MARKETING COMMUNICATIONS RESEARCH CENTRE

A REVIEW OF ADVERTISING AND FORGETTING

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Executive Summary

This report attempts to review the psychological and marketing literature relevent to consideration of the remembering and forgetting of advertising. Theoretical and empirical studies are described and implications for advertising research and practice are drawn.

Of the two theories of forgetting, one is dominent in the psychological literature. This fact is not reflected in current advertising research and practice, which appears to be based more on the less satisfactory of the two theories. A change in the foundations of both research and practice is thus advocated. The psychological literature reviewed provides a starting point for such a change.

The empirical studies reviewed demonstrate the importance of motivation and selective perception in determining the subsequent degree of forgetting. A shift in emphasis from forgetting per se to conditions affecting these variables seems desirable. The effects of competitive advertising emerge as possible major considerations in the forgetting of advertising.

The implications for advertising style and content, media scheduling, repetition and frequency are discussed. The dual nature (desirable/undesirable) of repetition and frequency is stressed and the importance of the particular situation revealed. General rules applicable to all situations do not exist. An imaginative approach to the particular situation is required.

Preface

This report attempts to demonstrate the importance of human memory when considering the effects of advertising. To achieve this aim, the relevant psychological and marketing literature is reviewed. The former is given more detailed coverage than the latter and it is felt that some explanation for this emphasis is desirable.

The marketing literature relevant to the overall topic is sparse and consists mainly of ad hoc studies which provide useful information but were not carried out for the ends discussed here. This paucity of appropriate studies indicates the amount of research required. The psychological literature provides the theoretical framework necessary to understand the applied studies discussed and can also act as a starting point for the required research. It is a useful source of theories, hypotheses and results which need to be tested in the advertising context. There are also implications for advertising practice which can be usefully drawn at this stage in the development of knowledge. That some of these implications run counter to current practice is a point which needs to be appreciated.

This report is divided into three major parts. The first part is introductory, defining the scope and importance of the subject. The second and longest part is the review of the psychological literature. This commences with two chapters defining basic terms and concepts followed by chapters on the two main theories of forgetting. These provide the theoretical base on which the following discussion is built. They also have important implications for advertising research and practice which are brought out at the end of the chapters. The next two chapters discuss the literature on short- and long-term memory, extending the previous discussion to more realistic conditions and relating them to the context of advertising. A concluding chapter summarises the findings of this part. The third part discusses the marketing literature, indicating what is and is not known about memory processes in the advertising context. The implications for advertising research and practice are discussed.

In summary, the conclusions of this review are that much needs to be done to advance the state of knowledge on forgetting processes and it is hoped that this report provides a summary of the current understanding and a reference point for the journey ahead.

Contents

1. Introduction

This paper is an attempt to review the literature of human memory as it relates to advertising. The "relevant" literature is vast, encompassing, as it does, the psychological literature relating to learning, retention, forgetting, and transfer as well as the marketing and advertising literature which provides much needed data on the remembering of advertising. As a result, this review is a selection, reflecting the author's biases and opinions as to what is and what is not important, the availability and accessibility of the literature, and the constraints of time and comprehension. It is hoped, however, that it will provide an introduction to the literature on this important topic, with the emphasis being placed on principles, on what is and what is not known, and on possible practical implications for both advertising research and practice.

1.1 The Importance of Memory for Advertising

We start from the premise that the purpose of advertising is to influence behaviour, principally purchasing behaviour. Many attempts have been made to establish a direct relationship between these two classes of variables, but with little success in relation to the level of effort. This approach is inspired by economics and tends to be concerned with the purchasing behaviour of aggregates or populations rather than with individuals or households. For a review of this literature, the interested reader should consult Corkindale and Kennedy (1973 : 1), Barnard (1974 :2), Montgomery and Urban (1969 : 3), and Schmalensee (1972 : 4). Bibliographies have been compiled by Mayer (1965 : 5), and The Advertising Research Foundation (1973 : 6), the latter updating Mayer's work. From his review of this literature, Schmalensee (1972 : 7) concludes:

> *"... there is barely a molehill of hard evidence behind the mountain of prose on the subject of advertising."*

Many authors, e.g. Hansen (1972 : 8), have attributed this failure to the aggregated nature of this economic approach and its implicit assumption of homogeneity of the consumer population. Consequently, "*a thorough understanding of consumer behaviour must be based in individual psychological theory*" (8). This observation applies equally to the study of the role of advertising in consumer behaviour. For an introduction to the relevant behavioural literature, the reader should consult Corkindale and Kennedy (1973 : 9), and, for more detailed coverage, Hansen (1972 : 10).

The psychological approach attempts to specify and relate the variables which link advertising exposure with purchasing behaviour. Several such specifications and mechanisms have been suggested, e.g. Nicosia (1966 : 11), and Howard and Sheth (1969 : 12), but the state of knowledge is insufficient to provide a rigorous test of them or even to indicate which is the potentially more useful. The role of memory is considered explicitly in some models of consumer behaviour, e.g. Nicosia (1966 : 13), but not in others, e.g. Howard and Sheth (1969 : 12).

The basic case for the consideration of the role of memory is quite simple. It has frequently been observed that exposure to advertising and the purchasing behaviour it is supposed to influence are separated in time. It is thus necessary to postulate some storage mechanism by means of which advertising's effect on the individual is held over to the purchasing occasion. Memory of the advertising is one such storage mechanism. It should be appreciated, however, that other mechanisms are possible. A change in attitude on exposure to the advertising is a much discussed alternative to the remembering of the advertising as such, e.g. Howard and Sheth (1969 : 12). An appreciation of the processes of memory remains necessary, however, since an attitude change is also stored in the memory.

Advertising is only one of the many possible influences on purchasing behaviour. Previous experience with the product, recommendations by friends and acquaintances, and the so-called "rational" influences such as price, also have to be taken into account. An understanding of memory is re-

quired in attempting to assess the impact of these other influences as well. As Hobson (1962 : 14) has commented:

> *"Virtually all consumer goods buying decisions at the moment of purchase are grounded on a combination of memories: memory of previous satisfaction or dissatisfaction, memory of advertising claims and associations, memory of the recommendation of friends, and so on... Consumer buying decisions are compounded of a large number of subjective associations as well as of objective values, and the subjective associations become for the purchaser an integral part of the product she buys. It is human memory which determines these associations and it is, therefore, an intrinsic element in the purchase."*

1.2 The Purposes of the Literature Review

This review covers both the psychological and the marketing and advertising literature. It aims to convey an understanding of the important variables and mechanisms relating to memory, to distinguish between what is and is not known, what is hypothesised, and the implications of such an understanding for advertising research and practice.

The psychological literature is considered first as it is basic to an understanding of much of the applied literature. The emphasis is very much on basic ideas and principles with a view to their application to and implications for advertising research and practice. This literature is important as it suggests hypotheses and theories which need to be tested in an advertising context as direct transfer of findings from one situation to another is always dangerous.

The marketing and advertising literature is then considered with a view to assessing the extent of knowledge about memory in the appropriate context and thus indicating what still remains to be done. This literature also provides information relevant to advertising practice. Tentative implications of the psychological literature for advertising practice will also be discussed, very much in the vein of Cox's *Clues for Advertising Strategists* (1961 : 15-17).

THE PSYCHOLOGICAL LITERATURE ON HUMAN MEMORY

2. Definitions, Orientations & Observations

2.1 Introduction

The main areas are those of learning, transfer and retention (the opposite of forgetting), terms which will be defined below. The difficulties in reviewing this literature caused by quantity are compounded by its nature. It is written by specialists for specialists; jargon abounds, familiarity with concepts and previous work is assumed, and the format and style is very much that of the stereotype of the scientific paper. Consequently, the author has mainly consulted secondary sources, such as books and review articles, rather than the original papers. This could result in omissions but the principal aim of this review is not completeness. Another result is that the picture of the area and its findings is that of the authors of the works consulted. This could result in distortions at worst and questionable emphases at best. It is felt that these disadvantages are outweighed by the advantages. Among them are that such an approach gives a broader coverage than a non-expert could obtain by use of the primary sources and that the experts' authority is greater than that of the author and hence less likely to distort or misrepresent the findings of the research.

Much of the research reported consists of experiments carried out in the laboratory on unrepresentative samples e.g. college students and under conditions simplified so much as to raise questions of relevance to real life situations. In partial justification of this, we would invoke the concept of parsimony in science. In the psychology of learning, this is exemplified by the view of Wickens (1964 : 18) that:

> *"It is perfectly obvious that the number of these (learning) tasks approaches the infinite and to assume that each one has its own laws would be to say that we cannot reduce the complexity of the behavioural universe. Were such the case, I think we would not be scientists, for the aim of a science is not only to find order in things, but to simplify and do with as few concepts as possible. This aim toward parsimony should prevent us from accepting too readily a position of multiplicity of learning processes, unless it is necessary to account for the data."*

It follows from this position that variables and concepts found relevant in much-simplified controlled experiments will be applied to more complex situations to test their relevance, and will be modified and added to only when the data require it. An understanding and knowledge of this experimental work is thus necessary and forms the foundation for more realistic studies.

It is the aim of this section to provide such a foundation. As a by-product, a certain familiarity with the jargon and methods of experimental psychology may be generated, which would allow the interested reader to dip into the primary and secondary literature and gain, perhaps, a greater understanding and familiarity with the problems of understanding human behaviour than hitherto.

Definitions of terms will now be given and the problems in their operational application discussed.

2.2 Learning

Lay definitions of learning focus on the acquisition of either knowledge (mainly verbal learning) or skill (mainly motor learning). Although these kinds of learning are important, they by no means include all the behaviour processes that are included in the term "learning" as psychologists use it. Moreover, learning is not necessarily improvement, as often seems to be assumed by the layman.

All-encompassing technical definitions of so complex a phenomenon as learning are difficult if not impossible. At least two major kinds of usage of the term may be distinguished. In the first usage, learning refers to ongoing behaviour and to changes in behaviour. In the second usage, it refers to some kinds of internal events which are presumed to underlie the behaviour processes.

Accepting for present purposes the former (behavioural) type of definition, we can most usefully and generally define learning as "a relatively enduring change in behaviour which is a function of prior behaviour (usually called practice)" (Marx, 1969 : 19). For an extended treatment of the problem of the definition of learning, the reader may consult Kimble (1961 : 20). Although this general definition may not satisfy everyone, and needs to be qualified, it nonetheless does indicate the basic meaning normally associated with the concept.

Certain qualifications need to be made before the definition of the term "learning" can be considered reasonably complete. Learning must be distinguished from other processes which produce behavioural changes but not as a function of prior behaviour in any directly relevant manner. Learning is also commonly distinguished from certain superficially very similar behavioural changes where different underlying mechanisms are assumed to operate (cf. the second kind of definition of learning).

With regard to the first kind of distinction, there are several causes of behaviour changes which need to be excluded due to the stated definition. Among these are maturation or growth (in the physiological sense), fatigue, drug and dietary effects, and adaptation. These processes owe their effects to physiochemical, genetic or other such mechanisms and are independent of prior behaviour.

The distinction between these various kinds of processes and learning is an important one both practically and theoretically; practically because the actions which need to be taken to affect behaviour differ markedly, and theoretically because we are concerned withthe correct identification of tne conditions underlying behaviour and behaviour changes.

One should also distinguish learning from performance. Although learning cannot be measured in the absence of behaviour, i.e. performance, nevertheless it is also true that lack of performance does not necessarily indicate lack of learning. Before learning can be demonstrated behaviourally, some degree of motivation must be present. A subject who has learned some particular response will not perform appropriately unless adequately motivated.

Distinguishing learning from adaptation is also difficult. Adaptation may be of two types - sensory or motor. Sensory adaptation refers to the progressive loss in sensory effectiveness suffered by stimuli over time. Motor adaptation, commonly called habituation, refers to a decrement in response to a particular stimulus that occurs merely from the presentation of the stimulus. In the first case, sensory mechanisms are progressively desensitised, and in the second case, the magnitude of the response to the stimulus is progressively reduced.

2.3 Learning, Retention & Transfer

In an intuitive way, the terms *learning*, *retention* and *transfer* are relatively simple to separate. Learning refers to behaviour changes that can be identified as functions of behaviour itself, i.e. practice; retention refers to the persistence of learning over some time interval (and is the opposite of forgetting); and transfer refers to the influence that previous learning has upon some new learning.

Viewed in terms of the processes themselves, however, the situation is somewhat more complicated than might be suggested by these descriptions. For example, it is apparent upon reflection that without retention there could be no measurable learning. For all tests of learning, evidence for learning is obtained *after* the presentation of the material to be learned. There seems to be no way to assess whether learning is occurring or has

occurred without doing so after the acquisition or learning period has ended. Thus, a subsequent test measures not only what was learned during the presentation, but also what was retained during the interval between the presentation and the test.

This paradox is partially resolved by means of a convention. When one is interested in the events which occur in a presentation (or in a series of presentations - known as trials), learning is considered to be studied. When interest focusses on the interval between presentation and test, or on events occurring during the interval, one is studying retention (Melton, 1963 : 21). It is also true for the most part, although there are important exceptions, that short retention intervals characterise studies of learning, whereas longer intervals characterise retention. Similarly, the retention intervals which occur between the trials necessary to master a learning task are included in the acquisition process; retention intervals which occur after mastery has been achieved or practice has ceased are usually employed to study retention or forgetting (McGeoch & Irion, 1952 : 22).

Transfer must also be distinguished from learning and retention. In general, transfer refers to the influence learning one task has on the learning of another one.

Three types of transfer may be distinguished, i.e. the learning of the second task may be facilitated (positive transfer) by the learning of the first task, or the second task learning may be impeded by the learning of the first task (negative transfer), or there may be no effect of first task learning on second task learning (usually called zerotransfer). It should be evident that for positive or negative transfer to occur, first task effects must still be present at the time of second task learning, that is, the first task must be retained. So transfer depends on retention and the two processes are not independent.

We see, then, that when we study human learning, we necessarily involve retention and transfer as well. By adopting certain conventions, we dis-

tinguish acquisition or learning from retention. We always study learning against a background of transfer. So long as we can hold the amount of transfer constant, the effects of a number of variables on the learning process can be assessed. Alternatively, we may vary the amount of transfer systematically and determine its effects on learning.

2.4 Introductory Orientations

The somewhat lengthy discussion of definitions of the relevant concepts was given to demonstrate several points. First, the operational specification of basic concepts in psychology is difficult and plagued by interdependencies. This needs to be appreciated especially for the design of experiments and in the interpretation of the results. Secondly, usage of terms differs and we should be clear from the outset what we mean when we use a particular concept. This is relevant to the later discussion of empirical results where the effects of certain factors are considered. If different meanings of the basic concepts were substituted, the discussion of the effects of these factors would seem pointless. Precise definitions are required to prevent the discussion being a matter of mere tautology. This factor is undoubtedly exacerbated by the difficulties of operational specification and interdependency already referred to. Finally, the interdependencies between the three concepts means that it is impossible to consider one in isolation from the other two. All three must be considered, it is merely a matter of interest which dictates any emphasis in the discussion.

The emphasis in what follows falls on retention and its opposite forgetting, the two concepts most important for a discussion of memory processes. Learning and transfer will only be discussed insofaras they are relevant to the primary considerations of retention and forgetting.

As perusal of any introductory psychology textbook would show, there are various categories of human learning and hence retention and forgetting.

Examples of these categories are classical conditioning, instrumental conditioning, motor or skill learning, and verbal learning. These terms refer to certain types of experimental situation and learning materials. For further information, the reader can consult any introductory psychology textbook, e.g. Wright et al. (1970 : 23). The point we wish to make is that not all of these categories are of equal relevance for the purposes of this paper. As our concern is with advertising, consideration will be limited to verbal learning and, to a lesser extent, the learning and retention of visual forms. The latter category will be considered only very briefly as the literature is somewhat sparse and the impact of visual images is thought to be conceptualised into verbal terms. This is not to say that these two categories are the only relevant ones, but that they are considered to be the most relevant. To the extent that the same concepts are used across categories, this will not detract from the exposition of the basic principles which is the prime concern of this section.

2.5 Some General Observations

At this stage, we would like to make a few points, which have already been touched on, more explicit.

The first point refers to the simplified tasks typically used in controlled experiments. The reason for their use is to permit the investigator to obtain less contaminated data, contaminated, that is, by other factors. This can now be appreciated fully due to the discussion on the difficulty of the operational definition of basic concepts. The interdependency between these concepts and the impossibility of their complete separation entails simple experimental situations so as to reduce the effects of the interdependency to a minimum controlled level. For example, further simplification of the learning task has taken place in an attempt to separate the effects of learning and motivation (24-27).

The measurement of learning and retention is only possible by means of a test of performance. This involves the effects of motivation to perform in a particular manner. In controlled experiments with human subjects, the task instructions are typically made explicit so that the subject knows what is expected of him. These instructions also constitute a motivation to perform the required task. It should not be assumed, however, that all of the motivation is carried in the formal instructions. Recent demonstrations of bias in experimental situations (Rosenthal, 1966 : 28) provide clear evidence for the potency of situational influences. Moreover, it is a serious mistake to assume that subjects will naturally be motivated to learn merely because there is a learning task presented (Marx & Tombaugh, 1967 : 29). More attention is needed than is often given to the effective motivating conditions in human learning research.

Finally, we return to the point about results obtained under a given set of conditions being applied under a different set of conditions. It bears repetition that such application is never completely safe. This is in large part due to the potency of situational influences already referred to (cf attitude research, Rokeach, 1966/7 : 30). As Marx has observed:

> *"One cannot safely assume that merely because human subjects are used, the results are ipso facto widely applicable to human problems. As a matter of fact, it is not even safe to generalise from time to time for the same individual. Obviously, the degree of safety varies widely in these situations."* (31)

3. The Nature of Retention

There are two principal objectives in the study of retention. One is to specify the conditions or variables that govern retention and the other is to develop conceptual formulations that will adequately account for the facts and phenomena of retention.

The concept of retention is a relational one in that, in terms of its most general usage, it is treated as an intervening variable (for a discussion of intervening variables, see Hansen (1972 :32)). Thus retention is not something we directly observe, rather retention is inferred from certain changes in a subject's performance. More generally, retention is defined in terms of the relationship between two classes of events: specified antecedent conditions and observable behaviour.

3.1 Some Terminology & Associated Research Emphases

In reading the literature, one frequently encounters words that are not being used in their more usual everyday sense and other terms which are peculiar to the technical literature - in a word, jargon. To allow more concise exposition and to familiarise the reader with such terminology, our account will make use of these terms. Also, some of these terms reflect various emphases in the empirical research literature. These emphases are the result of interest in certain aspects of retention, and will be reflected in the structure of our account. It is thus necessary to explain some of these terms at the outset.

First, a distinction is often made between short-term and long-term memory. There are two contexts in which these terms are used. In the empirical context, they are used to distinguish between two broad classes of retention experiments, i.e. those characterised by short retention intervals of the order of seconds or, at most, a few minutes, and those characterised by long retention intervals, minutes or units measuring longer time intervals. In the theoretical context, they are used to distinguish between two hypothesised types of memory store. Here, short term memory is used usually to refer to a type of memory store which can only hold items for a short period of time , again of the order of seconds or minutes, and long-term memory for the more permanent memory store.

Secondly, there are two main theories of forgetting - the memory trace decay theory and the interference theory. These theories and associated empirical evidence will be discussed more fully below, but, briefly, they may be distinguished as follows. The memory trace decay theory hypothesises that the memory trace progressively decays in the absence of repetition merely due to the passage of time. In contrast, the interference theory asserts that forgetting is not due to the passage of time, but to separate memory traces interfering one with another which results in a loss of differentiation and hence forgetting. Associated with this theory are two terms which are commonly encountered, i.e. proactive and retroactive inhibition. They refer to the time sequence of memory traces. Proactive inhibition is the effect of a previous memory trace on a memory trace acquired later in time. Retroactive inhibition is the effect of a more recent memory trace on a prior memory trace. Thus, with proactive inhibition, the focus of interest is on the forgetting of the later memory trace, and, with retroactive inhibition, on the forgetting of the prior memory trace.

Finally, a distinction is made between intentional and incidental learning. The former refers to the experimental situation where the subject is explicitly instructed to learn the material and is then tested for retention, and the latter to the situation where he is not so instructed. This distinction will serve for the time being although, as later discussion will make clear, in practice it is not at all clear cut. The two terms represent extremes of a continuum rather than a dichotomy.

Other technical terms, which will be used in this account, will be explained as and when they arise. The terms discussed above are the most important and are reflections of the different research emphases.

3.2 The Measurement of Retention

There are several measures of retention which can, under particular circumstances, reveal somewhat different aspects of the process. Indeed, the amount of retention obtained can readily vary as a function of the method of measurement, as shown by the classic study of Luh (1922 : 33). Measures of retention may differ in several ways including their degree of sensitivity and their relative vulnerability to extraexperimental influences.

We will only consider two measures, recall and recognition, here. For a fuller account, the reader should consult Ellis (1969 : 34). These two are considered as they are the main ones employed in both the psychological literature and the marketing and advertising literature.

(a) Recall

With this procedure, a subject is required to demonstrate what he has learned by reproducing it. Here, *reproducing* is used in its literal sense.

The more general limitation of the recall method is that it can be relatively insensitive as compared with other measures of retention. The fact that a subject is unable to recall any items does not necessarily imply that there is no effect from previous learning. Rather it may simply mean that the recall method is too "demanding" (or insensitive) to reveal any effects, and that a more sensitive measure may yield evidence for *some* retention. Reflections on the role of motivation would seem appropriate (see the comments in section 2.5).

Two types of recall measure are generally employed, i.e. serial recall and free recall. The former refers to the situation where recall is required in the same order as the presentation of the learned material, and the

latter to recall in any order. Empirical work using these two measures, comparison of them and the resulting implications is reported later (Section 6.3) in a different context. Therefore, to avoid repetition, a discussion of them will not be given here. We will merely make the observation that serial recall is a more demanding measure than free recall, and thus a less sensitive indicator of retention.

(b) Recognition

This technique requires a subject to select items that he has previously learned or experienced. Usually recognition requires that an item or items be selected from an array of similar items, or items imbedded in some context. However, single-item presentation may be used in which the subject responds yes or no to each test item.

The recognition method can, under certain circumstances, possess greater sensitivity than does the recall method as it depends upon contextual effects, i.e. upon the material in which it is imbedded (Korn & Jahnke, 1962 : 35). Nevertheless, Bahrick (1965 : 36) has argued that recognition is not *intrinsically* more sensitive than recall, but depends upon the alternatives presented in the recognition test. Furthermore, he argues that recall and recognition measures might yield similar values at one time and quite different values at another. In this connection McNulty (1965 : 37) has presented evidence which suggests that the usual superiority of recognition over recall is due, in part, to the subjects' opportunities to utilise cues from partial learning during the recognition test. He reasoned that although subjects learn less than the whole item, for some of the items, such partial learning may enable the subject to recognise a whole item correctly even though he is unable to recall the item. Accordingly, recognition will yield higher scores than recall because recognition requires learning about fewer aspects of the test items than does recall. By limiting the effects of partial learning, McNulty found that differences between recognition and recall were minimised.

Inherent in the recognition method are two principal limitations. First, the results of a recognition test depend, obviously, upon the number of alternatives present, with recognition performance decreasing as the number of alternatives increases (Murdock, 1963 : 38). Secondly, recognition performance depends upon the relation of the learned material to the non-learned contextual material (called distractors), and to the nature of the set of distractors. For instance, if the learned material is highly distinctive, a higher retention score will be obtained. It is desirable to construct test alternatives (distractors) that vary in some systematic way, preferably along quantitative dimensions. In this way, control over homogeneity can be maintained.

Related to the second limitation of the recognition method is the fact that interactions among the alternatives may exist, which may act to change the probability of a given selection response (Deese, 1963 : 39). Similarly, a distractor might be more frequently recognised than a correct item under conditions in which the distractor arouses stronger associations for the subject than does the correct item (e.g. relevance).

Another difficulty with the recognition method has been noted by Shepard and Teghtsoonian (1961 : 40) who found that the frequency of selection of distractors steadily increased as a result of ordinal position in the test sequence. However, Shepard and Chang (1963 : 41) devised a method which successfully corrected for this difficulty by means of a symmetric forced-choice procedure.

An important development in recognition memory has been the application of concepts and procedures from signal detection theory. This interesting topic, however, lies outside the scope of this paper. The reader may consult Egan (1958 : 42), Bernbach (1967 : 43) and Kintsch (1967 : 44) for information.

(c) Concluding Comments on Measurement

The recognition method has advantages over the recall method in studying memory, because the subject has only to select as distinct from reproducing. Another advantage is that it is possible to vary systematically the alternatives (distractors) along quantitative dimensions, such that the degree of difficulty of recognition and homogeneity of the alternatives can be specified (see Ellis & Feuge, 1966 : 45). Development of new measures has been outlined by Bahrick (1965 : 36) and Bilodeau (1966 : 46), including an increasing interest in using the variance as well as the mean in estimating memory changes.

This somewhat extended discussion of measurement has been given for a number of reasons. First, it is basic to an understanding of experimental work and the making of correct inferences from experimental results. Secondly, these types of technique are widely employed in marketing and advertising research, not only to assess the remembering of advertising but also as measures of advertising effectiveness (for critical discussions of this use, see Barnard (1974 : 47) and Newall (1974 : 48)). It thus provides information useful for the assessment of techniques and results reported in this literature. Furthermore, limitations exposed in controlled experimentation could well exist in applied research. Research to validate currently applied techniques is indicated, especially as systematic experimentation in the advertising area with regard to variables to which the measurement variables are sensitive seems lacking.

3.3 Some Issues in the Study of Retention

We will now raise and briefly discuss some issues in the study of retention regarding quantitative changes in retention as against qualitative changes.

(a) Quantitative Changes in Retention

The dominant interest of researchers in retention has been that of measuring quantitative changes in retention and determining the effective variables that govern such changes. Primary effort has been directed at reliably measuring the amount retained (or forgotten), as distinct from any qualitative changes, as a function of such conditions as the learning task, the subject and the method of measurement. Of particular interest has been the investigation of the variables that influence the temporal course of retention, which led to many studies of forgetting curves.

The principal variables that have been investigated in quantitative studies of retention can be grouped into five categories. These are:

1. the various conditions under which the original learning occurred
2. the events that occurred *prior* to the original learning
3. the events that occurred *between* the time of original learning and the test of retention
4. subject-related variables such as physiological and motivational states
5. the methods for measuring retention

Partly as a result of these investigations, two distinct views of the nature of retention have been developed. One view, that of interference theory, contends that forgetting occurs because of the interfering effects of prior and/or subsequent learning (see section 3.1; also McGeoch (1932 : 49) and Postman (1961 : 50)). The primary task of this theory is to state the various mechanisms which produce interference and to demonstrate that they do in fact account for forgetting. The second view, that of decay theory, contends that memory traces of learned events become hypothetically internalised and that these traces decay in accordance with certain autonomous processes. The

critical difference between these two theories lies in the trace notion itself (Osgood, 1953 : 51). According to decay theory, the hypothesised traces are autonomously active and change in the course of time in accordance with principles that are independent of external changes. A decay theory can take the position that *some* forgetting is due to interference (Ellis, 1969 : 52). In contrast, interference theory implies that there are no autonomous changes and that forgetting is due to external events.

These competing theories are important in efforts to account for quantitative and qualitative changes in retention, and in efforts to distinguish short-term memory from long-term memory.

(b) Qualitative Changes in Retention

The memory for an event may not only fade in time, but it may also show distortion, or modification, which appears to be not merely a matter of quantitative weakening. A long-standing issue has been whether the facts of qualitative change in retention require explanatory principles that are fundamentally different from those employed in accounting for quantitative changes, or whether both kinds of changes can be accounted for in terms of some common set of principles.

Students of qualitative changes in retention (e.g. Bartlett, 1932 : 53; Katona, 1940 : 54; Koffka, 1935 : 55; and Wulf, 1922 : 56) have frequently taken the position that such changes do require additional principles.

3.4 Capacity & Retention

Our senses are bombarded continually by an almost infinite variety of stimuli, well beyond the capacity of the reception and information processing mechanisms of the nervous system and brain. It is this fact

which gives rise to selective perception and the very nature of learning processes.

The experimental procedure which focuses directly on the capacity for the reception and immediate retention of information is the measurement of the immediate memory span. It is defined by the number of discrete units that can be reproduced in correct serial order after a single exposure.

Current emphasis is on inquiries into the mechanisms which are responsible for the breakdown in the subject's ability to retain and reproduce serially ordered material. The span is regarded as a measure of the organism's capacity to process and transmit information. Also, there has been an increasing recognition that the memory span cannot be considered in isolation from other memory functions, and that its magnitude and variability depend on the context in which it is measured.

The accuracy of report after a single exposure depends both on the discriminations which the subject makes among the units comprising the series and on the rate of forgetting for the successive units. The precise definition of the unit of recall is clearly a prerequisite to the measurement of span. The subject is likely, however, to bring to the experimental situation habits of grouping, and responding differentially to, sequences of such units. Thus it becomes necessary to distinguish between the nominal unit (the discrete item) and the functional unit (the perceptual unit of the subject) in the determination of memory span.

Miller (1956 : 57) has clearly shown that the length of the span is limited by the number of items and is essentially independent of the amount of information per item. This led to the suggestion that the functional unit is a "chunk" of information. There is a constant number of chunks which can be reproduced after a single exposure regardless of the amount of information per chunk. It follows that one can increase the amount of information in the span by grouping small chunks into larger ones with a higher information content. The process of increasing the size of the functional unit in the span is designated as recoding.

Recoding consists of the attachment of differential responses or labels to sequences of discrete units. The recall of the labels mediates the reconstruction of the sequences to which they were attached.

Verbal messages do not normally reach us in discrete series falling within the immediate memory span but instead are likely to arrive in sequences far in excess of the span. After exposure to such a sequence, some limited series of items can be reproduced consecutively, but the entire sequence cannot, i.e. *parts* of the sequence will fall within the span. As the sequence continues, the particular series which can be reproduced correctly will change, i.e. some old items will drop out and some new ones will be added. These considerations lead to an important extension of the concept of memory span and of the operations by which it can be measured. In this broadened definition (Waugh, 1960 : 58), the memory span refers to the length of a subseries within a long series which can be recalled correctly after a single presentation. Pollack, Johnson & Knaff (1959 : 59) showed that such spans varied inversely with the rate of presentation and the length of span preceding the test.

When the contextual determination of the span is fully explored, the limits of the span are likely to vary over a wide range.

4. The Decay Theory of Forgetting

We shall now consider the two theories which have been advanced to account for the facts and phenomena of forgetting. Our account will commence by considering the memory trace decay theory, especially the empirical research which has been designed to put it to the test.

4.1 Differential Short-term Forgetting

The rate of forgetting for materials falling within the immediate memory span has been used extensively in tests of hypotheses about the basic mechanism of forgetting. These hypotheses have centred around the concept of a memory trace. It is assumed that the perception of each item leaves a distinct neural after-effect or trace. This trace is said to fade or decay gradually unless it is restored by repetition of the stimulus or rehearsal by the subject. At any given moment in time, the probability of correct recall depends on the degree to which the decay of the trace has progressed. Since the trace is assumed to be short-lived, the temporal course of its decay must be investigated over very brief retention intervals after a single exposure to the learning material. Once the trace has been strengthened through repetition or rehearsal, additional neural mechanisms may come into play to determine subsequent retention. This was demonstrated by Hebb (1961 : 60) who showed that recall improved with repetition. This led to the proposal of a dual trace mechanism (Hebb, 1949 : 61) - a transient trace (an activity trace) and a more permanent trace involving structural growth (a structural trace), cf. short-term and long-term memory.

We turn now to the experimental procedures which have been devised to test the hypothesis derived from trace theory that forgetting is a direct function of the time interval between presentation and recall. Only brief accounts will be given, but sufficient detail is required to demonstrate the considerable methodological problems that arise in the testing of this hypothesis.

(a) Rate of Presentation & Recall

The experimental isolation of time as an independent variable offers major difficulties. It is necessary to vary the length of the retention interval while holding activity in the retention interval (called interpolated

activity) constant and minimising rehearsal within the retention interval. One procedure designed to meet these requirements is the manipulation of the rates of presentation and recall of the learned material. The slower these rates, the longer is the average time interval between the presentation and reproduction of an item. Thus, according to decay theory, the amount retained should vary directly with the rates of presentation and recall. This predicted relationship has been found in a series of experiments (62-64). Since speed of learning varies inversely with the rate of presentation, the results were interpreted as strong support for the decay hypothesis.

This experimental procedure is not free of methodological difficulties. It is true that the critical time intervals are varied with the amount of interpolated learning held constant. The opportunities for rehearsal, however, remain uncontrolled. Conrad and Hille (1958 : 63) suggest that to the extent that rehearsal occurs, it should work against rather than in favour of the hypothesis. This point is valid only if one assumes that under the conditions of their experiment:

1. rehearsal did not interfere with the perception of successive units; and
2. predominantly correct responses were rehearsed.

It is known however, that the opportunity for rehearsal does not necessarily improve retention since errors as well as correct responses may be practised (65, 66). Thus, the results from this method cannot be considered conclusive.

(b) Order of Recall

Manipulation of the order of recall provides another method of varying the retention interval for individual items within a series. The assumption

is that in the reproduction of a series the items which are recalled first are also recalled best because the period of delay between presentation and test is shortest for them. In ordered recall, the total period of delay is determined both by the position of an item in the series and by its position in recall. The effect of recall order, per se, can, however, be evaluated when presentation of the items is simultaneous and recall is successive. Under such conditions, those items reported first are recalled best (Broadbent, 1954 : 67).

For a theoretical analysis of these results, see Broadbent (1957 : 68; 1958 : 69), and for relevant empirical findings, see Broadbent (1954 : 67), Moray (1960 : 70), Broadbent (1956 : 71), Broadbent and Gregory (1961 : 72), Gray and Wedderburn (1960 : 73), and Peterson (1963 : 74).

There are three essential findings:

(1) In general the items recalled first are recalled best, provided the subject is free to reproduce the items in any order he wishes;

(2) When the possibilities of perceptual confusion are minimised, retention after simultaneous stimulation is at least as good as after successive stimulation through a single sensory channel (Broadbent, 1956 : 71). When successive responses are made to simultaneous stimuli, the rate of forgetting is no faster than after successive presentation;

(3) Short-term storage is possible, however, for only a strictly limited period of time (Broadbent, 1957 : 75; 1958 : 69). This is interpreted to mean that the stimulus trace fades rapidly unless it is restored by rehearsal.

For an account of some other experimental procedures, see Postman (1964 : 76).

To summarise our findings so far, the experimental procedures considered all suffer from the problem of an uncontrolled variable - the possibility of rehearsal. Rehearsal may reduce or prevent forgetting. As was pointed

out above, however, the opportunity for rehearsal does not necessarily improve retention. In any event, in tests of the decay hypothesis, it is essential to prevent rehearsal during the retention interval.

This problem led to the idea of occupying the subject during the retention interval with some activity - usually referred to as interpolated activity - so as to minimise the possibility of rehearsal. Recalling the basic ideas of interferences theory (see section 3.1), this may give rise to conditions of interference which mask the normal development of the trace of the intentionally learned material. According to decay theory, however, such interferences should be independent of the degree of similarity between the original learning task and the interpolated activity. Some versions of trace theory choose to posit some interaction among traces (55, 77).

A discussion will now be given of such procedures and their empirical findings. Generally, these experimental procedures consist of a single continuous exposure of the original and interpolated series. The interpolated activity is introduced in order to control the stimuli to which the subject is exposed during the retention interval, principally to minimise rehearsal. For these purposes, it is undesirable that the interpolated activity consist of a learning task. Interpolated learning may produce errors of generalisation which are to be separated sharply from forgetting attributable to the decay of the trace. Negative transfer between successive tasks must be avoided (cf. interference theory). In the light of these considerations, the first and second half of the continuous series are clearly differentiated and the subject is instructed to learn and recall only the former. However, incidental learning of the interpolated materials obviously cannot be prevented.

(c) Conditions of Interference

A deduction from trace theory concerns the relationship between the length of the learning series and rate of forgetting. The larger the number of items in a series, the longer is the average time of delay between the

presentation of an item and the end of the series. Since the trace is assumed to decay progressively during this period of delay, the strength of the average item at the end of the exposure should vary inversely with the length of the series. It follows that the amount retained after a constant retention interval should also vary inversely with the length of the series, provided rehearsal is prevented.

Brown (1958 : 78) found that the amount of retroactive inhibition varied directly with the length of the series, thus providing evidence in support of the above deduction. He also found that the degree of similarity between the learning items and the interpolated activity did not influence the amount of retroactive inhibition, nor was proactive inhibition a function of the interserial similarity.

It is a fact that an interpolated activity filling a very brief retention interval (of the order of 5 to 10 seconds) produces substantial amounts of retroactive inhibition. According to decay theory, the interpolated activity reduces retention because it prevents restoration of the fading trace by rehearsal. If this analysis is correct, it follows further that the detrimental effects should vary directly with the length of the interpolated activity, i.e. with the extent of reduction in rehearsal time. This implication was tested by Conrad (1960 : 79), who found that it is not the length of the interval but the fact of interpolation per se which is responsible for the retention decrement in this situation.

(d) Analysis of Errors

Decay theory does not specify the conditions under which overt intralist and interlist intrusions will occur, i.e. the situations where a correct item is recalled but in the incorrect order within the list, or an item from another list is recalled. Additional principles are required to account for the occurrence of such errors, and the question arises whether

such principles can be developed within the framework of decay theory or lead to a multiple-process conception of forgetting.

A first problem is posed by misplaced responses, i.e. correct items reproduced in an incorrect serial position. Such errors are quite common in tests of immediate memory. The fact that the correct item itself remains available implies that its trace had not faded altogether, yet the serial position has been forgotten. Consequently, a distinction is introduced between *order elements* and *item elements* (Conrad, 1959 : 80), with the former assumed to have less temporal stability than the latter. Brown (1958 : 78) has suggested that there is usually a higher degree of redundancy in the characteristics of individual items than in the specification of serial order. After partial decay of the memory trace, correct reproduction of individual items is, therefore, still possible whereas the serial order is lost. Brown extends this analysis to account for the fact that the memory span appears to be limited by the sheer number of items and to be independent of the amount of information per item (Miller, 1956 : 57, see Section 3.4). Since the span is defined by the length of the sequence which can be reproduced correctly, it may be the informational content of the order, rather than of the individual items, which is primarily responsible for the invariant length of the memory span.

A second issue arises in the interpretation of interlist intrusions when, as is customary, several tests of immediate memory are given in succession. Under these conditions, there are frequent serial-order intrusions, i.e. intrusions of items from corresponding serial positions in other lists (Conrad, 1959/60 : 80/81). The amount of forgetting attributable to the decay of memory traces becomes ambiguous if at least some of the retention loss is produced by the intrusion of competing responses from other lists. However, as Conrad points out, it is not necessarily the case that interlist intrusions *lead* to forgetting. It is possible that forgetting of the correct response in a given serial position is a condition for the occurrence of serial order intrusions. Having forgotten the correct response, the subject "selects"

the intruding item, which had been recalled and rehearsed, because it is appropriate for a given serial position.

To decide between these alternatives, Conrad (1960 : 81) varied the time interval between successive series. The critical question was whether changes in the frequency of intrusions as a function of time interval would be reflected in proportionate changes in the amount of forgetting. Conrad found that the number of intrusions declined steadily as a function of the interlist interval, whereas the amount recalled remained invariant. He concluded that the occurrence of interlist intrusions was a consequence rather than a condition of forgetting, i.e. in favour of his explanation.

(e) Summary

The experiments discussed under headings (c) and (d) have attempted to overcome the problem of rehearsal in tests of the decay theory, which was highlighted by the experiments discussed in (a) and (b). In this aim, they have attained considerable success, but the solution adopted, the use of interpolated activity, raises the possibility of interference between the learning materials and the interpolated activity. This fear is not laid to rest by the available results from analyses designed to test for this possibility.

4.2 Short-term Retention of Single Items

The basic mechanisms of forgetting postulated by general theories of memory typically embody a hypothesis about the conditions governing the forgetting of individual items. This is clearly true of trace theory. The specific mechanisms used in the elaboration of the interference theory of forgetting, see below, also apply in principle to the recall of individual associations. There are, of course, some important hypotheses about the

conditions of retention for a series of items, e.g. see Gibson (1940 : 82) and Deese (1959 : 83). It would appear to be possible to divide hypotheses about the mechanism of forgetting into those which entail predictions about the retention of single units, and those which, in principle, require the consideration of multiple units of learning. Difficulties of interpretation often arise when hypotheses formulated to account for the retention of single units are tested in experiments involving the learning and retention of multiple units. Thus, when a series of items is used in a study concerned with the temporal development of the stimulus trace (as was the case for the experiments described in Section 4.1, (a) to (d)) the analysis is complicated by the need to take account of intraserial associations and interferences. These difficulties are, of course, avoided when the learning material is a single item. Experimental arrangements permitting the use of single items were first developed in studies of memory for form and more recently with verbal materials.

(a) Memory for Form

The hypothesis, first formulated by Wulf (1922 : 56), that the memory trace of visual forms changes progressively toward greater simplicity and symmetry applies to the retention of single perceptual units. When the learning materials consist of a series of different forms, retention may be influenced by generalisation, i.e. loss of differentiation, among the items in the series. Gibson (1929 : 84) presented evidence for this.

As recognition provides a more sensitive measure of memory for form than does reproduction (Hannawalt, 1937 : 85; Zangwill, 1937 : 86), this technique is widely used in experimental studies of the hypothesis of autonomous change of visual forms. The procedure is exemplified by the study of Hebb and Foord (1945 : 87). However, their results can no longer be considered conclusive as exposure to multiple test items constitutes a significant source of interference (Carlson and Duncan, 1955 : 88).

This led to the use of a single item both during learning and in the test of retention. In studies of memory for form, this requirement can be met by an adaptation of the psychphysical method of successive comparison in which the standard and comparison stimuli are identical, but the subject is forced to make a judgement of some specified attribute. To gauge progressive changes in the memory trace of the standard, the time interval between the standard and the comparison stimulus is varied.

Experiments using such an approach have been conducted by Crumbaugh (1954 : 89) and Karlin & Brennan (1957 : 90). Neither experiment provided clear support for the hypothesis of autonomous change.

For a comprehensive review of the experimental literature for form, see Riley (1962 : 91).

Some methodological points raised by these studies deserve emphasis.

1. The use of a single item eliminates intraserial associations and interferences, permitting the test of hypotheses which in principle apply to the retention of single units.

2. Various procedures may be used for measuring temporal trends in retention besides the method of successive comparison, e.g. see Lovibond (1958 : 92). Incidentally, he found no evidence for progressive changes towards symmetry.

3. With such procedures, the activity filling the interval between the standard and the comparison stimulus should be added to the variables which must be brought under experimental control. In the studies cited above, no such control was attempted. It is clear that verbal associations to the stimulus figure can be rehearsed during the interval between presentations.

(b) Recall of Single Verbal Items

The basic experimental procedure is to measure recall after varying inter-

vals of controlled activity, designed to prevent rehearsal. This involves maximum dissimilarity between original and interpolated activities.

The basic procedures were developed by Peterson and Peterson (1959 : 93). They found that retention decreased rapidly as a function of the retention interval, declining to less than 10% after 18 seconds. The question has arisen as to whether the extremely rapid rate of forgetting is attributable to the accumulation of massive amounts of proactive inhibition during the repeated tests with the same subjects. Peterson (1963 : 74) has been inclined to discount this possibility. Keppel and Underwood (1962 : 94) have shown that proactive inhibition does, indeed, develop progressively in a situation such as that used by Peterson and Peterson (1959 : 93). This was supported by studies by Loess (1964 : 95) and Wickens, Born and Allen (1963 : 96).

A theoretical analysis of the conditions determining the recall of single items has been given by Peterson (1963 : 74).

4.3 Short-term Retention & the Concept of the Memory Trace

The various experimental procedures devised to test the concept of the memory trace have been explained and the empirical findings discussed in some detail in sections 4.1 and 4.2. All these studies were concerned with short-term memory, mainly because the theory assumes the trace to be short-lived. In fact, the evidence reviewed clearly supports the conclusion that substantial amounts of forgetting may occur over short periods of time. At face value, this could be taken as evidence for the concept of a decaying memory trace. However, this conclusion would be premature as the problem of the isolation of time as an independent variable still remains. The procedures discussed in section 4.2 have not overcome the basic stumbling block referred to at the end of section 4.1. We can make the point no more succinctly than Postman (1964 :76), who writes:

> *"In summary, experimental tests of the decay hypothesis are seriously, if not fatally, handicapped by the dual requirement of measuring forgetting as a function of time and preventing rehearsal. The latter requirement makes it necessary to fill the retention interval as effectively as possible with an interpolated activity. Once that is done, the relationship between forgetting and the sheer passage of time is obscured".*

The fact of retention over very long periods of time, as well as rapid short-term forgetting, has led to the postulate of a long-term memory operating in a different fashion from short-term memory. Such a postulate is implied by decay theory. The relationships between short-term and long-term memory and the evidence for their separate existence will be reviewed at a later stage.

The fundamental problems in the empirical testing of the concept of the memory trace, despite considerable experimental ingenuity, have been demonstrated. The relevance of the concept is thus brought into question. This has important implications for advertising practice, particularly media scheduling and the questions of repetition and frequency.

4.4 Implications for Advertising Research & Practice

The implications of the current inability to empirically test the decay theory of forgetting are significant for both advertising research and practice.

Advertising research studies, which will be discussed in detail below, have followed the psychological studies in attempting to measure the retention of advertising as a function of time. Different research designs have been used, ranging from laboratory experimentation to field observation. Generally, however, the situation has been closer to one of incidental learning than of intentional learning. This may well reduce the confounding effects of rehearsal, although the possibility of

cues in the situation biassing the response towards that of intentional learning should not be overlooked. The potential effects of interference in the periods prior to and separating exposure from test remain uncontrolled, especially as these periods tend to be of a fairly long duration, at least in psychological terms. Such studies can only demonstrate the fact of forgetting and are of little value in the attribution of causality. The effect of the repetition of advertising on its retention, frequently a major concern in these studies, is thus a correlational rather than a causal relationship. Comparison with the numerically greater number of studies attempting to relate sales (or market share) and advertising provides an apt reminder of the dangers inherent in correlational studies and undue reliance on their findings. Confirmation of a priori belief is not a sensitive and reliable measure of validity.

The implications for research are unfortunately negative in tenor. The possibility of the isolation of time as an independent variable in the advertising context seems remote. Attention should be directed towards testing the hypotheses suggested by interference theory, see below, and to the effects of motivation (cf. the work of Krugman, reviewed in Corkindale and Kennedy (1973 : 9)).

The implications for advertising practice relate mainly to questions of media scheduling, particularly repetition and its frequency. Some advertisers, perhaps as a result of the decay theory, assume that they have to advertise repetitively and frequently for their messages to be remembered. The doubts surrounding the decay theory bring into question the wisdom of this approach, the cruder forms of which have been criticised severely and at length by Kelvin (1962 : 98). Indeed, for a readable discussion of the issues and their practical implications, Kelvin's book is highly recommended. We will not reproduce his arguments here, but just touch on some main points.

Kelvin (1962 : 98) stresses the importance of motivation and selective perception as phenomena governing the effectiveness of advertising and the remembering of its messages. With regard to repetition, he acknowledges

the dilemma that it is necessary to achieve a sufficiently large audience and yet may have disadvantageous consequences in its effect on individuals. He strongly challenges the view that the various media are substitutes one for another, arguing that they complement each other and should be employed in an integrated manner. The characteristics of various media and their purposes in an integrated campaign are clearly and persuasively discussed. In conclusion, the book is an exposition of basic principles for imaginative application, rather than a guide book of how to prepare and schedule advertising campaigns.

5. The Interference Theory of Forgetting

5.1 Introduction

Interference theory is at present the dominant theoretical position accounting for the process of forgetting (Postman, 1961 : 50). In general, this theory contends that events are forgotten because other learning interferes with or prevents these events from being remembered (for a lucid introductory account, see Underwood (1964 : 99)). In turn, a fundamental task of interference theory is to develop an account of the various sub-processes or mechanisms which produce interference and to construct the laws governing the activity of these component processes. The investigation of these sub-processes or mechanisms usually takes the form of experiments in retroactive or proactive inhibition, in which two learning tasks are given to a subject so that the influence of one task on the retention of the other can be determined.

5.2 Retroactive Inhibition

One procedure for investigating interference effects in retention is that which produces retroactive inhibition (RI). RI is simply the decrease in retention of a previously learned task caused by the effects of interpolated learning of some new task. RI is inferred from the comparative performance of an experimental group and a control group. The experimental group learns an initial task, A, and then learns a second task, B, which is interpolated between the initial task and a test for retention of task A. The control group learns the initial task and is subsequently tested for retention without learning the interpolated task.

A comparison of the experimental and control groups in their performance on the retention test reveals the amount of forgetting that is due to the learning of task B. If the experimental group controls less than the control group, then RI is inferred. Several component processes or mechanisms can operate to produce RI; however, it is the *net* effect or sum of all these events that is called RI. Usually, the effect of the interpolated task is to produce interference, i.e. RI, however, it is possible for the relationship of task B to A to be of such a nature that the experimental group retains more than the control, thus allowing for retroactive facilitation. However, interest in this paradigm has been restricted to its interference, not its facilitative effects.

Control of the *rest* interval is, obviously, an important issue in the interpretation of the results. Subjects engage in some task which is designed ideally to prevent simultaneously the rehearsal of task A and yet not interfere in some *unknown* fashion with the consolidation of task A learning. Some interpolated activity is used which is judged to be relatively unrelated to task A and whose effect, which can conceivably produce some interference, can be estimated from prior experimentation.

5.3 Proactive Inhibition

Proactive inhibition (PI) is the loss in retention caused by the effects of some previously learned task. The effects are due to the learning of a task prior rather than after the to-be-tested task. PI also requires a comparison of performance between experimental and control groups. The former learns an initial task, B, prior to learning task A and is then tested for retention of task A. The control group only learns and is tested for task A. Comparison reveals the amount of forgetting due to learning task B. If the experimental group retains less of task A, then PI is inferred. Again, facilitation is possible. The usual procedure is to select tasks which are likely to produce interference so that PI effects can be studied.

It is a common procedure for the control group to rest for a period of time, comparable to that required for the experimental group to learn task B, prior to learning task A. This procedure can be regarded as unsatisfactory to the extent that warm-up and learning-to-learn effects in the learning of task A remain uncontrolled. These effects might be expected to confer an advantage on the experimental group, resulting in a faster rate of learning of task A for them than for the control group. It follows that obtained differences in the retention of A may be a result of both the interference effects of task A learning and differences in the degree of task A learning. In order to control for this possible confounding, an additional control group is sometimes given an irrelevant task prior to learning task A.

5.4 Variables Influencing Retroactive & Proactive Inhibition

The principal variables are:

i. the similarity between the two tasks;

ii. the degree of learning of the two tasks, including their relative strengths;

iii. the time interval between the various stages of learning;

iv. the time interval between learning and the retention test;

v. the number of original and interpolated and/or prior learning tasks; and

vi. the extraexperimental sources of interference.

A review of the major factors influencing RI and PI has been provided by Slamecka and Ceraso (1960 : 100), and a review of the earlier RI literature by Britt (1935 : 101).

The effect of overall task similarity on RI appears to be dependent upon the method for measuring retention.

With a wide range of materials, the data suggest that as the degree of original learning increases, while holding the degree of interpolated learning constant, RI tends to decrease (102-104). If the degree of interpolated learning is varied, holding the degree of original learning constant, an increase in amount of interpolated learning tends to produce an increase in RI (105-107, 104).

Turning to PI, the data indicate that an increase in the degree of initial task learning, keeping the second task learning constant, produces an increase in PI (108, 104, 109). PI bears a U-shaped relation to degree of second task learning, with degree of initial task learning held constant (104).

5.5 Interference Theory

The bulk of the support for the theory stems from the findings of RI and PI studies. An early formulation of interference theory was that of the hypothesis of *response competition* as described by McGeoch (1942 : 110). According to this view, responses acquired in the original and interpolated learning tasks remain available to the subject and compete with each other during the subject's effort to recall the original. The degree of competition depends upon the similarity of the tasks. Moreover, competition also depends upon the relative strength of the two responses, with the stronger response being given when the responses are of unequal strength whereas equal strength responses may block each other.

It has been noted (Barnes and Underwood, 1959 : 111) that there are actually two components of the response competition hypothesis. The first of these is the hypothesis of independence or integrity of the responses. The second is that of response dominance at recall. The independence hypothesis contends that the strength of the responses in the initial task is maintained and is not weakened as a result of second-task learning. The two responses remain intact and maintain their independence. The hypothesis of response dominance accounts for the *observed* loss in retention by assuming that a stronger response intrudes at recall.

These hypotheses are not necessarily linked (Postman, 1961 : 50). It is possible to accept the hypothesis of response dominance at recall while simultaneously rejecting the hypothesis of independence. Indeed, some investigations (111, 112) offer no support for the assumption of independence whereas response dominance at recall has received considerable support.

Response competition is not the entire picture as another mechanism, that of *unlearning*, is necessary for a more complete account of forgetting. An unlearning mechanism contends that the initial task responses are unlearned or extinguished during second task learning. This is the opposite of the independence hypothesis.

Melton and Irwin (1940 : 106) first called attention to an unlearning mechanism. A critical test of the unlearning hypothesis, uncontaminated by confounding or by methodological limitations (Ellis, 1969 : 113), was provided by Barnes and Underwood (1959 : 111). Their data strongly support the notion of unlearning. Other studies (112, 114-118) have provided additional support, directly and indirectly.

5.6 Additions to Interference Theory

In addition to response competition, unlearning and differentiation of stimuli (the opposite of similarity), other components concerned with interference have been identified. One such addition is the proposed distinction between *specific* response competition and *generalised* response competition proposed by Newton and Wickens (1956 : 119). Specific response competition refers to the displacement of a response from the learning task proper by a response from the interpolated learning task during recall. In contrast, generalised response competition may be identified as the subject's tendency to continue responding from whatever learning task he last practised.

Direct evidence for the usefulness of the generalised response competition concept has been provided by Postman and Riley (1959 : 104). Although, as Postman (1961 : 50) admits, the distinction between generalised and specific response competition may not always be sharp, it is still a useful concept in interference theory. This is because it emphasises the fact that considerable competition may occur even when there is no evident similarity between the learning material sets.

The possibility arises that, under certain conditions, generalised response competition rather than unlearning may be a primary causal factor in forgetting. This was considered by Postman and Stark (1965 : 120).

Another important development has been the growing awareness of the importance of PI as a source of interference. It was commonly believed for many years that the principal source of interference in forgetting stemmed from RI. However, Underwood (1957 : 121) presented an argument for the importance of PI and demonstrated that PI made a much greater contribution to forgetting than had been earlier recognised.

Underwood's analysis (121) calls attention to the importance of extra-experimental factors in interference, i.e. factors outside of the laboratory situation. Moreover, he demonstrated that most of the extra-experimental interference is likely to stem from PI rather than RI, because the opportunities for acquiring competing habits are much greater during the long time interval prior to the experiment, compared with the relatively short time interval between second task learning and the test for retention.

This recognition of the importance of PI and extraexperimental sources of interference led to further efforts at expanding interference theory by Underwood and Postman (1960 : 122). Their principal effort was directed at specifying the implications of interference theory for the forgetting of different kinds of materials, which led to efforts at identifying some of the specific factors that could produce extraexperimental sources of interference. A number of empirical implications followed from this theoretical analysis. Although several of these implications have received support (Postman, 1961 : 123), some discord has been noted in efforts to test the predicted relationship between meaningfulness and forgetting that follows from this analysis (124, 125).

5.7 Conclusions

It is tempting, perhaps, not only to conclude that interference theory is the dominant theory, which it is, but also that it can account for all

forgetting. This, however, would be premature, for although the data provide little support for alternative theories, it is not yet possible to rule out entirely the possibility of some decay in addition to interference. As Melton (1961 : 126) warns, we are not yet in a position to treat all long-term memory loss as the result of interference alone.

5.8 Implications for Advertising Research & Practice

The study of the forgetting of advertising within the framework of interference theory has hardly commenced. Its position as the dominant theory of forgetting provides justification for such study. The structure of the theory emphasises considerations such as the effects of competitive advertising, the effects of other environmental stimuli demanding attention as well as advertising (perhaps, putting advertising in a more realistic perspective?), prior learning and learning after exposure but prior to the purchasing occasion. All of these aspects have been neglected relatively speaking, yet intuitively seem potentially important.

Kelvin (1962 : 98) has discussed some implications of interference theory for advertising practice. The advertising world experiences fashions in style and content of advertising, which result in a certain similarity between advertisements. This fact may not only reduce the chances of perception of an advertisement, it being submerged in the stream of competing advertisements, but may also reduce its chances of being remembered. This could be due to the increased tendency to interference between stimuli with increasing similarity, a result due to interference theory. Similar remarks apply to the advertising and the environment in which it is imbedded (cf. the concepts of specific and generalised response competition). The implications for media scheduling, repetition and frequency are somewhat different from those arising from decay theory, emphasising an imaginative approach, dependent upon the particular situation.

6. Short-term Memory

6.1 Introduction

The material presented in Chapters 4 and 5 was relevant to considerations of short-term memory. The studies reported there were designed principally to test hypotheses relevant to the forgetting theories, employing much simplified experimental procedures for the purpose. We will now describe studies which have employed more realistic procedures so as to throw more light on the workings of human memory.

6.2 Short-term Retention During a Continuous Task

In all the experimental procedures discussed thus far, the presentation of materials and the test of recall are clearly separated in time. While this is experimentally convenient, it is clear that it is not representative of many practical situations in which short-term memory must function. When the organism is required to respond to a continually changing environmental situation, exposure to new items and recall of old ones are likely to occur in various patterns of alternation. In some cases, newly received information may have to be recalled and used immediately after presentation; in other cases, reception and recall of other items intervene. Thus fluctuating amounts of retroactive and proactive inhibition fall on the recall of successive items. Such situations provide information about what has been called the *storage capacity* of short-term memory, i.e. the average amount that can be retained while old items are being discarded and new ones are being added. The distinctive feature of the experiments described in this section is that the limits of short-term retention are tested by varying the storage loads imposed on the subject's memory during a continuous task. Such a task may simply involve recall or recognition of items presented previously, or performance of a series of responses guided by the retention of preceding signals. The former

is referred to as a continuous memory task, the latter as a continuous instrumental task.

(a) Continuous Memory Tasks

Lloyd, Reid and Feallock (1960 : 127) tested recall of a word by presenting the name of the class to which the word belonged as a cue (prompted recall). Presentation and recall were separated by varying numbers of other presentations and recalls. The major experimental variable was the *average storage load*, which was defined by the average number of items which the subject had to remember in order to be prepared for the tests as he progressed through the sequence. A direct relationship between the average storage load and the number of errors was found. The same relationship holds when unrelated words, each paired with letters as cues, are used (Lloyd, 1961 : 128). The presence of significant practice effects as a function of experimental days suggests that subjects *learn how to remember* in this type of complex situation. Other factors had little or no influence, so it was concluded that the average storage load was the major variable determining recall.

Reid, Lloyd, Brackett and Hawkins (1961 : 129) identified a second major variable determining recall, the average load reduction. This refers to the number of items which the subject is required to recall at each test point. With average storage load (number of items to be remembered) held constant, errors decreased as a function of the average amount of load reduction per recall point. The improvement in performance may be the result of (a) the reduction in the number of tests which serves to decrease the amount of interpolated activity between presentations and recalls, and (b) the opportunity for associative clustering to aid recall when several items from the same class are called for.

A related procedure has been developed by Yntema and Mueser (1960/62 :

130/131). Again storage load is a significant determinant of the accuracy of recall, their being inversely related. Performance also depends on the susceptibility of successive messages to associative interference. Thus, the error rate is higher when the messages all refer to the same attribute of different objects than when they refer to different attributes of the same object. The probability of a correct response declined with the number of items intervening between the message and the test of recall; and many of the overt errors were analogous to interlist intrusions, i.e. subjects tended to substitute a previously correct state for the one announced in the most recent message.

A technique for measuring recognition in a continuous task was reported by Shepard and Teghtsoonian (1961 : 40). The probability of a correct response declined as a function of the number of intervening items.

(b) Continuous Instrumental Tasks

We turn now to situations in which the degree of short-term retention for successive signals determines the accuracy of performance in a complex serial task. The available data indicate that forgetting under these circumstances is considerably more rapid than in a conventional memory situation (Mackworth, 1959 : 132, 133).

The difference in the efficiency of short-term retention in continuous memory tasks and continuous instrumental tasks clearly illustrates the importance of contextual variables.

6.3 Free Recall & Serial Recall

Associative processes and pre-experimental habits of classifying and ordering the learning materials are likely to be aroused whenever a

series of items is recalled. There is only limited opportunity to evaluate the influence of such habits when the series consists of homogenous units and reproduction in the serial order of presentation is required. This was the case for most of the studies of short-term retention considered so far. It is true that pre-experimental habits can influence the grouping of items and are thus reflected in the characteristics of the subject's errors. In general, however, homogeneity of the units and serial recall clearly limit the possibilities of *recoding* and rearranging the learning materials. The opportunity to observe the effects of such processes is greatly enhanced when the method of free recall is used with materials which exceed the span of immediate memory. We turn now to studies of short-term retention by the method of free recall and to an evaluation of the differences between free recall and serial recall.

(a) Experimental Procedures

Reproduction of a series of items in the order of presentation or in any order that the subject wishes define serial recall and free recall, respectively. When the series is presented more than once, there are three combinations of conditions defined by the constraints on serial order in presentation and recall (Waugh, 1961 : 134), i.e.

1. constant serial order of presentation and serial recall
2. constant serial order of presentation and free recall
3. varying order of presentation and free recall.

The alternation of presentations and recall defines a rote-learning task in which learning is measured by the rate of change in the amounts retained as a function of the number of repetitions (Murdock, 1960 : 135).

The methods of free recall and serial recall, singly and in juxtaposition, permit the analysis of a number of important relationships which cannot be

investigated directly in other situations, i.e.

i. the effects on retention of serial position in the list as distinct from the effects of serial constraints in recall

ii. the relationship between the order of recall and the frequency of recall

iii. the relationship between serial position in the list and order of recall

iv. the effects of inter-item associations on the frequency and order of recall.

Questions such as these become highly important in investigations of the effects of language habits and associative hierarchies on learning and retention.

(b) Basic Variables in Free Recall

Analyses of the variables determining immediate free recall have provided important information about the associative processes and pre-experimental habits. The most general conclusion which is supported by the evidence is that amount of recall depends on

1. the opportunities for rehearsal
2. the availability of integrated response units; and
3. the number and strength of the inter-item associations which exist or can be established within the series.

The effects of three major variables in free recall - length of list, time of presentation per item, and meaningfulness - can be interpreted as consistent with this generalisation.

In an extensive investigation of the variable determining the immediate free recall of unrelated words, Murdock (1960 : 135) has presented clear

evidence for the conclusion that the number of items recalled after one presentation of a series is a linear function of the total time required for presentation. The total time is the product of the length of the series and the presentation time per item. The amount recalled remains invariant as long as this product does. Recall increases as a function of both length and presentation time, but a reduction in one of these can be compensated for by an increase in the other. In Murdock's data, this invariance holds true over a wide range of the two variables and of experimental conditions. He also showed it to be present in the results of other investigators. It appears likely, as Deese has suggested (1960 : 136), that increases in either the length of the list or the presentation time per item, enhance the opportunity for rehearsal. To account for the invariance of amount recalled with time, it is necessary to assume further that only a limited number of items can be rehearsed during a given period of time, regardless of how many different items are presented. Rehearsal will strengthen the connection between each item and the situational context, but it will serve other functions as well, depending on the characteristics of the items in the list. Among these characteristics, meaningfulness is of major importance.

In the analysis of rote-learning, it has proved useful to distinguish between two stages in the process of acquisition: a response-learning stage and an associative stage (Underwood and Schulz, 1960 : 137). During the response-learning stage, the items to be recalled become available as responses. If they are not already in the subject's repertoire, they must be integrated through practice; if they are already available as integrated units, the range of responses must be restricted to those in the list. During the associative stage, the prescribed sequential connections between cues and responses are established. It is during the response-learning stage that meaningfulness has its major effects by determining the order in which responses become available for association. When free recall is considered within the framework of this analysis, it becomes apparent that response integration is just as essential here as in other situations in which the

recall of items is required. However, response learning, in the narrower sense of restriction of the repertoire to the required units, now becomes closely tied to associative learning. Response learning and associative learning are interdependent in the free recall situation because there are no restrictions on the order of recall. Thus, any and all associations which exist or are established among the integrated and available items will facilitate reproduction. By contrast, in paired associate and serial learning, all but the one required association become sources of intraserial interference. It follows from these considerations that amount of free recall should be a function of

i. degree of integration of the response units, and

ii. strength of inter-item associations when the list is composed of integrated units.

The facts are in accord with these conclusions.

Under otherwise comparable conditions, free recall for meaningful words is very much higher than for nonsense syllables (138,139,65). This difference increases with the length of the list. For nonsense syllables, the amount of free recall is a function of association values (140). Since association value and degree of response integration are closely related (137), all these results support the critical importance of response integration in free recall. The interaction between meaningfulness and length of list in these comparisons indicates that rehearsal serves different functions for the two types of materials, enhancing response integration for nonsense material and associative learning for meaningful items. It is reasonable to suppose that the former process develops more slowly as a function of rehearsal time than the latter.

The studies cited immediately above offer empirical evidence in favour of the conclusions stated at the beginning of this subsection (b). Further evidence is available and is reviewed by Postman (1964 : 141). This evidence will not be reported here as it adds nothing to the understanding required

for the purposes of this review. The studies reviewed are concerned with the phenomena of clustering in recall and sequential dependencies in free recall.

(c) Serial Order in Recall

It has been suggested that the order of presentation may affect the order of recall, even in free recall. Associated with this proposition are two effects - the primacy effect and the finality effect. The former refers to the effect on recall of the items presented first, and the latter to the effect of the items presented last. Serial position in free recall shows a substantially greater finality than primacy effect, as evidenced by studies by Deese and Kaufman (1957 : 142), Deese (1957 : 143) and Waugh (1961 : 134).

(d) Conclusion: Free Recall vs. Ordered Recall

The evidence reviewed in this section justifies the conclusion that the distinction between free recall and ordered recall is of major significance in the classification of studies of retention in general, and short-term retention in particular. The presentation of verbal materials is necessarily sequential, and the change produced by practice are of two kinds - in the availability of the correct responses and in the ability to order these responses. The separate assessment of these two components of acquisition becomes possible by comparisons between free recall and ordered recall.

The functional relations obtained by the method of free recall will diverge from those obtained by the methods of ordered recall to the extent that the experimental variables have differential effects on response availability and on the retention of order. The influence of response similarity is a case in point. Amount of free recall varies directly with response simi-

larity as may be expected on the basis of the positive correlation between degree of category clustering and recall (see Postman, 1964 : 141). By contrast, inter-item similarity is inversely related to the accuracy of ordered reproduction. These opposing trends have been clearly demonstrated in experiments making direct comparisons between the effects of response similarity on free recall on the one hand and on reconstruction of serial order (Horowitz, 1961 : 144) and paired associate learning (Underwood et al, 1959 : 145) on the other. It is clear that variables determining short-term retention must be considered in relation to the method of measurement. Any general theory of retention must take account of this fact.

6.4 Incidental Learning

The operations used in studies of incidental learning are typically those of experiments on the short-term retention for materials exceeding the memory span. The strategy of research has been to examine under incidental conditions functional relations known to obtain in intentional learning. The question which has typically been asked is whether and in what ways recall changes when instructions to learn are omitted.

Early experimental investigations were limited to demonstrating that incidental learning did occur and was significantly inferior to intentional learning (see Myers, 1913 : 146; Shellow, 1923 : 147). Considerable attention was given to changes as a function of age and other psychometric variables. The theoretical analysis of incidental learning and the systematic analysis of its determinants have been developing slowly. This neglect of the problem was due in large measure to the difficulties which arise in the formulation of a clear operational distinction between intentional and incidental learning.

6.4.i Definitions and Experimental Designs

(a) Definition of Incidental Learning

A basic obstacle to the definition of the term *incidental learning* has been that its connotations are negative, i.e. it refers to the *absence* of an intent to learn. This negative definition can be given operational meaning by omitting instructions to learn. But one is then assuming that learning under these conditions occurs without any intent to learn. As McGeoch wrote:

> *"... much of the learning which goes on with no overt instructions is, nonetheless, influenced by implicit instructions... certainly it cannot be said with any conclusiveness that there are experiments in which implicit (instructions) have not operated; but, more than this, probability is on the side of the hypothesis that all of the results (in incidental learning) have been determined by (implicit instructions)"* (1942 : 148).

It is thus hazardous to assert that learning is incidental in an absolute sense. Instead of seeking to demonstrate a dichotomy between intentional and incidental learning, we must shift our concern to the functional relations between the instruction stimulus on the one hand and measures of learning and retention on the other. The instruction stimulus is an integral part of the conditions which must be specified in any investigation of learning. It can also be manipulated systematically, and one of the dimensions along which it can vary is the amount of information given to the subject about the test of performance which he is to expect.

When the instructions do not prepare the subject for a test on a given type of materials, it is convenient to designate the learning of these materials as incidental. This designation should not imply that such learning occurred in the absence of any incipient instructions. Whether or not such instructions were conveyed to the subject is a matter of theoretical interpretation. It is necessary, however, to separate the problem of operational

definition from theoretical interpretation. Operationally, incidental and intentional learning are distinguished by the use of different classes of instruction stimuli - those which do and those which do not prepare the subject for a test of retention. In practice, manipulation of the instruction stimulus is often supplemented by a post-experimental inquiry which ascertains the subject's response to the instructions. Incidental subjects who anticipated a test or deliberately rehearsed the material are discarded and replaced. Again, the verbal reports should not be taken as absolutely valid, but the screening of the subjects on the basis of their statements sharpens the separation between the experimental conditions.

(b) Experimental Designs

Two types of incidental learning situations may be distinguished (cf. 149-152). In type I, the subject is exposed to the learning materials but given no instructions to learn. Following the exposure, his retention is tested unexpectedly. The choice of the test determines the criteria of incidental learning in a given experiment. These criteria may vary with respect to both the kind and amount of learning that is required for successful performance, depending on whether retention is tested by recognition, free recall, serial recall, or transfer to a new task. In the interpretation of experimental findings, it is important to bear in mind that conclusions about incidental learning are specific to the method of measurement.

In type II, the subject is given a specific learning task, but during practice is also exposed to materials or cues which are not covered by the learning instructions. His retention for those features of the situation which are not relevant to the task specified in the original instructions defines the amount of incidental learning, and the measure obtained will again be a function of the test. Type II situations may be further sub-divided into two classes on the basis of the relationship

between the relevant and irrelevant components of the total learning situation. The irrelevant components may be features or attributes of the materials which the subject has been instructed to learn, but which are irrelevant in the sense that their discrimination and retention are not required for the performance of the task defined by the experimenter. On the other hand, the irrelevant components may be materials or cues which bear no direct relation to the learning task in that the subject is not instructed to learn them but they are presented with the relevant learning materials. Thus, the two classes within type II refer to the incidental learning of intrinsic and extrinsic components of the experimenter-defined learning task.

Types I and II are both incidental learning situations because the subject is not instructed to learn the materials on which he is tested. In both situations, the basic question is whether these materials elicit responses which become associated with the experimental situation and which can then mediate correct performance on the test of retention. However, there are important differences between the two kinds of experimental arrangements. These differences derive from the fact that instructions to learn are given in type II, but not in type I. The learning instructions, however circumscribed and specific they may be, must be assumed to have two consequences:

i. The general class of responses which is entailed by instructions to learn, such as rehearsal, is activated. To the extent that such instrumental responses generalise to the irrelevant features and materials, the type II situation is in principle more favourable to incidental learning than is the type I situation. In the former, cue-producing responses are generalised to the irrelevant items, whereas in the latter they must be aroused by these materials alone.

ii. In the type II situation, the critical differential responses to the irrelevant materials must be given along with those to the relevant materials. When the exposure interval is limited, the responses to the relevant and irrelevant materials are, therefore, in competition with each other (Mechanic, 1962 : 150). No such task competition

obtains in the type I situation. In that sense, the type II situation is less favourable to incidental learning than the type I situation.

The net difference between the two situations will depend on the extent to which the beneficial effects of a generalised set to learn are offset by the effects of task competition.

Which of the two experimental arrangements is more appropriate depends on the question at issue. When the emphasis is on associative processes in incidental learning as determined by the nature of the materials and the conditions of presentation, type I is favoured because an evaluation of these variables can be made directly without the complications introduced by generalisation of learning and task competition. Investigators whose primary concern is with incidental learning as a function of motive and incentive conditions have usually turned to the type II situation. Such investigations have focussed on the question of how generalisation of set to learn and task competition are influenced by variations in drive and incentive. However, the difference between type I and type II must not be overstated. It is also important to recognise the continuity between them. This point will become apparent when we consider the role of the orienting task in incidental learning.

6.4.ii Orienting Tasks

In a study of incidental learning, the experimental arrangement must be such as to ensure the exposure of the subject to the learning materials. The particular procedure used for this purpose constitutes the orienting task. To be useful, it must satisfy two criteria, namely

i. it must create conditions which make it certain that the subject perceives the incidental learning materials, and

ii. it should minimise the development of implicit instructions to learn.

The requirement of an orienting task raises important problems of control and interpretation in the experimental analysis of incidental learning.

(a) Type I

As the orienting task may constitute a source of interference in incidental learning, a three-group design is required: two intentional groups, one of which does and one of which does not perform the orienting task, and the incidental group, which performs the orienting task. When this design is used, it is typically found that the performance of the orienting task reduces the amount learned under intentional conditions. As a consequence, the difference in learning attributable to intent per se is correspondingly reduced (153, 138, 151, 154).

The activities required by an orienting task may be more or less consistent with the responses which mediate associative learning. One may conceive of a continuum of orienting tasks, ranging from those requiring responses maximally favourable to learning to those requiring responses maximally antagonistic to learning.

When the orienting task is performed by an intentional and an incidental group, the difference between them in degree of learning should depend on the position of the orienting task along this continuum. It should be minimal when the orienting task falls at either extreme of the continuum. At the extreme unfavourable to learning, the beneficial effects of intent would be minimised by massive interferences from the orienting activity. At the favourable extreme, there would be maximal facilitation of incidental learning due to the implicit instructions to learn entailed by the orienting task. The data support these expectations. With materials and conditions of testing held constant, the differences between intentional and incidental learners may vary over a wide range as a function of the orienting task (138,155). What is most important, however, is that the

difference reduces to zero under conditions which appear to approximate the two extremes of the continuum of orienting tasks. These facts lead to the conclusion that intent per se has no significant effects on learning. All its effects are indirect, i.e. instructions to learn activate *responses to the materials* which are favourable to learning. The same results can be achieved by appropriate orienting tasks without instructions to learn.

(b) Type II

In the type II situation, the instructions to learn the relevant materials at the same time impose an orienting task for the irrelevant materials, provided both components of the task are intrinsically associated with each other (156, 157). However, when the irrelevant materials are extrinsic to the relevant ones, an additional orienting task is required, e.g. Mechanic (1962 : 150).

The systematic difference between these two classes of type II situations is brought out by the divergent effects of strength of incentive under these procedures. Bahrick (1954 : 156) found that the amount of incidental learning was inversely related to the strength of the incentive for performance of the intentional task. Amount of intentional learning increased directly with the strength of the incentive. Thus both intentional and incidental learning varied as a function of incentive, but in opposite directions. Similar results were reported by Bahrick, Fitts and Rankin (1952 : 158). By contrast, under the conditions of Mechanic's experiment, variations in incentive influenced neither intentional nor incidental learning (1962 : 159). These contradictory findings fall into place when the differences in degree of control over the subject's responses in the two situations are taken into account.

Variations in drive, like incentive, may be expected to influence the relative frequency of the subject's responses to relevant and irrelevant

stimuli. Several studies have investigated type II incidental learning as a function of anxiety. The results are not consistent, some experiments showing systematic effects on incidental learning (160, 161), some not (157). This lack of consistency is perhaps not surprising since it cannot be predicted with certainty exactly how the distribution of responses to the relevant and irrelevant stimuli will be influenced by anxiety in a given situation.

6.4.iii Functional Relations in Incidental Learning

Analysis of the effects of the orienting task has led us to the conclusion that intent per se is not a significant variable in learning, but that the instruction stimulus influences the amount and characteristics of learning by determining the differential cue-producing responses, including deliberate rehearsal, which occur during the period of practice.

Given the assumed effects of the instruction stimulus on the subject's responses to the materials during exposure, there is nothing in the available data to suggest any systematic differences between the functional relations which characterise intentional and incidental learning. This statement applies to the influence of such task variables as meaningfulness, etcetera. Since much of the experimental work on incidental learning has used the method of free recall, the conclusion can be made more specific by asserting that the same set of principles describes free recall after intentional and incidental learning (see Section 6.3). Postman (1964 : 162) has reviewed the studies which provide empirical support for this commonality of principles. It serves no purpose to report these studies in detail here. We will just make the observation that there is no evidence for differential rates of forgetting after intentional and incidental learning when degree of learning is taken into account (163, 65).

6.4.iv Conclusions

Except for purposes of convenient reference to experiments in which the instruction stimulus is manipulated, there is little or no reason to maintain a conceptual distinction between intentional and incidental learning. What is learned depends on the responses elicited by the stimuli in the experimental situation.

6.5 Conclusions

The studies reviewed in this chapter have extended those reported in chapters 4 and 5 to slightly more realistic experimental situations. The studies relating to short-term retention during a continuous task are important as they throw some light on the dynamics of memory capacity and information processing capability in a situation more closely approximating reality. This work is an extension of that reported in Section 3.4, and is basic to an understanding of selective perception and retention and places needed emphasis on the importance of contextual variables.

The comparison of the results obtained by means of serial recall and free recall produces information on the pre-experimental habits of ordering and clustering that an individual brings to any learning situation. These studies stress the importance of the prior history of the individual concerned on the process of retention.

Finally, the study of incidental learning shows that intent to learn does not affect the rate of forgetting but the degree of original learning. This result is important as advertising is "learnt" under incidental conditions. It follows that the degree of original learning is the major factor in the remembering of advertising.

The implications for advertising research and practice are that emphasis

should be placed on the individuals viewing the advertising, in what particular context, and on the variables affecting degree of original learning. Factors of motivation and relevance would seem likely candidates for consideration in the last case.

From the discussion in Section 3.1, distinguishing short-term from long-term memory, it will be apparent that in the advertising context we are principally concerned with long-term memory. The discussion thus continues with long-term memory and the connections between short-term and long-term memory. It is these connections which necessitate an understanding of short-term memory.

7. Short-term Memory & Long-term Memory

7.1 Introduction

We shall now consider evidence and theories relating to long-term memory and make a comparison of short-term and long-term memory. We shall commence with the comparison as the existence of long-term memory is very much tied up with what we know about retention and forgetting and what we know about and is explained by short-term memory.

7.2 Comparison of Short-term & Long-term Memory

The postulate of two memories and a comparison of them raises the fundamental issue of the *permanence* of learning and the related issue as to whether short-term memory (STM) and long-term memory (LTM) represent fundamentally different processes, with STM being subject to rapid decay

in contrast to the stability and permanence of LTM traces.

The fact of rapid loss of learning has been established by the studies of, for example, Peterson and Peterson (1959 : 93), described in Section 4.2, and Murdock (1961 : 164). The reader will recall that the implication drawn of two memories with fundamentally different processes operating with regard to them was seriously challenged due to the methodological difficulties of the technique (see Section 4.2, subsection (b), and references cited there). The main point was the demonstration that there were massive amounts of proactive inhibition developed by the use of the experimental technique of Peterson and Peterson (1959 : 93). The importance of this latter finding is to suggest that proactive inhibition has a similar function in both STM and LTM (Peterson, 1964 : 165). Moreover, this finding would tend to support the view that STM is basically similar to LTM in contrast to the view that they represent distinct or dichotomous processes.

The issue of whether STM and LTM represent fundamentally different processes remains in dispute. The question is, are they distinct or just the extremes of a continuum, i.e. the end points of a single dimension? There does, however, appear to be a moderate amount of evidence which suggests that they are governed by similar laws and hence represent continuous processes. It is instructive to examine some of the difficulties inherent in maintaining a position of two dichotomous processes. Two of these difficulties have been noted by Postman (1964 : 166). First, he notes that it is uncertain if the results obtained from studies of STM and LTM are sufficiently comparable to allow a sensible judgement about the relative rates of forgetting in the two situations and thus to infer the operation of two different processes in retention. Measures of retention in STM and LTM are usually different and hence may lead to differences in *forgetting* which reflect the measure itself rather than fundamental differences in processes. The reader will recall the importance of the measure and its sensitivity discussed above.

Second, Postman contends that a more fundamental difficulty concerns the appropriateness of drawing inferences about the properties of a hypothetical memory trace on the basis of many studies of STM. This point is concerned with the experimental difficulties of measuring forgetting as a function of time (see Sections 4.1 to 4.3). The postulate of two distinct processes, represented by STM and LTM, is derived from trace theory and not from interference theory.

A detailed analysis of the principal methodological difficulties inherent in comparisons of STM and LTM experiments has been reported by Keppel (1965 : 167). These difficulties concern three considerations of experimental design, which include the nature of the retention interval activity, the measurement of immediate retention, and the type of experimental design (the use of independent versus repeated measures). For example, the design for studying proactive inhibition in STM (Murdock, 1963 : 168; 1964 : 169) is not exactly comparable to designs for proactive inhibition in LTM.

7.3 Long-term Memory

The discussion in the previous section establishes the difficulties in the treatment of STM and LTM as representing distinct processes. Although the matter remains in dispute, there is evidence to suggest that the same principles apply to LTM as to STM. This has led to the idea that STM and LTM are separate *physical* stores of information and to concentration on the issue of how information is transferred from one to the other and on the processes of retrieval from the stores.

Theories concerning the exact nature of human information storage are rapidly changing and thus a detailed discussion will not be provided here (see, e.g. Bernbach, 1967 : 170). Suffice it to say that two or more different memory systems are postulated (21, 171-174). Most authors talk about a short-term memory, a medium-term memory and a long-term memory, all of

which are closely interconnected. The appropriate functioning of the first two seems to be a necessary condition for establishing long-term memory, although some recent theories have thrown doubt on this relationship (for a review, see Rosenzweig and Leiman (1968 : 175)). To avoid confusion, it should be pointed out that the use of the terms for the different memories does not correspond to that used hitherto. Here the terms refer to physio-chemical functions which may or may not correspond to the psychological processes referred to in all previous discussion. The point to be established is, as Hansen (1972 : 176) has observed:

> *"The process involved in establishing long-term memory from medium-term memories are not known".*

7.4 Conclusions

As has been pointed out above, the same principles seem to apply to STM and LTM. The question is whether these are the principles of trace theory or interference theory. The principles of the former theory have been expounded in the course of discussion on STM and the difficulties with this theory discussed at some length.

This similarity of principles, the changing research emphasis referred to in section 7.3 and its highly dynamic state make any further explicit consideration of LTM pointless. For an introductory account of recent work, the interested reader should consult Hansen (1972 : 177), and for more details the references cited therein.

8. Concluding Comments

We include here two brief sections demonstrating the importance of two sets of factors on retention.

8.1 Conditions of Learning which Influence Retention

Retention is influenced not only by interference factors, but also by variables in the original learning situation itself.

The importance of the original degree of learning has been emphasised by Underwood and Keppel (1963 : 125), who have taken the position that it is the principal original-learning variable influencing retention. Its importance has been demonstrated by Krueger (1929 : 178) and Postman (1962 : 179). However, a diminishing returns effect was also evident.

As the importance of this variable is well known, researchers have been more interested in whether other original-learning variables influence retention when the degree of original learning is controlled. Problems in controlling this variable, and thus preventing confounding, have been analysed by Underwood (1964 : 180).

Gillette (1936 : 181) suggested that fast learners retain more than slow learners under assumed conditions of equal degrees of learning. Underwood (1954 : 182) showed that this was not so. It is a common finding that increased similarity makes learning more difficult, but it does not appear to affect retention (Underwood, 1952 : 183; 1954 : 184). It has commonly been held that meaningful material is retained better than non-meaningful material (22). More recent studies (124, 125, 185) suggest that this may not be so when degree of learning is controlled.

8.2 Organising Factors & Coding Processes in Retention

Retention is also influenced by the manner in which individuals organise and code materials. Due in large part to Miller's important paper (1956 : 57) on encoding processes in memory, increasing attention has been given to the role of these variables in retention.

Coding processes refer to the transformation of items into a modified or new form to facilitate learning. The modified form serves as a cue. This process can readily vary with the subject's past history. There is considerable evidence for coding processes (186-191).

Another form of organising factor is clustering. Cofer (1965 : 192) has summarised some of the important factors which influence clustering.

8.3 Summary & Conclusions

We have reviewed a great deal of theoretical and empirical studies. The organisation and classification of this material into the various sections is necessarily arbitrary and reflects the treatment given in the main secondary sources employed for this review. Other classifications are obviously possible. A result of this is that material relevant to some topics may be found scattered through several sections. We now propose to summarise the main findings.

First, there are two main theories of forgetting, i.e. the decay theory and the interference theory. The decay theory is described and empirical evidence relevant to it reviewed in Chapter 4. The conclusions reached are that there are extremely difficult problems in experimental testing of this theory and its associated hypotheses, such as to make it untestable at the current time, and that there are some empirical facts which do not appear to be explained by this theory. As a result of this and its theoretical and empirical successes, interference theory is the dominant theory of retention. This material is reviewed in Chapter 5.

Secondly, the postulate of more than one memory type is necessitated by the facts of retention and forgetting. Whether such processes operate under different principles is seriously doubted, however, and the evidence is discussed in Chapter 7. Related to this are questions of perception, motivation, and degree of learning.

The phenomena of perception and motivation are not considered directly as they fall outside the scope of this review. However, it is believed that they are very important in consideration of learning and forgetting. The effects of motivation on selective perception would also appear to be important. Selective perception would appear to be important in relation to degree of learning. The notion of a memory span (Section 3.4) and the closely linked phenomena of coding processes (Section 8.2), would appear to be relevant to questions of selective perception. Motivation and degree of learning would also appear to be linked as evidenced, for example, by the comparison of intentional and incidental learning (Section 6.4).

Two major factors affecting retention would appear to be degree of learning (Section 8.1) and factors related to the individual, particularly past history of learning and coding and organising processes (Sections 6.3 and 8.2).

The importance and relevance of these matters will be discussed further when we consider the remembering of advertising and implications for advertising practice.

A final point regarding retention and the equation of it with any measure should be made, as it is important. As Postman (1964 : 193) has put it:

> *"The distinction... between what is available in immediate memory and what is reproducible on a given test emphasises the fact that retention is a theoretical construct which cannot be equated with any one measure such as recall. This conclusion applies, of course, to long-term as well as to short-term retention."*

THE MARKETING LITERATURE ON THE MEMORY OF ADVERTISING

Let us state at the outset that this literature is very sparse. The criteria adopted for inclusion were that the article should contain information on:

i. the way a measurement of retention, such as recall or recognition, changed over time; or

ii. the effects of repetition in terms of a retention measure; or

iii. the effects of various variables, such as advertisement position or the use of colour, on a measurement of retention.

The first criterion is the only one truly describing the forgetting of advertising, the other two being more relevant to questions of degree of learning.

9. The Remembering & Forgetting of Advertising

The classic study is that of Zielske (1959 : 194). The study was designed to determine the rate at which consumers learn and forget about advertising. One group of women was sent a series of 13 different advertisements through the mail at a frequency of one advertisement per week (the advertisements were from a national newspaper campaign). Another group was sent the same series of advertisements through the mail but at a frequency of one advertisement per four weeks. Throughout the one year test period, 3,650 telephone interviews were made with the women who had been sent the advertisements to discover if they remembered

the advertising. The women were aided in recall only by mention of the product - not by the brand name or by any mention of advertising by mail. A control group which did not receive the advertisements was also established. Each person was interviewed only once (sampling without replacement over time). This entailed division of the sample into matched subsamples.

Unfortunately the results reported in the paper employ smoothed data. The pattern was one of rapidly rising recall, while the campaign was in progress, followed by a precipitous drop immediately after the advertisements stopped for the weekly advertisements. The rate of forgetting, however, dropped at a slower and slower rate as time passed. The four-weekly pattern was one of alternating rises and falls in recall, the rises occurring on receipt of the advertisements and declining until the next receipt. The level of recall generally rose over time as more and more advertisements were received. The alternating pattern observed in the paper is questionable, however, as the data are not detailed enough to justify the fitted curve.

As will be apparent from various considerations raised in the psychological literature, the measurement of recall of the advertisements is a net effect, and not just a measure of the effects on memory of the advertisements themselves. A large number of potentially important variables remain uncontrolled. Interference phenomena from competitive advertising and other sources, selective perception, degree of original learning, and a whole host of other possibilities come to mind. The use of a control group is not adequate to remove these effects. The experimental results are essentially a net effect of a series of factors and are fairly aggregated at that due to the treatment of the data. The only conclusion that can reasonably be drawn from this study is that the forgetting of advertising does seem to occur, but causes remain unknown. The study is a pioneering one, however, and provides a starting point for further work.

The most detailed and carefully executed study to date, relevant to our topic, is that of Stewart (1964 : 195). The design of the study follows Zielske's design. A schedule of 0, 4, 8 and 20 consecutive weekly newspaper insertions for each of two new products went into matched quarters of Fort Wayne. Six thousand personal interviews evaluated the advertising impact of the different exposure schedules. New samples were drawn from each market area without replacement during successive interviewing periods, so that the total effect of the advertising could be measured over time. Stewart measured advertising effect on several different dimensions, including awareness (aided recall), product knowledge, attitudes and purchases. In this and other ways, the study was well thought out and apparently carefully executed. The reader interested in such matters is strongly urged to read this study himself. A great deal of care was exercised to control and remove possible confounding effects. Unfortunately, problems of the size of sample necessary to achieve statistically significant results were severe. With regard to conclusions on the remembering and forgetting of advertising, the results support the view that advertising is forgotten in the basence of repetition. This study, carefully designed and executed as it was, is not without fault. Some criticism has been given by Simon (1966/7 : 196; 1970 : 197). His points are mainly concerned with sample size, matching of samples and the shape of curves fitted to observed data. This last point is important as it throws doubts on the validity of some of the conclusions drawn by Stewart. The skillful use of control groups and sub-samples to remove confounding variable effects was impressive, but, it is thought, not entirely successful. The possibilities of interference from other advertising, for example, still remain.

There are a few other studies (198-202) which contain results of interest. They tend to support the view that advertising is forgotten over time, but add nothing to what has already been said. The possibilities of confounding variable effects remain and thus limit the value of all these studies.

There are also studies from the area of mass communications in general (e.g. 203, 204), which contain relevant material. These relate to the learning and forgetting of controversial material and associated attitude change. The phenomena of interest are usually source credibility, the sleeper effect and so on. These matters are naturally related to the subject under review, but are not of direct interest. They are more connected with selective perception and degree of learning and exert their influence on retention in an indirect manner via the influence of a mediating variable. For an introduction to this literature and the phenomena of perception and various other effects, the reader should consult Corkindale and Kennedy (1973 : 9). For more detailed information, see Hansen (1972 : 8).

In summary, the literature on the change in a measure of retention of advertising over time is very small and largely inconclusive. This is due to the uncontrolled variables in the situation which may cause confounding of the results. Forgetting seems to occur, but attributions of causality are unwarranted. Given the difficulties of controlled experimentation, even under much simplified conditions, the possibility of meaningful controlled experimentation in this area looks slight. The difficulties are exemplified by Stewart's careful study (1964 : 195). A more profitable approach would appear to be a combination of controlled experimentation, removing as many confounding variables as possible, and quantitative model building and analysis, to determine and thus allow for the effects of the uncontrolled confounding variables. This would be an evolutionary process of determining and measuring relevant variables and of finding the structural relationships between them. This approach would seem more appropriate, especially as the variables of interest seem highly interdependent. A dynamic structure of simultaneous equations is perhaps suggested. The literature of experimental psychology provides a starting point for such an undertaking. The use of mathematical models in psychology, especially learning theory, is increasing rapidly. For an introduction to this literature, see Restle (1971 : 205), and for a more

advanced account, Luce, Bush and Galanter (1963/65 : 206). The application of this approach to the learning and forgetting of advertising is suggested by the article by Rohloff (1966 : 202).

10. The Repetition of Advertising & its Effects

Closely associated with the forgetting of advertising are the effects of repetition, which is often supposed to offset or prevent the forgetting. Several studies (e.g. Stewart, 1964 : 195; Ostheimer, 1970 : 207), have examined these effects and come to the conclusion that repetition does affect the rate of forgetting, tending to reduce it if not eliminate it. In this section, we shall review just one set of studies. These studies (208-211) are reports on an extensive and continuing programme of research being carried out at Stanford University. We have restricted our consideration of this literature to this set of studies because it constitutes the most up-to-date and comprehensive knowledge on this topic available. Previous studies are also reviewed in some of these papers. As Ray and Sawyer (1971 : 212) have observed:

> *"... a great deal of behavioural research on repetition has actually been done. This past research has provided only the most general information, however. The (repetition) function is not estimated for repetitive exposures relating to specific audiences, ads, brands, media and competitive situations. Instead of information on attitude or sales response, the bulk of the studies deal with some learning response such as recognition or recall. When research has been done with sales measurement, the representation of repetition, the identification of advertising, and the control of exposure have all been weak."*

The overall aim of the Stanford programme is stated to be the development of a laboratory technique that can validly, cheaply and quickly estimate

the effects of repetition for specific advertising situations. It is a basic assumption of this research that the effects of repetition vary drastically depending on the advertising situation.

The laboratory technique (Ray and Sawyer, 1971 : 208) is basically an *after only* design in which advertising is presented repetitively and measurements are taken immediately after presentation. The authors assert that a number of precautions have been taken in order to avoid the bias and unnaturalness of such a lab setting. The technique has apparently survived the tests of face validity and predictive validity. Results are in accordance with expectations from past advertising research and from behavioural theory. Laboratory findings have been supported in general by field experimental results (Ray, Sawyer and Strong, 1971 : 209; Strong, 1971 : 213).

The most important finding of this research is that there are, in fact, dramatic differences in effect depending on the nature of the situation. More specifically, it has been found that the effects of repetition, as estimated by a repetition function, vary across measures, consumer segments, product type, brand, advertisement format, the use of illustrations, colour, schedules, type of appeal and the competitive situation. A more detailed exposition of how these factors mediate the effects of repetition may be found in Ray and Sawyer (1971 : 210), which provides a summary of the findings of the research, and references to the original studies. There seems little point in repeating this exposition here, and the interested reader is strongly urged to consult this important paper.

The general conclusion is that the effects of repetition are conditional upon the particular situation, sometimes being beneficial, sometimes not. A final point, before moving on to the next topic, is that this research is an example of the use of both experimental and quantitative modelling methods in understanding a complex, and often perplexing, range of phenomena. We feel that this point is very important and bears repetition.

The wearout of advertisements is a topic closely related to repetition effects and to the remembering of advertising. It represents yet another factor to be taken into account when considering the effects of advertising over time. This literature will not be reviewed here as a recent review has been given by Greenberg and Suttoni (1973 : 214). Again conclusions are not very specific. As Appel has shown (1971 : 215), wearout, as measured by recall over time, occurs in some cases but not in others, at least not in the time span and conditions considered in his study.

11. Measurement of Advertising Retention

Virtually all studies relevant to the retention of advertising use various versions of recall and recognition measures. We do not propose to discuss the vast literature on these techniques here, the reader may find such a discussion in Robinson et al (1968 : 216). We merely wish to make a few points regarding these measures.

The first point relates to accuracy, reliability and sensitivity of the various measures. There is a large and growing literature (e.g. 217-231) which raises strong doubts on all of these evaluative factors. Results are known to be dependent on the measure used (199, 210, 217). Also there is evidence that claimed recognition of advertisements may be totally spurious as recognition is claimed of advertisements that could not possibly have been seen (218-220). Recall measures may even vary by time of day at which they were obtained (229). As Durrant and Simmons (1968 :232) have argued, there is an obvious need for research into the various measures, both to determine the factors which affect them and need to be controlled, and to improve the measurement techniques. The work reviewed in Section 3.2 provides a starting point.

Secondly, retention measures vary according to other variables, the variables which are supposed to affect memorability. Variables in this class include the media in which the advertisement appears (McConnell, 1970 : 233), the immediate environment of the advertisement (227, 234-237), interest in the product itself (218, 238), the use of visual material (239), etcetera. The value of such studies is naturally limited by the properties of the retention measures and their limitations, referred to in the preceding paragraph.

Thirdly, studies using different measures and experimental procedures place a limitation on the comparability of results. Considerations raised and discussed in the psychological literature review bear witness to the validity of this statement. It is for this reason, the problem of measurement, and the importance of the situation, that results obtained are not cited and discussed. There would be no point as they are isolated, circumspect and possibly even spurious. This is almost inevitable given the ad hoc nature of much of the reported work, which was carried out for a whole host of reasons and for the attainment of a variety of objectives. A more systematic research programme is necessary for the attainment of meaningful results.

Finally, the multi-dimensional nature of memory and retention means that any single measure is almost certainly inadequare (cf. the comments in Section 8.3). This point has been recognised in the advertising research field before (e.g. Hansen, 1972 : 240), but, from the number of studies using single measures, bears repetition. This multi-dimensional nature of retention entails a far more sophisticated approach. A multi-dimensional phenomenon can only be fairly represented by a model and not by a single measure. This point has been appreciated in the field of psychology, but awaits realisation in advertising research.

12. Implications for Research & Practice

12.1 Research

The implications for research will be apparent from the points made at various stages in the discussion. To briefly summarise, research is needed on:

1. Measures of retention, their inter-relationships and validity
2. Models of the retention process
3. Variables relevant to retention and their inter-relationships
4. The relationship between retention of advertising and various other constructs in the process linking exposure to purchasing behaviour

Such research should take account of the importance of perception, motivation, and the nature of the situation. The importance of these factors is thought to be considerable, as indicated by psychological research, mass communications research and the best examples of marketing and advertising research. It will be appreciated that many of these factors operate at the level of the individual. This causes problems for research and for the application of the results of research. However, much of behaviour is believed to be determined by the interaction of the person with his environment (see Hansen, 1972 : 240). Also, there are believed to be a limited number of personality types (cf. the notion of parsimony in science) which are definable along certain dimensions. These facts would indicate research to identify meaningful aggregates which are sufficiently homogenous for the purpose at hand. These would be defined by personality and situational variables. This, of course, is the purpose of market segmentation.

12.2 Practice

Due to the lack of concrete knowledge revealed by this review and the demonstration that much depends on the particular situation, no specific recommendations can safely be made. However, much of advertising practice is based on unvalidated and often naive theories of human behaviour. An example of this is the unimaginative use of repetitive advertising in the belief that without repetition it will be forgotten (a crude application of the ideas of trace theory?). Such a view ignores the facts of selective perception, the far from passive nature of the audience (see Zimmerman and Bauer, 1956 : 241), the effects of competitive advertising, etcetera. There is even evidence that a few exposures may not only be enough but optimal (242-245). We would thus encourage thoughtful consideration of advertising practice *and its underlying assumptions* in the light of research results, from psychology, other behavioural disciplines and marketing/advertising, and experience derived from practice. It is appreciated that time is a factor militating against such an approach, as is the volume of *relevant* research and material reporting it. However, useful books and articles designed to bridge the gap are occasionally published. Good examples, which are recommended to the reader, are Cox (1961 : 15, 16; 1967 : 17), Kelvin (1962 : 98) and Golby (1964 : 245). As a useful source book, containing much relevant material, Hansen (1972 : 8) is recommended.

One of the most important areas of application for knowledge of the remembering of advertising is that of media scheduling. For an up-to-date review, see Newall (1974 : 247), Gensch (1973 : 248) and also Montgomery and Urban (249). This latter reference contains other material of interest to advertising practice.

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