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MOTIVES AND INCENTIVES IN CIGARETTE SMOKING

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There is a lovely little island in the Caribbean lying at the northern end of the Antilles called Saint Martin Island. Legend has it that in the 16th century both the Dutch and the French claimed possession, but rather than fight, they agreed to a rational solution to the problem. A Frenchman and a Dutchman were placed back to back on the beach and told to walk until they met again on the opposite side of the island. A straight line was then drawn from where they started to where they met, dividing the island into what have remained the French and the Dutch sides. The French got the bigger half. Some say this was because the Frenchman was drinking French champagne while the Dutchman was drinking Dutch whiskey, so the Frenchman was able to walk straighter and faster. However true all this may be, the French and Dutch have coexisted peacefully for 200 years under these terms, proving the wisdom of a rational approach to problem-solving.

Inspired by this rare 16th century display of human reason, the Council for Tobacco Research, U.S.A., chose St. Martin as the place for twenty-five scientists to meet in January, 1972. (The tropical loveliness and the warm January sunshine had absolutely nothing to do with the choice of a meeting place.) The purpose of the conference was to attempt to answer the question "Why do people smoke cigarettes?". Those who attended were pharmacologists, psychologists, sociologists and anthropologists. Much of what I will now present is drawn from the papers presented at the St. Martin Conference.

To begin I would like to state three propositions that got expressed at the St. Martin Conference.

The first proposition reflects the view of the majority of the conferees: The smoker primarily seeks the subtle transient physiological response to inhaled smoke. There are many other reasons why a person smokes, but the primary reason is to obtain the physiological response. All other reasons for smoking are secondary. They come into play only because smoking becomes so much a part of daily living. To emphasize the distinction between the primary and secondary reasons for smoking, I will use the analogy of eating as given by Prof. Seymour Kety of Harvard University in his summary of the conference. He pointed out that elaborate behavioral rituals, taste preferences, and social institutions have been built around the simple act of eating, so much so that even when not hungry we take many pleasures in eating. These many pleasures are second-order incentives to eating, superimposed upon the primary incentive of obtaining physical nourishment. It would be difficult indeed to imagine the fate of our highly evolved eating habits were there not ever any nutritional gain from food intake. As with eating, so it is with smoking. The physiological effect is primary while the taste and smell pleasures, the social symbolism and the satisfactions of lighting up, puffing and handling the cigarette are all of secondary importance.

The St. Martin pharmacologist conferees proposed this second proposition: Nicotine is the primary active constituent of cigarette smoke. They would contend that without nicotine, there would be no sought-after physiological response.

The third proposition reflects the expressed views of several of the conferees: The physiological responses to inhaled nicotine are sought after because these physiological responses have a positive effect upon the smoker's psychological efficiency.

The term psychological efficiency needs some explanation. It refers to how well a person makes use of his psychological resources in performing tasks and solving problems. Perhaps its best to think of it as a percentage determined from the equation:

$$\frac{\text{Actual Performance}}{\text{Capacity Performance}} \times 100 = \text{Psychological efficiency}$$

A person's efficiency varies widely over time. Because there are so many factors having an adverse effect, 100% efficiency is rarely achieved. Fatigue can have an adverse effect. So can poor motivation. Emotional state can also have a profound influence, sometimes working for, sometimes against, efficiency. Much of what we do in the normal course of living is aimed at raising or maintaining efficiency. The third proposition of this paper states that smoking cigarettes is one of the things many of us do to improve psychological efficiency.

Let me restate the three propositions:

1) One smokes primarily for the physiological response to inhaled smoke.

2) The primary constituent in cigarette smoke which produces the sought-after physiological response is nicotine.

3) The sought-after physiological responses result in increased psychological efficiency.

The three propositions are bound together by a postulated sequence of events:

Smoke Inhaled → Nicotine Absorbed → Physiological Responses → Improved Psychological Efficiency

The main thrust of this paper is in the marshalling of the evidence in support of the third proposition. In attempting to develop the thesis that the physiological response to inhaled nicotine makes for improved psychological efficiency, I will be making use of evidence from three sources:

1) Reports of physiological responses to inhaled smoke.

2) Reports of psychological differences between smokers and non-smokers.

3) Observations of situational factors which influence rate of smoking.

First, I will present a listing of those transient physiological responses to smoke inhalation as reported in the literature. They are all of mild degree, well within the range of response to be observed under the usual vicissitudes of life.

TABLE 1

TRANSIENT PHYSIOLOGICAL RESPONSES TO SMOKE INHALATION

1) Galvanic skin response (increased conductivity)
2) Elevated heart rate
3) Elevated blood pressure
4) Elevated blood sugar level
5) Release of epinephrine (adrenaline)
6) Electroencephalographic change (alpha suppression)
7) Basal metabolic rate increase
8) Increased muscle tension
9) Increased salivation
10) Lowered skin temperature in extremities
11) Inhibition of knee reflex

Where these responses have been plotted over time, they have been observed to have their onset within several minutes of smoke

inhalation. Also they decay quickly with a half-life of about thirty minutes. Onset and decay roughly parallel onset and decay of nicotine presence in the bloodstream.

In reflecting upon this list we can ask the question "Is psychological efficiency improved by any of these physiological responses?" Take for example elevated blood sugar level. Does this response make for improved efficiency? Before I can attempt to answer this question, we need to talk a moment about emotion. There are two aspects of an emotional experience: The body's response and the conscious experience. The conscious experience is determined by the person's interpretation of the situation. If it is a joyous situation, he experiences joy. If it is a threatening situation, he experiences fear, perhaps some anger. The most widely held view among psychologists today is that under all these varied emotional conditions, the physical body responds blindly; it does not distinguish among the different emotions. Whether it be fear, anger, or joy, the pattern of physiological response is the same. The emotions are differentiated only at the level of conscious experience. Body arousal will differ in degree as the intensity of the emotion varies, but the pattern is the same across all emotions.

The elements that make up the physiological response to emotion are listed in any standard textbook in introductory psychology. What makes these body accompaniments of emotion so relevant to a discussion of body responses to smoke inhalation is the remarkable

parallel in the two physiological patterns. In Table 2 I have listed the two sets of physiological responses side by side. Note that the first 8 items of the two lists are identical. There are

TABLE 2

PHYSIOLOGICAL RESPONSES:

To Smoke Inhalation	To Emotion
1) Galvanic skin response (increased conductivity)	1) Galvanic skin response (increased conductivity)
2) Elevated heart rate	2) Elevated heart rate
3) Elevated blood pressure	3) Elevated blood pressure
4) Elevated blood sugar level	4) Elevated blood sugar level
5) Release of epinephrine (adrenaline)	5) Release of epinephrine (adrenaline)
6) Electroencephalographic change (alpha suppression)	6) Electroencephalographic change (alpha suppression)
7) Basal metabolic rate increase	7) Basal metabolic rate increase
8) Increased muscle tension	8) Increased muscle tension
9) Increased salivation	9) Decreased salivation
10) Lowered skin temperature in extremities	10) Pupil dilation
11) Inhibition of knee reflex	11) Pilomotor response
	12) Respiration rate increase

some differences which need to be examined. First there are opposing salivary responses. Smoke inhalation increases salivation; emotionality

decreases salivation. We can account for salivation when smoking in terms of the mere presence of smoke in the mouth, suggesting that this particular response is not mediated by autonomic nervous system mechanisms but rather by the direct local action of smoke upon receptors in the mouth.

Pupil dilation is to be observed in emotional arousal; although dilation in nicotine-treated animals has been reported it has not been reported for human smokers. Perhaps this is due to mere failure in observation. The same can be said for pilomotor response; no one has ever attempted to observe for goose pimples while smoking, perhaps because it has never occurred to anyone to do so. There could possibly be such a response at a level detectable with electronic sensors, since the response even under emotion is so subtle as to be often not within our awareness. The inhibition of the knee reflex when inhaling smoke stands out rather conspicuously as deviant from the activation pattern. Dr. E. F. Domino, who originally reported the knee reflex inhibition, replied to my expressed puzzlement over the simultaneous occurrence of this response and muscle tension with this explanation in a personal communication: "Increased hand tremor and a reduction of the knee reflex appear to be quite independent phenomena. I believe there is excellent evidence that muscle tremor induced by nicotine is a higher central nervous system phenomena, while the reduction of the knee reflex involves the inhibitory system in the spinal cord. These two different phenomena are in no way incompatible".

My purpose in focusing upon the differences in the two lists has been to show that the presence of these particular differences does not detract from the argument that it is the similarity of the two patterns that is of over-riding consequence. So great is the similarity, in fact, that I am proposing the hypothesis that smoking is a means of inducing a body state that mimics emotional arousal, and that this, indeed, is what the smoker seeks.

Before elaborating upon this notion, let us review the second body of information about smoking. This has to do with the psychological differences between cigarette smokers and non-smokers. This is by far the most extensive body of fact that we have about the psychology of smoking. I have summarized in Table 3 the differences as they have been reported in the literature.

TABLE 3

Personality Traits

Smokers are more:

- extroverted
- active, energetic
- anti-social
- impulsive
- reliant upon external than internal controls
- risk-taking
- emotional
- anxious

Life-Style Characteristics

Smokers:

are more business oriented

have poorer academic records

use more alcohol

use more tea & coffee

attend religious services less often

remarry more often

change jobs more often

are hospitalized more often

are more active in sports

have more auto accidents

are of lower socio-economic status

These are the differences that appear when large groups of smokers and non-smokers are compared. Knowing all these facts about a given person, it is still difficult to predict whether or not that person is a smoker. In fact, were you given all this information about each person in a group of people, half of whom smoked and half didn't smoke, your hit rate in identifying the smokers would only improve from the 50% accuracy expected by chance to about 60%.

Nevertheless, there is a theme that emerges from among the traits in Table 3. Many of these traits are the traits displayed by people more prone to emotional arousal, either by virtue of their personality makeup or by virtue of their life situation.

This brings us to the third source of information; the situational factors which influence rate of smoking. People smoke more when excited or emotionally aroused. This is a commonplace observation, and one which is supported by the fact that people report in surveys that their reason for smoking is to relax. They also report that they smoke when bored, or to overcome monotony or when fatigued, but the great majority of the time a person will say he smokes to relax. This fits well with the personality characteristics of smokers; they are more frequently emotionally aroused than non-smokers. But smoking to relax doesn't fit at all with the physiological responses to inhaled smoke. Smoking tends to induce a physiological state which is the opposite of relaxation. Prof. Stanley Schachter of Columbia University made this paradox the thesis of his paper at the St. Martin Conference -- calling it the Nesbitt paradox, after a graduate student who collaborated with him in studying the phenomenon.

Let me state the Nesbitt paradox as clearly and succinctly as I can: The known physiological effects of smoking are those that we consider as indicating body activation or arousal. But smokers smoke more often when under stress and they report that smoking is relaxing. How can an agent that is physiologically arousing be perceived as calming? And why should an already aroused person seek further physiological arousal?

Schachter's formulation of the problem in terms of the Nesbitt paradox is fresh and provocative. Its resolution is a challenge

to anyone seeking to explain smoking. In fact, I can't think of a more effective test of a theory than its ability to explain this paradox.

There are two theories which in my judgment represent the most promising attacks upon the Nesbitt paradox to date. Schachter begins with the idea introduced earlier in this paper that the bodily arousal accompanying emotion is the same for all the emotions. Arousal takes on emotional meaning as the person interprets the circumstances under which the arousal is occurring. Sometimes the interpretation is faulty, leading to unusual consequences. I can give here a personal anecdote that well illustrates the point. Many years ago, the visit to the dentist was a far greater ordeal for me than it is now. After the injection of the local anesthesia for the filling of a major cavity I would suffer rapid heart beat, rapid breathing and all the other symptoms of being afraid. I assumed I was afraid, and continued to be afraid on every visit until quite casually the dentist informed me on one visit that there was adrenaline in the injection to localize the anesthesia and that it caused the body to respond in much the same way as when one is afraid. This was a great revelation to me. I discovered that the body arousal which I had interpreted to be due to fear was not due to fear. All this time I had not been afraid, or at least not as afraid as I had thought. I had been making a faulty interpretation of my bodily arousal, and feeling quite ashamed of myself for having been so lacking in courage. Today the visit to the dentist is not one of my greater pleasures, but I can go with the

dignity and the sense of manliness which that injected adrenaline had stripped me of before I knew what it was all about.

A more pertinant illustration comes from an experiment conducted by Schachter and one of his students. The subjects were told that the purpose of the study was to evaluate the effects of a drug called Suproxin on skin sensitivity. The test for skin sensitivity was a series of electric shocks progressively increased in intensity. The subject was to report when he first noticed the shock, when it became painful and when he could no longer tolerate it. Ten minutes before testing, the subjects took the Suproxin pill, which was of course a placebo. There were two conditions. In one condition, before they took the pill they were told the following about its side effects: "What will happen is that you may have some tremor, that is your hand will start to shake; you will have some palpitation, that is your heart will start to pound; your rate of breathing may increase. Also, you will probably get a sinking feeling in the pit of your stomach, like butterflies". All of these are symptoms which were widely reported by earlier subjects when they were asked to report their reactions when given electrical shock. To the extent that this manipulation is effective, subjects should attribute their shock-produced symptoms to Suproxin and not to shock.

In the other condition, subjects were told the following about Suproxin's side effects: "What will probably happen is that your feet will feel numb, you may have an itching sensation over parts of your body, and you may get a slight headache." None of these symptoms, of course, is produced either by the shock or the placebo.

Subjects in this condition, then, will experience the physiological symptoms produced by shock and anticipation of shock and, since no plausible alternative exists, will perforce attribute these symptoms to the shock experience. Under the first condition, when the subjects could attribute the shock-produced symptoms to Suproxin, they could tolerate an average of 1450 microamps. Under the second condition, when the effects were attributable directly to shock, they tolerated only 350 microamps.

In a second study from Schachter's laboratory, the same electric shock experiment was conducted, but this time cigarettes were used in place of Suproxin. Subjects were regular smokers. In one condition the subjects puffed on unlit cigarettes while being shocked, in the other condition they smoked normally. It was reasoned that the body arousal resulting from the shock would be in part attributable to the body arousal associated with the inhalation of cigarette smoke, therefore, the subjects inhaling smoke would tolerate more shock than those not inhaling smoke. And this proved to be the case.

Now how does Schachter apply all this to resolving the Nesbitt paradox? There is no paradox, of course, in the smoker seeking arousal when bored, but why smoke for arousal when already excited, as is so often the case? I quote him: "As we all know, disturbing and frightening events are presumed to throw the autonomic nervous system into action, epinephrine is released, heart rate goes up, blood pressure goes up, blood sugar increases, and so on. Now notice that many

of these physiological changes are precisely those changes that we're told are produced by smoking a cigarette. What happens, then, to the smoking smoker in a frightening situation? He feels the way he usually does when he's smoking a cigarette. Does he label his feelings as fright or as smoking a cigarette? I would suggest, of course, that to the extent that he attributes these physiological changes to smoking, he will not be frightened. And this, I propose, is a possible explanation for the strikingly calming effect that smoking a cigarette had on the chronic smokers in Nesbitt's experiments."

Schachter's interpretation may sound far-fetched, but let's examine it more carefully. We all seek emotional experiences. They make life interesting. But the control of emotion such that it does not interfere with our psychological efficiency is a fundamental and universal human problem. When a person judges his emotional arousal to be inappropriate, then that aroused condition becomes a threat to his well-being, triggers anxiety and produces further unwanted arousal. This sequence of arousal, threat to well-being, anxiety, and further arousal has come to be known as the vicious neurotic circle. Normal persons can and do experience it. Most of us have learned one or more of the many ways that this anxiety circle can be interrupted. I submit that smoking is one of these ways and the Schachter explanation is that smoking is effective because we can translate an inappropriate, threatening body arousal into an innocuous, non-threatening one merely by attributing the arousal to smoke inhalation.

The second theory I want to mention is in many ways like Schachter's. I call this the Emory-Ryan hypothesis. To my knowledge it was first proposed around 1965 by Prof. F. E. Emory while he was with the Tavistock Institute of Human Relations in London. This particular version of the hypothesis has grown out of discussions with Frank Ryan, a psychologist colleague at the Philip Morris Research Center in Richmond, Virginia. The Emory-Ryan hypothesis agrees with that of Schachter in that the smoker is seen to be smoking in order to control inappropriate or excessive emotional response. But the mechanism whereby this control is achieved differs from that proposed by Schachter.

A person's emotional arousal level while awake varies within a fixed range, from a low of drowsy calm to a high of pitched excitement. People differ in range. Some have wide ranges, some have narrow ranges. Those with wide ranges are subject to great swings in level of arousal. The magnitude of the swing can be so great as to be disruptive and interfere with one's psychological efficiency, hence those persons with wide ranges are more prone to seek out ways of controlling excessive or unwanted arousal changes. Cigarette smoking is one of those ways, for as we have already seen, smoke inhalation raises the level of body arousal. By smoking, a higher baseline of arousal is achieved, thus in effect narrowing the range within which arousal can vary. Body response to external events is therefore of reduced amplitude, i.e., the response is damped or muted. Through smoking, then, the smoker prepares himself for anxiety, or anger or any other emotion, such that the impact of these emotions upon his psychological efficiency

is less intense.

The Emory-Ryan hypothesis would not lead us to expect improved psychological efficiency but rather a reduction in the decrement in efficiency that might otherwise occur when the person is confronted with emotionally charged situations. Consider, for example, the person who is subject to excessive anxiety at social gatherings. He is painfully aware of his tendency to stammer, to move about awkwardly and, in general, to display poor psychological efficiency. He smokes a cigarette just before entering the room which raises his body arousal level. Upon entering, the body response to the presence of others occurs as anticipated, but the amplitude of the arousal is not as great as it would have been had he not smoked beforehand, hence the threat is not so great, hence the resulting anxiety is reduced. The vicious neurotic circle is interrupted, the anxiety does not feed upon itself, his body muscles are less tense so that he stammers less and moves about with more smoothly coordinated movements. In sum, he is functioning in a highly arousing situation with less loss of psychological efficiency.

Both the Schachter hypothesis and the Emory-Ryan hypothesis introduce a new dimension into research on the psychology of smoking. We are no longer justified in searching for simple order psychological gains from smoking in our efforts to explain smoking behavior. These hypotheses now force us into the study of the counter-effects of smoking and the situational variables at the time of smoking. Rather than ask what does the smoker gain, we must now ask what does the smoker retain through smoking that he might lose

by not smoking. If either of these hypotheses ~~are~~ is correct, we should be able to demonstrate that people with high amplitude arousal shifts will display less loss in psychological efficiency in emotionally charged situations when allowed to inhale smoke than when not allowed to inhale smoke.

In attempting to test out the Schachter and the Emory-Ryan hypotheses, there are a number of practical problems, not least of which is the empirical definition of our variables. How do we identify the person with high amplitude arousal shifts? How can we measure changes in psychological efficiency? How can we achieve emotionally charged situations?

The conference on the Dutch side of St. Martin Island was a significant scientific event. There are already a number of laboratories undertaking studies which have grown directly out of that conference.

The release of the conference proceedings to the larger scientific community will doubtless stimulate many additional investigations. The proceedings will be published shortly by V. H. Winston & Sons, Washington, D.C., under the title "Smoking Behavior: Incentives & Motives".