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Smoking reduction via covert sensitization plus normal smoking, rapid smoking or cigar-cigarette pairing

Martine M. Bussat

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SMOKING REDUCTION VIA COVERT SENSITIZATION
PLUS NORMAL SMOKING, RAPID SMOKING,
OR CIGAR-CIGARETTE PAIRING

A Thesis
Presented to the
Faculty of
California State College
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Psychology

by
Martine M. Bussat
April 1978
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Approved by:

Chairman

4/5/78
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ABSTRACT

This study was designed to compare the medical risks and relative effects on smoking reduction of three combined treatments. The treatment included a 5-week phase of stimulus control through a fixed-interval timer procedure without smoking reduction, followed by a 5-day phase of covert sensitization plus rapid smoking, cigar-cigarette pairing, or normal smoking. Ten subjects were assigned to each group. The results indicated that the mean smoking frequency of the combined groups declined by 28% at the end of the timer period, and that smoking rates continued to decrease over the covert sensitization phase for all three groups. Contrary to prediction, the cigar-pairing group did not maintain a significant reduction at 3-month follow-up, whereas the rapid and normal smoking groups did. However, statistical analyses failed to show any significant difference between the groups at any assessment period. Finally, the cigar-pairing technique did not appear to present greater medical hazards than normal smoking, but rapid smoking provoked abnormal decreases in arterial oxygen tension during hyperventilation, as well as significant increases in carboxyhemoglobin levels. Since rapid smoking and normal smoking with covert sensitization
produced similarly encouraging results (50% abstinent subjects in each group at 3-month follow-up), further investigation of these treatment components was recommended.
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INTRODUCTION

Despite an increased awareness of the hazards of cigarette smoking, a full quarter of the American public continues to smoke about 75 million packs a day. Cigarette use increased by 2 to 3% annually between 1970 and 1974, and it is now thought that up to 5,000 adolescents pick up the smoking habit everyday (Schultz, 1977). About 50% of habitual smokers, however, wish to give up smoking (Row, 1976) but only a million people a year succeed in stopping smoking on their own (Premack, 1971). The success rate for people who quit by themselves would therefore approximate 4% annually.

The overwhelming evidence of the major physical hazards associated with cigarette smoking as well as the desire to help unwilling smokers have triggered a large amount of behavioral research on smoking. While the main focus of these studies has been to better understand and treat the smoking habit (U.S. Department of Health, Education, and Welfare, 1964), workers in behavior modification have found an added interest in the fact that cigarette smoking constitutes an appropriate target behavior for outcome research in psychotherapy (Keutzer, Lichtenstein, & Mees, 1968).

There are many views on the causes of smoking. As
far as the nature of the phenomenon is concerned, smoking is generally considered to be a psychological habituation and not a physiological addiction (Bernstein, 1970; Keutzer, Lichtenstein, & Mees, 1968; U.S. Department of Health, Education, and Welfare, 1964). The pleasure derived from smoking may be partly related to physiological effects, but since these seem to vary greatly from one person to another, and quitting is not systematically associated with intense withdrawal symptoms, the physiological aspects of smoking are probably not as critical as the environmental contingencies which maintain the habit (Shapiro, Tursky, Schwartz, & Shnidman, 1971).

A Behavioral Analysis of Cigarette Smoking

A behavioral analysis of cigarette smoking reveals three main reasons which make the habit very difficult to give up. First, after initial smoking experiences, which are in many instances physiologically aversive but socially reinforced, the individual develops tolerance for the smoke. At first smoking is voluntarily associated with a few specific social situations; with repetition it soon becomes automatic and unconsciously linked with a number of environmental events (such as drinking, watching television, answering the telephone, etc.), which seem specific and unique for each person. These events start acting as cues for the smoking response; the act of lighting up a cigarette is only the
last, observable event of a chain of normally unconscious events which have been triggered by a cue. Every time the individual smokes in response to a cue, the soliciting power of the stimulus increases; over time, it becomes more and more difficult to resist the urge when the cue occurs. One major problem in the modification of smoking behavior arises because the ordinary cues are part of so many activities that they cannot be removed from the environment and the smoker is continually exposed to them (Shapiro et al., 1971).

Secondly, as it has already been noted, smoking fits a habituation model. Not only does smoking become automatic, but it is overlearned to such an extent (up to 146,000 puffs a year for the one-pack-a-day smoker) that, even after extinction, spontaneous recovery is likely to occur (Logan, 1973).

Finally, the contingencies involved in the smoking habit are such that the gratifying consequences (taste, anxiety reduction, etc.) accrue immediately while the aversive consequences (health risks, reduced life span, etc.) are considerably delayed (Ferraro, 1973). This pattern of reinforcement inhibits the motivation to quit, and many smokers further develop the "I can't quit" syndrome to reduce cognitive dissonance arising from the conflict between wanting to smoke and wanting to avoid physical harm caused by smoking (Clark, 1974). Weber, Mallue, and Conner (1975) have explained that smoking is a good example of a
social trap in that subjects consistently trade off future costs for present benefits.

Many attempts have been made to apply behavior modification methods to the control of habitual smoking. Several critical reviews of the literature on the modification of smoking behavior have revealed that the various treatments have consistently helped people temporarily reduce cigarette consumption and even achieve abstinence on the short term, but that prolonged abstinence is much more difficult to maintain (Bernstein, 1969; Keutzer et al., 1968; Lichtenstein & Keutzer, 1971; Row, 1976; Schwartz, 1969).

Hunt and Matarazzo (1973) noted that up to two thirds of presumably motivated subjects who quit smoking relapse within three months and only one fourth remain abstinent for over a year. More recently, Lichtenstein (Note 1) reported abstinence rates of 36% after 2 to 6 years. Considering the tremendous amount of overlearning involved in the habit, Hunt and Matarazzo (1973) suggested that treatment techniques be intensified along four lines: (1) providing stimulus conditions that generalize easily outside the laboratory; (2) combining several techniques; (3) extending the length of treatment and paying attention to the maintenance of behavior during the follow-up period; and (4) designing the treatment to take individual needs into account.

Drawing on the above mentioned observations and
recommendations, this study was based on the following rationale: a prolonged, multidimensional treatment aimed at both modifying smoking cues and changing the reinforcement value of smoking constitutes a promising approach to the achievement and maintenance of smoking abstinence. The behavior modification approaches theoretically suitable for inclusion in this type of intensified treatment include aversion conditioning (overt and covert) as well as environmental or stimulus control. These approaches, together with selected smoking studies using them, are reviewed in the following discussion.

Behavior Modification of Cigarette Smoking: A Selective Review

Since aversion conditioning is aimed specifically at behaviors which are socially undesirable, or undesirable in the patient's long-term interest, but which he finds reinforcing at least in part (Eysenck & Beech, 1971), aversive control has been one of the most frequently used behavioral techniques in helping cigarette smokers give up their habit. Aversion therapy in this case consists of making the presentation of some aversive stimulus (punishment), either internal or external, contingent upon the smoking of cigarettes, the rationale being that if smoking is associated with unpleasant consequences the reinforcing value of cigarette smoke will be reduced. The variety of noxious stimuli which have been employed include apomorphine,
electric shock, hot smoky air, cigar smoke, and rapid or chain smoking.

**Electric Shock**

Only one study has reported the use of chemical aversion (Raymond, 1964), but a number of researchers have used electric shock as an aversive stimulus. The outcome of these studies clearly indicates that aversive shock treatment brings about significant, short-term decreases in cigarette consumption as compared with no-treatment controls (Ober, 1968; Russel, Armstrong, & Patel, 1976). The results, however, did not differ significantly from those produced by other techniques such as: aversive breath-holding (Mees, Note 2); operant self-control (Ober, 1968); systematic desensitization (Koenig & Masters, 1965); supportive counseling (ibid); placebo subliminal shock (Mees, Note 2); and placebo attention (Russel et al., 1976; Beavers, Note 3).

Further, while there may have been a definite treatment effect observable at termination, these studies were either non-controlled (McGuire & Vallance, 1964), or there was total, immediate relapse as soon as treatment was discontinued (Powell & Azrin, 1968), or the follow-up reports showed significant relapse rates, indicating a rapid dissolution of treatment effect over time (Koenig & Masters, 1965; Mees, Note 2; Beavers, Note 3). In addition, one study resulted in conditioned avoidance responses to the treatment.
(Powell & Azrin, 1968), and another reported the conditioning of therapeutically irrelevant motor responses (Russell et al., 1976).

Even though aversive shock treatment could conceivably meet some of the requirements for an intensified treatment as described by Hunt and Matarazzo (1973), the technique seems deficient as far as their first suggestion (of being an effective stimulus condition) is concerned. While the use of electric shock offers some laboratory convenience and allows for close temporal control, this type of aversive stimulus presents a definite lack of cross-modality matching with the target behavior of smoking (Wilson & Davison, 1969) and offers little generalization potential outside the laboratory. Correlation of MMPI data and treatment outcome has further suggested that anxious subjects do not respond as well to aversive shock treatment as they do to stimulus satiation or placebo attention (Beavers, Note 3).

**Hot Smoky Air**

To avoid some of the disadvantages of electric shock, and neutralize the pleasant taste of cigarette smoke without increasing anxiety, Wilde (1964) used a ventilator to blow hot smoky air (aversive stimulus) in the face of the subjects as soon as they lit a cigarette. When the subjects had reached their tolerance limit, they were instructed to put out their cigarettes and say, "I want to give cigarettes up."
The blower then delivered fresh mentholated air (positive reinforcement) and the subjects were encouraged to eat a mint as substitute behavior. Four out of seven subjects became abstinent and one greatly improved after one or two sessions. At follow up, however, all five treated smokers had returned to their baseline smoking rate.

Franks, Fried, and Ashem (1966) improved Wilde's apparatus to reduce the delays in presentation of the aversive and positively reinforcing stimuli, and to provide a visual cue to facilitate discrimination between the aversive and reinforcing stimuli. Out of 23 subjects, 14 were lost to attrition. After six months, four of the nine subjects who completed treatment were abstinent, one smoked less, one smoked a pipe, and two had relapsed to their baseline rate.

Lublin and Joslin (Note 4) employed an apparatus and protocol similar to Wilde's. Twenty-one out of 78 subjects dropped out during treatment. At one-year follow-up, 40% of the subjects who completed more than 3 conditioning sessions were abstinent.

Grimaldi and Lichtenstin (1969) improved on the previous studies by including backward-conditioning and no-punishment control procedures. Reductions in smoking rates for all groups were equivalent, and it was concluded that contingent hot smoky air was thus not the critical factor in this smoking reduction study.
Schmahl, Lichtenstein, and Harris (1972) sought to replicate the work of Lublin and Joslin (Note 4) under more controlled conditions. Twenty-eight smokers received either warm smoky air or warm mentholated air and were required to smoke until they had satiated. All the subjects were abstinent at termination after an average of eight sessions (abstinence was required for termination) and 64% remained abstinent at six-month follow-up. There was no difference between the smoke- and menthol-air groups but, since all the subjects were also required to smoke rapidly, the resultant cumulative revulsion may have been the significant aversive factor.

The overall outcome of these studies on hot smoky air technique, which seems encouraging at first glance, becomes ambiguous under scrutiny. Abstinence or significant decrease was obtained rapidly but the initial results were marred or rendered uninterpretable by a variety of factors such as a high relapse rate (Grimaldi & Lichtenstein, 1969; Wilde, 1965), no control groups (Franks et al., 1966; Lublin & Joslin, 1968; Wilde, 1964), problems with low motivation and attrition (Franks et al., 1966; Wilde, 1964), and the confounding of rapid-smoking with hot smoky-air treatment (Grimaldi & Lichtenstein, 1969; Schmahl et al., 1972).

On the other hand, hot smoky air as an aversive stimulus (UCS) in the modification of smoking presents the advantage of closely resembling the pleasant stimulus of
cigarette smoke (CS). Thus it can help reduce discrimination problems in conditioning aversion while still allowing for control of timing. In support of this approach, a developing body of conditioning research has stressed the importance of stimulus relevance or meaningfulness, i.e., the mutual relationship between cues and consequences (Capretta, 1961; Garcia, 1968; Rozin & Kalat, 1971; Wilson & Davison, 1969).

As far as Hunt's and Matarazzo's (1973) recommendations on reinforced treatment are concerned, the most valuable aspects of the above mentioned studies on hot smoky air include: the increased meaningfulness of the UCS, as well as the combination of techniques (warm smoky air and satiation), extension of treatment until complete abstinence and frequent contacts during follow-up (Schmahl et al., 1972). Since warm smoky air used by itself has not led to impressive outcomes but has yielded good results when used in combination with satiation techniques, the differential effectiveness of satiation techniques used singly in the treatment of habitual smoking remains to be established.

**Negative Massed Practice**

Negative massed practice involves a process of stimulus satiation in which the subjects are repeatedly required to increase either their smoking rates (chain smoking or excessive smoking) or their inhalation rates (rapid smoking)
until they cannot tolerate it any longer. The effectiveness of these techniques has been tested in a number of studies.

In a complex study involving 213 subjects, Keutzer (1968) contrasted the following treatments: (1) negative massed practice with the smoker inhaling every 12 seconds; (2) covariant control, a specialized form of covert, operant conditioning developed by Homme (1965); (3) breath holding, a type of fantasy control through aversive conditioning; (4) a placebo drug treatment; and (5) a non-treated control condition. The treated groups were significantly more successful than the non-treated control group, but the negative-massed-practice group obtained the smallest reduction. A follow-up report by Lichtenstein and Keutzer (1969) disclosed that after six months the treated and non-treated groups had become barely distinguishable.

Resnick (1968) hypothesized that a conditioned revulsion of cigarettes would be learned if smokers chain-smoked a second cigarette after each one they had smoked voluntarily. The subjects were instructed to at least double their smoking rates for one week before abruptly quitting smoking. After four months, 63% (25 out of 40) of the treated group were still abstinent compared to 20% (4 out of 20) of the control group. Clairborn, Lewis, and Humble (1972) pointed out, however, that Resnick's data were confounded since the treated group received a convincing rationale and thus expected to reduce their smoking while the non-treated group
did not. Marston and McFall (1971) further criticized Resnick for having failed to check whether the subjects actually carried out his instructions.

In a study carefully designed to avoid the previous methodological flaws, Marston and McFall (1971) compared stimulus satiation, in which subjects tripled their smoking rate before going "cold turkey," with hierarchical reduction, cold-turkey quitting, and a placebo drug condition. All subjects participated in intensive group therapy, a factor which precluded analysis of the effects of saturation alone. All four groups reduced their levels of smoking significantly during the course of the study, but there was no difference among the groups; and a six-month follow-up revealed that they almost uniformly returned to their pre-treatment smoking rates.

Beavers (Note 3) compared a stimulus satiation program involving inhalation at six-second intervals, with two electric-shock conditions and a placebo-attention group. The smoking rates for all groups decreased significantly by the end of treatment, but this reduction disappeared at two-month follow-up. Beavers noted that the control group's success pointed to the importance of therapist influence as a factor in smoking withdrawal. The results also indicated that high scorers on the Welsh A (anxiety proneness) scale of the MMPI did not reach abstinence or even 50% of baseline in the electric shock groups but were able to do
so in the rapid-smoking and attention-placebo groups. Thus, Beavers concluded that treatment effectiveness might be increased by tailoring the type of treatment to the type of person.

Best and Steffy (1975) came to a similar conclusion in a study aiming at the development of treatment of choice for internal and external locus of control clients. They found that internal subjects who had received satiation treatment improved more than internal subjects not receiving satiation. External clients fared better under no-satiation conditions.

Lando (1975) contrasted rapid smoking with excessive smoking, and control conditions. The treated groups did significantly better than the control groups, but at 12-month follow-up the treatment effect had disappeared and all groups showed considerable relapse independent of condition. Two valuable points in this study are that the prescribed smoking was carried out both in and out of the laboratory, and that the reliability of self-reports was checked by breath tests measuring carbon monoxide concentration in the blood stream.

The results of the various studies on negative massed practice lead us to conclude that this technique has been more effective than no treatment in the modification of smoking (Keutzer, 1968; Lando, 1975; Marston & McFall, 1971; Beavers, Note 3) but it has not proved more effective
than covariant control, breath-holding, electric shock, hierarchical reduction, "cold-turkey" quitting, or placebo drug conditions (Keutzer, 1968; Marston & McFall, 1971; Beavers, Note 3). Even when a certain measure of success was achieved initially, relapse occurred rapidly (Best & Steffy, 1975; Keutzer, 1968; Lando, 1975; Marston & McFall, 1971; Beavers, Note 3). The three studies which reported good maintenance of treatment effects at follow-up were either confounded (Resnick, 1969) or uncontrolled (Dawley, 1975; Dawley & Aurich, 1975).

The conclusion was previously reached that hot smoky air as a method of modifying smoking behavior was effective only when combined with a satiation method. Similarly, satiation techniques do not seem to produce lasting results when used singly but are effective when used with other methods. These findings are congruent with suggestions by Hunt and Matarazzo (1973) stressing the need for combined techniques. In terms of their other recommendations, satiation techniques meet the requirement of providing a meaningful aversive stimulus which lends to generalization outside the laboratory. These techniques also present the advantage of not requiring any special apparatus; subjects can reinstate the treatment conditions on their own, whenever they feel a need for booster sessions.

Since rapid smoking, even when combined with another aversive method, appears to only bring about short-term
abstinence, recent work has focused on extending the effectiveness of the procedure (Lichtenstein, Note 1). Several studies, which combined a variety of maintenance strategies such as coping skills, social support, or cognitive procedures, found that these maintenance strategies have not produced any long-lasting incremental effects (Kopel, 1975; Penner & Lichtenstein, 1975; Danahe, Note 5; Glasgow, Note 6).

Though satiation techniques may lead to increased success rates when used in combination with hot smoky air, it is unclear at this time whether these techniques can be used safely with all kinds of smokers. Hauser (1974) emphasized that rapid smoking may be a risky procedure, especially with patients suffering from cardiovascular disease. Dawley and Dillenkoffer (1975) recommend screening out people with the following characteristics: obesity, poor physical health, over 40 years old, chest pain associated with physical exertion or emotional stress. Doyle (1974) has noted that:

In non-smokers as well as smokers, cigarette smoke and nicotine cause small but consistent increases in heart rate, in systolic, diastolic, and pulse pressures, in cardiac output, and in stroke volume. (p. 1563)

However, when Danahe, Lichtenstein, and Sullivan (1976) compared rapid smoking with normal smoking and a rapid-breathing control, they found that no subject exceeded estimated danger levels of blood carboxyhemoglobin or heart
rate increases. Danaher et al. concluded that rapid smoking is not unduly dangerous for healthy young adults but they still recommend a screening procedure.

Dawley, Ellithorpe, and Tretola (1976), Lichtenstein (1974), Hynd, Severson, and O'Neal (Note 7), as well as Shewchuck and Ruf (Note 8), also agreed that cardiovascular stress is present but minimal and that, as long as subjects are adequately screened, rapid smoking poses no serious risk. Their opinion receives support from the fact 35,000 people may have already been exposed to rapid smoking (Lichtenstein & Glasgow, 1977) without reported accident.

More recently, however, a study of the physiological effects of rapid smoking on healthy male smokers, aged 25-41, by Hall, Sachs, and Hall (Note 9), found that potentially serious clinical processes, such as hyperventilation and/or hypoxia, were activated. They recommended that, if rapid-smoking treatment is to be conducted, the subjects be examined by their personal physician and carefully screened on measures such as 12-lead EKG, arterial blood gasses and pulmonary function tests. They believe that "therapists should be conservative in their application of this treatment until data have been collected on its effects with persons having cardiopulmonary disease" (p. 1).

Miller, Schilling, Logan, and Johnson (1977) also found that rapid smoking may induce myocardial hypoxia in subjects with impaired coronary circulation, but they think
that the rapid-smoking technique may be used safely if adequate precautions are taken.

Horan, Hackett, Nicholas, Linberg, Stone, and Lukaski (1977) added fuel to the controversy concerning the safety of rapid smoking. After monitoring six rapid-smoking subjects, they reported higher heart rates, blood pressure, and carboxyhemoglobin levels than found in the previously mentioned studies. Cardiac arrhythmias also occurred in several subjects. In a subsequent article, Horan, Linberg, and Hackett (1977) strongly suggested that: (1) the symptoms reported by subjects after rapid smoking (dizziness, nausea, vomiting) are actually those of nicotine poisoning; (2) data on the amount of nicotine absorbed during rapid smoking must be gathered rapidly so that it can be limited to safe levels; and (3) nicotine poisoning is in fact the aversive stimulus, and the degree of nicotine poisoning is predictive of treatment success. Finally Horan, Linberg, and Hackett (1977) caution that their work needs to be replicated and extended.

Cigar Pairing

The cigar-pairing technique is based on aversive fading. Fading is a technique in which the stimulus conditions which control a response are modified gradually so that the behavior is brought under the control of a different discriminative stimulus (Moore & Goldiamond, 1964; Terrace, 1963).
The new stimulus may be related to, or totally different from, the former stimulus but it has generally been a positive reinforcer, and fading has been conceptualized as a technique for strengthening behavior (Sherman & Baer, 1969).

In a complex N = 1 study, Kantorowitz (Note 10) has applied a modified version of fading to the treatment of habitual smoking by gradually bringing cigarette smoking under the control of an aversive stimulus, thereby extinguishing the behavior. In combination with this aversive fading technique, cigar smoke was used as a new kind of noxious stimulus.

The subject in this case was taught to divide her total lung inhalation into 10 short equal successive breaths. Treatment proceeded as follows: the client was instructed to take one breath of the cigarette and nine breaths of a distasteful cigar, and to hold this inhaled mixture up to 10 seconds while observing any unpleasant internal sensations. After exhaling, the subject took in a breath of fresh air and again paid attention to the sensations aroused. The trials were given until cigarette smoke was rated as being almost as distasteful as cigar smoke alone. The procedure was repeated every second day. On each new session the number of cigarette and cigar inhalations were respectively increased and decreased by one. Cigarette consumption diminished progressively. The subject reached abstinence two weeks after the end of
treatment, and she remained abstinent at a 10-month follow-up.

Since many cigarette smokers consider cigar smoke as only moderately aversive, the technique cannot be applied to all. In the cases where it is noxious, however, cigar smoke has many advantages as an aversive stimulus in the treatment of habitual smoking. Not only does it closely match cigarette smoke in conditioning modality but, in contrast to hot smoky air, also involves a similar chain of motor responses. Cigar smoke requires no special apparatus and can easily be used by the client for booster sessions. Timing is easily controlled and the technique is very inexpensive. The effectiveness and possible medical ramifications of cigar pairing remain to be tested with further research on larger samples.

**Covert Sensitization**

As is clear from the previous review, the use of noxious stimuli in aversive therapy raises many problems. Behavior modifiers have focused on developing acceptable alternatives. Homme (1965) suggested that covert stimuli could eventually control behavior in a manner similar to overt stimuli. Bandura (1969) has argued that the efficacy of aversive conditioning is due to the clients' cognitive reinstatement of the aversive experience when they are tempted to transgress.

The value of placing the emphasis on covert behavior
in smoking reduction is receiving increasing recognition. Steffy, Meichenbaum, and Best (1971) found that shock contingent on covertly verbalizing the behaviors of smoking led to significantly less relapse than when it was made contingent on overt verbalization. Berecz (1972) further observed that, for moderate smokers, shock contingent on actual or imagined smoking resulted in equal decreases; for heavy smokers, however, shock paired with imagined smoking was more effective. Berecz (1974) reiterated that, in view of the importance of the cognitive factors involved in smoking, aversive conditioning should focus on endogenous cues.

The technique of covert sensitization or aversive imagery (Cautela, 1967; 1970) is a form of aversion therapy in which patients are first trained to relax and then instructed to pair the target behavior and the aversive stimuli in imagination. Smokers, for example, are asked to visualize the chain of events involved in smoking and, as the cigarette reaches their lips, to imagine becoming nauseous and finally vomiting. With training, the response to be controlled (i.e., smoking) is prevented from occurring by being preceded with the controlling response (i.e., imagining the nausea scene).

The findings with respect to covert sensitization are mixed. Sachs, Bean, and Morrow (1970) compared covert sensitization, self-control, and attention placebo. At the end of treatment, and at one-month follow-up, the covert
sensitization groups showed the largest decrease in smoking and the most abstinent subjects; it also, however, had the highest rate of attrition, and the difference with the self-control group was not substantial.

Wagner and Bragg (1970) concluded that systematic desensitization combined with covert sensitization was more effective than either technique alone. A series of other studies (Fuhrer, 1971; Lawson & May, 1970; McCallum, 1971; Sipich, Russel, & Tobias, 1974; Weiss, 1974; Wisocki & Rooney, 1974) found that covert sensitization was not more effective than other treatments, or that it was minimally effective.

Kasdorf (1974) compared covert sensitization, covert sensitization with booster-treatment opportunities, placebo attention, and placebo attention with booster sessions. All treatment groups showed similarly significant smoking reductions over treatment, and similar relapse rates at three-month follow-up. The results indicated, however, that the subjects assigned to booster groups were smoking significantly less than non-booster subjects at follow-up. Kasdorf further found an inverse relationship between smoking reduction and the length of time a subject had smoked, as well as an interesting positive correlation between smoking reduction and baseline smoking rates.

Severson and Hynd (1977) found that rapid smoking with covert sensitization was far superior to rapid smoking alone,
and to modeling with covert sensitization. At nine-month follow-up, the abstinence rate for the group which had received rapid smoking with covert sensitization was still 50%.

In summary, the rapid smoking with covert sensitization procedure seems particularly valuable for several reasons. First, when techniques are used alone, rapid smoking appears to be quite effective in inducing abstinence (Best & Steffy, 1975; Keutzer, 1968; Lando, 1975; Marston & McFall, 1971; Beavers, Note 3). Second, covert sensitization appears useful in the generalization and maintenance of smoking cessation (Severson & Hynd, 1977). Third, the use of the rapid smoking with covert sensitization technique has yielded a 50% abstinence rate at 9-month follow-up whereas the overall rates reported by Hunt and Matarazzo (1973) and Lichtenstein (Note 1) respectively were only 25% after one year and 36% after two to six years. Finally, the initial aversion appears inducible by only one session (2 trials) of rapid smoking, thus limiting subjects' exposure to an effective but potentially dangerous procedure.

Notwithstanding the above qualities, the rapid smoking with covert sensitization procedure, like all other aversive techniques, still fails to address itself to the issue of environmental stimulus control.

Stimulus Control

Stimulus control involves the notion that environments
in which behaviors have been numerously performed come to exert some control over the occurrence of those behaviors (Ferster, Nurnberger, & Levitt, 1962). The results of a questionnaire on smoking habits, administered to 750 subjects by Shapiro, Tursky, Schwartz, and Shnidman (1971), emphasized the intimate link between smoking and events in the environments of the smokers. Each smoker appeared to have a consistent, unique pattern of smoking in certain situations such as awakening, retiring, after eating, answering the telephone, watching television, drinking coffee, driving, stress, concentration, relaxation, etc.

Since these events, which become associated with the desire to smoke and take on the role of cues for smoking, cannot be removed from the smoker's environment, Shapiro et al. (1971) instructed 40 subjects to carry a small timer device which produced a tone at programmed intervals. Smokers were instructed to set their timer intervals on a random schedule (around their current mean frequency) and to smoke only when their timer sounded. After one week on this schedule, the cue-presentation rate was progressively decreased. The results were that subjects reduced their smoking frequency by 75% at the end of treatment but only 43% at 6-week follow-up. The subjects were enthusiastic about the method, yet many had difficulty following the program when they reached rates of about 12 cigarettes per day, or when they were facing unusual stress in their lives.
Upper and Meredith (1970) conducted a similar study. Within six weeks, the experimental subjects had reduced their smoking rate by 53%. Almost all subjects experienced at least one difficult point ("stuck point") in the program. Only four control subjects were able to go below the level of 12 cigarettes daily whereas 10 of 17 treatment subjects could do so.

Levinson, Shapiro, Schwartz, and Tursky (1971) contrasted a counter program versus a timer program. The timer condition was similar to that described above. The subjects in the counter condition retained control of the timing of their smoking; they merely were told to reduce their smoking at the same rate as the timer group. The results indicated that more subjects in the counter group reduced to zero cigarettes but relapsed within three months. More than half the subjects in the timer program were unable to quit completely, but 78% of those who did remained abstinent. In addition, the timer subjects gave a lower rating to their desire to smoke after quitting than the counter group subjects did.

Most studies on the modification of smoking call for a gradual reduction of the number of cigarettes smoked. Several studies (Marston & McFall, 1971; Sachs, Bean, & Morrow, 1970; St. Pierre, 1974; Pumroy & March, Note 11), which either made specific use of gradual reduction or set out to assess the contribution of this approach, have
reported conflicting results. The confusion may arise partly from the fact that some researchers used the theoretically unsound procedure of calling first for removal of "unnecessary cigarettes" associated with the weakest cues. As pointed out by Shapiro et al. (1971), this approach leaves behind the most reinforcing cigarettes, thereby strengthening the most powerful cues and further conditioning the smoking habit.

The random timer technique designed by Shapiro et al. bypasses the problem of inadvertent reinforcement of the strongest existing cues by creating new artificial random cues. Yet this technique does nothing to change the positively reinforcing quality of the cigarettes. Thus, when the reduced rate of presentation of random cues creates an equivalent diminution in cigarette (positive reinforcer) frequency, the appealing quality of the few cigarettes left is likely to become more intense, and the subject may experience an unfortunate deprivation in positive reinforcers, akin to punishment for the desired non-smoking behavior.

It seems therefore that a random timer technique would be put to better use if it served only to help smokers break their habitual cue pattern, and not to gradually bring about smoking cessation. Additional progress would result if, after working on decreasing cue intensity, the positively reinforcing cigarettes were made to acquire a negative quality through aversive conditioning.
Purpose and Hypotheses

Since no technique, used alone, has yielded long-lasting results, recent studies have been concerned with combined treatment approaches. Multidimensional treatments are generally based on the assumption that, while aversion can bring about short-term abstinence, other skills such as coping abilities, social support, and/or cognitive strategies, are needed to maintain prolonged abstinence (Lichtenstein, Note 1).

It was therefore hypothesized that cessation could be better maintained if it resulted from a combined treatment approach that would control the stimuli leading to smoking, change the reinforcing value of smoking from positive to negative, as well as provide a cognitive coping strategy to sustain the non-occurrence of smoking behavior. In consideration of the extensive overlearning inherent to the smoking habit, it was further proposed that the techniques selected to achieve these goals be simple and practical enough to be easily reused by the subjects at any time after completion of the initial treatment.

A multidimensional treatment combining a timer program, without smoking reduction, aimed merely at alteration in stimulus control, followed by an aversive conditioning treatment, to lower the positive valence of cigarette smoke, and a covert sensitization procedure, to provide a transferable cognitive strategy, seemed to fit the above requirements.
Considering the questionable medical risks involved in rapid smoking, it was further decided to compare rapid smoking with cigar pairing as the noxious experience. The cigar-pairing technique was selected because it appeared to decrease the medical risks involved in rapid smoking and because encouraging initial results were obtained with this procedure.

In conclusion, the purpose of this study was to compare the psychological and physiological effects of the timer procedure followed by rapid smoking and covert sensitization, the timer procedure followed by cigar pairing and covert sensitization, and the timer procedure followed with normal smoking and covert sensitization as a control procedure, in the modification of habitual cigarette smoking.

It was hypothesized that:

1. The timer procedure, without smoking reduction, would bring about substantial, if not significant, decreases in smoking rates.

2. The smoking rates of both the rapid-smoking and the cigar-pairing groups would be significantly and equally reduced both at the end of treatment and at follow-up.

3. At follow-up, both the rapid-smoking and the cigar-pairing groups would show relapse rates significantly lower than the normal smoking with covert sensitization control group.

4. Detrimental physiological responses would be greater for the rapid-smoking group than for the cigar-pairing group.
METHOD

Subjects

Seventy-seven smokers from the surrounding community responded to newspaper and radio advertisements for treatment of cigarette smoking. Potential subjects were screened to insure that they were between 18 and 60 years of age; had smoked more than one pack of cigarettes per day for a minimum of one year; would sign an Informed-Consent form (see Appendix A); would have their physician sign a Physician's Consent, certifying that the subject was free of heart or lung disease (see Appendix B); were willing to buy a pocket timer and a cassette tape at a total cost of $10.00; were willing to submit to two physiological assessments during treatment; and could attend all sessions as scheduled.

Thirty acceptable subjects (18 women and 12 men) were serially allocated, within scheduling constraints, to one of three groups. All of these groups followed a fixed-interval timer program and received covert sensitization. In addition the three groups received normal smoking, rapid smoking, or cigar pairing, respectively.

The mean ages of the normal-smoking, rapid-smoking, and cigar-pairing groups were 37.8, 42.1, and 42.9, respectively;
their mean years of cigarette smoking were respectively 20.8, 20.8, and 22.3. There were no significant differences between the treatment groups on either variable.

Experimental Design

A 3 x 5 mixed factorial design was used with treatment and time of assessment as the two independent variables. Three treatment groups were studied: (1) Timer, covert sensitization plus rapid smoking; (2) timer, covert sensitization plus cigar pairing; and (3) timer, covert sensitization plus normal smoking. In each group, smoking rates were measured at five points: pretreatment, at the end of Phase 1 (post-timer), at the end of Phase 2 (post-covert sensitization), three weeks post-treatment, and three months post-treatment.

Assessment Measures

The primary dependent measures were: the mean daily number of cigarettes smoked by the subjects over five-day assessment intervals; the mean daily intake of nicotine by subjects over five-day assessment intervals; and physiological measures including 12-lead EKG, arterial blood gasses, serum sodium (Na+), serum potassium (K+), plasma nicotine, vital signs, and pulmonary function tests.

Experimenters

The author, a female graduate psychology student and non-smoker, conducted all group and individual treatment
sessions. She was assisted during 30 out of a total of 150 individual sessions in Phase 2 of the study by a female senior psychology student; these sessions were limited to tape listening by subjects and allotted equally among the three treatments.

**Procedure**

**Intake**

All the subjects attended a one-hour orientation meeting one week prior to the start of treatment. The meeting was used to explain the rationale for treatment and to have the participants sign the Informed Consent (see Appendix A), return their signed Physician's Consent Form (see Appendix B), and fill out a Pretreatment Questionnaire designed to elicit demographic information and smoking histories (see Appendix C). The subjects were then given a Smoking Record form (see Appendix D). They were instructed to wrap this form around their pack of cigarettes and record on it each cigarette as smoked during the five-day baseline period. The subjects were urged to smoke at their usual rate during this period.

**Phase 1**

Following collection of baseline data, Phase 1 treatment began. Treatment was identical for all subjects in Phase 1.

During the first small group meeting, the participants purchased pocket timers (see Appendix E), computed their mean
smoking interval based on their baseline data (see Appendix F), and practiced using the timers. For the next five weeks, they were instructed to carry the timers, which they had to set to produce a tone whenever their mean smoking interval concluded, and to smoke only when their timers buzzed. They were further requested not to try to reduce their daily cigarette consumption during this period.

Four 50-minute, small group meetings were then held over the next four weeks to foster adherence to the program, answer questions, deal with concerns about anticipated weight gain, and record smoking impressions. The subjects were also asked to identify their most powerful cues for smoking, and to think of alternative behaviors that could be indulged in when smoking cues were confronted.

At the sixth weekly meeting, subjects were requested to stop using their timers, smoke as they wished, and to record their smoking frequencies on their record form over the following five-day period (post-timer data). The participants also filled out a Post-Timer Questionnaire (see Appendix G), which was intended to provide a systematic record of their reactions to the timer program.

**Phase 2**

Sessions in Phase 2 were held individually for 30 minutes daily on five consecutive days for all subjects.
Covert-sensitization plus rapid-smoking group. In the initial session of Phase 2, subjects assigned to the covert-sensitization plus rapid-smoking group listened to three five-minute segments of a covert sensitization tape (see Appendix H) which contained a superimposed "smoke" signal at six-second intervals. At the beginning of each segment, the subjects were told to light up a cigarette (their usual brand) and to puff and inhale whenever they heard the "smoke" signal. Additional cigarettes were provided as necessary. The subjects were required to smoke in the afore-mentioned manner until they were unable to continue or until they had consumed three cigarettes, whichever came first. The subjects were requested to pair any aversive sensations, which they experienced, with the tape contents. Each tape segment was followed by a five-minute rest period.

The first tape segment vividly described the physical sensations and damage plausibly occurring during rapid smoking. The participants were asked to select two additional tape segments (out of five prepared tape segments) that were most relevant to their particular smoking-cue patterns. Each of these segments was geared towards one of the specific contexts for smoking which occurred most frequently for our sample of smokers (for example, first cigarette in the morning, with a drink, with coffee, after a meal, and driving). These additional tapes graphically depicted the subjects becoming sick as they prepared to smoke in the
relevant contexts with nausea culminating in emesis.

Immediately preceding and following the first session, a physician assessed 70% of the rapid-smoking subjects on the following physiological measures: 12-lead EKG, arterial blood gasses, serum potassium (K+), serum sodium (Na+), plasma nicotine, vital signs, and Pulmonary Function tests. At the end of the session, the subjects received a cassette tape-recording which contained a progressive relaxation program (see Appendix I) and the covert sensitization script. They were instructed to listen to the tape at least once daily and whenever they felt a compelling urge to smoke.

At the end of the first session, the subjects were told to abstain from smoking; they were further informed that, should they smoke, all cigarettes were to be "rapid smoked" and recorded. The subjects were additionally encouraged to remove all smoking paraphernalia (ash trays, matches, etc.), to increase their consumption of water and fruit juices, and to avoid alcoholic and stimulant beverages. These instructions were given orally and in writing (see Appendix J).

The next four sessions were identical with the first one with the exception that there was no medical test, and no actual rapid smoking. At the end of the fifth session, the subjects were provided with a smoking record form and instructed to record any cigarettes which they smoked during the next five days; they were finally encouraged to keep
Covert-sensitization plus cigar-pairing group. The protocol for the covert-sensitization plus cigar-pairing group was identical with that of the rapid-smoking group in all respects with one exception—rapid smoking was replaced by cigar-cigarette aversive pairings.

As the subjects were listening to the three 5-minute segments of the covert sensitization tape, they were asked to hold a lit cigar, preselected for distaste (see Appendix K), in one hand and their normal brand of cigarette in the other. Whenever they heard the "smoke" signal, which in this condition came on at 40-second intervals, the participants were instructed to puff on their cigarettes and to inhale to one-fourth of their full lung capacity. While holding the cigarette smoke in their lungs, the subjects were told to puff on their cigars and inhale the smoke to full lung capacity. They were required to hold this smoke mixture in their lungs as long as they could, up to 15 seconds, before exhaling and breathing normally until the next "smoke" signal. The subjects were told to smoke in this manner until they could not continue or until the tape segment ended, whichever came first. They were instructed to pair any aversive sensations they experienced with the tape contents.

Before and after the first session, 70% of the cigar-
pairing subjects were assessed on the same physiological measures as the rapid-smoking subjects. The subjects were then instructed to abstain from smoking and to use the cigar-pairing procedure if they did smoke (they were given a cigar for this purpose).

Covert-sensitization plus normal-smoking group. Subjects in the covert-sensitization plus normal-smoking group received the same treatment as both other groups with the exception that these subjects puffed on their cigarettes at a generally normal pace of once per 40 seconds while listening to the covert sensitization tapes. Seventy percent of the normal-smoking subjects were assessed on the physiological measures.

One week after the last treatment session in Phase 2, all the subjects returned for a final group meeting; this meeting was used to collect the subjects' smoking rates (post-covert sensitization data), and to instruct them to keep listening to the tape recording as required. In the event that their smoking rate increased dramatically, the subjects were encouraged to reinstitute their smoking treatment on their own.

Follow-up

Three weeks after the end of treatment, the subjects were contacted by telephone and asked to report how many
cigarettes they had smoked over the last five days (three week follow-up data).

Three months post-treatment, the subjects were invited to a follow-up meeting during which their questions on the physiological and behavioral results of the study were answered. The subjects who did not attend the meeting were contacted by telephone. All the subjects were asked to report how many cigarettes they had smoked over the preceding five days (three-month follow-up data).
RESULTS

The results of the experiment are presented in two sections. The first section reviews the effects of treatment upon smoking behavior; the second section reviews the physiological responses of subjects to the rapid-smoking, cigar-pairing, and normal-smoking experiences.

Smoking Behavior

Cigarette Consumption

The mean smoking frequency of the combined groups declined from 26.7 to 19.6 over Phase 1 (timer) of the experiment. Statistical comparison by a student t test for paired data indicated that the difference between the subjects' smoking rates at these assessment periods was highly significant, $t(29) = 5.87, p < .0005$.

Figure 1 presents the treatment groups' mean smoking frequencies, expressed as percentages of baseline scores, at five assessment periods. The data in this figure are presented in line graph form though bar graphs would more legitimately depict the discrete five-stage assessment procedures. Line graphs are used to facilitate perception of changes in response over time.

The rapid-smoking, cigar-pairing, and normal-smoking groups consumed respectively a mean of 26.8, 28.8, and 24.5
Figure 1. Mean percent baseline smoking rates for the rapid-smoking, cigar-pairing, and normal-smoking groups at five five-day assessment periods.
cigarettes per day prior to treatment. At the end of Phase 1 (timer), the cigarette consumption rates of the rapid-smoking, cigar-pairing, and normal-smoking groups averaged 18.9 (67% of baseline), 20.7 (71.5%), and 19.3 (76.5%) respectively. The rates of all groups declined further over Phase 2 (aversion conditioning); the rapid-smoking, cigar-pairing, and normal-smoking groups averaged respectively 3.2 (11.5% of baseline), 7.3 (21.3%), and 1.8 (6.6%) cigarettes per day at the conclusion of aversive conditioning. At three-week follow up, the three groups maintained their mean smoking frequencies at 5.2 (16.5% of baseline), 13.8 (45.5%), and 3.9 (13.1%) respectively. Finally, at three-month follow-up, the rapid-smoking, cigar-pairing, and normal-smoking groups were smoking a mean of 8.6 (28.5% of baseline), 17.4 (59.4%), and 8.5 (31.2%) cigarettes per day respectively.

A two-way analysis of variance was performed on the cigarette consumption rates of the three treatment groups at the five assessment periods (see Table 1). With regard to the main effect of time, the analysis indicated a highly significant difference between assessment periods, $F(4, 108) = 79.25, p < .001$. The analysis further indicated no significant difference in the overall smoking rates of the treatment groups; similarly, there was no significant difference in the interaction of these treatment groups with assessment sessions.
Table 1

Summary of Analysis of Variance Comparing Smoking Rates for Three Treatment Groups at Five Assessment Periods, Pretreatment, Post-Timer, End-of-Treatment, Three-Week and Three-Month Follow-up

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>23490.43</td>
<td>149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>9515.67</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>1039.33</td>
<td>2</td>
<td>519.66</td>
<td>1.65</td>
</tr>
<tr>
<td>Error_b</td>
<td>8476.34</td>
<td>27</td>
<td>313.94</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>13974.76</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>10172.59</td>
<td>4</td>
<td>2543.15</td>
<td>79.25*</td>
</tr>
<tr>
<td>Treatment x Time</td>
<td>336.36</td>
<td>8</td>
<td>42.05</td>
<td>1.31</td>
</tr>
<tr>
<td>Error_w</td>
<td>3465.81</td>
<td>108</td>
<td>32.09</td>
<td></td>
</tr>
</tbody>
</table>

*P < .001.
To determine which sample means contributed to the significant effect of assessment sessions, Tukey's pairwise a posteriori comparisons among means were carried out for each treatment group (see Table 2). The results indicated that all three groups significantly reduced their smoking from baseline to end of treatment, $p < .01$. Significant reductions were maintained at three-week follow-up for the rapid-smoking and normal-smoking groups, $p < .01$, and at three-month follow-up for the rapid-smoking group, $p < .05$.

**Nicotine Levels**

In order to examine the effects of treatment directly upon the actual drug intake of subjects, the nicotine levels of the subjects' brands of cigarettes were multiplied by their consumption frequencies. The resultant levels of nicotine intake by subjects in the three treatment groups, at five assessment periods, are presented in Figure 2. As the nicotine level data resembled the cigarette frequency data closely, these data will not be discussed.

**Abstinence Levels**

At the end of Phase 2 (aversion conditioning), one cigar-pairing subject, six rapid-smoking subjects, and seven normal-smoking subjects were abstinent. At three-week follow-up, one cigar-smoking subject, five rapid-smoking subjects, and six normal-smoking subjects remained abstinent. At three-month follow-up, the abstinence levels
<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Baseline vs.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>End Phase II</td>
<td>3-Week Follow-up</td>
</tr>
<tr>
<td>Rapid Smoking</td>
<td></td>
<td>23.67*</td>
<td>21.62*</td>
</tr>
<tr>
<td>Cigar Pairing</td>
<td></td>
<td>21.55*</td>
<td>15.08</td>
</tr>
<tr>
<td>Normal Smoking</td>
<td></td>
<td>22.74*</td>
<td>20.64*</td>
</tr>
</tbody>
</table>

*p < .01.

**p < .05.
Figure 2. Mean daily nicotine intake in mg. for the rapid-smoking, cigar-pairing, and normal-smoking groups at five five-day assessment periods.
were one subject in the cigar-pairing group, five subjects in the rapid-smoking group, and five subjects in the normal-smoking group. A chi-square test indicated that there was no significant difference in abstinence rates between groups at the end of treatment, $\chi^2(2) = 4.43$, three-week follow-up, $\chi^2(2) = 4.31$, or three-month follow-up, $\chi^2(2) = 2.91$.

**Physiological Responses**

Although seven subjects were assessed in each group, the scores of one normal smoking subject had to be deleted due to equipment failure.

The physiological data for the rapid-smoking, cigar-pairing, and normal-smoking groups before and after one session (three trials) of prescribed smoking are presented in Tables 3 through 6. Respiratory rates, heart rates, and blood pressure increased slightly for the rapid-smoking and normal-smoking groups, and decreased slightly for the cigar-pairing group (see Table 3). None of these changes was significant. Arterial pH levels were not affected for any of the treatment groups (see Table 4). Arterial carbon dioxide tension rose slightly in the rapid-smoking and cigar-pairing groups while it diminished in the normal-smoking group but these changes were not significant (see Table 4).

Arterial oxygen tension decreased for the rapid-smoking and cigar-pairing groups while carboxyhemoglobin levels increased for all groups (see Table 4). A Kruskal-Wallis
Table 3

Mean (+ SD) Respiratory Rates, Heart Rates and Arterial Blood Pressure Before and After Rapid Smoking, Cigar Pairing, and Normal Smoking

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Respiratory Rate min⁻¹</th>
<th>Heart Rate min⁻¹</th>
<th>Blood Pressure Systolic mm Hg</th>
<th>Blood Pressure Diastolic mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid Smoking:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>18.3 (3.3)</td>
<td>79 (10)</td>
<td>124 (11)</td>
<td>79 (10)</td>
</tr>
<tr>
<td>After</td>
<td>20.9 (4.0)</td>
<td>83 (12)</td>
<td>129 (19)</td>
<td>75 (14)</td>
</tr>
<tr>
<td><strong>Cigar Pairing:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>19.1 (2.8)</td>
<td>79 (13)</td>
<td>124 (26)</td>
<td>82 (20)</td>
</tr>
<tr>
<td>After</td>
<td>18.3 (3.9)</td>
<td>77 (16)</td>
<td>123 (25)</td>
<td>81 (18)</td>
</tr>
<tr>
<td><strong>Normal Smoking:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>18.0 (4.2)</td>
<td>81 (12)</td>
<td>123 (21)</td>
<td>76 (16)</td>
</tr>
<tr>
<td>After</td>
<td>21.0 (3.0)</td>
<td>83 (03)</td>
<td>127 (18)</td>
<td>81 (13)</td>
</tr>
</tbody>
</table>
Table 4

Mean (+ SD) Levels of Carboxyhemoglobin, Arterial Oxygen and Carbon Dioxide Tensions, and pH Before and After Rapid Smoking, Cigar Pairing, and Normal Smoking

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>pH</th>
<th>PCO₂</th>
<th>PO₂</th>
<th>COHb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm Hg</td>
<td>mm Hg</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Rapid Smoking:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>7.42 (0.04)</td>
<td>33.3 (4.4)</td>
<td>90.8 (11.3)*</td>
<td>5.7 (2.6)*</td>
</tr>
<tr>
<td>After</td>
<td>7.42 (0.02)</td>
<td>35.7 (5.7)</td>
<td>81.6 (11.4)</td>
<td>9.0 (3.4)</td>
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<tr>
<td>Cigar Pairing:</td>
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<tr>
<td>Before</td>
<td>7.43 (0.02)</td>
<td>33.0 (3.0)</td>
<td>95.3 (8.2)</td>
<td>6.6 (3.3)</td>
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<tr>
<td>After</td>
<td>7.43 (0.01)</td>
<td>35.0 (3.6)</td>
<td>89.1 (6.5)</td>
<td>9.0 (3.3)</td>
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<tr>
<td>Normal Smoking:</td>
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<td></td>
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<tr>
<td>Before</td>
<td>7.45 (0.01)</td>
<td>33.3 (2.7)</td>
<td>90.5 (10.5)</td>
<td>5.9 (1.8)</td>
</tr>
<tr>
<td>After</td>
<td>7.45 (0.01)</td>
<td>32.0 (5.7)</td>
<td>92.5 (10.8)</td>
<td>6.5 (2.6)</td>
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</table>

*p < .05.
test indicated that these variations were significant for the rapid-smoking group in both the arterial oxygen tension level, $H(2) = 6.89, p < .05$, and the carboxyhemoglobin level, $H(2) = 6.35, p < .05$. Table 5 shows minimal changes in alveolar-to-arterial oxygen gradient, serum potassium, and serum sodium levels in all three groups.

Spirometry data indicate small, non-significant decreases for all three groups on both forced vital capacity and forced expiratory flow at 50% (see Table 6). There were no significant changes in EKG's. Due to technical difficulties, the plasma nicotine levels were not assessed.
Table 5

Mean (± SD) Alveolar-to-Arterial Oxygen Gradient, Serum Potassium, and Serum Sodium Levels Before and After Rapid Smoking, Cigar Pairing, and Normal Smoking

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>A-A pO₂</th>
<th>Serum Potassium</th>
<th>Serum Sodium</th>
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<tbody>
<tr>
<td></td>
<td>mm Hg</td>
<td>mEq/l</td>
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<td>Rapid Smoking:</td>
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<tr>
<td>Before</td>
<td>14.6 (9.7)</td>
<td>4.3 (0.6)</td>
<td>137.3 (2.2)</td>
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<tr>
<td>After</td>
<td>21.7 (7.3)</td>
<td>3.9 (0.2)</td>
<td>136.7 (3.5)</td>
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<td>Cigar Pairing:</td>
<td></td>
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<tr>
<td>Before</td>
<td>10.6 (6.7)</td>
<td>4.1 (0.2)</td>
<td>137.0 (2.5)</td>
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<tr>
<td>After</td>
<td>14.6 (7.4)</td>
<td>4.2 (0.3)</td>
<td>137.6 (4.3)</td>
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<td>Normal Smoking:</td>
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<tr>
<td>Before</td>
<td>15.2 (8.0)</td>
<td>4.0 (0.6)</td>
<td>135.3 (5.2)</td>
</tr>
<tr>
<td>After</td>
<td>15.0 (6.2)</td>
<td>3.9 (0.6)</td>
<td>135.3 (7.3)</td>
</tr>
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</table>
Table 6

Mean (+ SD) Forced Vital Capacity and Forced Expiratory Flow at 50% Before and After Rapid Smoking, Cigar Pairing, and Normal Smoking

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>FVC % predicted</th>
<th>PEF 50% % predicted</th>
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<tr>
<td>Rapid Smoking:</td>
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<td></td>
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<tr>
<td>Before</td>
<td>100 (15)</td>
<td>71 (24)</td>
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<tr>
<td>After</td>
<td>95 (16)</td>
<td>70 (17)</td>
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<tr>
<td>Cigar Pairing:</td>
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<tr>
<td>Before</td>
<td>103 (5)</td>
<td>75 (36)</td>
</tr>
<tr>
<td>After</td>
<td>100 (5)</td>
<td>79 (34)</td>
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<tr>
<td>Normal Smoking:</td>
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<td></td>
</tr>
<tr>
<td>Before</td>
<td>88 (8)</td>
<td>48 (18)</td>
</tr>
<tr>
<td>After</td>
<td>89 (12)</td>
<td>47 (15)</td>
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</table>
DISCUSSION

The first hypothesis, which stated that the timer procedure without instructions aimed at smoking reduction, would result in substantial if not significant reduction in smoking rates, was supported. The subjects' mean smoking frequency decreased significantly over the timer phase of the experiment from 26.7 to 19.6 cigarettes per day. This finding should be interpreted cautiously since there was no control group for this phase of the experiment and non-specific treatments have been shown to significantly reduce smoking over treatment (Bernstein, 1970). From a theoretical point of view, however, it would seem logical to expect such a reduction, since when subjects smoke in response to artificially timed cues instead of idiosyncratic cues, the later stimuli go unreinforced by cigarettes and are likely to lose some of the eliciting power. A number of subjects further commented that they were amazed and comforted to find that they could easily let many familiar stimuli go by without smoking. Apparently the use of the timer procedure allowed many subjects to gain increased confidence in their own power to control their smoking behavior. From this perspective, the timer program appears to help the smoker take a valuable first step towards recovery from the "I can't quit"
syndrome identified by Clark (1974).

The second hypothesis, predicting that the mean smoking frequencies of the rapid-smoking and the cigar-pairing groups would be significantly and equally reduced both at treatment end and at follow-up, was partially supported. These treatment groups significantly decreased their cigarette consumption to 11.5 and 21.3% of baseline, respectively, over the aversive conditioning treatment; only the rapid-smoking group, however, maintained a significant reduction at both three-week and three-month follow-up. Since both conditions involved an identical covert sensitization treatment component, it appears that the cigar-pairing technique was not as effective as the rapid smoking.

The third hypothesis, which held that the rapid-smoking and cigar-pairing groups would show relapse rates significantly lower than the normal-smoking group at follow-up, was not supported. There was no significant difference between treatment groups in smoking rates, or in number of abstinent subjects, at any of the five assessment intervals. It appears, therefore, that the rapid-smoking and cigar-pairing procedures were not more effective than normal smoking in boosting the effect of covert sensitization.

Since there were substantial disparities in number of abstinent subjects between treatment groups, the lack of statistically significant difference may be due to small sample sizes. It remains, however, that any comparative
comment about treatment procedures should be taken cautiously.

Maintenance of a 50% abstinence rate and 28.5% relapse smoking rate by the rapid-smoking with covert-sensitization group at three-month follow-up is consistent with the results previously obtained by Severson and Hynd (1976) using a similar procedure. Replication of these findings tends to confirm that rapid smoking with covert sensitization is more effective than rapid smoking alone, and that the covert-sensitization procedure allows subjects "to generalize and maintain the behavior change induced by the initial session of rapid smoking" (Ibid., p. 12).

The fact, however, that the normal-smoking with covert-sensitization control group performed as well as the rapid-smoking with covert-sensitization group, at least on the short term, tends to support Lando's conclusion (1975) that rapid smoking is no more effective than slow smoking. Since one session of normal smoking, as well as one session of rapid smoking, seem to lead to comparable change rates, the role of the latter experience in inducing change appears unclear. In this context, one could argue that covert sensitization was responsible for the observed change. This, however, seems unlikely since covert sensitization alone, or used in conjunction with certain other procedures such as video-modeling of rapid smoking (Severson & Hynd, 1976) or cigar-pairing in the present study, apparently fails to produce durable smoking abstinence. It appears, therefore,
that rapid smoking or normal smoking do interact with covert sensitization so as to bring about improved results.

Since normal smoking, contrary to cigar pairing, seems as effective as rapid smoking in this interaction, it becomes difficult to maintain that it is the aversive element involved in rapid smoking, or in cigar pairing, which increases the effectiveness of covert sensitization. It is rather possible that the simple act of handling and smoking cigarettes augments the emotional, cognitive, and/or imaginal impact of the covert sensitization scripts. Therefore, covert sensitization may not necessarily need to be accompanied by in vivo aversion but may benefit from in vivo involvement of all senses. To amplify, covert sensitization alone directly stimulates the sense of hearing only; the other sensory modalities, if involved at all, are activated only in imagination. Adding actual cigarette smoking to the aversive imagery technique may facilitate involvement of all the senses, thus stimulating a more complete array of autonomic reactions and associations.

On the other hand, the unfamiliar sensations aroused by cigar smoking may have prevented the cigar-pairing subjects from effectively associating the covert-sensitization treatment component with their real life cigarette smoking. This possible explanation of the lack of effectiveness of the cigar pairing technique parallels the comments of several unsuccessful subjects, who said that they had trouble
relating to the covert-sensitization tape contents because they would never smoke a cigar on their own.

It was further observed that, while normal-smoking subjects could immediately direct their full attention to listening to the covert sensitization tapes, and the rapid-smoking subjects seemed to adjust rapidly to the smoking procedure, the cigar-pairing subjects were distracted from listening, at least during the first few minutes, due to the more complex smoking procedure involved. It is possible that administration to subjects of practice smoking trials, prior to playing covert sensitization scripts, could alleviate this difficulty.

The last hypothesis, which predicted that medical risks would be greater for the rapid-smoking than for cigar-pairing group was supported. The cigar-pairing, as well as the normal-smoking group, did not show any statistically or clinically significant changes on any physiological measure. The rapid smoking-group, however, did present a significant decrease in arterial oxygen tension and increase in carboxy-hemoglobin levels.

The 9.09% diminution in arterial oxygen tension levels was larger than reported in previous studies (Dawley, 1976; Hall, 1976). This finding was clinically noteworthy because some rapid smoking subjects showed signs of hyperventilation and decreased arterial oxygen tension during hyperventilation. This is an abnormal response which can lead to hypoxia. The
3.31% rise in carboxyhemoglobin was in the range generally reported by previous researchers (Dawley, 1976; Hall, 1976). While rises in carboxyhemoglobin reduce myocardial and cerebral oxygen delivery and affect some nervous-tissue functions, the levels reached by the rapid-smoking subjects would not be clinically significant except in patients with advanced cardiopulmonary disease.

**Future Research**

Among this study's shortcomings were the small sample sizes, the absence of controls for the timer effect and for the covert sensitization component per se, and the lack of continuous monitoring of physiological data. These limitations prevented the drawing of firm conclusions although results indicated interesting trends.

The data suggested that the timer procedure might increase the subjects' confidence in their ability to quit smoking while diminishing the eliciting power of some smoking stimuli. This finding requires replication with adequate controls; the degree to which the timer technique enhances further smoking reduction or cessation in the subsequent aversive phase of treatment should also be assessed.

The finding that cigar pairing was minimally effective, though safe, needs to be further investigated. More distasteful cigars could be used and, since there does not seem to be significant medical risks, the in-vivo aversive treatment
could be extended until the subjects become abstinent. Pro-
longation of treatment until subjects reach total smoking
cessation seems important because of the sharp relapse
curves demonstrated by smokers who attain low rates of con-
sumption at the end of treatment.

The normal-smoking procedure seemed as effective short
term as the rapid-smoking technique, but without medical
hazards. Replication of this finding seems well worth
further research. Of particular interest, then, would be
the exploration of the factors which seem to enhance the
effect of covert sensitization. Some questions to be
studied would be: Is there a catalytic element common to
both normal and rapid smoking? And, do the effects of rapid
smoking and normal smoking with covert sensitization interact
with subjects' personality types? Finding ways to extend
the treatment effect of normal smoking with covert sensiti-
zation would also constitute a useful area of investigation.

In light of the present experiment, the notion that
nicotine poisoning may be the real agent of change in rapid
smoking (Horan et al., 1977) would equally require further
evaluation. Although nicotine poisoning may have occurred
in some subjects in the rapid smoking group, the overall
results would appear to suggest that the cognitive coping
tool provided by covert sensitization with in-vivo involvement
of all sensory modalities was the agent of behavior change
and maintenance. As concluded previously (Severson & Hynd,
1976; Lichtenstein, Note 1), cognitive coping strategies such as covert sensitization constitute a promising area of research in the treatment of habitual smoking.
APPENDIXES
INFORMED CONSENT

I desire to participate voluntarily in a study to be conducted at the Loma Linda University Medical Center in association with California State College, San Bernardino, under the direction of David Kantorowitz, Ph.D., and Donald Herrmann, M.D. I understand that the study is intended to assess the comparative values of different techniques designed to assist an individual in quitting cigarette smoking. I understand that I will be randomly assigned to one of three groups:

1. Timer with rapid smoking, relaxation, and covert sensitization.
2. Timer with cigar smoke, relaxation, and covert sensitization.
3. Timer with normal smoking, relaxation, and covert sensitization.

I agree to attend orientation meetings and a one hour session for nine consecutive weeks. I also agree to purchase a pocket timer and cassette tape for approximately $10.00.

During the course of this study I may be selected to have an electrocardiogram, to have blood withdrawn from an artery, to have a spirogram (breathing test) and to have my blood pressure, pulse and respirations taken. Further, I am willing to have these tests repeated later in the study if needed.

It has been explained to me how this smoking study will take place and of the potential risks and benefits as well as the alternate modes of treatment. One of the potential benefits
that has been described to me is: A rapid and effective method of eliminating cigarette smoking as one of my daily habits by a method that may have longer lasting, permanent results than other methods that have been utilized. Among the potential risks that I have been informed of are the following: (1) Arterial blood gasses may cause some temporary discomfort at the site of the puncture. This may produce a small amount of bleeding which is in most cases controlled by application of pressure for several minutes. In rare cases, a hematoma (localized clots of blood under the skin) may form. Very rarely, damage can be done to a nerve or clotting can occur in the blood vessel. This in turn could require a surgical procedure to correct this. (2) Regarding pulmonary function tests, in very rare situations, individuals may feel somewhat short of breath or fatigued after the performance of these studies. (3) The rapid smoking could conceivably precipitate an episode of cardiac arrhythmias or produce acute myocardial insufficiency resulting in a compromise of blood supply to the heart muscle.

My individual physician will be required to approve before I am cleared to participate. If I have any medical history of heart or lung disease, I will be eliminated from consideration. I realize that other risks may occur other than the ones described above.

I understand that trained personnel will be available at all times during treatment testing so that any adverse reactions will receive attention.

I have been informed that I may withdraw from this study at any time and that I have read and understood all of the foregoing and have received all the information that I desire concerning this study. I understand all results of this study will be kept confidential and that the identity of the persons who participate will not be divulged without their consent.

Date ___________________ Signature ___________________
Witness ___________________
APPENDIX B

PHYSICIAN'S CONSENT FORM

I hereby authorize that has been cleared by myself to participate in a smoking withdrawal study that is being conducted under the direction of David Kantorowitz, Ph.D., and Donald W. Herrmann, M.D., at the Loma Linda University Medical Center. I understand that the above individual may receive an electrocardiogram, pulmonary function tests, arterial blood gas, serum potassium and vital signs prior to and following the active part of the study. This part of the study involves a comparison of a one session exposure to either of two prominent methods of creating therapeutic aversions in smokers to the taste and odor of cigarette smoke. The participant may be assigned to a rapid smoking treatment group, during which the individual would take a puff on a cigarette every six seconds until he is not able to tolerate any further; during this time, he will be listening to an audio tape which describes some of the sensations that he may be experiencing at the time. He may also be assigned to another group which will involve the smoker taking a puff on a cigarette of his choice followed by inhalation of cigar smoke to full lung capacity. This will be continued until he cannot tolerate any further inhalations. The third group will utilize a relaxation technique on tape. I understand that if this individual has any evidence of heart or lung disease, I will not agree to his participation in this study, and further, that any abnormalities on pulmonary function tests, electrocardiogram or arterial blood gasses will also eliminate him from the smoking phases of this study.

Date: ___________________   Signature: ___________________

Please feel free to contact Donald W. Herrmann, M.D., at 796-7311, Ext. 3232, or David Kantorowitz, Ph.D., at 887-7226 if you would like to discuss any question which you might have.

Name, Address, and ________________________________

Telephone Number ________________________________
APPENDIX C

PRETREATMENT QUESTIONNAIRE

Name (Print) ____________________________________________________________

Address ________________________________________________________________

Phone __________________________ Age ________________________________

Male ( ) Female ( )

How many cigarettes do you smoke per day? ______________

What brand(s) of cigarettes do you usually smoke?

_________________________ Tar __mg.  Nicotine __mg.

_________________________ Tar __mg.  Nicotine __mg.

_________________________ Tar __mg.  Nicotine __mg.

Do you inhale? Yes ( ) No ( )

How many years have you been smoking? ________________________

How many times have you made a serious attempt to stop?____

When did you last try to stop smoking? ________________________

What is the longest single period of time you stayed away from cigarettes? ________________________________

How did you feel during this period of abstinence? ______

______________________________________________________________

______________________________________________________________

What prompted you to start smoking again? _______________

______________________________________________________________
How many cigarillos do you smoke per week? ____________

How many cigars do you smoke per week? ____________

How many pipe bowls do you smoke per week? ____________

Is anyone living with you currently smoking? ____________

How often do you feel tense or anxious?

   Seldom or never ( ) Often ( )
   Sometimes ( ) Constantly ( )

How do you presently handle feelings of tension or anxiety?

________________________________________________________________________

Have you systematically practiced body relaxation?

   Yes ( ) No ( )

   If yes, how? ____________________________________________

What is your main reason for wanting to give up smoking?

________________________________________________________________________
# APPENDIX D

## SMOKING RECORD FORM

Name (Print): ____________________________

Date: ____________________________

<table>
<thead>
<tr>
<th>day:</th>
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<th>day:</th>
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</tbody>
</table>
APPENDIX E

POCKET TIMERS

The pocket timer used in this study was the MemoTimer, distributed by the Charles Alshuler Company, 759 N. Milwaukee Street, Milwaukee, Wisconsin 53202.
APPENDIX F

MEAN SMOKING INTERVAL FORM

Name (Print): ________________________________

Date: ________________________________

1. Enter the number of cigarettes you have been smoking each day in the appropriate space.
   Day 1: [___]
   Day 2: [___]
   Day 3: [___]
   Day 4: [___]
   Day 5: [___]

2. Add these up. Total: [___] × 2 = [___].

3. To find your daily average, multiply the total by 2 and place the decimal point before the last figure of the result.

4. Estimate the number of hours you are up on a normal day: ________________________________
This last block is to be filled out ONLY by persons whose jobs ABSOLUTELY PREVENT them from smoking for LONG periods of time.

5. What is the total number of hours during which you are prevented from smoking on a normal working day? ........ ........ ....

6. Subtract this number from the number of waking hours which you reported in #4:

\[
\frac{\text{(waking)}}{\#4} - \frac{\text{(no smoke)}}{\#5} =
\]

7. State the reason why you cannot smoke:

YOUR TIMER WILL BE SET AT ____ MINUTE INTERVALS.
APPENDIX G

POST-TIMER QUESTIONNAIRE

Name _______________________________ Date ___________

Telephone (day) _____________________________
(evening) _____________________________

How many cigarettes do you smoke per day? ____________

What brand(s) of cigarettes do you smoke? __________________________

Do you inhale? Yes ( ) No ( )

How did you generally feel during the period you smoked with the timer? __________________________

How often do you feel tense or anxious?

   Seldom or never ( ) Sometimes ( )
   Often ( ) Constantly ( )

What are your main cues for smoking that you have identified during this five-week period? Rank-order these cues starting with the most powerful one:

1. ____________________________ 4. ____________________________
2. ____________________________ 5. ____________________________
3. ____________________________ 6. ____________________________

What was your beginning timer interval? ________________
If you modified it during these five weeks, state how, when, and why.

What was your final timer interval?

Has the use of the timer contributed to reduce the appealing quality of: some ( ), all ( ), or none ( ) of your "old cues"? If yes, which cues?

Has the timer program contributed to modify your smoking habit in any other way? Yes ( ) No ( ) If yes, how

Did you ever feel that you started to want a cigarette just as the timer was about to buzz? Yes ( ) No ( )
If yes, how far along in the program did it start to happen?

Evaluate how many times you smoked without the timer ("cheat")?

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
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<tbody>
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</tbody>
</table>

If you went without the timer for any length of time, state when, how long, and why?

Besides smoking with the timer, what else have you changed concerning your smoking habit?
Has there been any significant change in your life during the last five weeks? Yes ( ) No ( ) If yes, explain:

________________________________________________________________________

Regarding the timer program itself (not the timing device),

What did you like about it? ____________________________________________

________________________________________________________________________

What did you dislike?

________________________________________________________________________

What would you change about it? _________________________________________

________________________________________________________________________

Was the five-week period ( ) too long, ( ) too short, ( ) just right?

Were the weekly meetings helpful? Yes ( ) No ( )

In what way? __________________________________________________________

Do you think that you would have been able to follow the timer program just as well if you had not had these weekly meetings?

________________________________________________________________________

In your opinion, could periodical telephone contacts adequately replace these meetings? ________________________________

Regarding the timing device itself,

What did you like about it? ____________________________________________

________________________________________________________________________

What did you dislike?

________________________________________________________________________

Any suggestions for improvement? _________________________________________

Would you have been willing to use a larger timing device?
APPENDIX H

COVERT SENSITIZATION SCRIPTS

Depending on the group they had been assigned to, the subjects heard either one of three sets of taped smoking instructions, following which the remainder of the tape was the same for all subjects (covert sensitization).

A. SMOKING INSTRUCTIONS

1. Rapid smoking

Please follow the instructions on this tape as closely as you can. Sit comfortably in your chair and relax (short pause). You will hear a clicking noise like this (*) every six seconds. Whenever you hear the click, puff on the cigarette provided by the therapist and inhale. You are to smoke in this manner until you are unable to continue or until you have consumed three cigarettes, whichever comes first. (To be followed by covert sensitization script.)

2. Cigar pairing

Please follow the instructions on this tape as closely as you can. Sit comfortably in your chair and relax (short pause). Your therapist will provide you with a lit cigar and cigarette. You will hear a clicking noise like this (*) every 40 seconds. Whenever you hear the click, start out by puffing on your cigarette and inhale to one fourth of your full lung capacity. Then while still holding the cigarette smoke in your lungs, puff and inhale the cigar smoke to full lung capacity. Hold this mixture in your lungs for as long as you can, up to 15 seconds. Then exhale and breathe in a regular breath of air. Repeat this procedure whenever you hear the click until you are unable to continue or until the tape ends, whichever comes first. (To be followed by covert sensitization script.)
3. **Normal smoking**

Please follow the instructions on this tape as closely as you can. Sit comfortably in your chair and relax (short pause). You will hear a clicking noise like this (*) every 40 seconds. Whenever you hear the click, puff on the cigarette provided by the therapist and inhale the smoke if you normally do. You are to smoke at this average normal rate until the tape ends. (To be followed by covert sensitization script.)

**B. COVERT SENSITIZATION**

While you are smoking, I will ask you to imagine some scenes as vividly as you can. I want you to imagine that you are actually in the situations. Do not only visualize the scenes but also feel what I describe as intensely as possible. Use all your senses as though you are actually there. It is important that you visualize the scenes clearly and actually feel what I describe even though it is unpleasant. Now start smoking whenever you hear the click. (Clicking starts at appropriate rate.) Now close your eyes and take a moment to silently concentrate on your sensations as you smoke (40 second pause).

Now continue your smoking as I am talking. Open your eyes. Observe the smoke as it leaves your mouth and as it hovers in front of you. Look closely and intensely at the dirty, heated, whitish smoke. Analyze that smoke as you stare at it: see suspended in that smoke grit, dust, dirt, nicotine, tar, arsenic, and carbon monoxide. Now that you have looked at the smoke closely and intensely, close your eyes again.

As you take another puff and inhale the smoke deeply, feel the grit, dirt, and poisonous chemicals you just looked at going down your air tubes, filling your lungs and being carried to every part of your body in your blood stream. Feel the smoke bathing the delicate tissues of your lungs in an acid bath. See the cells of your lungs burning and chocking, and the delicate supple little air sacs becoming hardened. Feel that some of them are stretching and tearing themselves apart, making larger air sacs. See the quart of tar you absorb every year slowly coating your lungs charcoal black. See your lungs full of soot, full of dirt, full of black carbon particles. Visualize your lungs as raw, reddish-black masses of over-ripened flesh riddled with holes where the carbon has worn through.
Now observe your heart, feel it beating, working. Imagine the nicotine constricting and narrowing your blood vessels, making your blood thick and sludgy, forcing your heart to work harder, work faster, pushing it, pushing it to work harder, work faster, work harder, pushing it, pushing it. Feel the strong muscular cells of your heart beating, tiring, getting old, drawn, haggardly. Visualize them even surrounded by the dirty, whitish smoke, bathed in the burning smoke.

With each breath, renew these sensations and images. With each inhalation, feel the new smoke rushing into your body, burning, blackening, irritating, making raw, old, torn whatever nooks and crannies of your body it reaches. Continue to smoke and reform these images and feelings. Don't run away from them; they are happening even as we talk.

Feel yourself now starting to get headachy and nauseous. You have taken in all that smoke, so much smoke, you are feeling dizzy, headachy and nauseous. Emerse yourself in those feelings, concentrate on them. See and feel the dirty smoke you are taking causing the physical discomfort. See yourself in your mind smoking and getting sick and nauseous. Sink into those feelings of sickness. See and feel that smoke, disgusting smoke, wretching, hurting, nauseating your body.

Continue to smoke and concentrate on the sensations emanating from your body. Feel the bad taste in your mouth. Your throat is burning, your stomach is feeling sick, your heart is pounding. The smoke is almost choking you. Your head feels dizzy. All that smoke makes you feel like throwing up.

Each of the next five segments of the tape was geared towards a specific context for smoking: (1) first cigarette in the morning, (2) with coffee, (3) with a drink, (4) after a meal, and (5) driving. These five tape segments were identical except for one paragraph describing the specific situation.

All five segments started as follows:
The instructions for this part of the tape are the same as for the first script you listened to. Sit comfortably in your chair, relax, and as you listen to the tape, let yourself really see and feel what I am describing. Smoke in the prescribed manner whenever you hear the clicking noises. Now start smoking. As you smoke, close your eyes and take a moment to silently observe your sensations as the smoke goes in and out of your lungs (40-second pause).

This introduction was followed by presentation of one specific situation:

1. Now visualize yourself in the morning as you are about to want your first cigarette. Take a moment to really see yourself doing what you usually do when you first want to smoke (short pause). See the room around you (short pause). What are you doing? (short pause). Observe your sensations (short pause). You decide to have a cigarette. Visualize your pack of cigarettes where you usually keep it and start reaching for a cigarette. As soon as . . .

2. Now see yourself having a cup of coffee and wanting a cigarette. Really see yourself in your mind. Maybe you are at the office taking a break, or at your desk, or you could be in the house. Wherever you are, see the room around you (short pause). Observe the cup of steaming coffee. Feel the warmth of the cup in your hands, smell the coffee aroma (short pause). Now you have a strong urge for a cigarette. Feel your sensations as you decide to have a cigarette. See your pack of cigarettes and start reaching for one. As soon as . . .

3. Now picture yourself in a situation where you're about to have a drink and relax and you want a cigarette. Take a moment to see yourself. Where are you? Is it at home? Before dinner, maybe? or in a bar? after work? Alone or with your friends? Wherever you are, see the room and the people around you (short pause). Hear the sounds. Observe your sensations as you decide to have a cigarette (short pause). See your pack of cigarettes and start reaching for one. As soon as . . .

4. Now see yourself after a meal. You've just finished eating and you are about to want a cigarette. Take a while to visualize yourself. Which meal did you just have? See the room around you. Picture yourself in that room. Observe your sensations as you decide to have a cigarette (short pause). See your pack of cigarettes and start reaching for one. As soon as . . .
5. Now picture yourself in your car. You are driving and you are about to want a cigarette. Feel the firmness of the steering wheel in your hands. See the road ahead. Feel your back resting against the seat. Take a while to observe your sensations as you are driving and you decide to have a cigarette (short pause). Now you see your pack of cigarettes and you start reaching for one. As soon as...

The tape then went on as follows for all five segments:

As soon as you start extending your arm to reach for a cigarette, you get a funny feeling in your stomach. You begin to feel headachy and nauseous again. You are actually becoming sick to your stomach like you are about to throw up. You touch the package with your hand and a burp of bitter spit makes its way into your mouth. The taste makes you even sicker. When you take the cigarette out of the pack, small pieces of half-digested, stenchy food comes into your throat. Your throat now feels gritty and the acid from your stomach gives it a burning sensation. As you are holding the cigarette in your hand, the taste in your mouth is horrible.

You now feel really sick. You have stomach cramps, and chills in your back just looking at the cigarettes in your hand. Your forehead becomes sweaty, the palms of your hands become sweaty, too. Even your fingers are so moist with cold sweat that the cigarettes are sticking to your fingers. You feel very weak and dizzy. Your vision of the cigarette in your hand is getting blurry.

As you want to put the cigarette into your mouth, you can't control your stomach and you puke all over the pack of cigarettes. The cigarette in your hand is soggy and full of green vomit. There is a sickening stink coming from the vomit. Snots are coming uncontrollably from your nose. Your hands and lips feel all slimy and full of vomit. You've really made a mess of yourself. Your clothes are full of puke. You drop the cigarette and turn away from the vomit and the cigarettes. You immediately begin to feel relieved being away from the cigarettes. You go to the bathroom, rinse your mouth, wash up and feel great being away from the cigarettes.
APPENDIX I

RELAXATION TAPE

The relaxation script was fashioned after the script of Relaxation Procedures by Alan F. Rappaport, Ph.D., 1974, Biomonitoring Applications, Inc., New York, New York.
APPENDIX J

INSTRUCTIONS FOR THE EIGHTH WEEK OF TREATMENT

1. Do not smoke between sessions.

2. Listen to relaxation tape at least once a day. Read accompanying instructions before you first listen to the relaxation tape.

3. Listen to "covert sensitization" tape at least once a day, especially when you most desire to smoke. This tape is the same you listened to during your first individual session. No clicking noises have been recorded on your tape because you are not to smoke between sessions. Simply revivify in your mind the sensations you experienced while you were first listening to the tape. Let yourself reexperience these sensations and feelings as clearly as you can.

4. Put away or get rid of all your cigarettes, matches, ashtrays, etc.

5. Start flushing your body of nicotine; drink 8 glasses of water/fruit juices between meals. Avoid alcoholic beverages and stimulants like coffee, tea, or cola beverages.

6. When you feel an urge for smoking, remind yourself of your first session sensations. Should you still decide to smoke, "rapid smoke" your cigarette/pair your cigarette with the cigar you have been given/smoke normally and keep record of any cigarette on the record sheet. Bring the record sheet with you for every session.
APPENDIX K

CIGARS

The cigars used in this study were William Penn Braves from General Cigar and Tobacco Company, New York, New York 10016.
REFERENCE NOTES
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