

T063109

MOTIVES AND INCENTIVES IN CIGARETTE SMOKING

William L. Dunn, Jr.  
Philip Morris Research Center  
Richmond, Virginia

good source for  
constitutional  
hypothesis etc.

There is a lovely little island lying about 150 miles east of the Virgin Islands. It is at the northern end of the Antilles, that string of islands flung out crescent-like across the blue Caribbean waters. Legend has it that in the 16th century, both the Dutch and the French lay claim to possession of this tiny body of land. Rather than fight it out as was their wont in those days they showed a surprising and exemplary willingness to apply human reason. A Frenchman and a Dutchman were placed back to back on the beach and told to walk along the beach until they met again on the opposite side. They did so, and a line was drawn between the points of start and finish, dividing the island into the French half called St. Martin, and the Dutch half called San Marteen.

It seems that the Frenchman walked faster than the Dutchman, because the French got the bigger half. Some say this was because the Frenchman was drinking French champagne and the Dutchman was drinking Dutch whiskey. However true all this may be, the two colonies continue to live peacefully under these 16th century terms.

**TIMN 0100242**

In January, 1972, the Dutch side of St. Martin was invaded by an unlikely party of twenty-five scientists. There were pharmacologists, sociologists, anthropologists and a preponderance of psychologists. They came from England, Canada and the United States. Each brought with him a carefully prepared scientific paper which represented his best efforts at attacking the question "Why do people smoke cigarettes?"

Inspired by the rare 16th century display of human reason shown by the French and Dutch colonists, and while not sunning on the beach, they listened to and reflected upon each other's ideas.

You've heard many explanations for cigarette smoking. These were reviewed at the St. Martin conference. I think it appropriate that we list the more commonly proposed explanations here:

- 1) For social acceptance or ego-enhancement
- 2) For pleasure of the senses (taste, smell)
- 3) For oral gratification in the psychoanalytic sense.
- 4) A psychomotor habit for the release of body tension
- 5) For the pharmacological effect of smoke constituents.

I might mention one other explanation, not because anybody believes it but as an example of how distorted one's reasoning can become when under the influence of psychoanalytic theory. Smoking according to this argument, is the consequence of pulmonary eroticism. Translated, this means the lungs have become sexualized and smoking is but another form of the sexual act.

**TIMN 0100243**

If one asks the smoker himself why he smokes, he is most likely to say "Its a habit." If he is intelligent enough, he might be more to the point and say either one of two things: "It stimulates me", or "It relaxes me". And now we are already deep into our topic. The polarity of these two observations has plagued investigators for fifty years. The challenge to any theory as to why people smoke lies in the theory's ability to resolve this paradoxical duality of effect.

The St. Martin conference was called by the Council for Tobacco Research, U.S.A., in an effort to goad the scientific community into having another go at the problem. And go at it they did. Much of what follows in this presentation comes from that St. Martin conference.

Most of the conferees would agree with this proposition: The primary incentive to cigarette smoking is the immediate salutary effect of inhaled smoke upon body function. This is not to suggest that this effect is the only incentive. Cigarette smoking is so pervasive of life style that it is inevitable that other secondary incentives should become operative. The conference summarizer, Prof. Seymour Kety of Harvard, used eating as an analogy. Elaborate behavioral rituals, taste preferences, and social institutions have been built around the elemental act of eating, to such an extent that we find pleasure in eating even when not hungry.

It would be difficult for any of us to imagine the fate of eating, were there not ever any nutritive gain involved. It would

**TIMN 0100244**

be even more provocative to speculate about the fate of sex without orgasm. I'd rather not think about it.

As with eating and copulating, so it is with smoking. The physiological effect serves as the primary incentive; all other incentives are secondary.

The majority of the conferees would go even further and accept the proposition that nicotine is the active constituent of cigarette smoke. Without nicotine, the argument goes, there would be no smoking. Some strong evidence can be marshalled to support this argument:

- 1) No one has ever become a cigarette smoker by smoking cigarettes without nicotine.
- 2) Most of the physiological responses to inhaled smoke have been shown to be nicotine-related.
- 3) Despite many low nicotine brand entries into the marketplace, none of them have captured a substantial segment of the market. In fact, critics of the industry would do well to reflect upon the indifference of the consumer to the industry's efforts to sell low-delivery brands. 94% of the cigarettes sold in the U.S. deliver more than 1 mg. of nicotine. 98.5% deliver more than .9 mg. The physiological response to nicotine can readily be elicited by cigarettes delivering in the range of 1 mg. of nicotine.

I hope our English friends who are developing the synthetic nicotineless cigarette are not going to be too disturbed by all this.

**TIMN 0100245**

Why then is there not a market for nicotine per se, to be eaten, sucked, drunk, injected, inserted or inhaled as a pure aerosol? The answer, and I feel quite strongly about this, is that the cigarette is in fact among the most awe-inspiring examples of the ingenuity of man. Let me explain my conviction.

The cigarette should be conceived not as a product but as a package. The product is nicotine. The cigarette is but one of many package layers. There is the carton, which contains the pack, which contains the cigarette, which contains the smoke. The smoke is the final package. The smoker must strip off all these package layers to get to that which he seeks.

But consider for a moment what 200 years of trial and error designing has brought in the way of nicotine packaging:

Think of the cigarette pack as a storage container for a day's supply of nicotine:

- 1) It is unobtrusively portable.
- 2) Its contents are instantly accessible.

Think of the cigarette as a dispenser for a dose unit of nicotine:

- 1) It is readily prepped for dispensing nicotine
- 2) Its rate of combustion meters the dispensing rate, setting an upper safe limit for a substance that can be toxic in large doses.
- 3) Dispensing is unobtrusive to most ongoing behavior.

**TIMN 0100246**

Think of a puff of smoke as the vehicle of nicotine:

- 1) A convenient 35 cc mouthful contains approximately the right amount of nicotine.
- 2) The smoker has wide latitude in further calibration: puff volume, puff interval, depth and duration of inhalation. We have recorded wide variability in intake among smokers. Among a group of pack-a-day smokers, some will take in less than the average half-pack smoker, some will take in more than the average two-pack-a-day smoker.
- 3) Highly absorbable: 97% nicotine retention.
- 4) Rapid transfer: nicotine delivered to blood stream in 1 to 3 minutes.
- 5) Non-noxious administration

Smoke is beyond question the most optimized vehicle of nicotine and the cigarette the most optimized dispenser of smoke.

Lest anyone be made unduly apprehensive about this drug-like conceptualization of the cigarette, let me hasten to point out that there are many other vehicles of sought-after agents which dispense in dose units: wine is the vehicle and dispenser of alcohol, tea and coffee are the vehicles and dispensers of caffeine, matches dispense dose units of heat, and money is the storage container, vehicle and dose-dispenser of many things.

So much for extolling the virtues of the rod. Let us go back now and pick up our discussion of the motivational aspects of smoking. If we accept the premise that nicotine is what the smoker seeks, we've still not answered the question "Why do people smoke"? We've merely reformulated it to read "Why does the smoker take

**TIMN 0100247**

nicotine into his system?"

Systematic research on the question dates back some fifty years to the time when American Tobacco Co. funded the work of a psychologist later to become the most prominent American psychologist of his time. His name was Clark L. Hull. His question then was "Wherein lies the charm of tobacco for those accustomed to its use?"

In order to review the data that has been collected over these intervening fifty years, I have organized it under three headings:

- 1) Differences between smokers and nonsmokers.
- 2) Human physiological responses to inhaled smoke.
- 3) Situational variables related to smoking behavior.

First, then, let us quickly review what is known about the differences between smokers and nonsmokers.

TABLE 1  
INDIVIDUAL TRAITS AND GROUP CHARACTERISTICS BY  
WHICH A GROUP OF SMOKERS CAN BE DISTINGUISHED  
FROM A GROUP OF NONSMOKERS

PERSONALITY TRAITS

- More independent (Pflaum, 1965)
- Greater anti-social tendencies (Smith, 1970)
- More active, energetic (Schubert, 1959; Straits, 1965)
- Higher mean extroversion rating (Smith, 1970)
- "Happy-go-lucky" (Smith, 1969)
- Higher mean measure of "orality" (Smith, 1970)

**TIMN 0100248**

Poorer mental health (Smith, 1970)  
Less rigid, less orderly, more impulsive (Smith, 1970)  
Greater reliance on "external" than "internal" controls (Smith, 1970)  
More chance-oriented (Straits, 1963)  
More emotional (Smith, 1967)  
Less agreeable (Smith, 1969)  
"Type A" personality (More time-conscious, competitive, etc.)  
(Rosenman, 1966)  
Less "strength of character" (Smith, 1969)  
Higher anxiety level (Walker, 1969; Srole, 1968; Thomas, 1968)

#### LIFE STYLE CHARACTERISTICS

More business-oriented in occupation (Seltzer, 1964)  
Poorer academic performance (Veldman and Bown, 1969; Pumroy,  
1967; Salber, 1962)  
More users of alcohol (Higgins, Kjelsberg, & Metzner, 1967;  
Lilienfeld, 1969)  
More users of coffee and tea (Lilienfeld, 1959)  
Religious service attendance less frequent (Cattell, 1967;  
Straits and Schrest, 1963)  
Proportionately higher frequency of marriages and job changes  
(Lilienfeld, 1959)  
Higher incidence of prior hospitalizations (Lilienfeld, 1959)  
Higher incidence of smoking among parents (Salber and Abelin,  
1967)  
More active participation in sports (Lilienfeld, 1959)  
More auto accidents (Ianni and Boek, 1958)

**TIMN 0100249**



MORPHOLOGICAL TRAITS

- Greater body weight (Seltzer, 1963)
- Greater height (Seltzer, 1963; Baer, 1966)
- Thinner (Higgins and Kjelsberg, 1967)
- Higher height/(cube root of weight) ratio (Damon, 1961)
- Thinner skin folds (triceps and subscapular) (Higgins and Kjelsberg, 1967)

DEMOGRAPHIC CHARACTERISTICS

- More men (Public Health Service Publication No. 1000, 1970)
- Proportionately more 25-45 year-olds (Public Health Service Publication No. 1000, 1970)
- Lower mean socio-economic class (Salber and MacMahon, 1961)
- Proportionately fewer college men (Higgins, Kjelsberg, & Metzner, 1967; Lilianfeld, 1959)
- More urban residents (Higgins, Kjelsberg, & Metzner, 1967)

Many of these characteristics have little meaning without considerably greater explanation than is appropriate for this presentation. Suffice it to say that the list does summarize our state of knowledge on the smoker-nonsmoker differences. As for the relevance of this knowledge to the question of motivation in smoking, I would say that it is a rich source of hypotheses and hunches, but unfortunately, that is about as far as it can take us. And I regret to say that the major effort of psychologists has been to search for these differences. Hull warned us fifty years ago that the difference approach was a primrose path, but only recently have psychologists begun to appreciate Hull's warning.

**TIMN 0100250**

The pharmacologists and physiologists have done much better, which leads us to the second body of fact; the human physiological response to smoke. The list in Table 2 again is a summary of our knowledge. To be sure there are other responses, some of which have been noted in the literature, some likely yet to be discovered, but those listed have been reported by at least two non-related laboratories.

TABLE 2  
TRANSIENT PHYSIOLOGICAL  
RESPONSES TO SMOKE INHALATION

1. Elevated heart rate
2. Elevated coronary flow
3. Elevated blood sugar level
4. Lowered cutaneous temperature in the extremities
5. Increased blood flow in skeletal musculature
6. A reactive release of adrenalin
7. Alterations in electrical potential patterns of the brain involving alpha wave suppression
8. Inhibition of patellar reflex

Where these responses have been plotted over time, they have been observed to have their onset within several minutes of smoke inhalation, and they are short-lived, having a decay function with a half-life of about thirty minutes. Onset and decay roughly parallel the coincident plotting of nicotine in the bloodstream. (Isaacs & Rand, 1972)

**TIMN 0100251**

These facts are considerably more relevant to the motivation question than are the facts about smoker-nonsmoker differences. In psychology, when we talk about motivation we refer to a force which impels one to act, and the action is goal-oriented. Hunger, for example, is a motive which impels one to the action of ingesting food. The goal is a state of satiety. Reaching the goal is the reward, and the behavior which is instrumental in reaching the goal is reinforced.

With this in mind, we can now ask several questions "Are any of the listed physiological reactions sought after by the smoker?", "Are these physiological reactions symptomatic of a body state which is the goal of smoking behavior?"

One feature of the list which has impressed many investigators is its close resemblance to the physiological response pattern accompanying emotional arousal, such as fear, anger, even joy. Is this perhaps the goal of the smoker, to achieve a body state which mimics emotional arousal?

In the context of this question, let us now turn to the third body of fact, the situational variables related to smoking behavior. So as not to bore you with references and the recitation of all the evidence, permit me to present this body of fact in the form of a summary statement: The rate and incidence of smoking varies as a function of external conditions which influence the emotional state of the smoker. The evidence at hand permits us to go one step further; the rate and incidence of smoking is highest at the extremes of the arousal continuum.

**TIMN 0100252**

If one were to plot smoking rate against some measure of the smoker's level of bodily arousal, one would observe a nice U-shaped distribution. This observation brings us full circle, for you will recall that at the outset of this presentation I quoted the smoker as explaining his smoking in paradoxical terms: It calms me, it stimulates me.

You may also recall that I stated that the challenge to any explanatory theory of smoking is to resolve this paradoxical duality of effect. At the St. Martin conference, Professor Stanley Schachter, a psychologist at Columbia University, labeled this as the Nesbitt paradox; Nesbitt being a student of Schachter's who called the paradox to his attention.

Let me state this 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. This fits in nicely with the smoker's statement "It stimulates me". But it is highly discordant with the polar explanation which the smoker provides perhaps even more often - "It calms me". How can an agent which is physiologically arousing be calming? And why should an already aroused, excited person seek further physiological arousal?

Summarizing the known facts pertinent to the question of motivation:

- 1) Smoking is relateable to personality variables.
- 2) Smoke inhalation induces documented physiological responses similar to those induced by emotional arousal.

**TIMN 0100253**

- 3) Smoking rate varies as a parabolic function of body activation level.

I will end this presentation by summarizing the two major theoretical explanations proposed at the St. Martin conference. We shall see how each attempts to cope with the Nesbitt paradox.

The first is that of Hans Eysenck. To appreciate his explanation of smoking, you must sit still for me to give you a skeletal outline of his theory of personality. Eysenck contends that there are two major dimensions of personality. He uses the poles of the dimensions to label them: extroversion-introversion and neuroticism-stability. He states that the evidence shows no relationship between smoking and the neuroticism-stability dimension. There is, however, abundant evidence of a relationship between smoking and the extroversion-introversion dimension. His explanation for smoking proceeds as follows: Under identical external conditions of low-sensory input, extroverts will have a low level of cortical arousal and introverts a high level of cortical arousal. For every individual there is an optimum level of arousal. Since arousal varies with the level of sensory input, one can visualize as in Figure 1 the relationship of sensory input and hedonic tone, or sense of well-being. It can be seen that, in these terms, too much stimulation is to be avoided, and also too little. Introverts and extroverts require different levels of input for optimum arousal; the extrovert needs more, the introvert less. Extroverts will become stimulus seekers, introverts stimulus avoiders. Drugs are used to alter the level of sensory input. Nicotine is also

**TIMN 0100254**

used to alter the level of sensory input. Now we shall see how he resolves the paradox: He acknowledges that nicotine has an arousal, activating effect, and reasons that extroverts therefore should smoke more than introverts. And happily this is true. But what now does he do with his smoking introverts? Surprisingly, he does not attempt to resolve the Nesbitt paradox. He invokes it, pointing out that nicotine can have both arousing and sedating effects. He cites the well-known biphasic action of nicotine as documented by neuropharmacological research. At low concentrations, nicotine activates neural function, at high concentrations, it depresses neural function.

Two serious flaws in Eysenck's reasoning must be pointed out:

- 1) The neuropharmacological evidence for the biphasic action of nicotine is based upon observations of neural tissue response to the local application of nicotine in animal studies. Stimulation occurred at low concentrations of nicotine, depression at high concentration levels. It is absolutely impossible for the concentration level required to induce neural depression to be attained by means of smoke inhalation.
- 2) To postulate both activating and sedating effects is to defy the documented universality of the activating physiological effect of smoke inhalation.

Eysenck, then, has not dealt effectively with the Nesbitt paradox. And I would remark in passing that the theory of Sylvan Tomkins, widely acclaimed in some circles, suffers from the

**TIMN 0100255**

same criticism. Tomkins has proposed that there are different types of smokers each type seeking different effects from smoking. Tomkins, too, has chosen to overlook the universality of smoke-induced physiological arousal, agreeing with Eysenck that smoking can be either arousing or sedating, depending upon the person and the situation.

The second theoretical explanation from the St. Martin conference is that proposed by Professor Schachter, whom I have already mentioned for coining the phrase "the Nesbitt paradox". Schachter offers an ingenious resolution of the paradox, and an explanation of smoking which you will most certainly find novel and possibly noncredible. Again you must first be briefed on Schachter's theory covering all kinds of affective or emotional experience.

The bodily arousal accompanying emotion is the same for all emotions: fear, anger, joy, etc. The person interprets the bodily emotional state in terms of the circumstances under which the emotion is experienced. Sometimes there are faulty interpretations. These can be dramatically demonstrated in a laboratory setting. An example: A male college student is given adrenaline without his knowledge and under pretext that makes him unsuspecting. All this takes place in the presence of a very attractive female lab assistant. At about the time that the adrenaline begins to take effect the young woman crosses her legs provocatively and lets her hand linger a bit too long on his arm. The subject invariably interprets the adrenaline-induced arousal as an erotic arousal and behaves accordingly. The lab assistant threatened to quit if the experiment were to continue.

**TIMN 0100256**

Now how does Schachter apply this theory to resolving the Nesbitt paradox? There is no paradox, of course, in the smoker seeking arousal when at the low end of the arousal continuum, but why seek arousal through smoking when 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 frightened but he also 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."

There is a variant on the Schachter hypothesis that should properly be ascribed to Frank Ryan, one of my psychologist colleagues at the Philip Morris Research Center.

Ryan suggests that arousal by smoking is perhaps a means of muting or damping an arousal response to exciting or disturbing circumstances. There are limits within which a person will operate

**TIMN 0100257**



on the arousal continuum. If pushed up toward the upper limit by smoke inhalation, there is little room left for further arousal by external events. Thus the smoker can prep himself against the disturbing effect of anxiety or fear, or anger or whatever.

This is the end of my presentation. If you have been intrigued by any of these ideas, I recommend the recently published volume entitled "Smoking Behavior: Motives and Incentives", a compendium of papers presented at the St. Martin Conference, published by V. H. Winston & Sons of Washington, D.C.

**TIMN 0100258**