

smoking

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Literature Review

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Running head: smoking

General background regarding cigarette smoking.

The history of Western man's acquaintance with tobacco goes as far back as the discovery of America by Columbus. Since then tobacco smoking has spread rapidly in the Old World. In view of the current condemnation by the medical profession, it is surprising to learn that tobacco was once much-valued for its supposed medicinal properties. It was thought by many to be a prophylactic against the plague, and to have power to cure a variety of diseases including headaches, asthma, ulcers, scabies, and, ironically, cancer. Today, for obvious reasons, little is said in praise of smoking (Ashley & Stepney, 1982).

In spite of growing awareness about the dangers of cigarette smoking, there is still discouraging evidence that many continue the smoking habit (Evans, 1979; Pomerleau, 1979). The Surgeon General's report no smoking and health (1964) shows an overwhelming medical evidence linking lung cancer with cigarette smoking. The harmful effects of nicotine have been also shown in numerous studies. Epstein and Perkins (1988) indicate that major coronary heart disease risk factors are related to the smoking habit. Smokers are prone to higher stress and anxiety levels than non smokers (Heimstra, 1973; Kozlowski, 1979; Thomas, 1979), and

sleep difficulties are also associated with cigarette smoking (Soldatos, Kales, Scharf, Bixler & Kales, 1980).

Why is it then that regardless of the piling up warnings of the hazard of smoking, individuals maintain their daily smoking habit? The answer is manifold and a complex one. Nicotine possesses the property of a powerful drug and as a psychoactive agent is reinforcing either because it increases feelings of well being (i.e. relaxation, stimulation, regulation of social interactions) (Weltere & von Troshke, 1986) or because it decreases feelings of discomfort, pain or anxiety (Hutchinson & Emeley, 1973). Most smokers describe smoking as pleasurable experience, but it is not totally clear that nicotine has euphoric effects in humans (Heimstra, 1973).

#### Models for smoking behavior.

There is indisputable evidence that pharmacological effects of tobacco have an immediate influence on the establishment and maintenance of smoking behaviour. The chemical composition of cigarette smoke contains many substances of different pharmacological strength. Nicotine, the most active substance in tobacco and the pharmacological agent of prime importance is believed to have strong psychoactive side effects on humans and animals when introduced into the bloodstream (Armitage, 1973; Jarvik, 1979). The acute effects of tobacco are reported in the

central nervous system and in the brain where nicotine stimulates nicotine receptors. Once the smoking habit has been established, the growing tolerance to the drug requires higher doses of nicotine to maintain its level in the brain and the bloodstream (Ashley & Stepney, 1982).

The pharmacological model of addiction is one among many other models of addiction. Behavioral scientists, although they do not ignore the pharmacological approach, focus on the fact that smoking is initiated by psychosocial factors such as mass media, family and peer pressure (Kozlowski, 1979; Pomerleau, 1979). Others (Tomkins, 1966) see smoking behavior as a replacement for some innate reflexes, especially oral manipulation or sucking behavior. Any sucking or smoking behavior can reduce negative affects (i.e. distress, anger, fear etc.) and evoke positive affects (i.e. excitement, enjoyment etc.). It can do this innately (sucking behavior) as well as on the basis of later learning (smoking behavior).

### Psychological factors in smoking behavior.

There are many psychological factors that play an important role in maintaining the smoking habit. Within 24 hour after cessation individuals undergoing withdrawal symptoms are prone to an increase in irritability, frustration, anxiety, anger, insomnia and craving for nicotine (Huges, Gust, Keenan & Fenvick, 1991) . The psychological discomfort after cessation is a main reason for a high rate of relapse and resuming cigarette smoking to alleviate the withdrawal distress (Svikis, Hatsukami, Huges, Carroll & Pickens, 1986). This is consistent with the psychological model of addiction (Ashley & Stepney, 1982). According to that model smokers smoke in order to attain psychological comfort. After the fall in nicotine levels in the body is experienced, the symptoms of withdrawal, including psychological discomfort (i.e. an increase in anxiety and stress level) are taking place. These signals lead the smoker to resume cigarette smoking in order to restore psychological comfort (i.e. increased vigilance, relaxation, enjoyment etc.). The psychological model of addiction indicates that there is a learned pattern in smoking behavior.

### Classical conditioning and smoking.

A central feature of learning is the ability to grasp temporal sequences. Classical conditioning involves association of temporal sequences. Association of one external event with another in temporal sequence, so that the first event becomes a signal for the second, is the core of classical conditioning. The fundamental principle of learning theory then, is that behavior is controlled by its consequences. The probability that an act will be repeated increases if the act results in reward. This reward may take the form of an event which in itself is pleasurable (ie. positive reinforcement)(Bootzin, 1991). In smoking behavior the positive reinforcement is the stimulation of "pleasure" centers that leads to changes in arousal (i.e. increased alertness, enhanced performance etc.). The probability that a behavior will be repeated is also increased if the behavior bring to an end or prevents the occurrence of an unpleasant stimulus (i.e. negative reinforcement). Such negative reinforcement occurs when smoking eliminates the aversive state of withdrawal that in turn leads to relief of anxiety and stress (Rose, Amanda & Jarvik, 1983).

Working on morphine tolerance, Siegel (1977,1978) elaborated an addiction model that is consistent with the principles of classical conditioning. The administration of a drug normally constitutes classical conditioning because the pharmacological stimulation (UCS) is almost always signalled by a variety of

environmental cues (CS) uniquely presented when the drug is administered. These cues consist of the procedures, rituals, and other environmental stimuli that regularly precede the drug effect. The anticipation for receiving the drug, paired with the usual CS stimuli elicits compensatory responses. Environmental cues or CS stimuli are important in establishment of tolerance to the drug as well as in understanding the role of mental set (i.e. anticipation) in addictive behaviors.

#### Anxiety and smoking behavior.

Anxiety as a psychological phenomenon has a very broad definition, varying from describing a feeling of dread and apprehension about the future to a secondary drive involving an acquired avoidance responses (Chaplin, 1985). A plausible, for the purpose of this study definition of anxiety, would be : a psychological phenomenon of discomfort and apprehension. For a smoker, this psychological condition, paired with environmental cues, would be a sign to resume cigarette smoking in order to return to the state of psychological comfort by reducing the level of anxiety.

The most popular test for measuring anxiety is the Spielberger State-Trait Anxiety Inventory. The S-T Anxiety Inventory has been used extensively in psychological research and clinical practice. The test contains two parts: self-report for

State Anxiety and self-report for Trait Anxiety. The self-report State Anxiety scale consists of twenty statements that evaluate how subjects feel "right now" at the moment of being tested. The self-report Trait Anxiety scale consists of twenty statements that assess how people generally feel. The validity and reliability of the S-T Anxiety Inventory have been assessed by numerous studies (Spielberger, 1991).

It has been mentioned earlier that deficit of nicotine or perceived stressful situation elicit smoking behavior. The research shows that nicotine smoking decreases the state of anxiety (Thomas, 1973) at least under some circumstances. The use of tobacco products clearly increases when smokers are placed in stressful situations (Rose, Amanda & Jarvik, 1983). These observations lead to the suggestion that people have learned to smoke in an attempt to cope with stress. Although many smokers identify the production of a relaxed state as a motive for smoking, some experiments on the relationship between smoking and anxiety were inconclusive (Huges, Gust, Skoog, Keenan & Fenvick, 1991; Svikis, Hitsukami, Huges, Carroll & Pickens, 1986). Problems in demonstrating the antianxiety effect of nicotine in smokers may arise because such studies usually use subjects who have been withdrawn from nicotine for several hours which may result in withdrawal-induced increases in anxiety. Pomerleau (1984) assessed the effects of nicotine-containing cigarettes and



zero-nicotine cigarettes on anxiety produced by presenting the subjects with unsolvable anagrams. The subjects were nominally deprived smokers who refrained from smoking for one hour before testing. The nicotine-containing cigarettes elicited a measurable reduction in anxiety as measured by the Spielberger State Trait Anxiety Inventory.

#### Anticipation of smoking and anxiety.

Anticipation is defined as a mental set or readiness to receive a stimulus (Chaplin, 1985). Classical conditioning model of addiction presupposes anticipation of pharmacological and nonpharmacological events (Siegel, Krank & Hinson, 1986). The anticipation for receiving the drug paired with usual environmental cues (i.e. cues that were present during the conditioning process) elicits compensatory effects. Those compensatory effects are usually the ones that are opposite to the effects of the pharmacological drug effects. For instance, rats anticipating an injection of morphine within the same environmental cues are showing more sensitivity to painful stimuli when injected with morphine. It means that anticipatory reaction to receiving morphine elicits the same pharmacological effects of morphine itself. When both effects (i.e. psychological-anticipation and pharmacological-drug) experienced by the organism are combined together, the antinociceptive properties of the drug

are lessened (Siegel, 1978). Modern research on smoking indicates that anxiety experienced by the organism is related to nicotine deficit in the bloodstream and in the brain. However, there is a gap between psychological and pharmacological data that would link anticipation and anxiety experienced under two conditions: anticipatory smoking and removal of anticipatory smoking. It is expected that anxiety that accompanies the deficit of the drug in the organism will significantly increase. However, when an anticipatory response is introduced with an association with the CS (i.e. environmental stimuli, such as time, smell of coffee, alcohol etc.), the anxiety level is expected to increase. Since the organism is expecting (anticipating) the administration of the drug (cigarette) the compensatory effects of anticipation will decrease the level of anxiety and will keep it under control until administration of the drug will take place and the pharmacological effects of the drug itself will take over the control of the anxiety level. Smokers are expected to decrease and maintain anxiety levels through the process of anticipation, whereas smokers deprived of the anticipation of smoking are expected to show a significant increase in anxiety level.

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Armitage, A.K. (1973). Some recent observations relating to the absorption of nicotine from tobacco smoke. In Dunn, W. S. Smoking Behaviour: Motives and Incentives. V.H. Winston & Sons, Washington, D.C., 83- 91.

The human smoker adjusts the dose of nicotine they take into their mouth very subtly, by adjusting either the size of the puff or the rate at which they puff. Experiments with rats show that very small doses of nicotine when suitably administered can affect the behaviour of normal rats. Animals show more lever pressing behaviour, indicating a high arousal level. The effects of nicotine on blood pressure, heart rate and brain functions are discussed on the bases of animal studies.

Ashton, H. & Stepney, R. (1982). Smoking. Psychology and Pharmacology . Tavistock Publications. London and New York.

A comprehensive publication on smoking behaviour containing chapters on the physiological importance of nicotine, the development of smoking behaviour, self regulation of nicotine intake, smoking as psychological tool, smoking and personality, learning and breaking the habit.

Bootzin R.R., Bower, G.H., Crocker, J., Hall, E. (1991).

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Chaplin, J.P. (1985). Dictionary of Psychology. Dell Publishing,  
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Epstei, L.H.; Perkins, K.A.(1988). Smoking, stress, and coronary  
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56, 342-349.

Smoking is a major coronary heart disease risk factor that  
has been proven to be very resistant to the treatment  
efforts. For many smokers, environmental stress, which has  
also been related to coronary heart disease risk, appear to  
be strong determinants of smoking behaviour and of relapse  
after cessation. This study focuses on the interrelation  
between stressors and smoking and on the potential impact of  
this interrelation on coronary heart disease risk beyond  
that which is due to stressors or to smoking alone.

Evidence supporting the interrelation between stress and  
smoking and its relevance to the risk of heart disease is  
reviewed. Authors discuss the mechanisms that may explain  
why smokers smoke more during stress and why stress may  
cause relapse.

Evans, R.I. (1979). Smoking in children and adolescents:  
Psychological determinants and prevention strategies.  
Research Monograph Series, 26, 70-96.

Becoming a smoker may have the immediate value to some teenagers of being accepted by their peers, feeling more mature because smoking is an adult behaviour forbidden to the child, providing a level of physiological stimulation and pleasure. Smoking may even serve the function of an act of defiance to authority figure. Relevant conceptual models in developmental and social psychology, typical psychosocial influences on the smoking decision such as changing sex roles, parental smoking habits, siblings who smoke, rebellion against family authority, peer pressure, mass media and individual characteristics are discussed.

Heimstra, N.W. (1973). The effect of smoking on mood change. In Dunn, W. Smoking Behaviour: Motives and Incentives. Washington, D.C.: V.H.Winston & Sons, 197-207.

This study was concerned with the affective state labelled mood and with the effects that smoking has on mood change under a variety of experimental conditions. Subjects participated in five experiments. In experiment V a total of 231 subject were involved. The subjects were assigned to group of nonsmokers, smokers, and deprived smokers. The subjects completed the Mood Adjective Check List (MACL) and then viewed a stressful film ("Hiroshima-Nagasaki, August 1945"). Immediately after the film, the subjects again completed the MACL. In the nonsmoker and smoker-

deprived groups, all mood factors showed significant change between the pretest and posttest administration. However, in the smoker group no significant changes took place in the mood factors of aggression, anxiety. The data obtained from this study strongly suggests that smoking will modify mood states or will to reduce fluctuation or change in mood.

Huges, J.R, Gust, S.W., Skoog, K., Keenan, R.M., Fenwick, J.W. (1991). Symptoms of tobacco withdrawal. Archives of General Psychiatry, 48, 52-59.

Three hundred fifteen smokers who wished to quit were randomly assigned in a double blinded manner to groups using either nicotine or placebo gum. Self-reported and observed symptoms of tobacco withdrawal were collected before cessation and follow-ups of 1 to 2 weeks, 1 month, and 6 months. Self reported and observed anger, anxiety, craving, difficulty concentrating, hunger, impatience, and restlessness were the most prominent symptoms of tobacco withdrawal.

Hutchinson, R.R. and Emeley, G.S. (1973). Effects of nicotine on avoidance, conditioned suppression and aggression response measures in animals and man. In Dunn, W.(Ed.) Smoking Behaviour: Motives and Incentives. Washington, D.C.: V.H. Winston & Sons, 171-196.

The authors trained a squirrel monkey to obtain food rewards by pressing a lever. Over the period of training, tone stimuli were occasionally paired with the delivery of an electric shock. The animal came to associate the tone with the shock. In the post-training period, presentation of the tone alone disrupted the food-acquisition response. The administered nicotine counteracted this stress-induced suppression of behaviour. Biting behaviour decreased during the nicotine administration. The authors suggested that the human counterpart of biting behavior in the squirrel monkey is the jaw-clenching and teeth-grinding which accompanies irritability and frustration. They noted that abstaining smokers showed an increased frequency of the jaw-clenching and investigated the possibility that nicotine could modify this behaviour. Four nonsmokers were chosen for an experiment in which the force and frequency of jaw-clenching was measured from records of electrical activity in the masseter muscle. Administration of 5mg of nicotine in drinking water fifteen minutes before the test considerably reduced the clenching response, compared to the control condition in which distilled water was given.

Jarvik, M.E. (1979). Biological influences on cigarette smoking. Research Monograph Series, 26, 8-45.

The article reviews current knowledge on the biological, biochemical, and physiological correlates of the smoking habit over three stages of its development: establishment, maintenance, and cessation of the smoking behaviour.

Kozlowski, L.T. (1979). Psychosocial influences on cigarette smoking. Research Monograph Series, 26, 98-125.

The psychosocial factors on the establishment of smoking behaviour include: individual factors such as extraversion, neuroticism, antisocial tendencies, internal-external control, personality and attitudes toward drug taking and social factors such as family and peer pressures, social class and social mobility. In cessation, personality characteristics (i.e. extroversion, introversion and neurotism) from the point of view of individual and social factors are discussed.

Pechacek, T.F. (1979). Modification of smoking behaviour. Research Monograph Series, 26, 130-162.

The author analyzes the intervention strategies which include public health educational campaigns and individual and medical counselling. The core of the article is devoted to controlled experimental research on intervention strategies that includes drug treatments, hypnosis, social psychological approaches, social learning and behaviour modification.



Pomerleau, O.F. (1979). Behavioral factors in the establishment, maintenance and cessation of smoking. Research Monograph Series, 26, 48-67.

The author focuses his attention on social learning theory and nicotine regulation model as general considerations to provide a context for a behavioral analysis of smoking. An evaluation of the contributions from the experimental analysis of behavior to the treatment of cigarette smoking and recommendations for future research are made.

Pomerleau, O.F., Turk, D.C., Fertig, J.B. (1984). The effects of cigarette smoking on pain and anxiety. Addictive Behaviours, 9, 265-271.

The antinociceptive consequences of smoking a nicotine-containing cigarette or zero-nicotine cigarette were investigated in minimally deprived habitual smokers. Five subjects were studied in each of two experiments. In the first one, pain was induced using the cold pressor test. In the second one, anxiety, using unsolvable anagrams. All subjects exhibited pain- and anxiety-reduction after smoking a nicotine-containing cigarette. The results support the hypothesis that nicotine from smoking can produce psychological changes that are independent of the state of nicotine withdrawal.

Rose, J.E., Ananda, S., Jarvik, M.E. (1983). Cigarette smoking during anxiety-provoking and monotonous tasks. Addictive Behaviours, 8, 353-359.

Cigarette smokers were exposed to three conditions within a single session: Stagefright anxiety, monotonous concentration, and relaxation control. One cigarette was lit during the second 10-minute half of each condition, and smoking topography (i.e. number of puffs and cumulative volume smoked) was recorded. Subjects smoked significantly more in the two task conditions than during relaxation. The results support the hypothesis that anxiety-provoking and attention-demanding situations elicit smoking behaviour.

Siegel, S. (1977). Morphine tolerance as an associative process. Journal of Experimental Psychology: Animal Behavior Processes, 3, 1-13.

Results of this study support hypothesis that morphine analgesic tolerance is a manifestation of an association between the drug administration ritual and the systematic drug effect.

Siegel, S., Hinson, R.E., Krank, M.D. (1978). The role of predrug signals in morphine analgesic tolerance: support of Pavlovian conditioning model of tolerance. Journal of Experimental Psychology: Animal Behavior Processes, 4, 188-196.

Animals that are given pretest morphine administrations are much more tolerant to the analgesic effects of the drug than subjects given the same number of unpaired morphine administrations. Morphine tolerance depends more on the number of pairings of a drug-predictive cue with the systematic effects of the drug than on the frequency of pharmacological stimulation. The study supports Pavlovian conditioning theory. According to this theory, drug preparatory CRs, elicited in anticipation of the actual pharmacological assault, attenuate the pharmacological insult.

Siegel, S., Krank, M.D., Hinson, R.E. (1986). Anticipation of pharmacological and non pharmacological events: classical conditioning and addictive behavior. Journal of Drug Issues, 17, 83-110.

Soldatos, C.R., Kales, J.D., Scharf, M.B., Bixler, E.O., Kales, A. (1980). Cigarette smoking associated with sleep difficulty. Science, 207, 551-553.

A group of 50 smokers in this study experienced greater sleep difficulty than a group of 50 nonsmokers matched by age and sex. The two groups did not differ in personality patterns or drug consumption. Sleep patterns significantly improved in a group of eight chronic smokers when they abstained from cigarette smoking. However, they experienced some

psychological effects such as depression, anxiety, anger, irritation, lack of concentration and tension.

Svikins, D.S., Hatsukami, D.K., Huges, J.R., Carroll, K.M., Pickens, R.W. (1986). Sex differences in tobacco withdrawal syndrome. Addictive Behaviours, 11, 459-462.

Twenty inpatient and 50 outpatient subjects were examined for sex differences in tobacco withdrawal symptoms. With each subject serving as his/hers own control, changes of physiological, psychological and behavioral measures were determined from baseline to tobacco abstinence condition. For all measures, no statistically significant differences between men and women were found in either the number or severity of tobacco withdrawal symptoms.

Thomas, C. (1973). The relationship of smoking and habits of nervous tension. In Dunn, W. (Ed.): Smoking Behaviour: Motives and Incentives. Washington, D.C.V.H. Winston & Sons, 157-170.

The findings on the smoking behaviour of a medical population was observed up to 25 years. The smoking behaviour was related to habits of nervous tension, habits of daily life and other psychological characteristics. Comparison of the psychological profiles of 321 lifetime nonsmokers and 279 continuing and former smokers showed significant differences in aggression and anxiety.

anticipation

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Anticipation of smoking and  
the state of conditioned anxiety  
in smokers.

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### Abstract

Modern research on smoking limits itself mainly to pharmacological studies of the effects of nicotine on smokers' behavior and health. This study explores the psychological factors that may play an important role in smoking behavior. Anxiety was proposed as a psychological factor in smoking behavior. The anxiety levels in smokers have been assessed in relation to anticipation and not anticipation of smoking. Fifty three subjects from the Introductory Psychology course, assigned to two control and two experimental groups, were tested for the anxiety state. The Spielberger State-Trait Anxiety Inventory was administered to all subjects. Results of the study supported the hypothesis that anticipation of smoking lowered anxiety and non anticipation of smoking led to higher anxiety in smokers. Anxiety management training has been proposed for smokers undergoing cessation from the smoking habit.

Anticipation of smoking and the state of conditioned anxiety  
in smokers.

There is no doubt that cigarette smoking occupies a prominent place on the list of modern man's addictions (Evans, 1979). There are two reasons for this. First of all, nicotine belongs to that category of drugs that are widely available to the people, and secondly the research shows alarming consequences of the smoking habit, including medical costs (lung cancer, heart disease) (Epstei, & Perkins, 1988) and psychological costs (withdrawal symptoms, increased preoccupation with the habit) (Heimstra, 1973; Huges, Gust, Skoog, Keenan, & Fenwick, 1991; Svikins, Hatsukami, Huges, Carroll, & Pickens, 1986).

The existing models of addiction, from pharmacological to psychological, attempt to explain the phenomenon of smoking behavior (Ashton, & Stepney, 1982). One of the many proposed motives for smoking is to decrease anxiety that smokers experience under stressful situations or resulting from the pharmacological deficit of nicotine in the organism (Armitage, 1973). For this reason the modern research limits itself mainly to assessing anxiety in relation to the pharmacological deficit of nicotine in the bloodstream (Jarvik, 1979). Data show that anxiety in smokers can be controlled or decreased by reintroducing nicotine to the

organism (Pomerleau, Turk, Ferting, 1984). However, the modern research has paid less attention to study of anticipation of smoking and its effects on conditioned anxiety in smokers (Rose, Ananda, Jarvik, 1983).

One model of addiction is that of classical conditioning, which includes the anticipation or the feedforward principle. According to that model, addiction to drugs involves a classically conditioned physiological response to stimuli associated with drug administration. Such a response in effect increases the need for the drug in situations where it has previously been received (Siegel, 1975). The role of Pavlovian classical conditioning in acquiring a tolerance to drugs has been widely supported by research.

Two phenomena are incorporated into the classical conditioning model: feedback and feedforward (or anticipation) principles. The phenomenon of feedback is often incorporated in explanations of the organism's response to a drug. The organism protects itself from disturbances induced by an acute drug administration and deals with chronic drug effects (i.e. developing of tolerance) by various classically conditioned compensatory mechanisms (Siegel, 1977). An ancillary concept to feedback is that of feedforward or anticipation. The concept of anticipation means responding, not to disturbances, but to stimuli that have been associated with any drug administration in the past (Siegel,



Krank, Hinson, 1978; Siegel, Krank, Hinson, 1986). Research shows that the drug effects are mediated not only by responses elicited by the drug but also by responses elicited in anticipation of the drug administration (Siegel, 1977).

The purpose of this study is to test the effects of anticipation of smoking on anxiety levels in smokers, experienced under two conditions: anticipation of smoking and non anticipation of smoking. It is hypothesized that anticipation of smoking will lower anxiety levels whereas non anticipation of smoking should result in higher anxiety in smokers as measured by the Spielberger State Trait Anxiety Inventory.

## Method

### Subjects

Subjects for this experiment were recruited from the Introductory Psychology course offered at Algoma University College. Fifty three subjects participated in the study. Subjects received one credit toward their Introductory Psychology course work for their participation. Their age ranged from 18 to 48 years old. Subjects were divided into "smokers" and "nonsmokers" on the basis of their self -report, and each of these was randomly subdivided into two groups, "anticipation" and "non anticipation".

### Procedure

On the day of the test the instructor, at the beginning of the evening class, gave the subjects a preliminary questionnaire designed to identify smokers. At the beginning of the break (8:15 P.M.) all participants received a kit which included instructions, an English text and the Spielberger State Trait Self-Evaluation Questionnaire. Smokers and nonsmokers who were assigned to the "anticipating" groups received a kit marked with a small green dot. Smokers and nonsmokers in the "non anticipating" groups received the kit marked with a small pink dot. The first name and the capital letter of the subject's last name were written on the instruction page. Subjects were instructed to tear off this page after completing the experimental task. The last sentence of the introductory instruction was altered for smokers anticipating smoking and their control group and for smokers not anticipating smoking and their control group: "anticipating" groups were instructed that after they have completed their experimental task a short coffee break will follow, whereas subjects in "non anticipating" groups were instructed that upon the completion of the experimental task the lecture will be resumed.

In order to keep the subjects busy during the experiment, they were given two pages of an English text and were asked to underline all spelling mistakes in it. Next the subjects answered the Self-Evaluation Questionnaire. At the end of the experiment all participants received written feedback which included an explanation of the study and expected results and a receipt for one credit in the Introductory Psychology course.

### Results

The measurement of anxiety levels was based on the data obtained from 53 subjects who rated their anxiety state according to the Spielberger State Trait Self Evaluation Questionnaire. The exploratory data analysis showed a non significant difference in anxiety means for non smokers in "anticipating" group and non smokers in "non anticipating" group ( $M_{nsa} = 31.250$   $M_{nsna} = 30.933$ ). Anxiety means for smokers anticipating smoking and smokers not anticipating smoking differed significantly ( $M_{sa} = 34.273$   $M_{sna} = 47.083$ ).

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Anxiety levels for both groups of smokers (anticipating and non anticipating smoking) were significantly higher than anxiety levels for non smokers in two control groups respectively ( $F(1, 50) = 24.60, p < 0.05$ ).

The Newman - Keuls test was performed with the four groups (smokers and nonsmokers in "anticipating" and "non anticipating" groups).

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Smokers not anticipating smoking showed higher anxiety than smokers anticipating and nonsmokers in two control groups. There was no statistically significant difference in anxiety levels for smokers anticipating smoking and nonsmokers.

## Discussion

The results obtained in the present experiment support the hypothesis that anticipation of smoking led to a lower anxiety level and that non anticipation of smoking was associated with higher anxiety in smokers. Two interpretations can possibly account for these results. First, smokers were more anxious, but relaxed in anticipation of a cigarette. Second, smokers became anxious when informed they would not get their customary cigarette.

The literature on the smoking habit often suggests that smoking addiction is a form of a coping mechanism for a smoker experiencing anxiety produced by stressful situations (Rose, Ananda, Jarvik, 1983). If this is the case, then anticipation of smoking according to the feedforward principle should elicit effects that may mimic the effects of the drug itself. Smokers anticipating smoking should experience the effects of nicotine upon the presentation of the stimulus (i.e.anticipation of smoking during the break between lectures). The results of the present study seems to support this idea. Smokers anticipating smoking showed a significantly lower level of anxiety than smokers not anticipating smoking. The process of feedforwarding elicited then mimicry effects of the drug (i.e.nicotine) in spite of the absence of the pharmacological stimulus (i.e.a nicotine containing

cigarette). In the presence of pharmacological deficit of nicotine in the bloodstream and a general increase of anxiety caused by this deficit, smokers anticipating smoking were able to regulate their anxiety level, and, as a result, actually keep it at a low level.

It is possible then to conclude that anticipation of smoking leads to temporary lowering of anxiety in smokers, whereas non anticipation of smoking produces an increase in conditioned anxiety.

The author of this study takes account of the presence of confounding variables that would influence the experimental outcome. First and foremost, the study did not assess the anxiety levels in subjects prior to the experiment. It is possible that some subjects have had no opportunity to smoke prior to the lecture, thus the withdrawal symptoms, usually present after 1.5 hours after cessation, would have influenced the anxiety state. Psychological factors such as fatigue, preoccupation with the school work, personal or family problems would also effect the experimental results.

Future research should address the issue of assessing anxiety levels prior to anticipation and of using, for instance, electroencephalographic measures of general arousal.

The findings reported here support the idea that stress (or anxiety) management training should be incorporated into

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smoking cessation programs (Lichtenstein, & Brown, 1980; Pechacek, 1979). Since smokers show an ability to control their anxiety through the principle of feedforward it is then possible that the psychological factors may play the most important role in cessation of smoking. If this is the case, then, a program in which a smoker is trained to find alternative substitute behaviors when exposed to anxiety may be a valuable supplement to an anxiety-reduction approach and thus leading to the extinction of the smoking habit.

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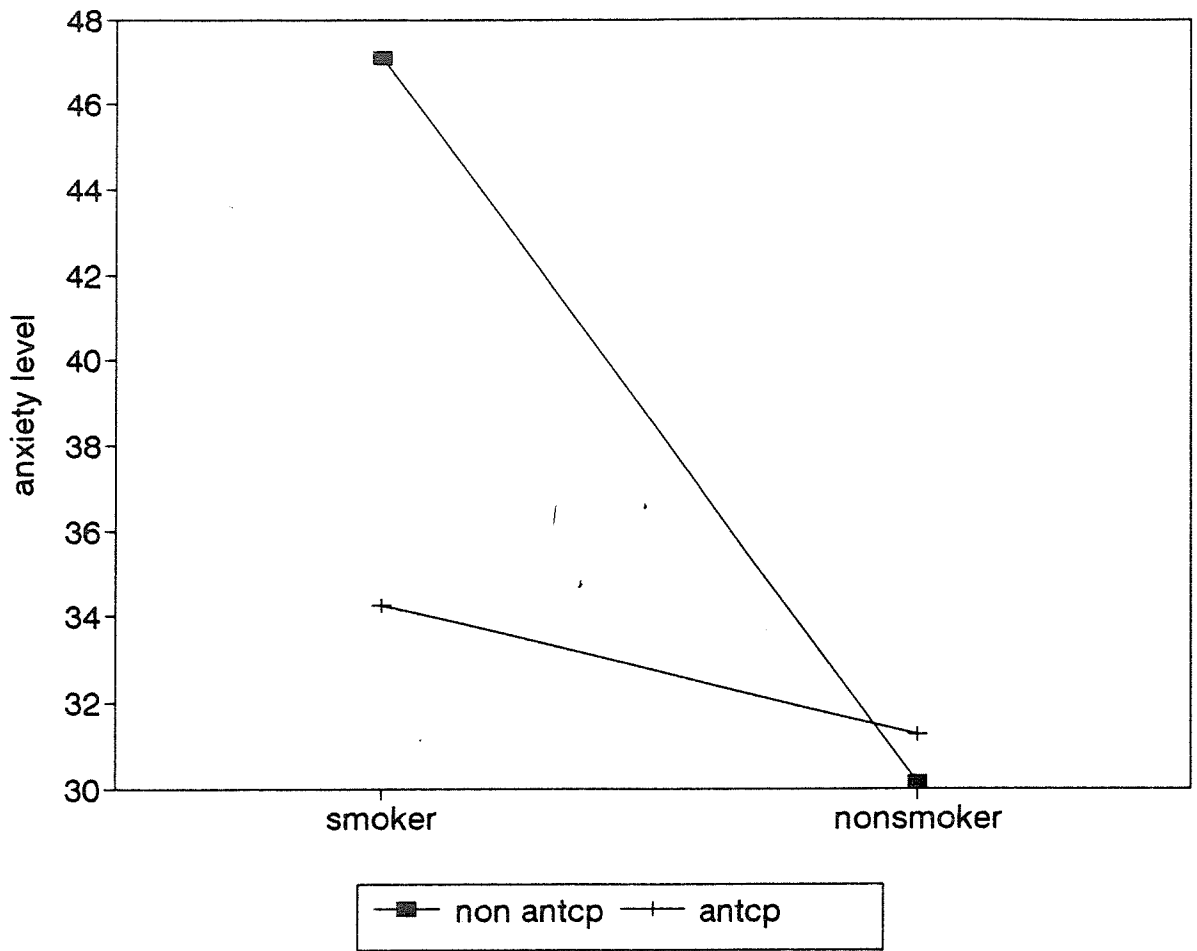


Table 1.

		nsna	nsa	sma	smna		
		<u>M</u>	<u>M</u>	<u>M</u>	<u>M</u>		
		30.13	31.25	34.27	47.08	r	Wr
nsna	<u>M</u> 30.13	-	1.12	4.14	16.95*	4	7.54
nsa	<u>M</u> 31.25		-	3.02	15.83*	3	7.01
sma	<u>M</u> 34.27			-	12.81*	2	6.12
smna	<u>M</u> 47.08				-		

nsna - nonsmokers not anticipating

nsa - nonsmokers anticipating

sma - smokers anticipating

smna - smokers not anticipating