographies of self-stimulatory behavior as a reinforcer does not appear to increase the overall amount of its occurrence. In fact, it is remarkable how constant Steve's total level of self-stimulation remained throughout all three conditions.
There are at least two explanations for the occurrence of this constant level. The organism may be attempting to maintain some optimum level of stimulation, in whatever form it is available; when a preferred topography of stimulation is available, this behavior may make up a larger proportion of the broader self-stimulation response class although the total amount of stimulation remains the same. An alternate explanation is that it may become punishing to engage in self-stimulatory behaviors which are incompatible with correct responding, as the correct responses acquire strength through the reinforcement process. It can be seen in Figure 3 that Steve's self-stimulation with body and task materials alone does occur significantly less during the intervention condition when correct responding is at its highest levels.

Mike's overall amount of self-stimulation was actually lower during the intervention condition than at other times and near the end of the condition, shows an inverse relationship with the rate of correct responding. Throughout the study, there are other hints of the inverse relationship between self-stimulation and learning proposed by Koegel and Covert (1972) and Koegel, Firestone, Kramme and Dunlap (1974). (Compare Figures 1 and 3, noting Steve's baseline I and all conditions for Mike.) But the relationship is not strong enough to lend unqualified support to their theory. Taking self-stimulation measures for every training session would aid a future attempt to evaluate this relationship.

It is not possible to draw firm conclusions about whether or not the amount of self-stimulatory behavior that occurred outside of
training sessions changed during the course of the study. Only seven classroom probes were taken for each subject during the study so that means were calculated from only two to three data points. In a study of this length (52 session days), it would be desirable to have more classroom probes to insure that the data would be representative of the actual behavior level. Anecdotal reports from teachers who work with these subjects revealed that no change in the amount of self-stimulatory behavior was noticed during the course of the study with the exception of day-to-day fluctuations. A finding of no change in self-stimulation in nonexperimental situations would be consistent with Devany and Rincover's (Note 1) work. Future studies should adopt their method of daily extra therapy probes to insure accurate analysis of changes in self-stimulatory behavior within and outside experimental sessions.

The social significance of this study lies in the fact that these two difficult-to-teach children increased their rate of correct responding (on a type of task commonly found in their curriculum and considered to be a prerequisite for other, more advanced skills) without increasing the amount of a behavior (self-stimulation) considered to be inappropriate. Thus, the use of self-stimulatory behavior as a reinforcer seems to be justified on experimental and ethical grounds. However, issues of practicality must be dealt with as well. On one hand, the opportunity to engage in self-stimulatory behavior is a readily available and cheap reinforcer. It is also a reinforcer on which subjects do not seem to satiate (Devany & Rincover, Note 1). On the other hand, the data obtained on correct responding make it clear

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that certain conditions must be met before self-stimulatory behavior can be successfully used as a reinforcer.

Basically, in order for the contingently encouraged self-stimulatory activity to remain a potent reinforcer, other forms of stimulation which could be acting as competing reinforcers must be identified and controlled as much as possible. This was accomplished in the present study using two different methods. First, the physical environment was manipulated to decrease visual and auditory feedback through table-padding and enclosure of a corner of the room. Many techniques of this type which could profitably be used in future research and application are currently being developed (Rincover, 1978; Rincover, Cook, Peoples & Packard, 1978; Rincover, Newsom, Lovaas & Koegel, 1977). Second, the teaching procedure was modified to prevent self-stimulation at unscheduled times by physically restraining the subjects' hands at the start of a trial. Since a great deal of self-stimulatory behavior in retarded individuals is performed with the hands, it may be more practical in future research to restrain the hands of the subject at all times other than when he is being allowed to perform the task or stimulating with the presented object. Of course, this action must be weighed against the possible positive reinforcing effect of physical contact with the subject which follows an incorrect response.

A third method of controlling nonprogrammed, self-stimulatory behavior (not used in the present study) would be to choose a task that is as physically incompatible with self-stimulation as possible, preferably one that requires the use of two hands. If this is
impossible, the hand that is not required for performance of an
one-handed task might be restrained.

In summary, self-stimulatory behavior functioned as a reinforcer
for the behavior of the two subjects studied. This activity may also
function as a reinforcer for training other behaviors in retarded or
autistic students. The generalizability of the present study's results
should be explored, pending solutions to some of the practical problems
posed by using a behavior already being performed at a high rate as a
consequence for performance of some desired low-rate behavior. The
primary problem is efficient alternation between first restricting and
then encouraging self-stimulatory activity. The goal in a program
using self-stimulatory behavior as a reinforcer should be to very
gradually lean the schedule of reinforcement as a task is learned so
that while the subject is learning new skills he will also be reducing
his performance of a socially stigmatizing behavior. Over a long
enough period of time, self-stimulatory behavior may further diminish
because of increasing amounts of reinforcement acquired from the per-
formance of a broader repertoire of new skills.
Reference Note

References


Figure Captions

Figure 1. Percent of correct task responses by each subject on a motor task. Arrows are trend lines drawn using the "split-middle" technique. "A" indicates the point at which Steve began receiving five warm-up trials at the start of the session (see page 18 in text). "B" indicates the point at which Steve's table was padded (see page 8). "C" indicates the day that sessions were moved to a new room for both subjects (see page 7). At point "D," several changes in procedure were made for both subjects (see page 19). Also, at point "D," Steve's sessions began to be held in an enclosed section of the room used for sessions (see page 7).

Figure 2. Average latency of each subject's correct responses in daily 10-minute training sessions. Points "A," "B," "C," and "D" as in Figure 1.

Figure 3. Percent of intervals in which self-stimulation occurred for each subject. The top line in each condition shows the highest level of self-stimulation that occurred; circular data points always indicate self-stimulation without the introduced preferred object (see page 22 of text for further explanation). Points "A," "B," "C," and "D" as in Figure 1.
Figure 1

BASELINE | PREFERRED OBJECT PRESENTATION | BASELINE II

PERCENT OF CORRECT TASK RESPONSES

- = Training Session
■ = Pre-experimental Probe

CONSECUTIVE SESSION DAYS

STEVE

MIKE

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Figure 2

CONSECUTIVE SESSION DAYS

BASELINE

PREFERRED OBJECT PRESENTATION

BASELINE II

STEVE

MIKE

AVERAGE LATENCY OF RESPONSE (IN SECONDS)
Figure 3

- BASELINE
- PREFERRED OBJECT PRESENTATION
- BASELINE II

○ = Self-stim. with Body or Task Materials
△ = Self-stim. with Body, Task Materials and Preferred Object

PERCENT OF INTERVALS IN WHICH SELF-STIMULATION OCCURRED

CONSECUTIVE SESSION DAYS