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To: Dr. T. S. Osdene Date: November 5, 1981

From: W. L. Dunn

Subject: Plans and Objectives - 1982

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INTRODUCTORY REMARKS

Over the years the Behavioral Research Lab has stated its mission to be threefold: To study why, how and what cigarette smokers smoke. Of late we have been focusing more intensively on the question of why people smoke. Several reasons can be cited for this shift in emphasis: It is without doubt the most fundamental unanswered question for the cigarette industry today. As legal, political and social anti-industry pressures mount, the impetus for explaining smoking likewise mounts - to cause smokers' own behavior to be more credible to them, to strengthen legal defense arguments, to mollify legislators and to assist Philip Morris development people in product improvement. It is also true that the probability of being able to answer the question has increased as a result of new knowledge and new technology.

Smoking is complex behavior requiring any one or a combination of neuropharmacological and/or psycho-social explanations. We now believe that not only do smokers vary amongst themselves as to their motives for smoking, but a given smoker's motives will vary with psychological state and circumstance. The ultimate explanation is clearly not to be had in simple terms nor with a single conceptual model.

Our Behavioral Research program is therefore manned by psychologists with distinctive contributions to make; they represent a number of the many subdisciplines of the field, the subdisciplines selected because of their potential for contributing useful knowledge about smoking and the smoker. As an overview, the subdisciplines within the group and the personnel who represent them are presented here.

Psychology Specialty	Researcher
Social Psychology	Sandra Dunn, Research Scientist
Electrophysiology	Frank Gullotta, Research Scientist Cindy Shultz, Assoc. Scientist A
Experimental Psychology I	Frank Ryan, Research Scientist
Experimental Psychology II	Jan Jones, Scientist
Behavioral Pharmacology	Vic DeNoble, Research Scientist Paul Mele, Scientist Yvonne Dragan, Assoc. Scientist A

Our plans and objectives are arranged hereafter by subdiscipline, accompanied by a brief descriptive statement which attempts to characterize the specialty.

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SOCIAL PSYCHOLOGY PROGRAM

Nature of subdiscipline - Besides their more pragmatic work in public opinion and attitude surveys and market research, social psychologists have developed their own distinctive techniques and conceptual models to study the individual as a social creature. They have focused upon such phenomena as communication, conformity, role playing and the dynamics of the group process.

Objectives

1. To apply social psychology techniques to the study of cigarette preference.

2. To contribute to the understanding of those social forces which act as primary and/or secondary determinants of smoking behavior.

Planned Studies

The Direct Interview as a Means for Assessing Cigarette Preferences

The current state of the art of product testing still calls for continuing the search for more reliable, more sensitive techniques. We will be reviewing both individual and group interview formats with the intent to devise an alternative strategem for eliciting smoker reaction to new and improved products. Although this study is consigned to the social psychology program for planning purposes, the varied skills of

the entire Behavioral Research Laboratory staff are "on call" for this effort.

The Pharmacological Versus the Psychological Effects of Smoking as a Stress Handling Strategem

Smokers do smoke more under stressful conditions. Is it the act of smoking as a behavioral event, or is it the pharmacological effects of components of smoke that mediate the inferred benefits derived from smoking? We are currently designing a series of studies that will be aimed at (1) partitioning out the respective contributions of these two driving forces, and (2) revealing their possible interaction.

Cigarette Smoking as Image Enhancing Behavior

It is generally agreed that the prospective smoker is attracted to smoking as part of the effort to confer adultness to the image of his person. These psychosocial values of smoking continue on to a greater or lesser degree with the regular smoker. Can we make a more definitive assessment of the characteristics attributed to smokers by both smokers and nonsmokers? Do these two groups differ in their social assessment of the smoker? If so, can we identify the critical attributed traits or characteristics? We will be designing a study this year to attempt to answer these questions.

Personality Correlates of Smoking

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Previous research suggests that people may smoke for different physiological effects. Some smokers report that cigarette smoking has an arousal effect and others report that cigarette smoking has a calming effect. Based on findings from our research, we suspect that smokers who prefer low delivery brands may be those smokers who find cigarette smoking arousing and the smokers who prefer high delivery brands may be those smokers who find cigarette smoking calming. The basis for this hypothesis is that low delivery brand smokers seem to have these personality attributes that characterize people who seek to increase environmental stimulation - e.g. more emotional, anxious, etc. Similarly, the high delivery brand smokers evidence personality attributes indicative of people who are motivated to reduce stimulation from the environment - e.g. calm, peace of mind, etc. We plan to pursue these ideas, perhaps in the form of a laboratory study aimed at revealing these differences between the two groups of smokers.

ELECTROPHYSIOLOGY PROGRAM

Nature of Subdiscipline - Signals in the form of microvoltage changes in the electrical field at various points on the human scalp reflect events occurring within the underlying brain. At first encounter, the patterns are exceedingly complex and uninterpretable. Major technological advances, principally in

the form of increasing analytical sophistication made possible by the application of the speed and multivariate capacity of the computer, are permitting the isolation of elements within the complex electrical pattern which represent heretofore unobservable neural events associated with the sensing and processing of stimuli.

Objectives

On the premise that the events which reinforce the smoking act are central nervous system events, we are systematically examining these newly observed electroneural signals for the effects of cigarette smoke inhalation.

Planned Studies

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Olfactory Evoked Potentials

In March or April of next year we will begin experiments on olfactory evoked potentials (OEPs). The work will be done in collaboration with Flavor Development, specifically Dr. R. Ikeda. Our goal is to find means by which we can obtain useful information about certain subjective effects of tobacco flavorants in an objective, quantifiable and non-verbal manner. Dr. Ikeda has postulated that feeling factors, as mediated by free trigeminal nerve endings in the nose, are important to the pleasure one derives from smoking. We should be able to ascertain the degree of trigeminal involvement of different odorants by studying the waveform characteristics of the OEP. We hope to also categorize odorants in terms of OEP waveform morphology.

Perception and the Effects of Cigarette Smoking on Pattern Reversal Evoked Potentials

The purpose of this study is to assess the influences of both pharmacologic and perceptual factors on the pattern reversal evoked potential (PREP). We have previously demonstrated that cigarette smoking produces PREP latency shifts, and that these latency shifts reflect nicotine delivery. However, cigarette smoking also affects PREP amplitudes. Amplitude changes are frequently correlated with psychological state.

The study will elicit judgments by smokers of smoke intensity and record PREP measurements. The analysis is expected to permit the partitioning of (1) the effects of the absolute physical intensity and (2) the effects of the subjective perception upon the PREP measures. We expect to observe one kind of change in the PREP when a subject smokes a high delivery cigarette but perceives it low and a different kind of change if he perceives it high. We hypothesize that latency effects will reflect nicotine delivery, while amplitude effects will reflect the *perceived* intensity of what he has smoked.

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EEG Power Spectra in Cigarette Smoking and Abstinence

The purpose of this study is to systematically quantify the electrical activity of the brain under various smoking and deprivation conditions. Our interest in this area stems from both human and animal literature on the effects of smoking and nicotine on the EEG. There is a general lack of agreement on exactly what kinds of EEG alterations are produced by smoking and nicotine. Much of this disagreement could be resolved by quantifying the changes in a more systematic fashion. We propose to do this by studying EEG power spectra from different cortical loci under various deprivation and smoking conditions.

Smoke Deprivation and the Pattern Reversal Evoked Potential

We have previously conducted this study using flash evoked potentials. However, because flash EPs are so variable, both within and between subjects, our results were not easily interpretable.

Using pattern reversal evoked potentials (PREPs), we will conduct studies on individuals who are giving up smoking. We will bring them in for recording before they quit and then study them, over time, after cessation.

The question we are interested in is whether cessation alters the PREP and if it does, how long do these alterations last. We have reason to believe that quitting will distort the PREP for a time in some (but not all) individuals. We further believe that whatever PREP distortions occur will resolve over time.

EXPERIMENTAL PSYCHOLOGY I & II

Nature of Subdiscipline - This is the traditional research contingent of psychology. Sensation, perception, cognition and learning are the usual topics of study, with almost a century of laboratory experience embodied in methods, instruments and theory upon which to draw.

Objectives (Experimental Psychology I)

1. To gain a better understanding of the role of nicotine in smoking

2. To study the basic dimensions of the cigarette as they relate to cigarette acceptability

Planned Studies

Salivary Nicotine

(This study appeared in the Plans for 1981. Subsequently Mr. Ryan was designated as the computer software person for the

B.R.L., such that the time projected for this study was consumed in training and service in his new software specialist role. We anticipate completion of the study in 1982.)

It has been postulated that smokers modify smoking behavior to maintain certain levels of nicotine in the blood. Historically this has been the basis of nicotine titration hypotheses. Knowledgeable consideration of the issue suggests that the changes in level may be more important than the absolute levels - that the input of nicotine from a cigarette creates a "spike" which is the summation of the discrete puff-induced spikes.

We now have the ability to measure via gas chromatograph the level of nicotine in saliva. Observations from previous work with salivation and smoking suggest that systemic nicotine in saliva tracks with systemic nicotine in the blood. We plan to use the g.c. measure to:

A. Monitor the appearance and decline of nicotine in saliva following smoking. This will shed light on the question "Does a low systemic level of nicotine trigger the smoking response." The question can only be answered if measures are made many times. Therefore, we will:

B. Observe changes in salivary nicotine level across time and smokings, relating the changes to the delivery of cigarettes smoked and the time since prior smokings. The data will bear upon the issue to the extent that salivary nicotine reflects tissue and blood levels of nicotine. This must be confirmed by means of:

C. A correlational study of the salivary nicotine with blood nicotine. This is awkward research to perform because taking blood samples is intrusive and objectionable to participants and because it requires medical supervision. Obviously executing this segmant of the research will be contingent upon determining that there are systematic changes in the salivary nicotine data. We have made some preliminary contact with our medical staff, and they will support us when needed.

There are tentative plans for one other project in which nicotine will be delivered intravenously in different sized spikes of different duration, to yield a broader picture of the role of the spike, the level, and the reinforcement characteristics of the substance. The execution of this project is contingent upon the execution of study I-C above, since both involve the dosing of numerous subjects with nicotine.

Smoking and Time Estimation

Time seems to pass more slowly in an unpleasant situation than in a pleasant one. In some of our research projects the

participants have commented that the smoking sessions passed more quickly than the nonsmoking ones. If smoking does make time seem to pass more quickly, then we can understand why people smoke in boring or stressful situations (and perhaps why some people don't smoke on weekends but do smoke at work...!).

We will be conducting a series of studies in which smokers make some responses which are time related and some which are not to determine if these two classes of responses are differentially affected by smoking.

Objective (Experimental II)

1. To record and interpret changes in smoke inhalation patterns in response to changes in smoke composition.

2. To study the interrelationships of puffing, inhaling and nicotine retention.

Planned Studies

Changes in Smoke Inhalation Patterns as a Function of Nicotine Delivery

Data collection will continue into 1982 on this long-term switcher study. Because of the recent trend to low tar, low nicotine cigarettes the question has been raised whether the smoker is actually getting lower amounts of nicotine, or whether the individual is becoming a more efficient smoker by altering the intake behavior to compensate for reduced delivery. We are looking at changes in inhalation behavior as smokers switch among cigarettes delivering high (.94mg), medium (.5-.7mg) and low nicotine (.27mg) at constant tar deliveries (approx. 15mg).

Inhalation Patterns on Market Brands and their "Light" Versions

This study will continue into 1982, providing us with information on inhalation behavior as subjects smoke current market brands and switch to the "light" brand of the same name. In this study we are not isolating a single smoke component to experimentally manipulate, but rather are looking at the effect of the reduction in overall delivery. The inhalation data are being supplemented by puff profiles recorded on each brand at the end of the two-week switching period.

The Interrelationships of Puffing Dimensions, Inhalation Dimensions and Nicotine Retention

We are observing in our inhalation studies that inhalation patterns do change as a function of smoke composition. Are these changes "titration behavior", that is to say, adjustments toward maintaining some degree of constancy in nicotine intake, or are they caused by some other variable such as smoke acceptability?

This year we will expand our inhalation program to address the following questions:

(1) Do puff parameters vary as a function of nicotine delivery?

(2) Do inhalation patterns vary with puff patterns?

(3) Do inhalation patterns influence nicotine retention?

(4) Which puff and inhalation parameters are the critical variables influencing nicotine retention?

The information will be obtained through the coordinated use of the smoking machine, the puff recorder, the Respitrace system (for inhalation measures), an exhalant nicotine collection device and a gas chromatograph. With this array, the fate of nicotine can be tracked from burning coal through successive intake events to exhalation into the ambient air.

BEHAVIORAL PHARMACOLOGY

Nature of Subdiscipline - This is the neuroscience branch of psychology, wherein psychologists, pharmacologists, physiologists and biochemists share a common conceptual model. Through observations of behavioral changes in response to the introduction of exogenous substances into the organism, inferences can be made about the substance, the organism and the effect of the former on the latter.

Objectives

1. To develop a better understanding of the actions of nicotine and other smoke compounds, especially those actions which reinforce the smoking act.

2. To empirically differentiate nicotine from the classical abuse substances.

3. To use behavioral pharmacological methods to evaluate the nicotine-likeness of other compounds.

4. To contribute to knowledge of the neurological loci of the significant reinforcing event in smoking.

Planned Studies

Continue to investigate the reinforcing effects of smoke components.

Examine the nicotine analogues for reinforcing effects.

Examine the contribution of cholinergic, catecholaminergic,

serotonergic and other neurotransmitter systems on smoke component self-administration.

Use discrimination and intraventricular administration techniques to develop structure/activity relationships among nicotine analogues.

Examine the effect of smoke components on frustrative non-reward behavior.

Begin collecting data on electrophysiological correlates of nicotine-induced behavioral changes.

Distinguish the pharmacological from behavioral effects of nicotine on schedule-controlled behavior.

Begin brain mapping studies to determine the sites of action of nicotine.

To further investigate the intraventricular self-administration of nicotine.