

*THE EFFECTS OF REINFORCEMENT ON THE
MODIFICATION, MAINTENANCE, AND GENERALIZATION
OF SOCIAL RESPONSES OF MENTAL PATIENTS¹*

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Social greeting responses of three withdrawn, chronic schizophrenics were experimentally modified. Initially, none of the subjects spoke to an experimenter. Prompts and cigarette reinforcement were employed to produce increases in the rates of greetings. Then, the prompts were faded so that the greetings came under the control of the presence of the experimenter. Reversal and subsequent reinforcement procedures were employed to demonstrate that the responses were controlled by their consequences. Next, the schedule of cigarette reinforcement was leaned out so that greetings continued to occur in the absence of cigarette reinforcement. However, low or zero rates of greetings occurred in the presence of a second experimenter. Five new experimenters employed the prompting, fading, reinforcement, and schedule-leaning procedures. Subsequently, all subjects emitted appropriately high rates of greetings in the presence of the second experimenter. Without further application of the experimental procedures, greetings were still occurring in the presence of both the first and second experimenters almost three months later.

Withdrawal, as defined by a low rate of social interaction, is a commonly observed behavior problem in mental institutions. Kant (1948) reported that up to 22% of all patients with so-called simple schizophrenic reactions include withdrawal as a particular problem. Moreover, Murray and Cohen (1959) collected sociometric data which show that the frequency of social isolation in schizophrenics increases as a function of the duration of hospitalization.

A wide variety of causal factors (Jackson, 1960) and treatment procedures (Coleman, 1956) have been speculatively related to this behavioral abnormality. However, most of the proposed etiological factors are based on simple correlations. Moreover, attempts have not been made to determine experimentally the causal variables which control the development of social isolation. Similarly, most therapeutic approaches have either neglected to collect validating data or have relied on in-

direct and possibly subjective data such as hospital-staff ratings of improvement (Powdermaker and Frank, 1953).

Several studies based on operant conditioning principles have demonstrated that social behaviors are functionally related to specifiable environmental events. In contrast to previous approaches, these studies have directly and objectively measured the social behaviors in question and have emphasized the importance of environmental consequences, reinforcers, as controlling variables. This research area began with Azrin and Lindsley's (1956) laboratory demonstration of the reinforcement control of arbitrary cooperative responses between children. Subsequently, more therapeutically oriented research has included the modification of isolate and cooperative behavior in nursery school children (Allen, Hart, Buell, Harris, and Wolf, 1964; Hart, Reynolds, Baer, Brawley, and Harris, 1968), the development of social verbal behaviors in adult mutes (Sherman, 1965) and a mute child (Blake and Moss, 1967), and the development of social approaches, physical contact, and affectionate behaviors in autistic children (Lovaas, Schaeffer, and Simmons, 1965).

The present study focused on the experimental development of social behaviors in withdrawn, chronic schizophrenics. Unlike the subjects of Sherman's study, these patients had

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appropriate social responses in their behavioral repertoires. However, each patient would be described as withdrawn because all emitted social responses at very low rates.

A possible therapeutic solution to the general problem includes three specific steps. First, stimulus control or instructional techniques (Ayllon and Azrin, 1964; Hopkins, 1968) and experimental reinforcement techniques must be developed to produce normal rates of responding in appropriate situations.

If normal rates of responding can be developed, these behaviors must then be maintained in the absence of contrived reinforcers. However, abruptly terminating contrived reinforcement may weaken the response, even though social interactions regularly occur as consequences of greetings. Hopkins (1968) has shown that this problem can be solved by developing behavioral changes with relatively powerful experimental or contrived reinforcers and then progressively "leaning" this schedule of reinforcement until the behavior can be maintained in the absence of contrived reinforcers.

Finally, any experimentally or therapeutically produced change in responding may become discriminated with respect to the environment in which the change was produced (Lovaas *et al.*, 1965) or with respect to the experimenter or therapist who engineered the behavior modification. In institutional settings, the latter form of discrimination is particularly important. Therapeutic changes in social behaviors must be generalized to a number of persons in the patient's environment if isolation or withdrawal is to be diminished significantly. The present experiment demonstrated a relatively simple technique for producing desired transfer of stimulus control to persons not directly involved in an experimental or therapeutic program.

METHOD

Subjects

Three hospitalized, male mental patients were all classified as chronic schizophrenics. Subject 1 was 41 yr old and had been hospitalized for 20 yr. Subject 2 was 34 yr old and had been continuously hospitalized for 12 yr. Subject 3 was 40 yr old and had been hospitalized for 17 yr. All three patients had been diagnostically noted to be withdrawn.

Casual observations revealed that each subject rarely interacted with staff or other patients. Subject 2 had been mute for about 2 yr, but by the beginning of the experiment, verbal behavior had recovered so that he talked in at least some conditions. Both Subject 1 and Subject 2 emitted appropriate verbal behavior, but usually only in response to direct questioning.

Setting

All experimentation was conducted in the closed ward on which the patients lived, on an adjoining porch, and in an institutional sheltered workshop. The ward was generally organized into a rehabilitative behavior modification program based on a token economy. Concurrently with this research, each patient was involved in one or more other therapeutic projects concerned with behaviors such as work skills, self-care, and academic skills.

Responses

Specific social responses selected for experimentation were greetings. A greeting was generally defined as a subject's saying: "Hi!" or "Hello, Mr. _____". Greetings were further divided into two classes of responses. Spontaneous greetings were defined as those emitted within 10 sec of the time a subject and a staff member first came within 5 ft of each other. Prompted greetings were defined as those emitted after a subject and a staff member had been within 5 ft of each other for over 10 sec and the staff member had given the subject a verbal and visual signal to emit some greeting.

Reliability checks were made for responses of Subject 1 by occasionally having an observer accompany the experimenter as he worked with the subject and also by audio tape-recording the verbal exchanges between Subject 1 and the experimenter and then having an observer later classify the subject's responses. In all instances, data collected by the experimenter and the observer agreed perfectly.

Behavioral Consequences

Two different classes of consequences of greetings were manipulated. Cigarettes were used during parts of the experiment. All three subjects had been observed to smoke and to buy sack tobacco and cigarettes at the ward store. Therefore, it was likely that cigarettes would have reinforcing properties. In addition, certain social interactions were controlled

during the experiment. These interactions included the experimenter patting a subject on the shoulder and saying, "Good!" or "Very good!" and then continuing to talk with the subject for several seconds.

Procedures

Experimentation was conducted daily. Each session consisted of a number of contacts between the experimenter and the subject. A contact was defined as the experimenter and subject standing or sitting within 5 ft of each other with the experimenter within the subject's field of vision. A contact could result from either the subjects' or experimenter's normal movements about the ward. At the convenience of the experimenters, contacts could result from the experimenters approaching the subjects for the purposes of this experiment. Each contact was maintained for approximately 30 sec. At least 10 min elapsed between all successive contacts included in this study. During the first nine and the last two conditions of the experiment, Subject 1 had 10 contacts per session while both Subject 2 and Subject 3 had six contacts per session. During the tenth condition, the generalizing procedures, all subjects had 10 contacts per session. If a subject initiated a contact less than 10 min after the last contact, or if normal ward procedures required more than the designated number of contacts per day, the experimenter responded to the subject in accordance with whatever experimental conditions were in effect at that time. However, the subjects' behaviors during such contacts are not included in the data for this experiment.

Experimental Conditions

Twelve different experimental conditions were scheduled. The changes in independent variables are specified below and the headings correspond to the condition specifications in Fig. 1 to allow for easy referencing between procedures and results.

Baseline. During the contacts under this condition, the experimenter, E_1 , simply stood by the subjects for 30 sec. If a subject walked away during a contact, the experimenter walked to remain near him until 30 sec had passed. This condition was maintained for 10 sessions for Subject 1 and for four sessions for Subject 2 and Subject 3.

Reinforcement and Prompt. During Sessions

11 and 12 for Subject 1, Sessions 5 to 8 for Subject 2, and Sessions 5 and 6 for Subject 3, four contingencies were in effect. If a subject emitted a spontaneous greeting during the first 10 sec of a contact, the experimenter immediately gave him a cigarette and provided the social consequences for the remainder of the 30 sec. If a subject did not emit a greeting during the first 10 sec, the experimenter then prompted him by holding a cigarette about 12 in. in front of the subject's face and saying: "Say 'Hello!'" or "Say 'Hi, Mr. _____!'" If a subject emitted a greeting in response to the prompt, the experimenter gave him the cigarette and provided the social interaction during the remainder of the contact. If a subject did not emit a prompted greeting, the experimenter simply waited until the contact time elapsed and then walked away.

Reinforcement and Fade Prompt. The consequences for responding in this condition were exactly like those of the previous condition. However, the form of the prompting was gradually changed over contacts and sessions. First, when the experimenter came into contact with a subject, he told him that he (E_1) would walk away for a few seconds (minutes) and that when he returned, he wanted the subject to tell him hello. When the experimenter returned, he gave the subject no further verbal prompts, but held out a cigarette as a visual prompt. If the subject responded to the visual prompt, the experimenter immediately gave him the cigarette and talked with him for the remainder of the 30 sec. The time between the first contact and the experimenter's return with visual prompting was progressively increased from a few seconds to about 10 min. Simultaneously, the experimenter began fading the cigarette through space. On successive contacts, the experimenter held the cigarette further away from the subject's face and closer to the experimenter's pocket until the cigarette was placed in the pocket. Then, the experimenter's hand was faded away from his pocket. This fading was accomplished during the seventh session for Subject 3 and the ninth session for Subject 2. Fading was much more gradual for Subject 1 and continued from Session 13 through Session 25.

Reinforcement. During this condition, the contingencies were identical to those in the two immediately preceding conditions except that no prompts were given. For each contact,

the experimenter remained near a subject for 30 sec. If a spontaneous greeting occurred, the experimenter immediately gave the subject a cigarette, a pat on the back, and talked with him for the remainder of the 30 sec. If the subject did not emit a spontaneous greeting, the experimenter remained by him until 30 sec had passed and then walked away. These contingencies were in effect for Subject 1, from Session 26 through Session 51, for Subject 2, during Sessions 10 through 16, and for Subject 3, during Sessions 8 through 13.

Reversal. During this condition, contingencies were altered to determine if the rates of responding were controlled by their consequences. A simple extinction reversal was employed for Subject 2. If Subject 2 emitted a spontaneous greeting, the experimenter conversed with him as before but did not give him a cigarette. If he did not respond, the experimenter stood by him for 30 sec and then walked away. A differential-reinforcement-for-other-behaviors (DRO) procedure was employed for Subject 1 and Subject 3. For both of these subjects, cigarette reinforcement and social reinforcement were given if spontaneous greetings failed to occur during the contacts. If either of these subjects emitted a greeting, the experimenter immediately walked away. No prompts were employed during any of the contacts. This condition was maintained during Sessions 52 to 55 for Subject 1, Session 17 for Subject 2, and Sessions 14 and 15 for Subject 3.

Reinforcement. This condition was exactly like the *Reinforcement* condition above. Cigarettes were given to a subject contingently on his emitting a spontaneous greeting and the experimenter talked with him for the remainder of the contact.

Lean Reinforcement. This condition was like the *Reinforcement* conditions above except for the schedule with which cigarettes were given contingently on responses. The experimenter still talked to a subject after he emitted a greeting but the schedule of cigarette reinforcement was made progressively leaner over sessions. Greeting responses by Subject 3 were initially reinforced on a variable-ratio 2 (VR 2) schedule starting at Session 32. On the average, every second response produced cigarette reinforcement. This schedule was leaned to VR 6 by Sessions 53 and 54. Responses by Subject 2 were reinforced on a VR 1.2 during

Session 50 and the schedule was leaned to a VR 12 by Sessions 73 through 76. Responses by Subject 1 were reinforced on a VR 1.25 starting at Session 61 and the schedule was leaned to a VR 20 by Sessions 79 and 80. The exact number of cigarette reinforcements per session for each subject is displayed in Fig. 1.

No Cigarette Reinforcement. During this condition, conversations between the experimenter and a subject still occurred contingently on spontaneous greetings during contacts, but no cigarettes were given to any of the subjects during this condition. These contingencies were in effect from Sessions 81 through 85 for Subject 1, 77 through 81 for Subject 2, and 55 through 59 for Subject 3.

Generalization to E_2 . Beginning with Sessions 86, 82, and 60 for Subject 1, 2, and 3, respectively, a second experimenter, E_2 , began working with each patient. Contingencies identical to those employed during the *No Cigarette Reinforcement* conditions were employed. If a subject emitted a spontaneous greeting during a contact, E_2 immediately responded to him and continued to talk to him for the remainder of the contact. However, no cigarettes were given to subjects during any of the contacts. This condition was maintained during five consecutive sessions for each of the subjects.

Generalizing Procedures, E_{3-7} . Five new experimenters were introduced during this condition. Each experimenter made two contacts each session with each of the subjects so that each subject was involved in 10 contacts per session. Each subject was given seven sessions under these conditions. Contingencies were progressively changed during this condition to replicate in condensed form the *Reinforcement and Prompt*, *Reinforcement and Fade Prompt*, and *Lean Reinforcement* conditions above. During the first sessions, each experimenter employed the verbal prompts and held cigarettes before the subjects' faces whenever spontaneous greetings failed to occur. In addition, cigarettes were presented and conversations occurred contingently on the occurrence of all greeting responses. Over subsequent sessions, the verbal prompts were faded through increasing periods of time and the cigarette prompts were faded through space to the experimenters' pockets; then, the experimenters' hands were faded through space away from their pockets. Starting with the

fourth session under this condition for Subject 2 and 3, and the fifth session for Subject 1, the experimenters began progressively to lean the schedules of cigarette reinforcement for greeting responses. These schedules were leaned rapidly so that during the seventh session, Subject 1 received two cigarettes for 10 responses, Subject 2 received three cigarettes for 10 responses, and Subject 3 received only one cigarette for 10 responses. Throughout this condition, greeting responses of all subjects were followed by a brief period of social interaction with the experimenter. Again, this consisted of the experimenters patting the subjects on the back, talking to them, *etc.* These generalizing procedures were in effect for Subject 1 from Session 91 through 97, for Subject 2 from Session 87 through 93, and for Subject 3 from Session 65 through 71.

Generalization to E_2 . During Sessions 98 to 103 for Subject 1, Sessions 94 to 99 for Subject 2, and Sessions 72 to 77 for Subject 3, Experimenter 2 again worked with each patient exactly as he had done during the *Generalization to E_2* condition above. Social interactions occurred for spontaneous greeting responses, but no cigarettes were given to the subjects for any of these responses. No prompts were employed.

Durability Checks, E_1 and E_2 . Approximately three months after the last sessions on the second tests for generalization to E_2 , both E_1 and E_2 conducted two sessions each with all of the subjects to determine the durability of the previously produced changes in responding. Contingencies during these contacts were identical to those employed during the previous *No Cigarette Reinforcement* conditions. Neither experimenter presented prompts or cigarettes, but both engaged in conversations with the subjects contingently on spontaneous greetings. The time between the last sessions on the generalization tests and the first session on the checks for durability of responding were 84 days for Subject 1, 82 days for Subject 2, and 91 days for Subject 3.

RESULTS

Results for all three subjects and the number of cigarette reinforcements presented per session during the *Lean Reinforcement* condition are presented in Fig. 1.

During baseline conditions none of the

subjects emitted greeting responses. When the verbal and visual prompts and the contingent cigarette and social interactions were begun, all three subjects began emitting prompted greeting responses. By the last sessions under this condition, all subjects emitted prompted greetings on 100% of the contacts. In addition, Subject 1 emitted spontaneous greeting responses during 30% of the contacts in Session 11. However, his rate of spontaneous greetings decreased to zero in Session 12 and neither Subject 2 nor 3 emitted any spontaneous responses during the sessions of this condition.

When cigarette and social interactions continued to occur contingently, but the verbal and visual prompts were faded (Session 7 for Subject 3, Session 9 for Subject 2, and Sessions 13 to 25 for Subject 1), the percentage of spontaneous greetings increased for all three subjects. Concomitantly, the percentages of prompted greeting responses decreased. The sum of the percentage of prompted responses and the percentage of spontaneous responses per session for any one subject could take on values less than or equal to 100.

When the prompts were discontinued, but E_1 continued to deliver both cigarettes and social interactions contingently on spontaneous greetings (the *Reinforcement* condition), the rate of spontaneous greetings quickly approximated 100% for all subjects and remained at that level for the remainder of that condition.

During the *Reversal* condition (Sessions 52 to 55 for Subject 1, Session 11 for Subject 2, and Sessions 14 to 15 for Subject 3), no subjects received cigarette reinforcement contingently on the occurrence of greetings. Moreover, both cigarettes and social interactions occurred as consequences of responses other than greetings for Subject 1 and 3. During these sessions, the percentage of contacts on which spontaneous greetings occurred rapidly decreased for all three subjects. However, when cigarettes were again presented contingently on spontaneous greeting responses during the second *Reinforcement* condition, the relative response rates of all subjects again increased to 100%. This increase in rate was gradual and orderly for Subject 1, erratic for Subject 2, and immediate for Subject 3.

As the schedule of cigarette reinforcement was progressively leaned (Sessions 61 to 80 for Subject 1, 50 to 76 for Subject 2, and 32 to 54

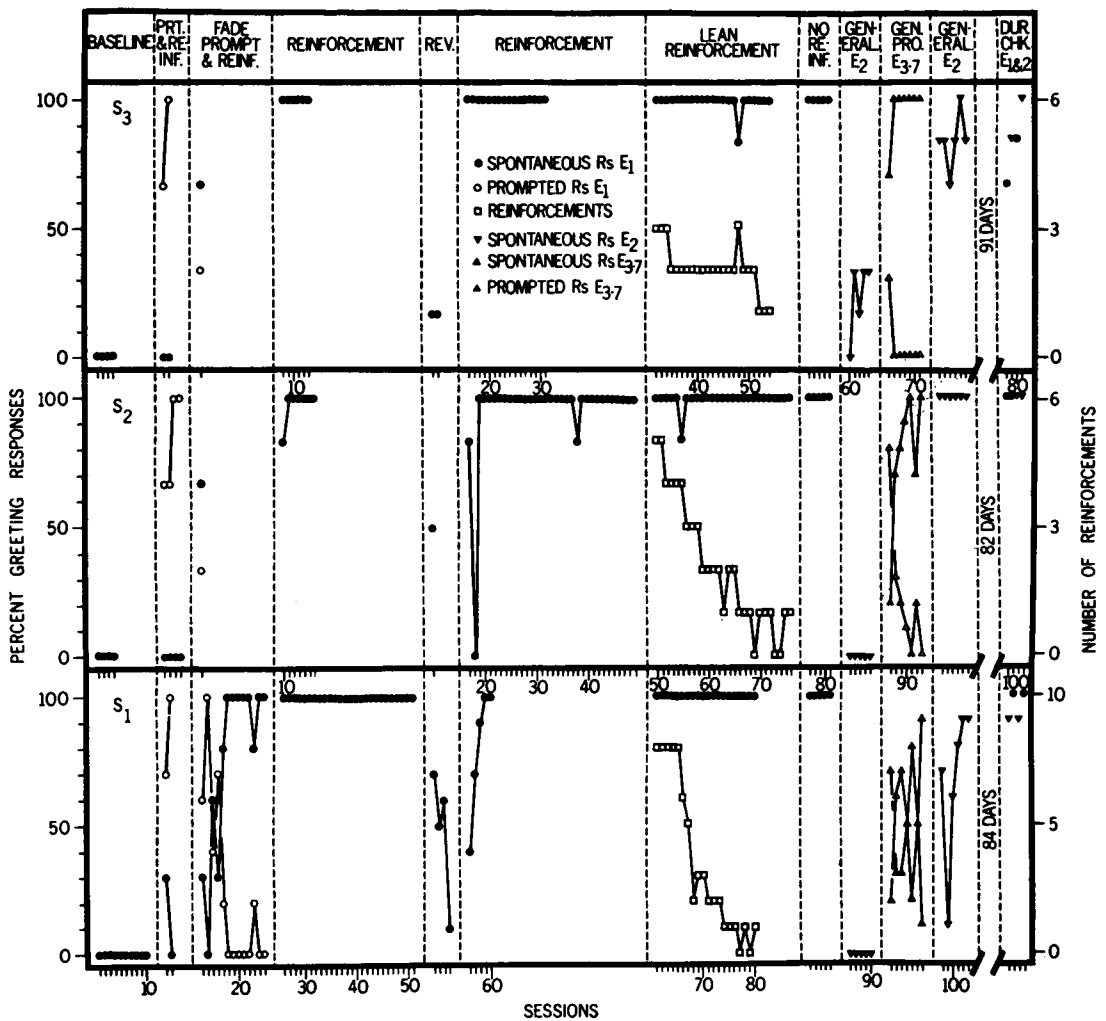


Fig. 1. The percentage of spontaneous and prompted greeting responses emitted by the subjects during each session of the experimental conditions. Legends across the top, BASELINE—DURABILITY CHECK, E_1 & E_2 refer to the experimental conditions in effect for the indicated sessions. The right-hand ordinate is scaled for the number of cigarette reinforcements presented during the LEAN REINFORCEMENT condition.

for Subject 3), there were no general decreases in the rates of spontaneous greeting responses. During Session 55, Subject 2 emitted spontaneous greetings on only five of the six contacts. However, his rate recovered in Session 56 even though the schedule of cigarette reinforcement was leaned even more during this session. A similar anomalous decrease in rate was recorded for Subject 3 in Session 48.

Following the progressive leaning of the schedule of cigarette reinforcement, the *No Cigarette Reinforcement* conditions were established for five sessions for all subjects. Social interactions still occurred contingently on spontaneous greeting. Contrary to the re-

sults obtained during the *Reversal* condition, the relative rate of spontaneous greeting responses remained at 100% for all subjects.

The first *Generalization to E_2* condition was designed to determine the extent to which the high rates of spontaneous greetings occurring to E_1 generalized to a second staff member, E_2 . This condition was begun in Session 86 for Subject 1, Session 82 for Subject 2, and Session 60 for Subject 3, and was continued for five sessions for each subject. Neither Subject 1 nor 2 emitted any spontaneous greetings during this condition. Although Subject 3 emitted no spontaneous greetings during the first session, his relative rate subsequently

increased and apparently stabilized at about 33% by the last sessions in this condition.

During the seven sessions in the conditions designed to produce generalization, all subjects quickly exhibited non-zero rates of spontaneous greeting responses. Moreover, these rates increased regularly over successive sessions so that both Subject 2 and 3 were responding during all or nearly all of the contacts by the end of this condition. The rate for Subject 1 was more variable and had not increased beyond 90% by the seventh session. The percentages of prompted greeting responses decreased as complements of the percentages of spontaneous responses.

When E_2 again began contacting the subjects to test for generalization of the previously produced changes in response rates, all three subjects exhibited much higher percentages of spontaneous greeting responses than they had in the first test. Under this second *Generalization to E_2* condition, Subject 2 emitted spontaneous greetings during every contact of all six sessions. This compared to no greetings over five sessions during the first test. The comparative increase in rate from test 1 to test 2 was not as great for Subject 1. However, the rate eventually increased to 90% by Sessions 102 and 103. Effectively, the rate for Subject 3 stabilized near 83%. Although the data indicate failures to emit spontaneous responses during one contact in both Session 75 and 77, desirable behaviors occurred during both of these contacts. In fact, Subject 3, instead of saying, "Hi!" or "Hello, _____!", began talking immediately about relevant events. For example, when he and E_2 came near each other, he began talking about his workshop activities or about everyday happenings on the hall without first emitting a greeting. On such occasions, E_2 engaged him in appropriate conversations similar to the generally employed social interaction procedures because these verbal behaviors were therapeutically desirable. Nevertheless, these verbal responses were not counted as greeting responses because they did not correspond to the original response definition.

During the sessions in which durability checks were made, the percentages of spontaneous greetings to both E_1 and E_2 were within appropriately high ranges for all subjects. Again, on all four contacts during which Subject 3 failed to emit greetings he instead

began talking spontaneously about relevant events.

DISCUSSION

The behavioral consequences clearly controlled the social responses of all subjects. The rapid decreases in responding during the reversal and the equally rapid increases in rates when cigarette reinforcement was reinstated (the second *Reinforcement* condition) are evidence that the greetings were operant responses and that the cigarettes were positive reinforcers. All of these changes in responding occurred while the antecedent conditions, the presence of the experimenter, remained constant.

Although cigarettes were efficient reinforcers for these patients' social behaviors, there are probably many limitations to this effect. For example, the behaviors of patients who do not smoke probably would not be affected by cigarettes. If patients lived in hospital areas where cigarettes were in plentiful supply, or if cigarettes were available independently of work or behavioral improvements, the utility of cigarettes would probably be seriously reduced. There are probably even more serious limitations on generalizing the technology to non-institutional settings. The therapist who would use these techniques for similar problems, should not treat the technology as rigidly tied to specific reinforcers. Rather, he should allow his subject's behavior to select the most effective reinforcer at his disposal.

Similarly, the prompting technique apparently produced the desired initial increase in responding. However, the verbal instructions and the held cigarette should not be considered the only possible prompts. Therapists should use whatever prompts that produce the desired behaviors. If no effective prompts can be found for a particular patient, shaping and/or chaining techniques, such as those employed by Sherman (1965), can be used to develop initial rates of responding.

Prompts for social responses probably should not be employed for long periods of time. A greeting occasioned by a waved cigarette is not a normal response and the behavior must be eventually occasioned by the presence of a second person. If responses to the cigarette are frequently reinforced for a long time, while greetings in the presence of other people

are not reinforced, there is a danger that responding will become discriminated to the presence of the cigarette (Terrace, 1966). The present experiment did not provide evidence that prompts had to be faded rather than abruptly discontinued once the desired behavior occurred at a reasonable rate. However, fading is a particularly reliable technique for transferring control from one stimulus to another (Terrace, 1966) and transfer from the prompts to the presence of the experimenter clearly occurred during these procedures.

The general purpose of leaning the schedule of reinforcement is to maintain a desired behavior while gradually eliminating an artificial maintaining reinforcer (Hopkins, 1968). Before schedule leaning, the response rate of Subject 2 decreased radically when the cigarette reinforcement was discontinued (during the *Reversal* condition). However, the response continued to occur at a high rate in the absence of cigarette reinforcement after the schedule of cigarette reinforcement had been gradually leaned. At this point the behavior was possibly maintained by the social interaction which occurred as a consequence of greetings.

Generalization of therapeutic changes from a therapist to other persons would also appear to be an empirical and pragmatic question. Some attempts at behavior modification with some subjects may obtain generalization without relying on specific techniques to produce generalization. If, however, generalization fails to occur, procedures such as were employed in this experiment are appropriate. Generalization of appropriate greeting responses not only occurred to the second experimenter, but they were made to occur without his having to employ any modification techniques.

Although this experiment required considerable elapsed time (107 days for Subject 1), the therapeutic procedure was not particularly time-consuming or expensive. The 107 sessions devoted to Subject 1 required only about 18 hr from all experimenters. Supply costs for Subject 1 totaled about \$5.40 for cigarettes. These time and cost estimates would be even

more modest if a behavior change program included only the conditions leading to therapeutic goals and eliminated conditions related to the experimental analyses.

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