Smoking Behaviour

PHYSIOLOGICAL AND PSYCHOLOGICAL INFLUENCES

Edited by

Raymond E. Thornton

Churchill Livingstone

SMOKING BEHAVIOUR

Physiological and Psychological Influences.

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Preface

This book is the result of the International Smoking Behaviour Conference held at Chelwood Vachery, Sussex, England, in November 1977. The objectives of the conference were:

> 'To explore some of the physiological and psychological effects of smoking which may be important in smoking behaviour and motivation, and to relate these effects (where possible) to:
> (a) differences between smokers and non-smokers;
> (b) the smoker's intake of tar, nicotine and carbon monoxide, including the extent to which this intake can be influenced by changes in cigarette design'.

Fifty-five behavioural, biological, medical and physical scientists convened at Chelwood to discuss these issues, and the thirty-one papers presented are the refined views of many of the workers in the wide area of smoking behaviour. Some authors act as spokesmen for research teams, while other papers represent the personal views of people engaged in research in this field. The views expressed are, of course, entirely those of the authors and not necessarily those of British-American Tobacco Company Limited or the editor. Papers are given here in the order they were presented at the conference.

No simple or single answer will be found to the questions raised by the conference objectives, but among the papers will be found a 1977/78 view on topics such as the differences between smokers and non-smokers, the effects of smoking on the central nervous system and on performance, the difficulties in relating laboratory studies to the real-life situation, the format of league tables, and the importance of nicotine in smoking motivation.

The editor would like to thank all those delegates who were prepared to put aside their other duties and responsibilities and spend three days at Chelwood, as well as a number of his colleagues for their help with various aspects of the conference. Kay Comer, in addition to her contribution towards the conference planning, meticulously checked many of the papers and references in this book. David Creighton helped at all stages of the conference and in the preparation of papers. Joan Pressey also helped both in preparing for the conference and in the publication of this book. Barbara Stone prepared the index.

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Contents

1. Coping mechanisms in the brain

IVOR H MILLS

Using our brains in everyday life, both for work and for relaxation, is a process that we take for granted. We do not as a rule ask ourselves what the mechanisms are in the brain which enable it to carry out what we ask of it. If the processes are mechanical, like lifting an arm to reach a book on a shelf, we know fairly clearly how this movement is effected. It has been shown that during such muscular work, the part of the brain related to the movement has an increase in its blood supply (Ingvar and Schwartz, 1974).

Thinking and solving problems are quite different processes in the brain from initiation and control of muscle movements. For problem solving, changes occur in the blood flow through the brain. These results have been obtained by using injections of radio-active xenon or krypton into one carotid artery and measuring the radiation emitted by means of a series of 32 radio-active counters arranged around the skull. When the injection is stopped the radio-active gas is washed out of the brain by the blood flow and the rate of washout is proportional to the rate of blood flow (Sveinsdottir *et al,* 1970).

By computer analysis of the radio-activity picked up by each counter, the distribution of the blood flow in different parts of the brain can be established. Attempting to solve reasoning problems increases the blood flow through the association areas of the brain (Risberg and Ingvar, 1973). At the same time a rise in blood pressure of 10 to 30 mmHg occurs while the problem-solving is going on (Sharpey-Schafer and Taylor, 1960; Ludbrook, Vincent and Walsh, 1975). When the solution is arrived at the blood pressure comes down. In some individuals the rise in blood pressure is greater than 30 mmHg and in some there may be an appreciable delay before the blood pressure returns to normal when the problem is solved.

Many of the events of daily life are akin to problem solving exercises and we may assume that similar changes in brain blood flow occur with these problems as with those which are studied in the laboratory. Studies have not been carried out over a long period of time, equivalent to a full day's work, and it may be important to obtain such information. The very nature of everyday life is that of a series of challenges and little is known about the neuronal mechanisms associated with continued problem solving.

Catecholamine release

Another technique which has been used to assess the response to challanging events is the measurement of adrenaline and noradrenaline in the urine. This type of technique gives results which are an integration over time since the urine collections are usually of at least one or two hours duration and sometimes much longer.

Almost anything which causes mental stimulation leads to an increased excretion of these catecholamines in the urine (Levi, 1972). The stimulus may be something which is pleasurable, such as an exciting film, or it may be something which produces excitement by generating fear. Films which portray frightening events or high suspense may produce exactly the same biochemical responses as in real life. Crudely sexual films excite male subjects and though many female subjects may be disturbed by the films, stimulation of adrenaline excretion still occurs.

The arousal mechanism

There is no doubt that, in general, some excitement in life is pleasurable. A day with nothing going on is less satisfying than one punctuated by a series of events. Raising the arousal level is something which most people enjoy unless it is associated with fear or it causes severe fatigue. Within a certain range, which varies from one individual to another, some challenging events in the day produce the elevations of arousal that lead to a sense of satisfaction. Such challenges would be expected to cause changes in brain blood flow and in the excretion of catecholamines in the urine.

Though we know what happens in the short term with such challanges we do not know much about the longer term. There is evidence that constant presentation of minor challenges leads to adaptation so that the mental and physiological responses eventually fail to occur each time. On the other hand some types of repeated challenge maintain a constant response. This was shown, for instance, when invoice clerks were changed from weekly wages to piece work rates. So long as they were on piece work their adrenaline excretion remained high (Levi, 1972).

The term arousal has been used in a variety of ways. The sense in which we are using it here is well-known in everyday life. If you are involved in something which is very exciting shortly before you go to bed, you may have difficulty getting to sleep. If what you are doing is tiring, or if, before the exciting evening, you had had demanding activity all day, you may sleep because the fatigue overcomes the effect of the mental excitement.

Arousal is sometimes using in the sense of what would happen if you were suddenly faced with an attack by a wild animal. You would produce a lot of adrenaline but other things would happen as well, such as, an increase in your pulse rate and blood pressure, constriction of blood vessels in skin, kidneys and intestines; your hair might stand on end and you might well come out in a cold sweat. This is what happens in the fright reaction but all these things do not normally occur if your mental arousal level goes up while having an enjoyable party. Measurements of skin sweating and heart rate may not, therefore, give a good indication of the level of excitement of your brain.