EFFECTS OF CANDY AND SOCIAL REINFORCEMENT, INSTRUCTIONS, AND REINFORCEMENT SCHEDULE LEANING ON THE MODIFICATION AND MAINTENANCE OF SMILING¹

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Two retarded boys exhibited abnormally low rates of smiling. In Exp. I, the frequency of a boy's smiling was first increased with candy reinforcement, but the frequency of the response did not decrease when candy reinforcement was terminated. When the subject wore a sign designed to make social interactions contingent on not-smiling, the frequency of smiling decreased. The sign was then changed to make social interactions contingent on social interactions contingent on silling and the rate of smiling increased. In Exp. II, a second boy initially never smiled. Establishment of a contingency for candy reinforcement did not increase this zero response rate. Instructing the child to smile initially increased smiling, but the instructions then became progressively more ineffective. Candy reinforcement increased the rate of smiling to a normal range, but the rate of the response promptly decreased when this reinforcement was discontinued. Continuous candy reinforcement was again employed to increase the response rate and then progressively leaner schedules of variable-ratio candy reinforcement was again eliminated. Subsequently, the rate of smiling did not decrease when candy reinforcement was again eliminated. Subsequently, signs were employed to regulate social interactions and the rate of smiling was shown to be controlled by these interactions serving as reinforcers.

The effects of several variables controlling the frequency with which two retarded children smiled were experimentally analyzed. Both children were claimed to have problems because they smiled at abnormally low rates. Two distinctly different considerations were involved. First, little is systematically known about the kinds of variables which routinely control smiling behavior. Second, even if information about possible controlling variables can be discovered, there is no guarantee that these can be incorporated into a therapeutic program which might produce durable and beneficial results for a particular child.

EXPERIMENT I

More traditional approaches to child development suggest that abnormal emotional behaviors result as a function of general environmental conditions such as insufficient affection (e.g., Hurlock, 1964), or stem from internal states such as fear and anxiety (e.g., Jersild, 1954). However, there is no experimental evidence that quantities of attention or affection effectively modify emotional behaviors, and the hypothesized role of internal states is moot because they cannot be observed or manipulated independently of other possible controlling variables.

A potentially viable alternative is suggested by recent research which shows that a variety of human emotional behaviors are operants (Williams, 1959; Hart, Allen, Buell, Harris, and Wolf, 1964; Risley, 1965; Wolf, Birnbrauer, Williams, and Lawler, 1965). In each of these studies, the occurrence of some abnormal response was shown to be closely controlled by reinforcing consequences of the response. If smiling should similarly prove to be an operant behavior, considerable leverage would be available to produce experimentally some desirable changes in how often a child smiles.

Candy serves as a suitable reinforcer for operant behaviors of most children (Bijou and Orlando, 1961; Wolf, Risley, and Mees, 1964). Presentation of candy contingent on the occurrence of smiles is likely to increase their frequency if they are operant responses. Sub-

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sequently, withholding candy for smiles for a period of time would decrease the frequency of smiling, and reinstating candy reinforcement would again increase smiling. This procedure could be repeated as often as necessary to establish the functional relationship between smiling and the consequences of smiling.

However, the experimental manipulation of a probable candy reinforcer for smiling will not necessarily produce a desired increase in smiling in natural situations. Indeed, if it is necessary to employ candy continually to cause a child to smile at a normal frequency, the procedure is likely to be judged a failure. Social environments rarely include the contingent presentation of candy to maintain appropriate emotional behaviors in children. A therapy program is successful only if desired changes in behavior are eventually brought under the control of naturally occurring reinforcers in the social environment. The interactions between a smiling child and his social environment must routinely include reinforcers to maintain the child's smiling. Then, experimentally contrived reinforcers can be discontinued with good reason to expect that the changes in behavior will prove durable.

Method

General Procedures

The subject was a 10-yr-old retarded male who attended the Psychology Research School at Florida State University as a day-care student. The school staff had casually observed that this boy frequently emitted facial responses which were variously described as "pitiful", "sad", and "dejected". Variations in these facial responses made them extremely difficult to observe reliably. However, the experimenter and an observer-assistant yielded 96% agreement on 184 different occasions that the subject exhibited or failed to exhibit a smiling response. Therefore, it was decided that attempts would be made to increase the subject's frequency of smiling. Smiling in contrast to not-smiling included a slight opening of the subject's lips, a turning up of the corners of his mouth, and an increase in the protrusion of the skin over his cheek bones.

All experimentation occurred during walks which the experimenter, observer, and subject took in the school environs. Each walk was continued until at least eight different people who responded with a verbal greeting to the subject had been encountered. Both the experimenter and the observer carried two hand counters on which they recorded: (1) the number of people encountered, and (2) the number of encounters during which the subject smiled within 5 sec of the time that the first verbal exchange began.

This general procedure was continued for 66 walks distributed over 47 different days. No more than two walks occurred on any one day.

Procedural Variations

Variations from the general procedure are detailed below. The letter symbols associated with the variations are also employed in Fig. 1 under Results to allow for easy comparisons between changes in procedure and correlated changes in behavior.

BL-During the first seven walks, the general procedure was employed. This provided a baseline of the relative frequency of occurrence of smiling, against which changes in this response rate could be compared.

A-From walk 8 through walk 23, the experimenter gave the subject a piece of candy, an M & M, or piece of candy corn, each time he smiled within 5 sec of the time that a verbal exchange began with any person met during the walk. If the subject failed to smile, the experimenter did not respond to him for at least 15 sec while they continued to walk.

B-Beginning with walk 24, the experimenter stopped providing candy whenever the subject smiled. This was equivalent to a return to the general procedure employed during the baseline condition.

C-From walk 34 through walk 44, the subject wore hanging from his neck an 8.5-in. by 11-in. sheet of white cardboard. Lettered on this sign were the statements, "If I smile-ignore me. If I look sad-talk to me." During the first four encounters on walk 34, three of the people failed to follow the instructions on the sign. For the remainder of this condition, the assistant walked about 30 ft ahead of the subject and experimenter and asked each of the people who were likely to be encountered by the subject to be sure to read and to follow the instructions. For the remainder of this condition, only three people failed to follow the instructions.

D-From walk 45 through walk 56, the sign worn by the subject was changed to read, "If I smile-talk to me. If I look sad-ignore me." Throughout this condition, the assistant again walked ahead of the subject and experimenter and asked each person encountered to read and to follow the instructions.

E-Beginning with walk 57 and continuing through walk 66, baseline conditions were again employed. The subject wore no sign and experimenter made no attempts to reinforce differentially any of the subject's behaviors when people were encountered during walks.

RESULTS

During baseline conditions, the relative frequency of smiles varied unsystematically from 0.125 to 0.50 as shown in Fig. 1. Throughout the experiment, there were no obvious correlations between the occurrences of smiling and particular people encountered. In other words, smiling did not appear to be discriminated on the subject's encountering some people, but not others. On instances when the subject failed to smile, his facial movements took on the general characteristics described above as "pitiful", etc.

After the contingent presentation of candy (A) was initiated, the relative frequency of smiling quickly increased to 1.0 by the seventeenth walk and stabilized at that level. When the candy reinforcement was discontinued at walk 24 (B), the relative rate of smiling remained stable at 1.0 throughout the nine walks under this condition.

The rate of smiling did not decrease immediately when the subject first began wearing the sign designed to control the interactions with his social environment. However, the rate began decreasing with the thirty-sixth walk and continued to decrease irregularly to 0.375 by Session 44. The instructions to the social environment to interact with the subject only when the child failed to smile, which were begun at (C), effectively controlled these social interactions and smiling subsequently decreased.

When the sign was changed to instruct the social environment to interact with the subject contingent on his smiling (D), he began to smile more frequently. By walks 53 through 56, the relative frequency of smiling had again stabilized at 1.0.

Removal of all experimental contingencies at (E) did not decrease the rate of smiling. The subject continued to smile at every person encountered on the walks through the remainder of the experiment.

DISCUSSION

There is little doubt that the smiling responses of this child were operant behaviors under the control of the environmental events which occurred after the responses. Altogether, the experiment included three different alterations of the consequences of smiling which are correlated with considerable changes in the frequency of smiling.

The continuation of a high rate of smiling when candy reinforcement was discontinued at B deserves special consideration. Research on the variables which control the behaviors of individual human subjects frequently employs a reversal technique to establish the reliability of the variable's effect on the measured behavior (Baer, Wolf, and Risley, 1968). A variable is applied in some procedural context and behavior is recorded to determine the extent to which it changes. If some change in behavior occurs, the variable is then removed to see if the behavior returns to its prevariable form or frequency. The variable may then be reapplied, etc. If the behavior changes systematically each time the variable changes, the effect of the variable becomes clearly demonstrated.

In the present experiment, there was a correlation between the initiation of contingently presented candy and an increase in the relative frequency of smiling. However, when candy presentation was stopped, the frequency of smiling remained high, rather than returning to the approximate frequency which occurred during the baseline conditions. At this point in the experiment, there were two obvious alternative explanations for the failure to obtain reversibility: (1) the original increase in the frequency of smiling may have been produced by some unknown processes or variables or, (2) the increase in frequency may have been produced by candy reinforcement with some second variable maintaining the frequency at a high level once it was established. The first alternative would mean that candy had not functioned as a reinforcer and possibly that the behavior was not an operant.



Fig. 1. The proportion of encounters for each walk during which the subject of Exp. I smiled. The baseline general procedures were in effect from BL to A. At A, candy reinforcement was made contingent on smiling. The candy reinforcement was discontinued at B. At C, the subject began wearing a sign which instructed people to interact with the subject only when he failed to smile. The sign was changed to make social interactions contingent on smiles at D and was eliminated at E.

The second alternative would constitute a case of functional irreversibility of an operant-reinforcer relationship with the high response rate possibly maintained by some reinforcer which had not been experimentally controlled.

Both the experimenter and the assistant had casually observed that most of the people encountered during the walks were indiscriminately attentive to the subject. If he smiled during an encounter, they talked to him for a few seconds before walking on. If he failed to smile, they were likely to pat him on the head, ask him what was wrong, tell him to cheer up, etc. It was possible that all of these social interactions had served as reinforcers which tended to maintain the variable, low rate of smiling during the initial baseline period and the high rate of smiling when candy reinforcement was discontinued at B. The subsequent manipulations of the social interactions revealed that they were effective as reinforcers. If the interactions occurred contingently on the child's failure to smile, he smiled less frequently. If they occurred only when he smiled, smiling increased.

Speculatively, it seems likely that the social environment's indiscriminant reinforcement of any of the child's facial responses probably contributed to the original problem by maintaining the low rate of smiling observed during the initial baseline walks. If, for some unknown reason, the child began emitting undesirable facial responses at a high rate, the noncontingent reinforcement could maintain that rate.

As a therapeutic model, the procedures employed in this experiment appear promising. An experimentally contrived reinforcer, candy, can be employed to increase the rate of smiling to a normal range. If there are, then, naturally occurring reinforcers such as the social interactions, the desired response rate can be maintained indefinitely after the candy reinforcement is discontinued. In this particular case, the maintaining reinforcers happened to occur on a noncontingent basis. The same model should hold for reinforcers which only occurred contingently on the desired behavior. For example, a contrived reinforcer might be employed to increase the probability that a child would clean his room. This increase in response rate might then be maintained by his mother's complimenting him. The mother would not ordinarily say complimentary things if the child did not clean his room. In other words, her reinforcers occur only when the response occurs. Nevertheless, they could serve as effective maintaining variables.

Speculations that an abnormally low rate of smiling results from internal states or feelings appear irrelevant. There is no necessity to resort to hypothetical and probably untestable speculations because the environment predictably and reliably controls the behavior. On the other hand, speculations such as Hurlock's (1964) that abnormal emotional behaviors result from a lack of affection are possibly dangerously incorrect. In this experiment, "affection" probably initially maintained the problem behavior. Moreover, decreases in the overall amount of affection, as temporarily occurred at D when social interactions were made contingent on smiling, can produce increases in smiling. If affection is defined as social reinforcement, Hurlock is correct in suggesting that it is an important variable. However, it appears that increasing the amount of affection given to a child has real potential to strengthen problem behaviors unless that affection occurs only as a consequence of improvements in behavior.

EXPERIMENT II

Several other considerations and variables can become relevant to the control of smiling with only minor variations in the nature of the initial problem. One consideration stems from the possibility that a particular child may never smile in the desired situation. If this occurs, there is little to gain from establishing a potential contingency between smiling and a reinforcer, as was done in Exp. I. If the response never occurs, no reinforcement is presented. The behavior never comes into contact with the reinforcer. Therefore, the frequency of the response can not be increased.

If no discoverable condition reliably occasions smiling, the experimenter will probably resort to the method of shaping or reinforcing approximations to the desired response (Skinner, 1953). However, this should be an infrequently occurring circumstance for most populations of children. More often, the child will smile in some stimulus situations but not in the situation in which smiling is desired. In this case the experimenter can employ some part of an effective stimulus situation to develop an initial non-zero response rate which can then be improved by reinforcement. Verbal instructions will be one of the most convenient stimuli if they effectively produce the response. Ayllon and Azrin (1964) have demonstrated the usefulness of instructions when employed in some context which involves reinforcement for the desired response when it occurs.

A second consideration, which can complicate applications of these techniques, is the possibility that a high rate of smiling, once it is developed with a contrived reinforcer, may not easily transfer to control by naturally occurring reinforcers. For example, in Exp. I. the child's rate of smiling could have gradually decreased when candy reinforcement stopped occurring. Assuming that the social interactions are reinforcers, the difficulty could stem from the fact that the candy reinforcer is abruptly discontinued. A more gradual leaning of the schedule with which candy reinforcement is presented might allow the relatively weak social reinforcers to maintain the response rate.

Method

General Procedures

The subject was an 8-yr-old retarded boy who attended the same class as the subject in Exp. I. He was selected because he, too, was observed to smile very infrequently when greeted by or encountering people around the school. In contrast to the subject of Exp. I, this boy emitted no particular change in facial response when he encountered people, but continued to maintain a "straight" or "pokerfaced" response. Again, these responses were difficult to define, but there was good agreement for observations of instances of smiling. Smiling responses included the subject's opening his mouth, thinning his lips, and partially closing his eyes.

Experimental variables were manipulated and data collected on walks exactly as in Exp. I, except each walk was continued until at least 10 different people were encountered. This experiment included 130 walks distributed over 76 days.

Procedural Variations

Each procedural variation is identified by a letter symbol. These symbols are also employed in Fig. 2 under Results.

BL-For walks 1 through 5, the general procedures were employed to determine the baseline relative frequency of smiling.

A-Beginning with the sixth walk and continuing through walk 10, a potential contingency was established between smiling and the experimenter's giving the child a piece of candy. If the child should smile during the first 5 sec of an encounter, the experimenter would immediately give him a piece of candy. If the child failed to smile, the experimenter responded to him in no way for at least 15 sec.

B-From walk 11 through walk 19, each time the subject encountered a person, the experimenter leaned down and said to the subject, "Smile!" or "Smile when you say hello to ______." The experimenter made no attempts to manipulate consequences for any of the subject's responses during these encounters.

C-Beginning with walk 20 and continuing through walk 40, the instructions to smile were discontinued and the contingency between smiling and the experimenter's giving the subject a piece of candy was reinstituted. If the subject smiled during an encounter, he immediately received a piece of candy. If he failed to smile, the candy was withheld and the experimenter made no response to the subject for at least 15 sec.

D-From walk 41 through walk 46, candy was no longer presented following smiles. The experimenter made no responses to the child for at least 15 sec after an encounter.

E-The experimenter immediately gave the child a piece of candy if he smiled during an encounter and did not respond to him if he did not smile throughout the period from walk 47 to walk 55.

F-In conditions C and E, candy reinforcement was delivered continuously or on a fixedratio 1 schedule of reinforcement. Every time the child smiled, he was given a piece of candy. During condition F and the next four conditions, the candy reinforcer was delivered according to intermittent schedules. For walk 56 through walk 63, reinforcement was programmed on a variable-ratio (VR) 1.25 schedule. The candy was presented after the subject emitted a variable, but predetermined number of smiles. The mean number of responses required for reinforcement was 1.25.

During the next four procedural variations, the response requirements for the variableratio schedules of reinforcement were progressively increased as indicated below.

G-VR 1.67 during walk 64 through walk 73.

H-VR 2.5 during walks 74-83.

I-VR 5.0 during walks 84-87.

J-VR 7.5 during walks 88-102.

K-Beginning with walk 103, the candy reinforcement was discontinued. No candy was given to the child during the remainder of the experiment.

L-From walk 112 through walk 116, the subject wore from his neck a sign similar to the one employed during Exp. I. Printed on the sign was, "If he smiles-ignore him. If he does not smile-talk to him." Again, the assistant preceded the subject to instruct each person encountered to read the sign before interacting with the child.

M-During the next five walks (117 to 121), the sign was changed to read, "If he smilestalk to him. If he does not smile-ignore him."

N-Beginning with walk 122, and continuing through the remainder of the experiment, the use of signs to control the social interactions was discontinued.

Results

The data for this experiment are displayed in Fig. 2. Each walk corresponds to a single data point which shows the proportion of the 10 encounters during which the subject smiled.

Throughout the baseline condition (BL to A), the child never smiled during the first 5 sec of an encounter. Similarly, the child did not smile during any of the 50 encounters when the potential contingency between candy and smiling was in effect (A to B).



Fig. 2. The proportion of encounters for each walk during which the subject of Exp. II smiled. The baseline conditions began at BL. Beginning at A, candy reinforcement would have been presented if smiling occurred. From B to C, the experimenter instructed the child to smile each time he encountered a person. At C, candy reinforcement occurred for each smile. At D, continuous candy reinforcement was terminated. From E to F, candy reinforcement was again given following each smile. The schedule of candy reinforcement was changed to a VR 1.25 at F and subsequently to a VR 1.67 at G, a VR-2.5 at H, a VR-5 at I, and a VR-7.5 at J. All candy reinforcement was eliminated at K. A sign was used to make social interactions contingent on failures to smile at L and was changed to make them contingent on smiles at M. The sign was eliminated at N.

Immediately after the instructions to smile (B) were introduced, the proportion of encounters on which the subject smiled increased considerably. This proportion was 0.8 on walk 11 and 0.9 on walk 13. However, as the instructions were continued, the relative rate of smiling decreased regularly. By walk 19, the subject smiled at only 2 of the 10 people encountered.

After candy reinforcement was introduced, the relative rate of smiling increased rapidly. The proportion of encounters during which the subject smiled was 1.0 on the twenty-fifth walk and apparently stabilized with some variability between 0.8 and 1.0 for walks 25 through 40.

When candy was no longer presented as a consequence of smiling (D), the proportion of smiles decreased from 0.8 during walk 41 to 0.1 during walk 46. After the contingent presentation of candy (E) was reinstated, the proportion of smiles again increased to the 0.8 to 1.0 range.

As the schedule of reinforcement was progressively thinned from VR 1.25 (F) to VR 7.5 (J), the mean relative response rate remained approximately constant. The proportion dropped to 0.7 on the ninety-first walk during the VR 7.5 schedule, but did not decrease beyond that point. The rate then recovered and during the last several walks under this schedule, the child smiled at every person encountered. Now, when candy reinforcement was discontinued (K), relative response rate did not drop below 0.9 through walk 111.

When the sign, designed to make social interactions occur only as consequences for not smiling, was introduced (L), there was an immediate and progressive decrease in the rate of smiling. By walk 116, the proportion of smiles had decreased to 0.4. At (M) when the sign was changed to make social interactions contingent on smiling, the proportion of smiles increased rapidly until the subject again smiled during most of the encounters with people. Beginning at walk 122 (N), the baseline conditions were in effect for the remainder of the experiment. No candy reinforcement was employed and no attempts were made to control the occurrence of social interactions. The subject continued to smile at most of the people encountered on each walk.

DISCUSSION

Again the results argue strongly that smiling is an operant behavior because it is controlled by its consequences. In Exp. II, there were five sharp changes in the rate of smiling which were attributable to changes of the consequences of the response.

As expected, a contingency between presentation of candy and smiles was completely useless to increase a zero rate of the response. The response never occurred and there was, therefore, no opportunity to strengthen it with reinforcement. It is possible that the contingency might be effective if it could be maintained indefinitely. The child might have eventually smiled. However, neither an experimenter nor an abnormally behaving child can afford the luxury of time to employ such a procedure. Moreover, if social interactions are reinforcing non-smiling responses, the probability of a smile decreases the longer this procedure is in effect.

The instructions were useful to produce an initial increase in the relative frequency of smiling, but this increase was not durable. This is similar to the result with mental patients reported by Ayllon and Azrin (1964). Antecedent stimuli such as the instructions may be effective to control an operant behavior. However, this control diminishes unless the response is sometimes followed by reinforcement. In some practical applications, instructions might be useful to durably increase smiling without the necessity for a contrived candy reinforcer. This could occur if instructions produce an increase in the rate of smiling and then that rate is maintained by naturally occurring social reinforcers. It is important to stress that the consequences of the response are ultimately responsible for the effects of the instructions. Finally, instructions will probably prove to be ineffective in producing the response if the child has not historically been rewarded for following instructions.

The technique of gradually increasing the variable-ratio requirement for the contrived reinforcer should be treated as a tentatively useful tool for bringing smiling under the control of social reinforcers. Smiling decreased in frequency when candy reinforcement was first eliminated. And, smiling continued at an acceptable rate when candy reinforcement was discontinued subsequent to the procedures which involved progressively leaner schedules of candy reinforcement. However, it should be noted that some candy reinforcement was delivered throughout the 47 walks during which the ratio requirement was increased. It is possible that the same eventual result would have occurred if continuous reinforcement had been programmed for an equivalent number of walks.

For some children it might be difficult to transfer control of smiling from an experimental reinforcer to social variables because the latter are weak reinforcers. Lovaas, Freitag, Kinder, Rubenstein, Schaeffer, and Simmons (1966) reported data to show that social variables are null reinforcers for some autistic children. They also demonstrated techniques which are effective to establish such variables as reinforcers. If appropriate, the techniques of Lovaas *et al.* for developing social reinforcers could be used in place of or in conjunction with a progressive leaning of food reinforcement to produce the transfer of control to natural variables.

This research adds one more specific to the rapidly growing body of literature which shows that unfortunate occurrences of social reinforcers can maintain abnormal problem behaviors and that carefully employed social reinforcers are sufficient to eliminate these problems or maintain desirable behaviors. These demonstrations now include such diverse behaviors as psychotic talking (Ayllon and Michael, 1959), isolate behavior (Allen, Hart, Buell, Harris, and Wolf, 1964), regressed crawling (Harris, Johnston, Kelley, and Wolf, 1964), cooperative play (Hart, Reynolds, Baer, Brawley, and Harris, 1968) and studying and disruptive behaviors in school children (Hall, Lund, and Jackson, 1968). It is impossible to prove that misuses of social reinforcement had originally produced the above problem behaviors. In each of the above studies, the original causes were historical events and, as such, were not available for experimental manipulation. In addition, most researchers will be hesitant to employ social reinforcers deliberately to see if they can develop such abnormal behaviors because of possible detrimental effects for their subjects. Nevertheless, research increasingly raises the suspicion that many behavioral problems are a result of little more than the misuse of social reinforcement. The ubiquity of this variable in the environments of most people strongly recommends it not only as an appropriate subject for further research, but as a socially important focus of training for every individual who has any reasonable probability of interacting with other people.

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