THE DYNAMICS OF BUYER BEHAVIOUR -

A SIMULATION OF THE HOWARD & SHETH MODEL

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ABSTRACT

THE DYNAMICS OF BUYER BEHAVIOUR -

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The fundamental purpose of this study was to investigate the dynamics of buyer behaviour through the exploration of the time varying internal characteristics of the buyer. This study was accomplished largely through the modelling of a general theory and the digital computer simulation of the model. The static characteristics and feedback relationships were drawn from the general theory of consumer behaviour known as the Howard and Sheth Theory of Buyer Behaviour. The dynamic characteristics and functional relationships within and between the variables that represent buyer behaviour were drawn from this general theory to a large extent and from postulations generally accepted among researchers in the field of psychology and consumer behaviour.

The ultimate objective of this investigation was to analyze the systematic changes which occur in the individual's internal characteristics, such as satisfaction and confidence over time and in response to changes in selected variables such as the elements of stimulus display. The consumer was monitored over a full year (52 weeks) and at the end of each cycle (week) the internal characteristics and the output (purchase) behaviour were re-examined to analyze the changes apparent in the consumer's behaviour.

The model was intentionally designed to replicate the processes characteristic of an individual consuming unit in the purchase of a packaged convenience good consumed on a regular basis. To test the general theory's

basic assumptions, postulates and variable relationships, the model was subjected to sensitivity analysis through variable manipulation. Through this analysis, suggestions as to areas of ambiguity and greater concern for future research were disclosed.

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Computer simulation was an integral aspect of this investigation and I must thank Professor R. I. Hall for his interest and concern in the modelling and programming stages of the study.

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CHAPTER I

INTRODUCTION

A. Purpose, Importance and Significance

This investigation is entitled the Dynamics of Buyer Behaviour - A Simulation of the Howard and Sheth Model of Buyer Behaviour. This topic will include the conceptualization of the Howard and Sheth Model as a closed system exhibiting feedback relationships and time varying behaviour.

The purpose of this study is to provide a systematic framework for the analysis of the dynamics of buyer behaviour. Through the integration of all aspects central to buying behaviour into a complex system model exhibiting feedback relationships, subsequent analysis is made possible. The Howard and Sheth Model is representative of a complex model, capable of being systematized and being simulated using computer simulation techniques to monitor its behaviour. Through such modelling and simulation, insight into the validity and reliability of the Howard and Sheth theory is fostered. Furthermore, such analysis will provide a new perspective from which the business and academic environment may view buyer behaviour.

This study of the Dynamics of Buyer Behaviour represents a new frontier in the development of marketing theory. As yet no one has attempted to define buyer behaviour in terms of a closed system and apply a true systems methodology to analyse it over time. Time represents a relatively new dimension which has been incorporated in relatively few theoretical discussions on buyer behaviour. However, none have utilized a true systems methodology for such analysis.

Models, frameworks and theoretical constructs of buyer behaviour have been hypothesized more or less by such authors as Maslow in "Drive

Reduction Theory", Howard and Sheth in "The Theory of Buyer Behaviour", and Nicosia in "Advertising Management, Consumer Behaviour and Simulation", but most have neglected feedback relationships and/or time dimensions.

This study will attempt to define the Howard and Sheth Model of Buyer Behaviour as a closed systems with inherent feedback relationships and time delays. This study will furthermore attempt to add the dimension of time by simulating and monitoring the behaviour of the system over a given period of time. In essence, the addition of these two elements, it is hoped, will contribute significantly to the advancement of marketing theory with regard to buyer behaviour.

B. The Problem

1. Question

The problem is to define "What is the behaviour of the Howard and Sheth Model of Buyer Behaviour when conceptualized as a closed system composed of interacting positive and negative feedback loops and delays when it is simulated over time and in response to changes in specified variables and parameters?"

The very nature of this study and the definition of the problem as stated generally precludes the postulation of any specific hypotheses. Rather, one very general hypothesis may be stated:

Ho_1: The proposed model based on the Howard and Sheth Theory of Buyer Behaviour is not a valid and reliable indicator of the general nature of buyer behaviour.

Ho_a: The proposed model based on the Howard and Sheth Theory of Buyer Behaviour is a valid and reliable indicator of the general nature of buyer behaviour.

2. Limitations of Scope of Problem

The limitations of the scope of the problem are delineated primarily by the boundary of the system under consideration, and variables or parameters as established by the Howard and Sheth Model of Buyer Behaviour.

The primary focus of this study is the behaviour of the individual consumer over time and, as such, all interactions external to this system are assumed as insignificant to the outcome of the model. Those influences which are deemed significant to the system but, however, not interacting with the system, have been labelled as exogenous variables.

The limitations to this study are centered upon the fact that no conclusive evidence is available as to the theory's validity and reliability. However, this study is designed to provide useful insight into the sensitivity of the variables and parameters of the model as well as delineate topics or areas of concern which require greater empirical research and investigation in validating and operationalizing the model.

This chapter has been designed primarily to acquaint the reader with the purpose of this investigation, the problem, and its scope and limitations. In the following chapter, the problem will be developed further through a review and analysis of the applicable literature available. A solution to the problem will also be proposed, as developed through an analysis of methodologies available and already utilized.

Subsequent chapters will outline the basic structure, processes and relationships inherent in the general model. A model will be developed utilizing the proposed methodology on a subsystems basis. The subsystems will be integrated and simulated over time, and in response to changes in selected variables and parameters. Sensitivity analysis of the model will be performed, and finally a summary of the findings and recommendations will be presented in the last chapter.

C. Definitions of Terms Used in This Study:

1) Closed system (feedback) - is a grouping of parts that operate together for a common purpose such that results of past action control future action.

2) Positive feedback - is that which generates growth processes wherein action builds a result that generates still greater action.

3) Negative feedback - is that which seeks a goal and responds as a consequence of failing to achieve the goal.

4) Delays - refers to an interval of time between receipt of information and action.

5) Dynamic - refers to time varying behaviour.

6) Dynamo - a digital computer simulation language especially suited to dynamic continuous systems.

7) Counterintuitive - that which would not be expected intuitively.

8) Dynamo compiler - is a computer program which accepts the equation for a model of a dynamic feedback system and produces the requested simulation results as numerical tables and graphical plots.*

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* Dynamo has been designed by the Industrial Dynamics Group at the Sloan School of Management. Mass. Instit. of Technology.

CHAPTER II.

PRESENT STATUS OF CONSUMER BEHAVIOUR

A. REVIEW OF THE LITERATURE

1. Development Prior to 1960

The evolution which has occurred in emphasis from the internal structure and functioning of the individual firm to the buyer is manifested in the multiplicity of articles, books and publications presently available on the topic of consumer behaviour. Marketing as a discipline is concerned with every aspect of the flow of goods and services from the producer to the final end consumer. The consumer is the last link in this chain and is perhaps the most crucial link, in that it is his behaviour measured in terms of purchase and repurchase cycles that critically determines the effectiveness and efficiency of all prior marketing strategies and tactics. The conscientious manager is concerned with the intricacies of consumer behaviour and how he can improve the efficiency and effectiveness of the flow of goods and services to the consumer.

Traditionally, the social sciences, specifically psychology, have concerned themselves with individual behaviour or the realm of what moves the individual to action and reaction. The emphasis, however, has been on experimentation and observation and, to a large extent, on abnormal patterns of behaviour largely as a repercussion of earlier norms mediating against examining the psyche of so-called healthy patients.

The development of sociology and the examination of group behaviour also was largely bent on deviations from normal but again was based largely upon empirical observation. As social psychology evolved to fill the gap between the two disciplines, a somewhat simultaneous shift in the firm's emphasis occurred toward the individual consuming unit.

Management began to adopt piecemeal some of the concepts and findings of the social sciences into its decision-making processes. The language and terminology of these social sciences crept slowly but surely into the vocabulary of the marketing manager of the firm. In essence, it is synonomous to a jigsaw puzzle, where management gained some new pieces but really had no idea of how they all fit together. Howard and Sheth (1967) as cited by Day and Ness (1971, p.507), provide a most interesting description of this situation. "The existing variety of formulations resembles the variety of responses of seven blind men touching different parts of an elephant and making inferences about the animal which necessarily differ from, and occasionally contradict one another."

It is not difficult for one to see, however, the merging of what originally were separate and distinct areas of concentration. As such interlocking occurs one cannot help noticing that everything is intricately involved in a larger, more complex system of which one subsystem is the individual and his environment. The psychological, sociological and physiological systems of any given individual are, in fact, merely subsystems interacting with one another attempting to attain equilibrium.

The post war advances in technology and quantitative techniques have been a great boon to the development of management science and operations research. The techniques are sophisticated to a large extent, however, their original development occurred largely as a problem solving exercise. Today, many of these techniques are finding applications in marketing but as Sheth (1967) puts it, "The theory which attempts to explain the observed phenomenon of buyer behaviour and the quantitative techniques which provide adequate definitions and measurement have been developed independently of each other to the detriment of the maturity of the discipline."

The diverse and fragmented pieces of information concerning the individual consuming unit have been gradually and continuously increasing. The growth and specialization which has occurred in marketing has led to increasing emphasis on the consumer from the Marketer's standpoint. To understand the behaviour of the consuming unit, theoretical models have been developed to explain and predict behaviour emanating from the buyer. Essentially, this process of modelling has attempted to systematize the processes that are involved in buyer behaviour.

Aaker (1970), points out that the modelling of buyer behaviour does provide a structure for the processes which are involved and accordingly has resulted in some productive managerial uses for these models. He adds that, "As insights are gained into the processes which are involved, management decision making is fostered and policy or strategy is improved." The existence of laws of consumer behaviour has been considered by A. Schuchman (1968), and he concludes that the results encourage the developing of a science of marketing. Specifically, he reports and describes two instances in which there are observable regularities in behaviour which could acquire the status of marketing laws.

The development of models of individual behaviour began largely in psychology through the work of Lewin (1936) as cited by Markin (1969, p. 105) in his concept of a "Life Space", where he predicted the external and internal forces impinging on the individual.

Maslow (1954), in the development of psychoanalytic theory, brought forward the concept of needs and their hierarchical structure. He linked needs to motivation and satisfaction and, as such, treated behaviour very much in a systematic fashion. These two developments are still a fragmented approach to the topic of consumer behaviour. However, this is largely due to the function and purpose for which they were originally intended. Despite their drawbacks they represented significant steps toward the development of a comprehensive scheme of behaviour.

The development of theoretical models gained significant momentum with Kornhauser and Lazarfields' (1935) representation as cited by Day and Ness (1971, p. 493), in the Analysis of Consumer Actions. They depicted behaviour as an action schema and noted the importance of time in mapping the flow of consumer action. The scheme of action, however, is very much simplified but it laid the foundations for further development.

2. Recent Developments

The evolution of theoretical models of behaviour made significant progress as varied constructs emerged in the 1960's. Among such models was one developed by Engel, Blackwell and Kollat (1968) cited by Engel (1968, p. 1-5), which treats the process as a problem in decision-making. Consumer behaviour is treated here as a closed system with information feeding back to a central control unit. Learning and habit formation are treated in this context as important facets in the process. The model is still very much simplified in that the processes internal to the consumer are treated much as a "black box" and the decision process is in the form of an "on-of", "yes-no" decision or a halt in the flow of action.

Another model recently developed by Nicosia (1966) treats behaviour as a decision process encompassing four fields: the message exposure to the consumer, search for and evaluation of 'means-end' relations, the act of purchase, and the feed back. Again, Nicosia (1966) treats the processes as a system composed of feedback loops interacting within a larger structure. The scheme of the loop is a computer program that describes the structure of consumer behaviour. Significantly, Nicosia (1966) outlines the dynamic property which the model exhibits through the use of a computer program. The model, however, utilizes only a "funnel" approach to decision making by the consumer and only one type of message - an advertisement. Nicosia (1966) recognizes that time lags do exist and that certain parameters of the model cannot be assumed constant but are rather a function of time.

The purpose and intent of the model that Nicosia (1966) describes was to build a simple scheme for several reasons:

> "One could build a simulation model that is a direct translation of the whole scheme. This, however, would be difficult because simulation of the scheme requires more 'fine grain data' than those usually generated by current marketing, advertising and consumer research."
>
> "By its very nature, simulation compels the researcher to realize that more than a hyphen lies between a stimulus and a response."
>
> "Notions of equilibrium or optimality, therefore, may become elusive or may vanish altogether as the complexity of the system that is portrayed increases."

Nicosia goes on to point out that ... "we cannot further our understanding of consumer behaviour unless we conceive it to be a system of relationships."

"These are attempts to pinpoint not properties of individual entities but properties stemming from the modes by which entities mutually relate, that is, properties of systems."

The development of comprehensive models of buyer behaviour has gained the greatest momentum with the introduction of the Howard and Sheth (1969)theory of buyer behaviour. This model represents the most comprehensive scheme that, to date, has been developed and gained recognition by both the business and academic worlds. Through the integration of the fragmented bits and pieces of information into a pattern, Howard and Sheth (1969) have been able to create a theoretical structure of buyer behaviour which is highly functional to the understanding and prediction of buying behaviour.

The model treats buyer behaviour as a closed system of relationships and emphasizes the feedback which occurs from one variable to the next. As Howard and Sheth (1969) describe it:

"The theory is at a medium level of formality and abstraction."

"The theory is fairly idealistic in the sense that no commitment is necessarily made that the structure it imposes on the empirical facts of buyer behaviour is really there. Some of the constructs do exist in physical or neurophysical fact, but we are not certain about all of them."

"By constructing the theory at a medium degree of abstraction it has been possible to achieve a level of detail in the analysis which enables the user to capture essential distinctions required to integrate a variety of bodies of theory and research which in turn incorporate the distinctions required for dealing with problems at what we think of as the 'marketing level'."

Much buying behaviour is, in essence, more or less a cyclical phenomenon as Howard and Sheth (1969, pp. 391, 392) describe it, wherein the consumer makes repetitive brand choice decisions. These purchase cycles will essentially determine how often the consumer will buy a given product. The purchase cycle assumed by the buyer will vary largely in accordance with the given product category. For example, in durable goods purchases, the cycle will be lengthy. However, for many other products such as toilet soap and other grocery or personal items, the cycle is short, purchases are frequent and there is the element of repeat buying.

The consumer, faced with repetitive brand choice decisions, stores relevant information in order to simplify the psychological and physical processes necessary to routinize the decision. Howard and Sheth (1971, p. 509) emphasize:

> "What is crucial, therefore, is to identify the elements of decision making, to observe the structural or substantive changes that occur in them over time due to the repetitive nature, and show how a combination of the decision elements affect search processes and the incorporation of information from the buyer's commercial and social environment."

The buyer is thus faced with a repetitive brand choice decision, which is composed of 3 basic elements as Howard and Sheth (1971, p. 509) describe it: (1) a set of motives; (2) several courses of action; and (3) decision mediators by which the motives are matched with the alternatives. The alternative courses of action are recognized as brands constituting a buyer's 'evoked set' with the potential to satisfy the buyer's motives; the motives being specific to the product class, and reflecting the needs of the buyer. The decision mediators represent the set of rules that the buyer employs to match his motives and his means of satisfying those motives. They serve the function of ordering and structuring the buyer's motives and then ordering and structuring the various brands, based on their potential to satisfy these ordered motives, (learning being a key element in developing these decision mediators).

The buyer, depending on his stage in his life cycle, will develop decision mediators and will accordingly actively seek or receive information. This information is subjected to bias and perceptual processes which modify and limit this intake of information to suit his own frame of reference.

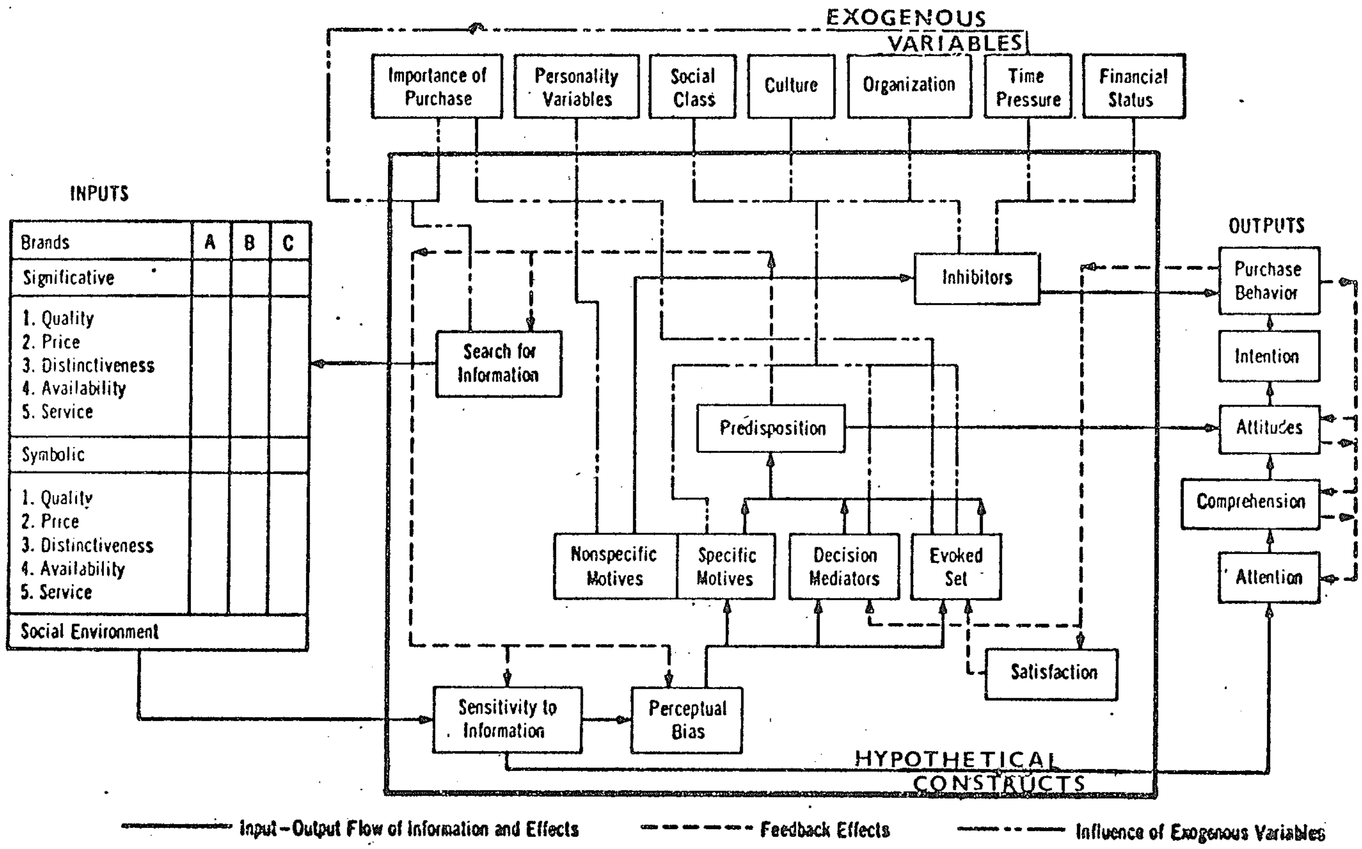
Contingent upon, and with this active search for information, the buyer may, to some extent, generalize from past experiences either through physical or non-physical properties. The buyer thus develops decision mediators which enable him to choose a brand seemingly with the best potential to satisfy the needs as aroused. If purchase creates satisfaction, the potential of the brand to satisfy his motives is increased. With repeated satisfaction through purchase the likelihood of routinization is increased, brand preference is established, and some event which triggers the process may actually complete the choice decision.

The buyer, in actuality, has acted to simplify his environment and reduce active search behaviour. The environmental stimuli become more meaningful and tend to reinforce his decision. He becomes less attentive to competing information and generally distorts such information if it is received.

The buyer, however, after attaining routinization of his decision, may be aroused by the simplification of the process due to monotony or boredom. Complication of the decision process is then desirable, and the cycle begins once again toward resimplification of the decision process.

Figure 1 represents the theory of buyer behaviour as Howard and Sheth (1971) diagramatically represent it. The theory is composed of four sets of constructs or variables: input variables, hypothetical constructs, exogenous variables and output variables. The hypothetical constructs are at a higher level of abstraction. ..."They give a description of the buyer's mental state related to a buying decision and therefore map it by identifying, classifying and labelling various conditions." The theory focuses on the transmission of a stimulus labelled inputs, through a set of perceptual constructs, to a set of learning constructs which in turn create outputs, of which one is the purchase decision. Learning and habit formation are integral to the processes involved in the hypothetical constructs and, as such, substantially increase the complexity of the theory. Through the incorporation of exogenous variables the theory is better able to represent the environmental factors mediating on the processes involved in the purchase decision.

As a unified whole the theory is perhaps the best representation of the multitude of forces which impinge on the purchase decision. John U. Farley and L. Winston Ring (1970) have empirically tested the Howard and Sheth (1969, p. 392) theory using eleven equations to define the system. The test assumes linearity in the model and utilizes a multiple equation econometric model. The results of the tests indicated that improved data will be required for more precise work with the model. The data used for the test was obtained from consumer panel information collected by J. Howard at Columbia University.



A THEORY OF BUYER BEHAVIOUR

FIG. 1

This theory, as previously stated, is at a medium level of formality and as Howard and Sheth (1969, p. 392) describe it, "It can easily be simulated." Perry (1968) simulated a model similar to the theory developed by Howard and Sheth to predict consumer brand choice based on a latent demand. The goal of the model was to predict the sequence of changes in the consumer's attitude and self confidence. The simulation model chosen was a dynamic process type on the micro level.

This study was accomplished under the direction of J. Howard from Columbia University, the co-author of The Theory of Buyer Behaviour. The quantification of the processes and feedback relationships of the model was difficult as little applicable empirical evidence was available. This necessitated the development of many and varied postulates as to the processes and relationships involved. The postulates may be typically described as generally accepted principles among researchers but as yet no conclusive findings are available to validate their existence. As such, they provide a convenient starting point for the modelling of a dynamic simulation of the theory of buyer behaviour.

The systems dynamics methodology developed by Forrester (1968) in association with Pugh (1970) has several decided advantages over other techniques when simulating closed systems. This methodology forces the researcher to succinctly define feedback relationships in a quasi-quantitative fashion between variables. Furthermore, in defining the boundaries of the system the researcher is again forced to delimit by defining those variables which have crucial interactions within the system and those which are exogenous to the system. This methodology is highly effective in investigating dynamic behaviour properties of closed systems and facilitates sensitivity analysis of the systems' parameters. Precision and accuracy of relationships may be sacrificed because of the constraints and limitations imposed on the system as it is defined, i.e., in such large complex systems, the large number of parameters so restrain each other's performance that large errors in stating individual relationships between variables do not significantly affect the system's performance.

A related advantage which this methodology offers is that decisions or actions may be conceptualized as dynamic interactions rather than simplified 'yes-no', 'on-off' decisions. The fact that this methodology encompasses time-varying integrations of these flows into levels or pools put it at a decided advantage over other methodologies in simulating systems which exhibit time varying behaviour through feedback relationships. Of significance here is the fact that Howard and Sheth (1971) continuously refer to individual buyer characteristics as "levels" or "states" of the system. This connotes that a construct such as motives may be conceptualized as a basin of water with a tap regulating the flow in and a drain regulating the flow out. The aggregate level of water in the basin being then functionally related to the rate of water flowing in and out. The systems dynamics methodology incorporates this concept into the modelling of the system under consideration, which presents a decided advantage over other techniques.

Finally, the fact that this technique is not constrained or limited to linear relationships between variables aids in its applicability to such systems as buyer behaviour which generally exhibit non-linear relationships between variables.

B. THEORETICAL TYPOLOGIES

The simulation technique of describing buyer behaviour systems is but one of the applicable techniques. Other techniques include operations research and experimentation.

1. Operations Research

Operations research has contributed significantly to the study of buyer behaviour. The bulk of the research, however, has been in terms of first order Markov chains applied to brand loyalty over time.

These stochastic, or rather probablistic, methods rest on the assumption that brand purchase behaviour is a first order stationary Markov Process.

Nicosia (1966) points out:

> "Knowledge of tomorrow's behaviour is essential for building any marketing and advertising program. Much consumer research attempts to gain this knowledge by extrapolating past observations - this amounts to relying on the 'wisdom of hindsight' ... Markov chains algorithms make it possible to use panel data to observe the whole system of relations among consumer purchases and brands, and thus to assess the dynamic tendencies of the system. Although the stress on the whole makes this approach to prediction conceptually and practically much richer than separate extrapolations of past sales of each brand, the prediction of the state of the system is not based on knowledge of the causal mechanisms that determine change in the transition probabilities. Similar to curve fitting to time-series or trend data, applications of Markov chains to panel purchases assume that the underlying causal structure remains invariant."

Sheth (1967) has outlined three major problems with this methodology:

1) Aggregation:

> "The problem of aggregation arises because of the practise of using proportions of customers purchasing brand i as the probability of each individual buyer buying that brand."

2) Interpurchase Time:

> "The second problem arises because of the diversity of the individual purchase cycles in a group of buyers, and the inevitable discrepancy between average purchase cycle and the time period chosen for Markov analysis."

3) Estimation:

> "The third problem of estimation relates to the utilization of the preliminary estimates obtained from a sample to the national population."

Some of these difficulties have since been removed through modifications of the Markov chains. However, the problems of utilizing stochastic methods to describe buyer behaviour still generally exist. A number of studies have been made utilizing stochastic analysis to describe the processes of buyer behaviour - Day (1965), Haines (1969), Pyatt (1964), Lipstein (1971), Kuen (1971), Howard (1971) and Day (1970).

2. Experimentation

Experimentation refers to creation of a controlled environment wherein the researcher may measure the effects of changes in the independent variable on the dependent variables. This technique has been utilized extensively in advertising research but is relatively new in buyer behaviour. As a rule, this method is designed largely to test the subsystems of the buyer behaviour model and generally must be limited to a few variables.

3. Simulation

Simulation has been introduced to absorb the complexity of such phenomenom as buying behaviour. Through variable manipulation the same effects can be achieved as through experimentation. However, more variables may be manipulated at a given moment to monitor the impact on the entire system. In addition to the simulation studies previously mentioned by Nicosia (1966) and Perry (1968) there are several other noteworthy studies that have been completed.

Cook and Herniter (1971) have developed a model called NOMMAD or "How Consumers Behave" which is a simulation model of consumer behaviour. The model is basically probablistic again and identifies the variables affecting low priced consumer product purchases. The program, however, assumes a binary event in awareness and correspondingly does not take into consideration time-varying states of the system.

Bettman (1971) has attempted to formulate a structure of consumer choice processes by developing an overall paradigm of behavior. A complex and a simple model is tested and they conclude that the complex decision process models can be approximated largely by a more simple model. They, however, felt that the collapsing of the complex model into simple models is not at all well understood and requires more study.

Simulation techniques appear to be the key to understanding complex systems composed of many variables exhibiting feedback relationships. Complex systems tend to exhibit counterintuitive behaviour over time in response to manipulation of selected exogenous variables. The systems dynamics methodology provides a key to unlocking and exposing these properties through the tabulation and graphical depiction of the variables over time. The piecing together of the various subsystems requires, however, a formalized <u>quasi</u>-quantified definition of relationships. Through the use of the systems dynamics methodology approximations of such relationships on a subsystem basis can be made and simulation attempted to monitor the behaviour. As adjustments are made in relationships in response to expected behaviour patterns on a subsystem basis, the larger, more complex system may be assembled and integrated through a network of interlocking relationships.

The theory of buyer behaviour as presented by Howard and Sheth (1969) has gained considerable acceptance in the business community as expressed in a recent article in Business Week (1970) which gives a favorable review of the theory in perspective with other theories. There are new theories continually being developed and new labels to attach to the neurophysical processes which exist in purchase behaviour. Lawrence (1969), for instance, contends that purchase patterns may be designated as reversion, conversion, vacillation, and experimentation or third brand trial. Despite the minor modifications, the theory of buyer behaviour, as proposed by Howard and Sheth (1969), represents perhaps the most well recognized general theory of buyer behaviour that comprehensively integrates the major facets of the processes involved.

C. MODELS AND MODELLING

1. Approaches to Modelling

A model may be defined as representation of reality which is less encompassing than reality itself but is sufficiently complete to approximate the behaviour being investigated. Several approaches to modelling have evolved in the field of buyer behaviour.

Operations research has contributed significantly to one approach to modelling. Such models so described may be categorized as stochastic or probablistic models which focus primarily on the external behaviour of a given consumer. These models have applied Markov analysis, Bernoulli probability theory and negative binomial distributions in attempts to describe and predict the behaviour of a given consumer over time.

The limitations to this approach to modelling are severe in that all attempt to predict behaviour based on past actions and neglect the underlying processes internal to the consumer. Attempts have been made to minimize these limitations, as through Sheth's (1967) factor analytic model of buyer behaviour. However, it is still limited to the extent that it does not explain behaviour but merely describes the same.

Experimentation represents a second approach to modelling wherein variables and parameters are manipulated and the outcomes are examined in the light of the changes. Such an approach treats the processes internal to the consumer very much in terms of a "black box". This approach leads to association between a specific input and a given output neglecting and giving no explanation to the causal sequence. As an approach it is limited to the manipulation of a few variables at a time.

"Research methods do not permit associating a great number of variables, with much interaction and sometimes contradicting effect among them simultaneously." (Perry, 1968).

A third approach would be one which describes in an analytical fashion the relationship between the inputs and outputs. By applying a general theory to a specific situation a precise and analytical evaluation of the consumer's actions are generated. Interactions between many variables and theories from several disciplines are thus considered. Models which are established based on this particular approach may be labelled as 'behavioural process models'.

2. Behavioural Process Models

Most behavioural process models developed thus far in the field of buyer behaviour focus on a single element of the entire process. Ideally an analytic model must describe the relevent processes involved on a micro individual level, but must at the same time take into consideration the dynamics of behaviour over time. A model described as such may be formulated either in a qualitative or quantitative fashion.

A quantitative analytic model which describes the processes in terms of mathematical relationships merely provides a formalization of the qualitative or verbal model.

Through quantification, the verbal relationships must be clarified and sequentially described in a precise manner. The addition of this precision generally leads to increased generality of the model. Furthermore, with the introduction of digital electronic computers, analysis of complex models far beyond human mental capabilities is facilitated, and has become increasingly predominant.

D. COMPUTER SIMULATION OF MODELS

1. Applications of Computer Simulation

A computer simulation model, being an expression of a mathematical behavioural process model, enjoys all those advantages unique to quantitative, as opposed to qualitative, models. In addition simulation models add the dimension of time to enable a more precise replication of reality.

Perry (1968) has outlined several advantages one can expect when using computer simulation models to investigate consumer behaviour:

"a) Expressing a model in the form of a computer program leads to systematization of the verbal propositions and thus allows more adequate exploration of their logical implications and permits paired comparisons among sets of generalizations -- comparisons which may not be obvious, given the structure of verbal formulation.

b) The very process of translation to programming language forces sharper definitions and more precise descriptions of components and their relationships, thus helping to recognize ambiguities and implicit assumptions in the verbal model.

c) Because of the computer's step-by-step mode of operation, the complexity of the model is not a serious obstacle. A computer program allows one to handle a very complex system with many variables and many interactions simultaneously and thus frees one from relying on one-at-a-time approaches, with their restrictive requirements that all other things be held constant.

d) The simulation model can serve as a 'laboratory for marketing'. Assumptions may be varied, parameters may be changed, and the dynamic effect of these upon other components and upon the system as a whole may be tested without the delays and often exorbitant costs of real life experimentation. Great numbers of changes may be tested, singly or in combination and for any period of time. A sensitivity test, for instance, may disclose the relative significance of each variable to the system and will direct future research and data gathering to the important ones; a strategy test ... in which management decision rules will be changed ... will provide management a tool to examine the possible outcomes of each of its alternative strategies; and so on.

e) The simulated system may be made to operate quickly through relatively long periods of simulated time, thus disclosing trends and fluctuations in the behaviour of the system or any part of it.

f) If the input of the simulation is concrete data on a specific market it can serve as a prediction tool. In such cases, part of the input (e.g., the part that is under management control) can be changed, and the possible outcomes will be predicted.*

Simulation of consumer behaviour has become increasingly predominant, e.g., Nicosia (1966), Haines (1969) and Perry (1968), to the extent that attention has been directed to the individual consuming unit.

Another relevant study, not previously cited, was developed by Amstutz (1967). This simulation study is a comprehensive scheme which integrates and incorporates almost all sectors in the chain of distribution. As such, its major strength lies in its ability to simulate alternative marketing strategies and analyze the consequent consumer response.

2. The Present Investigation

The present investigation is a simulation study on the micro individual level which incorporates the dynamics of buyer behaviour over time. It is a model, but is a comprehensive scheme, in that it incorporates and describes the entire process of a consumer's decision-making.

In the following chapters a computer model of consumer behaviour will be developed based largely on the theory proposed by Howard and Sheth (1969). A verbal description of the factors and processes involved will be presented and then a quantified mathematical description will be proposed. The model will be assembled, through the integration of the subsystems of the model, with a network of interlocking relationships and simulated through a digital computer. Finally, the model will be analyzed and evaluated using sensitivity analysis. The by-products of which are hypotheses and insights into the validity and reliability of the proposed model as well as the Howard and Sheth (1969) theory of buyer behaviour.

CHAPTER III

THE THEORY OF BUYER BEHAVIOUR

SUMMARY OF THE THEORY

1. The Need for a Theory

Marketing represents a total system of action oriented toward the satisfaction of consumer needs and preferences. The consumer is but one subsystem of this larger system. The marketer must learn more about the interactions occurring within this subsystem if he wishes to formulate more efficient and effective marketing strategies. Marketing management, in planning future strategies, must be able to predict why the consumer will buy and which particular products and quantities thereof he will purchase.

The analysis of consumer or buyer behaviour is thus an integral element in the design and formulation of optimal marketing strategies. The objective of all such analysis, being to gain sufficient insight into the processes of buying behaviour so that one can with some degree of validity and reliability predict how a consumer will behave in purchasing a given product.

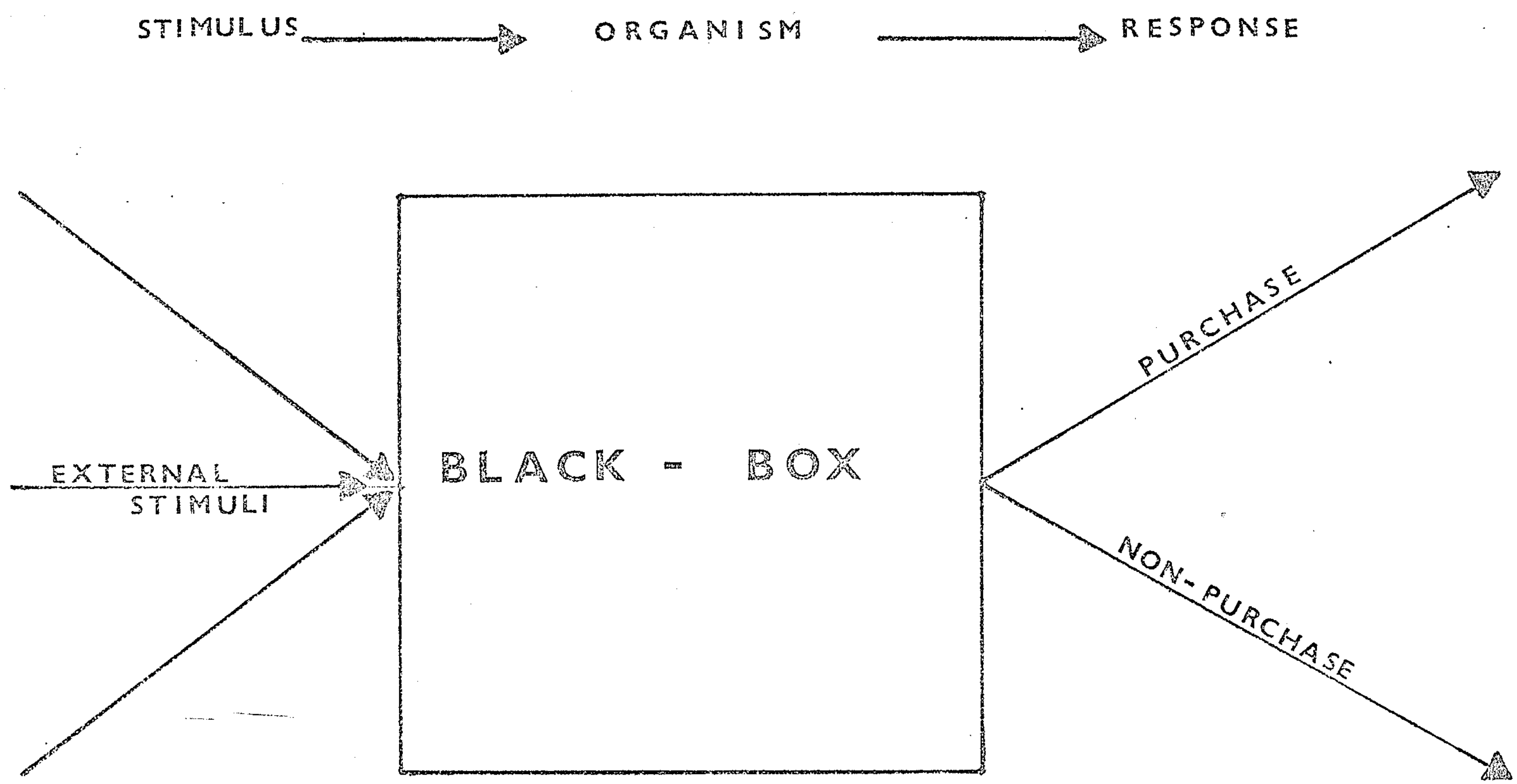
Historically, the focus in consumer behaviour has revolved around tangible factors such as level of expenditure and population. The pattern of expenditure of a given consumer is in reality merely the response or output to a given stimulus. Data such as this may be termed historical data in that it is gained after the fact. The marketer may extrapolate purchase behaviour based on past behaviour in order to predict, but there is no reason to believe that past behaviour will ever repeat itself again.

This type of data, being largely based on socioeconomic or demographic characteristics, is of little value when a marketer wishes to predict which product or brand will be purchased. Such prediction requires greater analysis of consumer buying as well as general behaviour patterns.

Marketing has looked to other disciplines for explanations of buyer behaviour, specifically the behavioural sciences. Psychology, sociology, social psychology and anthropology have added significantly to the understanding of the processes of consumer behaviour. The social sciences, however, have been primarily concerned with behaviour generally and not with consumer or buyer behaviour as such. Attempts have been made to link empirical investigations in the behavioural sciences to the prediction of consumer behaviour with some success but their objectives remain separate and distinct. Today there are more behavioural scientists that recognize the interrelationships between business or marketing problems and the behavioural sciences and they are focusing their efforts directly on solving these problems from an integrated approach.

The classical approach to consumer behaviour has viewed the processes largely in terms of the Pavlovian stimulus-response paradigm or rather the "black box". The theory conceptualizes the consumer as a "black box" which is subjected to external stimuli and factors. The consumer internalizes these stimuli and responds by either purchasing or not purchasing the product. The processes are diagramatically represented in Figure 2.

The concept of the "black box" is not restricted to one discipline, but rather pervades many of them. In each discipline a characteristic mode of behaviour is assumed such that some rationale for behaviour exists. Some economists will typically assume that the individual attempts to evaluate stimuli in light of their cost and utility, whereas some psycho-



THE BLACK-BOX, S-R, PARADIGM

FIG. 2

logists prefer to see individuals as "Freudian men" motivated by inner subjective feelings sometimes focused on sexual considerations.

The conceptualization of consumer behaviour in terms of a "black box" is but one way of viewing behaviour. Consumer behaviour is multi-dimensional; again it is a total system of action which cannot be explained by one behavioural theory.

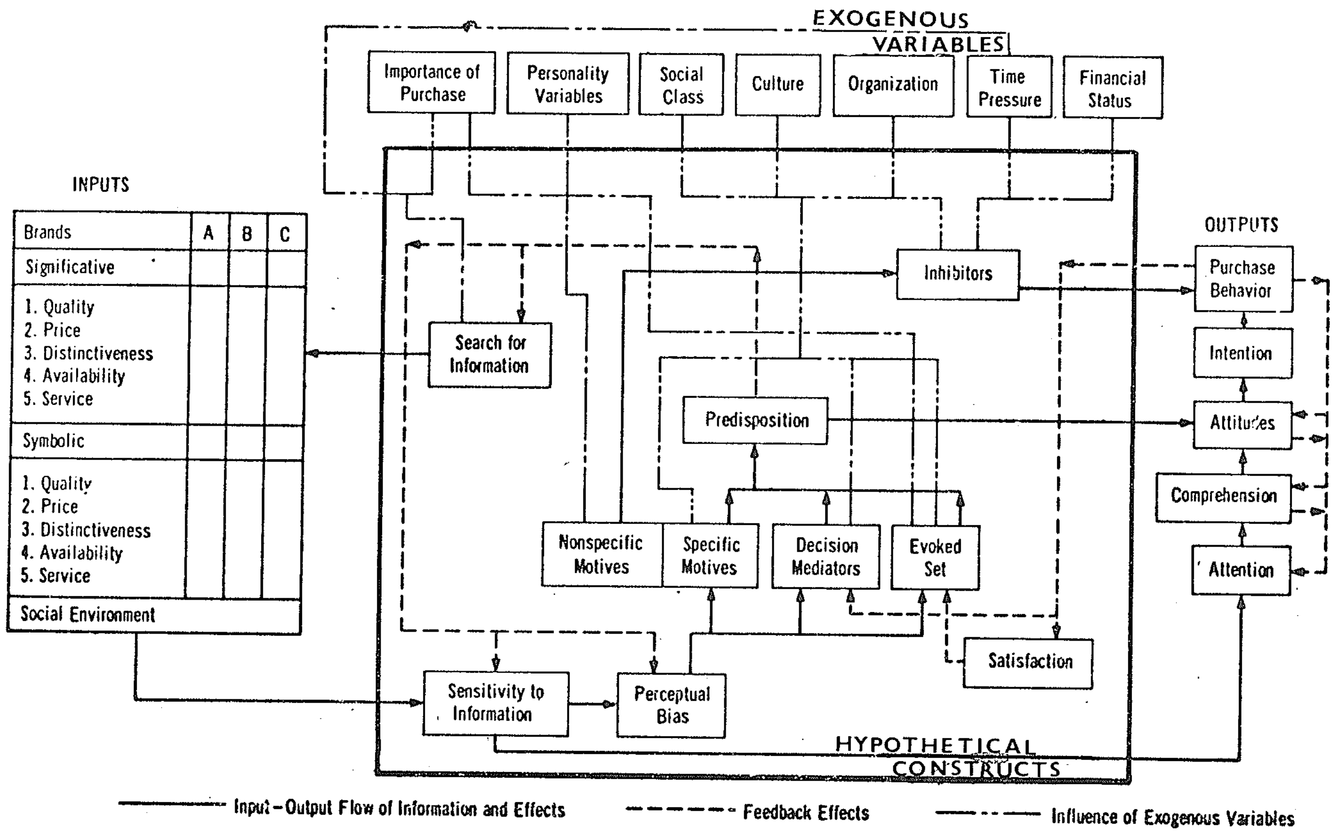
The marketing man must attempt to consolidate and integrate the varied and diverse disciplines into a cohesive framework for the prediction of consumer behaviour. There is to date no statistically valid nor reliable model or framework of the processes inherent in the "black box", and the marketing manager must still rely heavily on his own experience, intuition and judgement.

J. A. Howard and J. N. Sheth (1969) attempted to consolidate and integrate the various disciplines, conceptualizations and theories into a comprehensive framework of buyer behaviour. Their theory provides no conclusive answers but does provide a great deal of insight into the processes inherent in the "black box".

2. The Basic Structure

The Howard & Sheth (1969) theory of buyer behaviour is essentially a behavioural process model. The theory may be presented diagramatically as in Figure 1.

The theory or model consists of 4 sets of constructs: input variables, exogenous variables, output variables and hypothetical constructs.



A THEORY OF BUYER BEHAVIOUR

FIG. I

The input-output variables are the most concrete and the functional relationships among them are more precisely defined. The hypothetical constructs are abstractions from reality and correspondingly are not concretely defined. Nevertheless, these variables constitute what Howard and Sheth (1969) refer to as "the heart of the theory". The exogenous variables are the parameters which describe the nature of the market, the buyer and his environment. They serve to move the theory from gross generalities to specifics concerning a given market segment. As such they are not integral to the decision-making process, but are key factors modifying the process.

Input Variables:

the Input variables are labelled "INPUTS" (to the left in Figure 1). These inputs represent the stimuli which affect the buyer's internal characteristics at any given point in time. These stimuli are classified as being either commercial or social. The commercial stimuli are those stimuli that emanate from the marketing activities of various firms which are attempting to communicate to the consumer. The commercial stimuli include significative as well as symbolic stimuli. Significative stimuli are defined as those stimuli produced by the commercial activity of the company in displaying the physical brand as a total entity, whereas the symbolic stimuli are defined as impersonal, external stimuli produced by commercial signs to stand for the brand. Such signs may be linguistic, orthographic or pictorial.

Each brand is deemed to have at least 5 elements that are crucial to its existence, those being - quality, price, distinctiveness, availability and service. These elements are present in both the significative as well as the symbolic stimuli in varying proportions.

The social environment which contains the social stimuli represents all other stimuli other than commercial stimuli. The social stimuli are defined as those stimuli which emanate from other people, particularly the buyer's friends and relatives providing information concerning the product class and brand. Such stimuli are characterized as being linguistic or non-linguistic.

The sum of these stimuli interacting over time represents the Stimulus Display to which the buyer is exposed. The Display is defined as a physical event to which the buyer is exposed and stirs or prods the buyer, is external to the buyer and is associated with sensory processes. These external stimuli must be differentiated from internal stimuli which are created in fact by the external physical event. Contextual cues, being those outside of the Stimulus Display.

Exogenous Variables:

The exogenous variables are labelled exogenous in the sense that no explanation is provided for their formation and change. They represent past influences as opposed to inputs affecting a current decision. They are designed primarily for the analysis of data and the purposes of market segmentation. The exogenous variables and their contextual meaning are as follows: (As shown in the upper portion of Figure 1.)

a) Importance of Purchase: is defined as a variable in the buyer's frame of reference that corresponds to intensity of motives regarding a product class.

b) Personality Traits: are defined as enduring dispositions or qualities of a person that account for his relative consistency in emotional, temperamental and social behaviour. They are traits that account for differences among people.

c) Financial Status: is defined as the quantity of funds that a buyer expects to have available for expenditure on goods and services during some specified time period.

d) Time Pressure: is defined as the inverse of the amount of time the buyer has available to perform the behaviour involving the purchase and consumption acts associated with a particular product class and the information-seeking that precedes the purchase act.

e) Social and Organizational Setting: is defined as involving two separate but closely related ideas. The social aspect of the setting of the buyer's purchase and consumption acts refer to the close social arrangement implied by the term "reference group". By the latter we mean any group with which the buyer identifies and/or compares himself to such an extent that he tends to adopt its standards, attitudes and behaviour as his own. This group is said to provide a social anchoring for the buyer whereby his brand judgements and purchase and consumption acts are influenced by this relationship as well as by other facts he perceives. The "organizational" aspects of the purchase and consumption setting refers to the much more structured arrangement represented by such formal organizations as a company.

f) Social Class: is defined as a description of the condition that society is divided into classes, some of which are viewed by members of the society as being more important than others. In a society these classes can be ranked according to the views of its members as to the value of each class in terms of its contribution to the society as a whole. As implied by the life style concept, empirically, it is stated, these classes are not clearly demarcated but instead represent arbitrary cuts across a continium of status positions.

g) Culture: is defined as a selective manmade way of responding to experiences, consisting of patterns of behaviour transmitted from person to person. In general it reflects a sense of homogeneity among people bound together and separated from other sets of people by various physical boundaries.

Hypothetical Constructs

The hypothetical constructs, as mentioned earlier, are more abstract, but yet lie at the heart of the theory. The constructs may be classified according to two classes, i) those involved with perception, and ii) those involved with learning.

Perceptual constructs serve the function of information processing while learning constructs serve the function of concept formation. The two constructs may be outlined as follows:

Perceptual Constructs: serve to process the incoming stimuli from the three basic sources mentioned earlier. The perceptual constructs in Figure 1 are i) sensitivity to information, ii) perceptual bias, and iii) search for information and are outlined as follows:

i) Sensitivity to Information: is defined as the opening and closing of sensory receptors which control the intake of information. This behaviour is manifested in either perceptual vigilance or defence. Theoretically, sensitivity to information then performs the "gate-keeper" function. Only if the stimulus is in the moderate range of ambiguity will the buyer pay attention and freely absorb the information. The more interesting the information, the more likely the buyer is to open up his receptors and pay attention. Interest being cogently linked to the level of motivation.

ii) Perceptual Bias: refers to the fact that even though information may enter his mental state, he may actually distort it. He does this to make the stimuli congruent with his frame of reference as determined by the amount of information he already has stored. This perceptual phenomena described is likely to be less operative if the information is received from the buyer's social environment, due to the greater credability ascribed to this source.

iii) Search for Information: refers to those stages where a buyer actively seeks information. It is believed that there is less distortion when he actively seeks such information. This active seeking of information is especially acute when brand ambiguity exists. Such ambiguity is generally relegated to the extensive problem-solving stage of the decision-making process. The buyer will also actively seek information when he has not yet routinized his purchase-decision process. However, once his routinized decision-making becomes boring he will once again actively seek information.

Learning Constructs

The learning constructs which serve the function of concept formation contain the following categories: a) Motives - specific and non-specific, b) brand potential of evoked set, c) decision mediators, d) predisposition toward the brands, e) inhibitors, and f) satisfaction.

a) Motives: are defined as the impetus to action. They refer to the goals in purchasing a product class. The specific motives are closely anchored to the attributes of a product class and as such become purchase criteria. Motives serve the function of raising the buyer's sensory state and attuning him to the inputs.

The non-specific motives are learned primarily due to acculturation. The non-specific motives also contain a hierarchy within themselves.

b) Brand potential of evoked set: A buyer, familiar with a product class has an evoked set of alternatives to satisfy his motives. Therefore, the elements of the buyer's evoked set constitute some of the brands that make up the product class. The specific brand conveys certain meaning including its potential to satisfy his motives. Through the process of learning the buyer stores knowledge regarding each brand's potential of satisfying his motives.

c) Decision mediator: The brand potential of each of the brands forms a pay-off matrix. The decision mediators represent the buyer's mental rules for matching the alternatives with his motives. The decision mediators thus represent enduring cognitive rules established through learning to match brands and motivations.

Essentially, there are two sources of learning - i) actual experience with the brand and ii) information about the brand. Learning can occur through generalization from actual experiences or through stimuli generated from the buyer's commercial or social environment.

d) Predisposition: is defined as the summary effect of the previous three constructs. It refers to the buyer's preference toward brands in his evoked set. The uncertain aspect of predisposition can be called Brand Ambiguity, in that the more confident he holds it, the less ambiguous is the connative meaning of the brand to the buyer and the more likely he is to buy it.

e) Inhibitors: are defined as forces in the environment which create disruptive influences in the actual purchase of a brand even when the buyer has reasoned that the brand has the potential to satisfy his motives.

Howard and Sheth (1969) postulate that there are at least four types of inhibitors, those being i) high price of the brand, ii) lack of availability of the brand, iii) time pressure on the buyer and iv) the buyer's financial status. All four factors being crucial to the final purchase decision. The inhibitors may persist for long periods of time but never become internalized.

f) Satisfaction: is defined as the degree of congruence between the actual consequences from purchase and consumption of a brand and what was expected from it by the buyer at the time of purchase.

If the outcome is adjudged as less, the buyer will be dissatisfied and his attitude toward the brand will be less favorable. If it is more satisfactory than expected, the buyer will enhance the attractiveness of the brand. Therefore satisfaction may affect the ordering of the brands in the evoked set.

Output Variables

There exists a variety of buyer responses on outputs from the decision-making process which are relevant for different areas of marketing strategy. Most of the output variables are related directly to some and not to other constructs. They are: a) attention', b) comprehension', c) attitude', d) intention to buy', and e) purchase.

a) Attention': is related to sensitivity to information. It is defined as a response of the buyer which indicates the magnitude of his information intake.

b) Comprehension': is defined as the store of knowledge about the brand that the buyer possesses at any point in time. This varies from simple awareness to complete knowledge of the brand but lacks the motivational aspects of behaviour.

c) Attitude': is defined as the buyer's evaluation of the brand's potential to satisfy his motives. Attitude is directly related to predisposition and so consists of both the evaluation of a brand in terms of the criteria of choice from mediator and the confidence with which that evaluation is held.

d) Intention to Buy: is defined as the buyer's forecast of his brand choice some time in the future. It may be summarized as something short of actual purchase behaviour.

e) Purchase: is defined as the overt act of purchasing a brand. It is the overt manifestation of the buyer's predisposition in conjunction with any inhibitors that may be present.

3. The Basic Processes

Howard and Sheth (1969) state that much of buying behaviour is more or less repetitive brand choice decisions. During his life cycle, the buyer establishes purchase cycles for various products, which determine how often he will buy the products. For some products, this cycle is very lengthy, for example, the infrequent buying of durable appliances. There is, however, invariably the element of repeat buying whatever the purchase cycle.

In the face of repetitive brand choice decisions, the consumer simplifies his decision process by storing relevant information and routinizing the decision process.

The buying process begins with the brand choice decision, given that the buyer is motivated to buy a product. The elements of his decision are 1) a set of motives, 2) alternative brands, and 3) choice criteria by which the motives are matched with the alternatives. Motives are relevant and sometimes specific to a product class, and they may combine to reflect some smaller number of higher-ordered motives. The alternative courses of actions are the various brands as well as their potential to satisfy the buyer's motives. The brands that become alternatives to the buyer's choice decision are generally a small number, collectively called his "evoked set". The size of the evoked set is at best a fraction of the brands that he is aware of and a still smaller fraction of the total number of brands that are actually available in the market. The choice criteria match the buyer's motives and his means of satisfying the motives. They serve the function of ordering and structuring the motives. The choice criteria develop by a process of learning about the buying situation.

When the buyer is just beginning to purchase a product class, such as making a purchase required by a change in the stage of his life cycle, he lacks experience; he has neither well-defined choice criteria nor any knowledge of the various brands and their potential. He, therefore, actively seeks information from his commercial and social environments. The information that he seeks or even accidentally receives is subjected to perceptual processes that not only limit the intake (magnitude) of information but modify it to suit his own frame of reference.

Along with active search for information, the buyer may, to a considerable extent, generalize from similar experiences in the past.

Whatever the source, the buyer develops sufficient choice criteria to enable him to choose a brand that seems to have the best potential for satisfying his motives. If the brand proves satisfactory, the potential of that brand is increased. With repeated satisfactory purchases of one or more brands, the buyer learns about buying in that situation. It is even probable that he may manifest a routinized decision process whereby the sequential steps in buying are well structured so that some event that triggers the process may actually complete the choice decision. Routinized purchasing implies that the choice criteria are well established and that the buyer has strong brand preferences.

The phase of repetitive decision making, in which the buyer reduces the complexity of a buying situation with the help of information and experience, is called the psychology of simplification.

The farther he is along in simplifying his environment, the less is his tendency toward active search behaviour. Furthermore, the environmental stimuli related to the purchase situation become more meaningful and less ambiguous. Finally, the buyer establishes more cognitive consistency among the brands as he moves toward routinization, and the incoming information is then screened with regard to both its magnitude and its quality. He becomes less attentive to stimuli that do not fit his cognitive structure and he distorts those stimuli that are forced on him.

A surprising phenomenon is said to occur in many instances of frequently purchased products, such as grocery and personal care items. The buyer, after attaining routinization of his decision process, may find himself in too simple a situation. He is likely to feel monotony or boredom associated with such repetitive decision making. It is also very likely that he is satiated with even the most preferred brand. In both cases, he may consider all existing alternatives including the preferred brand to be unacceptable. He, therefore, feels a need to complicate his buying situation by considering new brands, and this process can be called the psychology of complication. The new situation causes him to search for identity with a new brand, and so he begins again to simplify in the manner described earlier. Thus with a frequently purchased item, buying is a continuing process with its ups and downs in terms of information seeking, analogous to the familiar cyclical flucations in economic activity.

4. Assumptions

Howard and Sheth (1969) refer to their model as "The Theory of Buyer Behaviour". This is undoubtedly somewhat of a misnomer in that it has not yet been proven to be statistically valid and a reliable indicator of buyer behaviour. It may be suggested that a more appropriate title for the book would be "A Theory of Buyer Behaviour". One must recognize that even though this theory may be generally accepted as the most comprehensive theory developed to date, other theories do exist that may be, in fact, more valid and reliable indicators of buyer behaviour than the one which is presently being discussed.

A fundamental assumption lying behind the entire theory is that there is a general process by which buyers, both industrial and consumer, behave and purchase products and services. Once one accepts the premise however, that there is some logic or rationale behind all behaviour, whether one terms it as being rational or irrational, the fundamental assumption becomes easier to accept.

Michael Perry (1969) has simulated a model very similar to Amstutz' consumer model and has outlined five major premises which lie at the core of his model. It may be contended that these same five premises are fundamental to the Howard and Sheth model of consumer behaviour. They are as follows:

a) At any given point in time a consumer has particular motives and attitudes, indicating his orientation and preference toward any product or brand in the market. This includes "indifference" or "null" attitude, the latter meaning he has never heard of the product.

b) The attitude may or may not be important for the consumer's behaviour, depending on his confidence in his ability to judge the product or the relevant brands.

c) The consumer's motives, attitude and self-confidence may change as a result of receiving information about the product or the relative brands.

d) Motives, attitude and self-confidence are the major determinants of the consumer's intention to buy, and thus a change in them is most likely to cause a change in his intention.

e) The consumer's intention to buy will lead him to purchase unless there are some constraints on his intention, such as price and availability.

These five premise are also predicated upon the assumption that the hypothetical constructs outlined in the Howard and Sheth "The Theory of Buyer Behaviour" do exist either in physical and neurological fact.

Many theories from many disciplines have been pieced together to build the structure and integrate the subsystems into the basic processes, yet there exists no factual data to support these theories and their interrelationships. Despite the assumptions and premises, innate in the theory there is still considerable credence to viewing buyer behaviour from the micro level. In this way one can gain greater insight into the subsystems comprising the theory and the nature of its overall behaviour when viewed as a total system of action.

The following chapter will attempt to outline the basic structural, functional and feedback relationships inherent in the Howard and Sheth Theory of Buyer Behaviour. Furthermore, the concept of systems dynamics modelling will be introduced, at which point the general theory will be broken apart on a subsystem basis and presented according to the systems dynamics methodology.

CHAPTER IV

THE MODELLING OF A THEORY

A. The Howard and Sheth Model Redefined

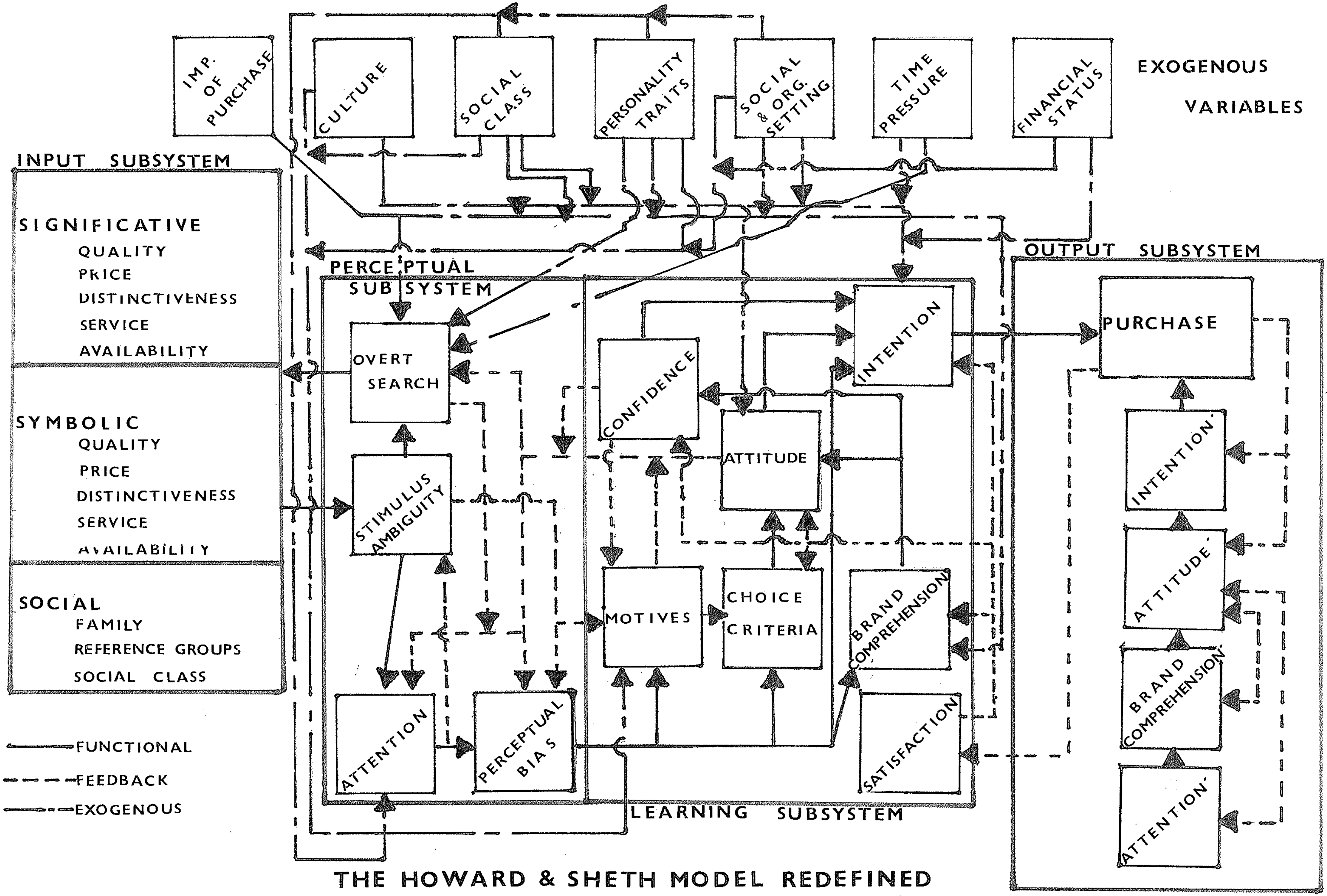
The basic structure of the Howard and Sheth theory as outlined in Figure 1 remains unchanged. However, to better illustrate the precise and complex relationships which have been postulated, an attempt has been made to integrate these processes into a single flow chart. Figure 3 is a diagramatic representation (flow chart) of the basic structure, processes and feedback relationships inherent in the model.

a) External Stimuli Subsystem (INPUT)

The inputs are broken down into 2 basic components; the firm and the environment, which corresponds directly to the commercial and social stimuli respectively, as outlined previously. The firm maintains control over the significative and symbolic stimuli inputs. Specifically, the firm has control over the quality, price, distinctiveness, service, and availability of the product or service which it is offering. In essence, this corresponds somewhat to the marketing mix (excluding service) that a particular firm maintains control over, in strategy formulation.

The four elements of the marketing mix may be equated as follows: product and quality (service), price and price, promotion and distinctiveness, and place and availability.

The environment simply consists of all societal group, the family, the reference group and the social class to which the buyer belongs. These three forces interact to produce a single stimuli input labelled 'social stimuli'.



THE HOWARD & SHETH MODEL REDEFINED

FIG. 3

The output of the external stimuli is a single multidimensional force called Stimulus Display, (not labelled on Figure 3). This force is diagrammatically represented by the convergence of three lines at one point and being directed to the rectangle labelled "ATTENTION".

b) Exogenous Variables Subsystem

The exogenous variables (labelled to the upper portion of Figure 3) remain intact as in Figure 1. However, their interaction with other variables in the system is represented by direct line (- —— -) relationships.

Importance of purchase has 2 direct functional relationships; importance of purchase directly influences the degree of overt search (search for information) as well as the degree of brand comprehension.

Culture has 4 direct functional relationships; those being with the motives level, the degree of brand comprehension, the attitude of the buyer toward the product and his intention to purchase the product.

Social class exhibits the same 4 direct functional relationships with motives, attitude, brand comprehension and intention to purchase.

Personality exhibits a direct functional relationship with the level of overt search, the level of motives, attitude and the degree of brand comprehension.

The social and organizational setting exhibits 4 direct functional relationships. The relationships are with the degree of brand comprehension, the level of attitude, the level of motives and the intention to purchase.

The last exogenous variable, financial status, also exhibits only 2 direct functional relationships, one with the level of motives and the other with intention to purchase.

c) Perceptual Subsystem

The perceptual subsystem is basically composed of 4 variables labelled, Overt Search, Attention, Perceptual Bias and Stimulus Ambiguity. (See Figure 3). Their relationships may be outlined as follows:

Overt search does not maintain a direct functional (input-output) relationship with any other variable in the system, other than stimulus ambiguity. It is affected by the exogenous variables of importance of purchase, time pressure and the personality traits of the buyer. It is also affected by the level of motives or needs of the individual buyer. The level of overt search feeds back, however, and influences the external stimuli (input), and also feeds back to influence the buyer's level of attention with respect to external stimuli.

The level of attention regulates the flow of external stimuli into the individual and as such is influenced by the level of overt search and the degree of stimulus ambiguity.

Stimulus ambiguity affects the degree of attentiveness a given buyer displays. The ambiguity being proportional to the flow of external stimuli forced on the buyer. Stimulus ambiguity also feeds back to affect the level of motives or need level of the buyer, and in some respects may modify the external inputs through perceptual bias.

Perceptual bias, the fourth variable in the perceptual subsystem is the key, in that even though a given stimulus may have entered the individual, the stimulus may be still distorted. The degree of perceptual bias is affected by the attitude of the buyer toward the product and the current level of motives.

d) Learning Subsystem

The learning subsystem is composed of 7 variables or hypothetical constructs which are functionally related to one another and to the output variables.

Motives are functionally related to the external stimuli which have been internalized by the individual. The exogenous variables of culture, social class, personality, social and organizational setting and financial status all have an important bearing on the formation of motives. Motives can be developed as such through external stimuli or may be aroused repetitively through habit formation and learning.

Choice criteria are developed through the formation of motives and the stimuli which are internalized by the buyer. Satisfaction with purchase will also serve to reinforce the level of choice criteria.

Brand comprehension is directly related to the stimuli internalized by the buyer. The level of brand comprehension is also influenced by the exogenous variables of importance of purchase, culture, social class, social and organizational setting and personality. The degree of satisfaction with purchase will also serve to reinforce the level of brand comprehension.

Attitude is directly related to the levels of brand comprehension and choice criteria established by the buyer. Attitude is also influenced by the exogenous variables of culture, personality, social and organizational relationship to satisfaction with purchase.

Intention is directly related to 3 variables, attitude, confidence, and the stimuli internalized by the buyer. Intention is also indirectly related to satisfaction from previous purchases. A number of exogenous variables serve as possible inhibitors to purchase; those being, culture, social and organizational setting, social class, time pressure, and financial status.

Satisfaction, the last variable in the learning subsystem is not directly related to any variables but maintains an indirect relationship through feedback from the act of purchase.

e) Output Subsystem

The output subsystem is composed of 5 variables which are primarily related to one another but are extensions of hypothetical constructs within the learning and perceptual subsystems. The 5 variables being: attention', brand comprehension', attitude', intention' and purchase'.

Attention' is defined as a response of the buyer that indicates the magnitude of his information intake. Attention maintains an indirect functional relationship to attitude', and functionally affects brand comprehension'.

Brand comprehension' is defined as the buyer's verbal statement about his knowledge of brands in a product class. Brand comprehension' also maintains an indirect functional relationship to attitude' as well as functionally affecting attitude'.

Attitude' is defined as the buyer's verbal evaluation of a brand's potential to satisfy his motives, his description of the connotative meaning of a brand. Attitude' maintains an indirect functional relationship to purchase', brand comprehension' and attention' while at the same time functionally affecting intention'.

Intention' is defined as the buyer's expectation expressed verbally that, given his information about all aspects of a buying situation and his prediction about the future status of the environment, he will buy the brand he likes most the next time he is motivated to buy. Intention' maintains an indirect functional relationship to purchase while at the same time functionally affecting purchase'.

Purchase', the final variable within the output subsystem, is defined as the overt act of purchasing a brand. Purchase' links the output subsystem to the hypothetical constructs by way of the variable intention to purchase.

However, within the output sybsystem it is functionally affected by intention' and feeds back to affect intention' and attitude'. Purchase' also feeds back to affect the variable satisfaction within the learning subsystem.

Thus far, the Howard and Sheth Theory of Buyer Behaviour has been redefined in order to indicate the complexity and the magnitude of the functional, feedback, and exogenous relationships. The objective has been to describe and integrate all relationships within the theory into a single model and a single flow chart. The following subsections represent the first steps in the methodology - breaking the model apart on a subsystem basis and redefining and modelling the relationships according to the systems dynamics methodology. The last subsection within this chapter will reintegrate the subsystems again into a single model and a single flow chart. Subsequent chapters will deal with the behaviour and testing of the model.

B. Systems Dynamics Modelling

1. General Structure of Systems

J. W. Forrester (1969) points out that "To model the dynamic behaviour of a system four hierarchies of structure should be recognized:

I. Closed Boundary around the System

II. Feedback Loops (F.B.) as the Basic Structural Elements within the Boundary

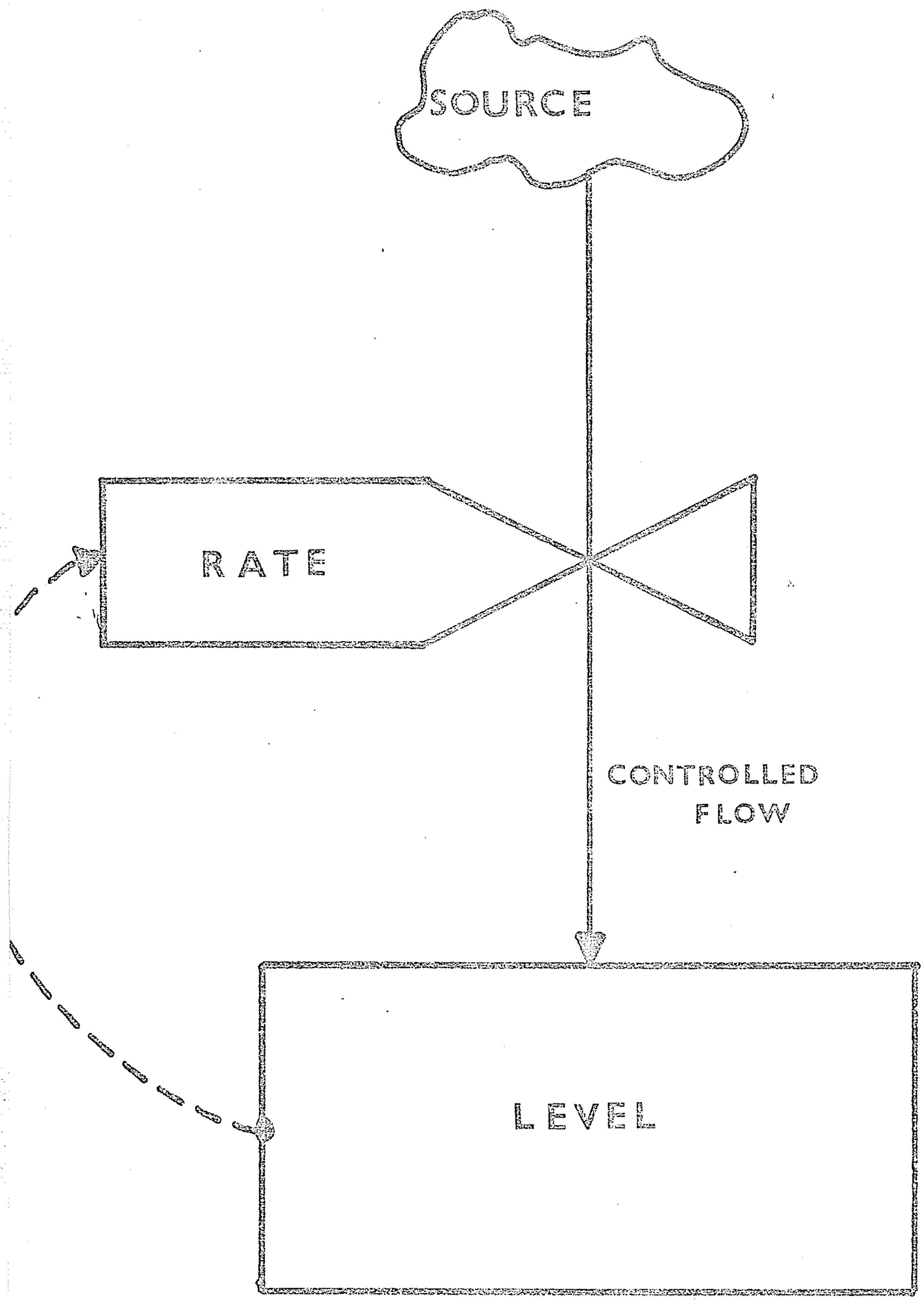
III. Level (state) Variables Representing Accumulations within the Feedback Loops

IV. Rate (flow) Variables Representing Activity within the F.B. Loops

i) Goal
ii) Observed condition
iii) Detection of discrepancy
iv) Action based on discrepancy "

The closed boundary around the system dictates that dynamic behaviour is generated within the boundary and that all activities external to it are insignificant to the outcome within. It must be large enough to include those elements necessary to generate the modes of behaviour which are of interest to us. This concept, as Forrester points out, implies that the system behaviour of interest is not imposed from the outside but created within the boundary; and that those occurrences outside can be viewed as random happenings that impinge on the system and do not themselves give the system its intrinsic growth and stability characteristics.

The dynamic behaviour of systems is generated within feedback loops, which, in essence, are the building blocks of systems. A feedback loop, as the hierarchical structure implies, is made up of level variables and rate variables which are necessary and sufficient for its existence. Figure 4 shows the simplest possible feedback loop structure. Within the feedback



SIMPLEST POSSIBLE FEEDBACK LOOP

FIG. 4

loop a single decision point - the rate equation (symbolically represented by a "valve" symbol) - controls the flow into the level. Information about the level is the basis on which the flow or rate is controlled. The level variables are mathematical integrations of the rates. Thus, the rates cause the levels to change, and the rate variables are only affected by information about the levels. No rate can directly affect any other rate nor can any level directly affect another level. As Forrester (1969) states "Any path through the structure of a system will encounter alternating levels and rates, never two variables of the same type in succession."

The rate equations are, in essence, policy statements. Within each rate equation there is an explicit or implicit goal toward which that policy decision point is directed. However, in making the decision the condition of the system must be detected and very often the actual condition of the system is distorted with delays and lags. Thus a rate equation only states the discrepancy between the goal and the perceived condition of the system. The rate equation then alters its decision and takes action in the direction of the goal.

2. Structure of the Simulation Model

The purpose of this investigation, as previously outlined, is to provide a systematic framework for the analysis of the dynamics of the buyer behaviour. The primary focus of this study being the behaviour of the individual consumer over time.

The first step in the methodology then is to define the boundary of the system under consideration. Interest here is on the dynamics of the internal characteristics of the consumer. The model should show how a consumer exhibiting non-purchase behaviour toward the product in question develops to routinely buy the product and eventually stops purchase. Marketing interests being centered on reviving demand again for the product.

It can be assumed that any single buyer is small enough that he does not affect the outside environment. Thus, for the purposes of this investigation, the individual can be taken as a living system that communicates with the environment but does not substantially influence it.

The specific boundary chosen for the system under consideration can be best defined in terms of the interacting components within it. Figure 5 shows the principal level and rate variables chosen as the core of the simulation model. The ten rectangles represent the system levels which are accumulations of the rates flowing in and out of each of them. The twenty principal rates are shown by the valve symbols controlling the decision points. The information network is not included.

Figure 5 portrays the four basic subsystems of input, perception, learning and output. The fifth, the exogenous subsystem, is excluded in this instance.

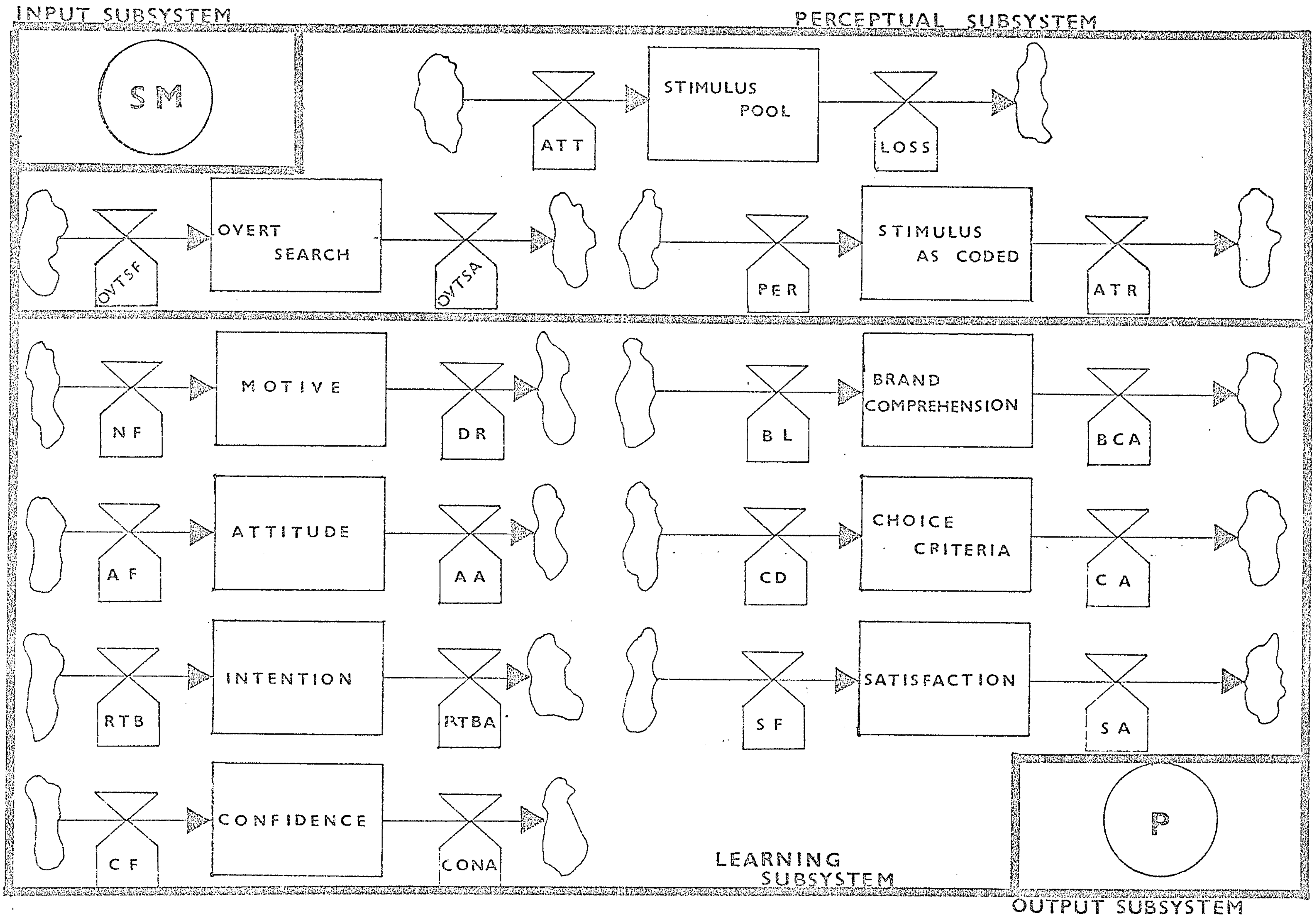
These four subsystems chosen appear to be the core factors or subsystems integral to buyer behaviour as well as to the Howard and Sheth Model of Buyer Behaviour. It should be noted that two circles appear in Figure 5, Stimulus Multiplier (SM) and Purchase (P). These variables may be viewed as subdivisions of rate equations which have been split apart. Their complex structure will be revealed subsequently.

At this point it should be noted that the output subsystem has been altered somewhat due to the boundary of the system, as defined. The duplication in the output variables of attention', brand comprehension', attitude',

FIGURE 5

INDEX

VARIABLE	TYPE OF EQUATION	NAME
S.M.	Auxiliary	Stimulus Multiplier
OVTSF	Rate	Overt Search Formation
OVTSA	"	Overt Search Attrition
ATT	"	Attention
LOSS	"	Loss of Attention
PER	"	Perception
ATR	"	Perception Attrition
NF	"	Need Formation
DR	"	Drive Reduction
AF	"	Attitude Formation
AA	"	Attitude Attrition
RTB	"	Readiness to Buy
RTBA	"	Readiness to Buy Attrition
CF	"	Confidence Formation
CONA	"	Confidence Attrition
BL	"	Brand Loyalty
BCA	"	Brand Comprehension Attritio
CD	"	Choice Decision
CA	"	Choice Attrition
SF	"	Satisfaction Formation
SA	"	Satisfaction Attrition
P	Auxiliary	Purchase



THE MAJOR LEVELS & RATES

FIG. 5

and intention' have been eliminated. These four variables are superfluous to the system since they are utilized by a firm to analyze and evaluate the consumer's disposition toward a product or service. Due to the fact that no interaction occurs between the firm and individual consumer, for the purpose of this investigation they will be eliminated and disregarded, as not being within the boundary of the system under study.

C. Modelling the Subsystems

1. Input Subsystem

The input subsystem as defined in Figure 1 includes all external stimuli from the environment. This encompasses commercial stimuli significative as well as symbolic and social stimuli.

Howard and Sheth (1969) treat external communication from the firm and the buyer's social environment as inputs into the buyer's sensory processes. The non-social stimuli are dichotomized into significative and symbolic stimuli, each with varying impacts on the disposition of the consumer. These stimuli categories are both composed of the same major factors: those being quality, price, distinctiveness, service and availability. The social stimuli are labelled as separate and distinct and are composed of three major factors: those being the family, the reference group, and society. These factors are all summarized into a single multidimensional variable called stimulus display which incites activity in the buyer, is external to his physical being, and is the input to his sensory processes.

The simulation model utilizes a similar classification procedure with respect to the external stimuli but, however, treats all such variables as exogenous to the system and not purely as inputs.

The total impact of the three stimuli generators is summarized in the stimulus display as outlined in the Howard and Sheth Model of Buyer Behaviour. A related factor, overt search, constitutes another element in the stimulus display - its impact will be treated under the perceptual subsystem subsequently.

The stimulus display has been labelled the stimulus multiplier (SM.K) in the model, with a direct correspondence between the two. It serves to integrate the three stimuli generators within the input subsystem.

A SM.K = (SYMM.K+SIGM.K+SSM.K) * OVTS.K 17

SM.K - Stimulus Multiplier (Units of "Energy")
SYMM.K - Symbolic Stimuli Multiplier (Units of "Energy")
SIGM.K - Significative Stimuli Multiplier (Units of "Energy")
SSM.K - Social Stimuli Multiplier (Units of "Energy")
OVTS.K - Overt Search (Dimensionless)

In this instance, the stimulus multiplier is construed as being functionally related in an additive relationship to the symbolic stimuli multiplier (SYMM.K), the significative stimuli multiplier (SIGM.K) and the social stimuli multiplier (SSM.K), as well as the level of overt search (OVTS.K). The additive relationship implies that all are similarly important factors in the stimulus display (multiplier) as modulated by the level of overt search. A zero factor in any of the three internal generators will reduce the impact but will not radically alter the outcome - the stimulus display which is focused on the consumer.

i) Symbolic stimuli: as defined by Howard and Sheth (1969) refer to the words, sentences and pictures disseminated by the seller. The model places specific emphasis on the fact that the source of these symbolic stimuli is the firm and its specific marketing efforts. The firm has at its disposal the five factors of quality, price, distinctiveness, service and availability and may manipulate its emphasis according to the needs and desires of the target market. All parameters essentially represent a given dollar expenditure on the factor under consideration, excluding price where the firm must maintain a consistent and harmonious relationship between the product, the price, and the needs of the consumer.

The simulation model, which conceptualizes the general theory in terms of the systems dynamics methodology may be diagramatically represented as in Figure 6. The figure shows all three sub-categories of external stimuli: symbolic (SYMM), significative (SIGM) and social (SSM). The auxiliary equations are diagramatically expressed as circles.

Equation 1 is an auxiliary equation which describes a function for determining the marketing emphasis corresponding to a given dollar expenditure on quality per week. Quality emphasis is a non-dimensional parameter in that one cannot define, nor directly measure, its impact as a communicative device. It has a tangible meaning to the extent that a manufacturer, when communicating with the target market, may choose to emphasize a specific aspect of the product which ordinarily will involve a greater dollar expenditure on the part of the firm. Simplicity is afforded, however, by referring to the degree of emphasis in terms of stimulus impulses generated by the firm or "energy" communicated on a weekly basis. Summarizing, the firm expends dollars on the quality it wishes to emphasize in its product. Each level of dollar expenditure/week corresponds directly to the number of impulses or "energy" generated each week.

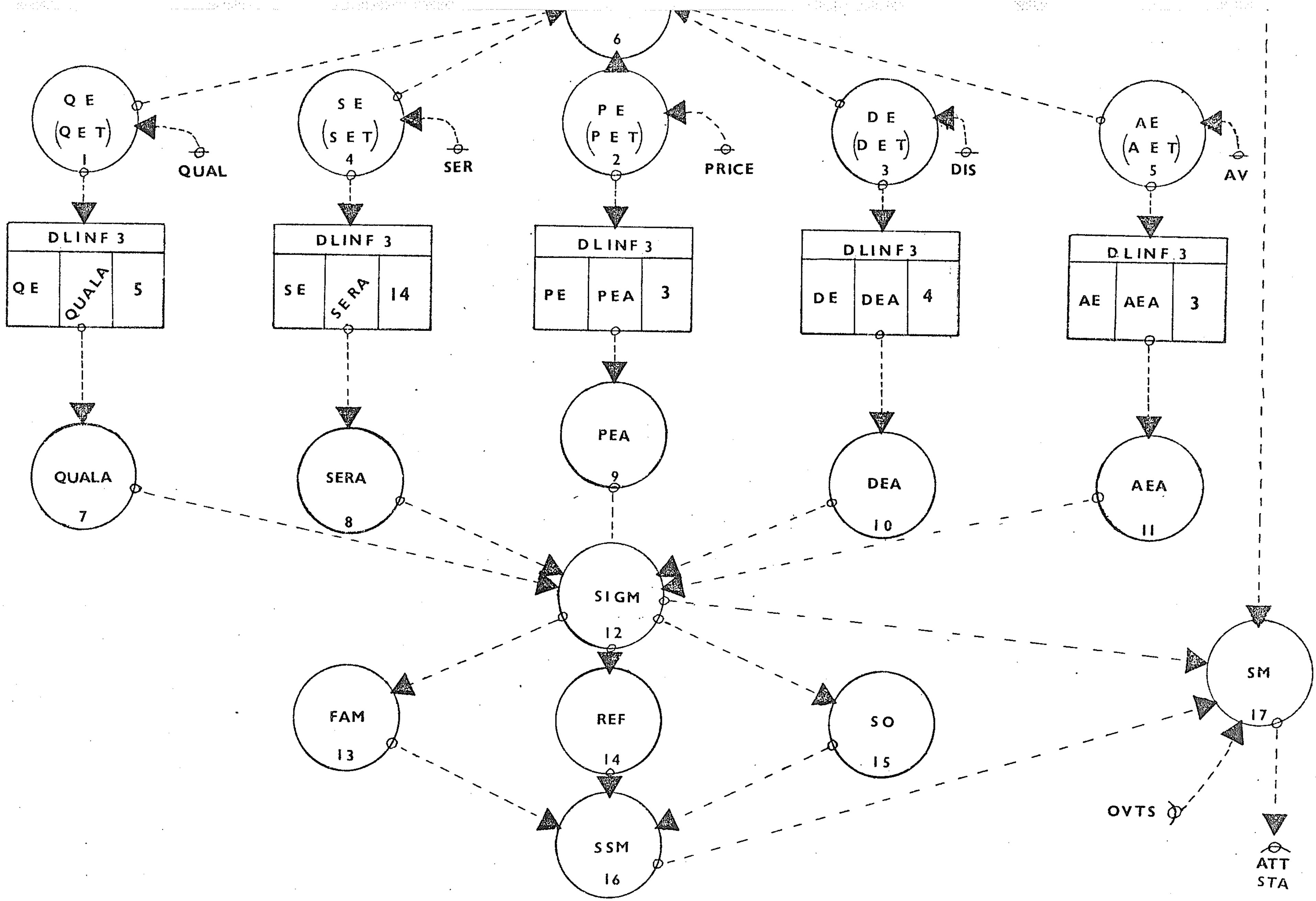
```
A   QE.K    =   TABHL(QET,QAL.K,10E3,1E3)        1
T   QET     =   0/0/0/1/3/4/6/7/8/8/8            1.1
A   QUAL.K  =   NORMRN(8E3,.IE3)                 1.2

    QE.K    -   Quality Emphasis (Units of "Energy")
    QET     -   Quality Emphasis Table (Dimensionless)
    QUAL.K  -   Quality Expenditure (Dollars)
    NORMRN (MEAN, STD.) - Dynamo Macro Function providing a
                          normal random number of mean (MEAN) and
                          standard deviation (STD.)
```

FIGURE 6

INDEX

VARIABLE	TYPE OF EQUATION	NAME
SYMM	Auxiliary	Symbolic Stimuli Multiplier
QE	"	Quality Emphasis
QET	Table	Quality Emphasis Table
SE	Auxiliary	Service Emphasis
SET	Table	Service Emphasis Table
PE	Auxiliary	Price Emphasis
PET	Table	Price Emphasis Table
DE	Auxiliary	Distinctiveness Emphasis
DET	Table	Distinctiveness Emphasis Tabl
AE	Ausiliary	Availability Emphasis
AET	Table	Availability Emphasis Table
DLINF3	Macro Delay	Third Order delay in information
QUALA	Auxiliary	Quality Emphasis Average
SERA	Auxiliary	Service Emphasis Average
PEA	Auxiliary	Price Emphasis Average
DEA	Auxiliary	Distinctiveness Emphasis Average
AEA	Auxiliary	Availability Emphasis Average
SIGM	Auxiliary	Significative Stimuli Multiplier
FAM	Auxiliary	Family
REF	Auxiliary	Reference Group
SOC	Auxiliary	Society
SSM	Auxiliary	Social Stimuli Multiplier
SM	Auxiliary	Stimuli Multiplier



THE INPUT SUBSYSTEM

FIG. 6

The functional relationship existing between the dollars expended and the corresponding "energy" generated is of significance to the model's performance. Figure 7 describes the functional relationship existing between dollar expenditures (QUAL) and the impulses generated (QE) such that a positive correlation exists between the two variables.

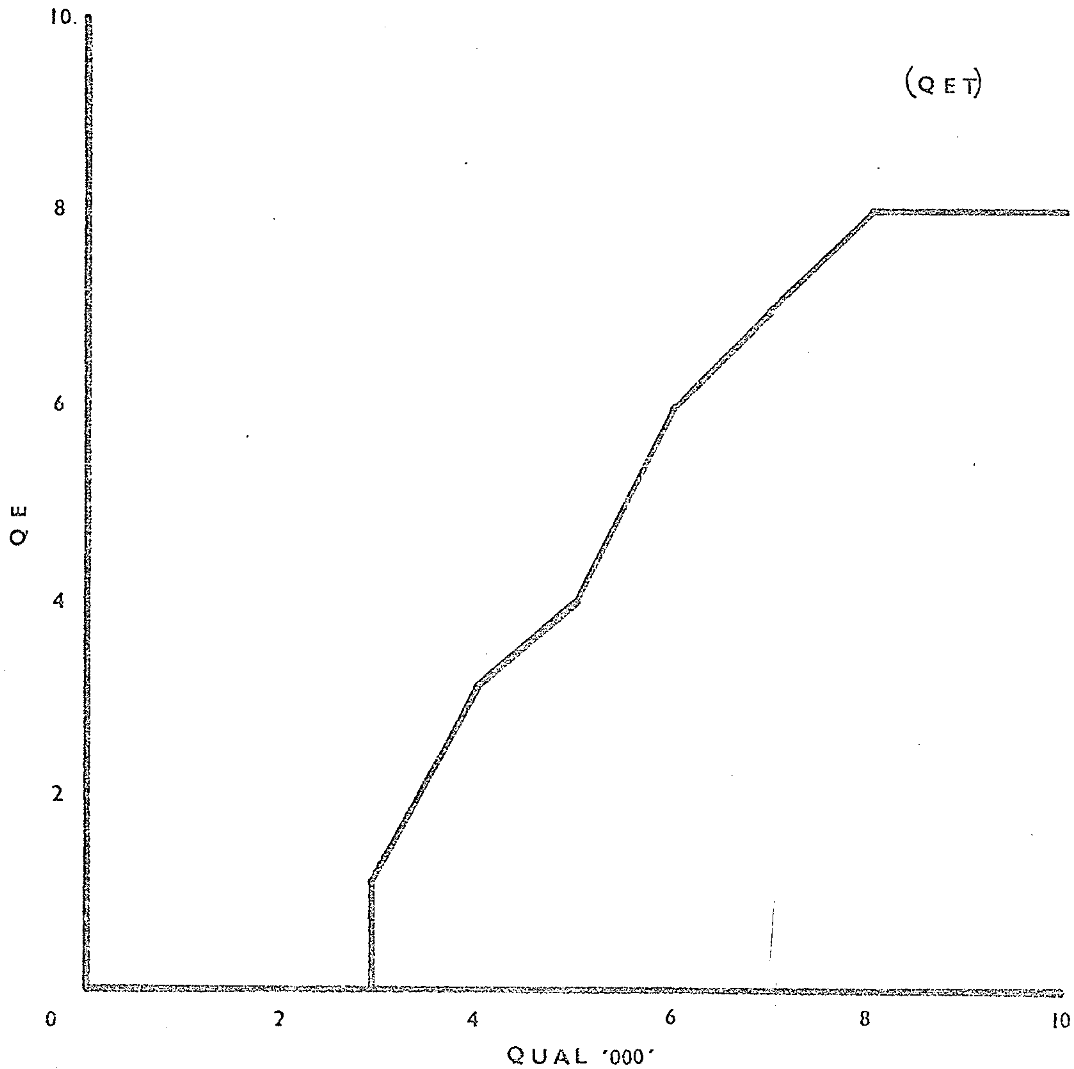
The plateaus in the curvalinear relationship are evidence of a need on the part of the firm to ensure that minimum quality standards are met and that excessive expenditures attempting to saturate the product image with quality are avoided. The nature of the shape of the curve is realistic in the light of the fact that convenience or staple goods generally come under the scrutiny of consumer protection agencies as well as government departments. A firm must then expend a certain amount to meet these standards before it has even a chance to have an impact on the consumer. Furthermore, excessive expenditures on quality bordering on a snob appeal become largely undetectable and undesirable for a product in the convenience goods category, as opposed to a specialty goods category.

Equation 1.1 is the table of values which quality emphasis may assume, depending, of course, on the value of the expenditure made by the firm. The value of QE ranges from zero to ten in the variable QE. The values in the table are purely arbitrary to the extent that they represent variations in "energy" or impulses generated in accordance with dollar expenditures. There exists no factual nor physically defined relationship between the two variables, hence one must postulate that for any given dollar of expenditure, there will be an accompanying flow of impulses or "energy" generated. It may also be postulated that as the level of expenditure increases there will be a greater saturation of "messages" directed

FIGURE 7

INDEX

VARIABLE	TYPE OF EQUATION	NAME
QE	Auxiliary	Quality Emphasis (impulses)
QUAL	Auxiliary	Quality Expenditure ($),000/week
QET	Table	Quality Emphasis Table



QUALITY EMPHASIS

FIG. 7

toward the consumer and correspondingly a greater probability of exposure to the message.

Equation 1.2 computes the value of the dollar expenditure the firm is willing to make on quality. A normal noise function has been added to create variation in spending levels on a weekly basis and to add the element of noise in communication. This must not be construed as stimulus ambiguity which is part of the perceptual processes of the consumer. One cannot accurately predict how much noise or distortion will occur, but one can say that some shall occur and that it will occur in a random fashion. The values chosen for the initial expenditure level and the mean and standard deviation in the noise function are arbitrary and may be modified since they are, in fact, exogenous to the system.

Equations 2 through 5 are constructed on the same basic postulate that equation 1 was formulated upon. Equation 2 is an auxiliary equation describing a function which determines the marketing emphasis in impulses or "energy" generated from a given price level.

```
A    PE.K      =  TABHL(PET,PRICE.K,0,.5,.05)        2
T    PET       =  0/0/0/8/8/7/7/6/3/2/3              2.1
A    PRICE.K   =  NORMRN(.28,.02)                    2.2

     PE.K      -  Price Emphasis (Units of "Energy")
     PET       -  Price Emphasis Table (Dimensionless)
     PRICE.K   -  Price Level (Cents)
```

Again the degree of emphasis obtainable from a given price level is non-dimensional or rather only pseudo-dimensional to the extent that one can attach varying values to the emphasis and measure it in comparison to other parameters. Essentially then, the firm selects a particular price which it chooses to emphasize. Given the target market and the nature of the product category, it is postulated that varying levels of impulses or "energy" will be generated in response to the price level chosen.

Figure 8 describes the functional relationship existing between price levels (PRICE) and the impulses generated (PE) such that a highly negative correlation exists which resembles somewhat the form of a "kinked" demand curve.

The shape of the curve is realistic in the sense that low prices below acceptable quality levels create little or no activation in stimuli. A relevant price range provides the greatest activation of impulses and as the price rises the degree of emphasis falls until a point is reached where the price becomes associated with that of the luxury snob appeal and correspondingly creates greater stimuli activation.

Equation 2.1 lists the table of values which price emphasis may assume depending again on the value chosen for the price. The initial price level is arbitrary and as an exogenous variable it may be manipulated as listed in equation 2.2. A normal noise function again has been added to consider possible distortion and noise which may enter the communication channel.

Equation 3 is an auxiliary equation describing a table function for computing the marketing emphasis attainable from a given level of distinctiveness or product expenditure.

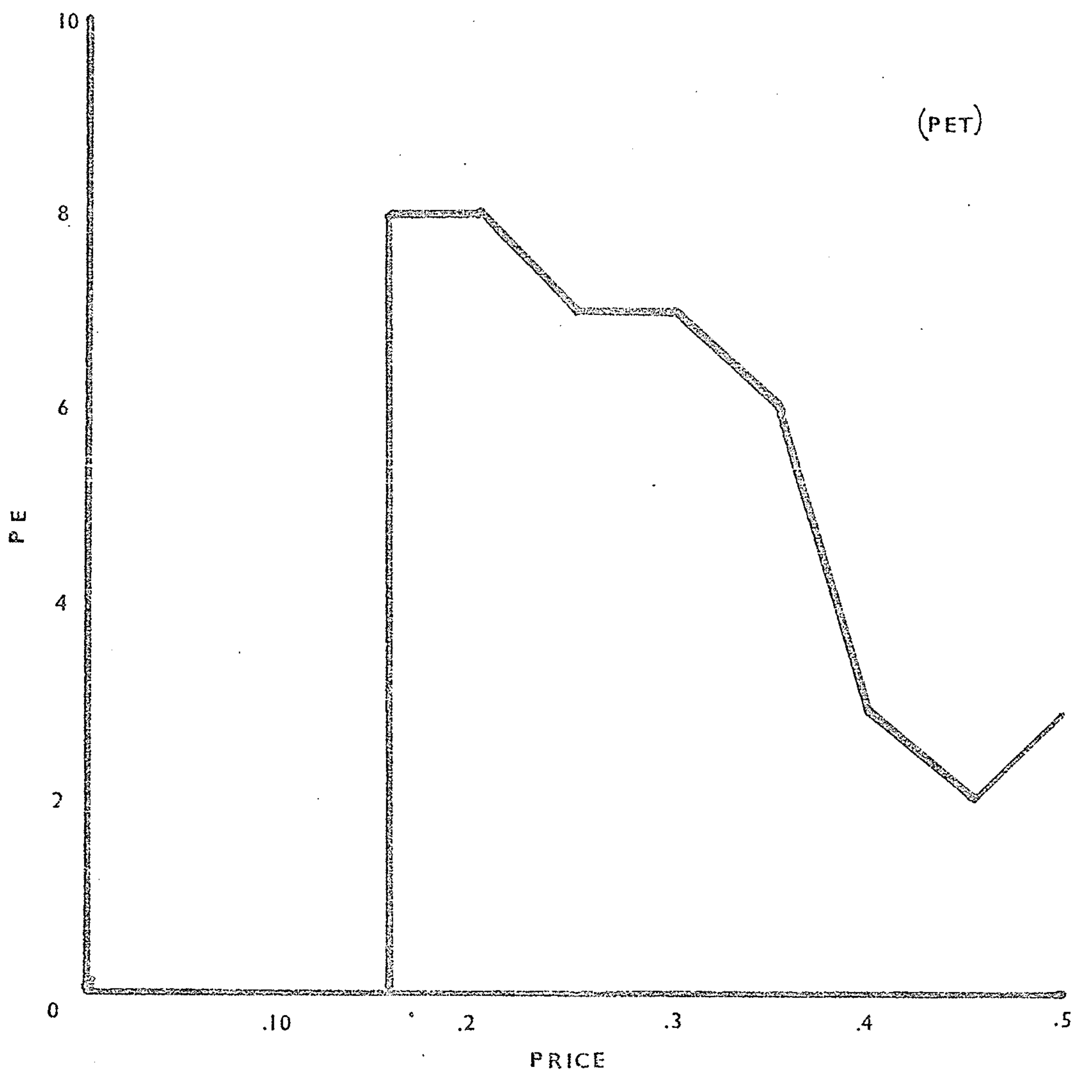
A	DE.K	=	TABHL(DET,DIS.K,0,IOE3,IE3)	3
T	DET	=	0/1/1/1/2/4/6/8/9/10/10	3.1
A	DIS.K	=	NORMRN(8E3,.1E3)	3.2

DE.K	-	Distinctiveness Emphasis (Units of "Energy")
DET	-	Distinctiveness Emphasis Table (Dimensionless)
DIS	-	Distinctiveness Expenditure (Dollars)

FIGURE 8

INDEX

VARIABLE	TYPE OF EQUATION	NAME
PE	Auxiliary	Price Emphasis (impulses)
PRICE	Auxiliary	Price Level (cents) ea. wk.
PET	Table	Price Emphasis Table



PRICE EMPHASIS

FIG. 8

The initial value for the product distinctiveness is set at \$8,000/week, with a normal variation of \$100/week. Distinctiveness, as defined, is roughly equivalent to promotion as an element of the marketing mix. Promotion is the medium through which a firm can communicate the distinctiveness desired and required to attain consistency with the needs and preferences of the target market consumers. For example, this firm would be spending approximately \$400,000 annually on promoting the distinctiveness of its product to the market in question.

This set of equations functions in the same manner as the two previous sets. A given dollar expenditure will create a specific marketing or product distinctiveness emphasis that must be consistent with the consumer specific needs and preferences.

Figure 9 describes the functional relationship existing between product distinctiveness expenditures (DIS.K) and impulses generated (DE.K), such that a positive correlation exists between the two variables.

A plateau is shown to exist for lower levels of expenditure such that fewer impulses are generated if the product does not achieve some level of distinctiveness. This is generally consistent with marketing theory which postulates that product differentiation is required for products in the convenience goods category in order to move them out of a homogenous product situation.

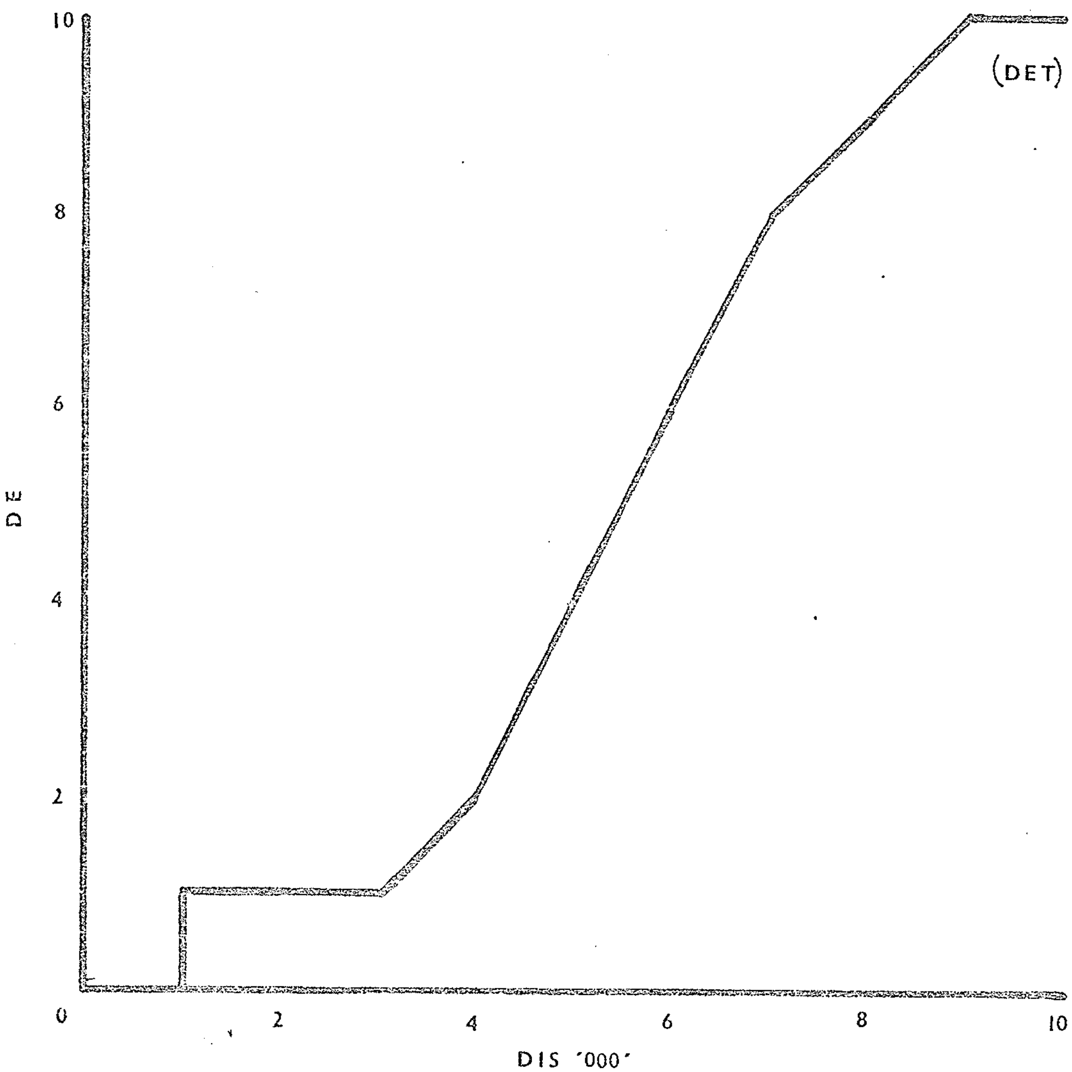
Equation 3 lists the table of values which distinctiveness emphasis may assume. The expenditure being preset automatically creates an emphasis of approximately 9 on the scale ranging from 0 to ten.

Equation 4 is an auxiliary equation describing a table function for computing the marketing emphasis attainable from a given level of expen-

FIGURE 9

INDEX

VARIABLE	TYPE OF EQUATION	NAME
DE	Auxiliary	Distinctiveness Emphasis (impulses)
DIS	Auxiliary	Distinctiveness Expenditure ($),000/week
DET	Table	Distinctiveness Emphasis Table



DISTINCTIVENESS EMPHASIS

FIG. 9

diture on service.

A	SE.K	=	TABHL(SET,SER.K,0,IOE3,IE3)	4
T	SET	=	0/4/5/5/5/5/5/5/5/6/6	4.1
A	SER.K	=	NORMRN(2E3,.5E3)	4.2

SE.K	-	Service Emphasis (Units of "Energy")
SET	-	Service Emphasis Table (Dimensionless)
SER.K	-	Service Expenditure (Dollars)

The initial value for the service expenditure is set at approximately \$2000/week with a normal variation of \$500/week. This set of equations functions in an equivalent fashion to the previous three sets. Again, a given dollar expenditure on service will create a specific marketing or service emphasis that should be consistent with the needs and preferences of the consumer.

Figure 10 describes the functional relationship existing between service expenditures (SER.K) and impulses generated (SE.K), such that a slightly positive correlation exists between the variables.

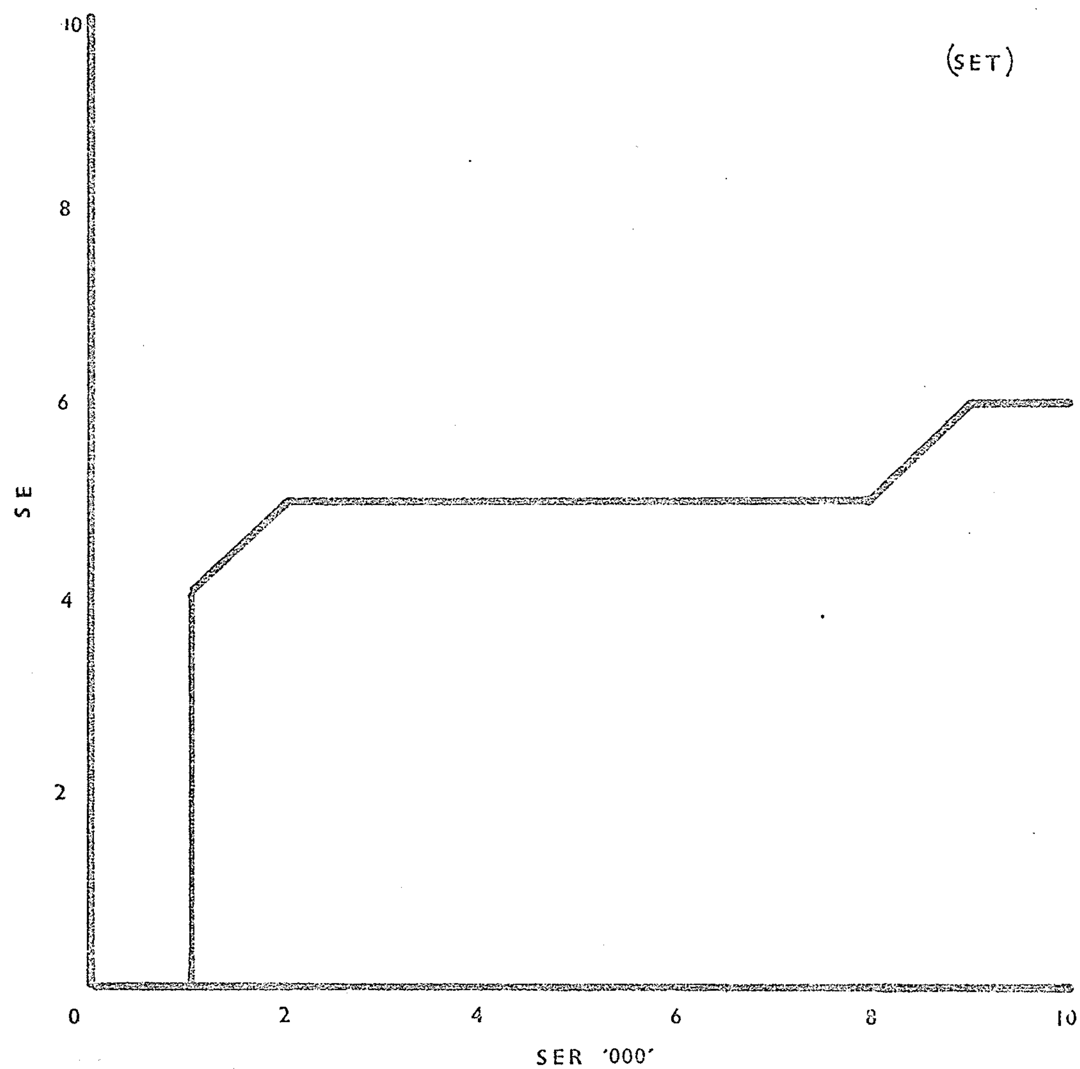
A plateau extending for several levels of expenditure is postulated to emphasize that it will take substantial increases in service level expenditures to create a perceived difference in emphasis on the part of the consumer; the reasoning being that service is not an integral part of the product offering for a convenience good. Furthermore, this emphasizes the fact that at least some minimal level of service is required to meet the needs and preferences of the consumer.

Equation 4.1 lists the table of values which service emphasis may assume. The service expenditure is preset at approximately \$2000. and automatically creates a service emphasis level of approximately 5 on the scale ranging from 0 to ten.

FIGURE 10

INDEX

VARIABLE	TYPE OF EQUATION	NAME
SE	Auxiliary	Service Emphasis (impulses)
SER	Auxiliary	Service Expenditure ($),000/wk.
SET	Table	Service Emphasis Table



SERVICE EMPHASIS

FIG. 10

Equation 5 is an auxiliary equation describing a table function for computing the marketing emphasis attainable from a given level of expenditure on distribution.

A	AE.K	=	TABHL(AET,AV.K,0,IOE3,IE3)	5
T	AET	=	0/2/4/5/6/8/8/8/9/10/10	5.1
A	AV.K	=	NORMRN(6E3,.25E3)	5.2

AE.K	-	Availability Emphasis (Units of "Energy")
AET	-	Availability Emphasis Table (Dimensionless)
AV.K	-	Availability Expenditure (Dollars)

The initial value for distribution expenditure is set at approximately \$6000/week with a normal variation of \$25/week. These equations again function equivalently to the previous 4 sets. A given level of expenditure on distribution will create a specific marketing emphasis that should be consistent with consumer needs and preferences.

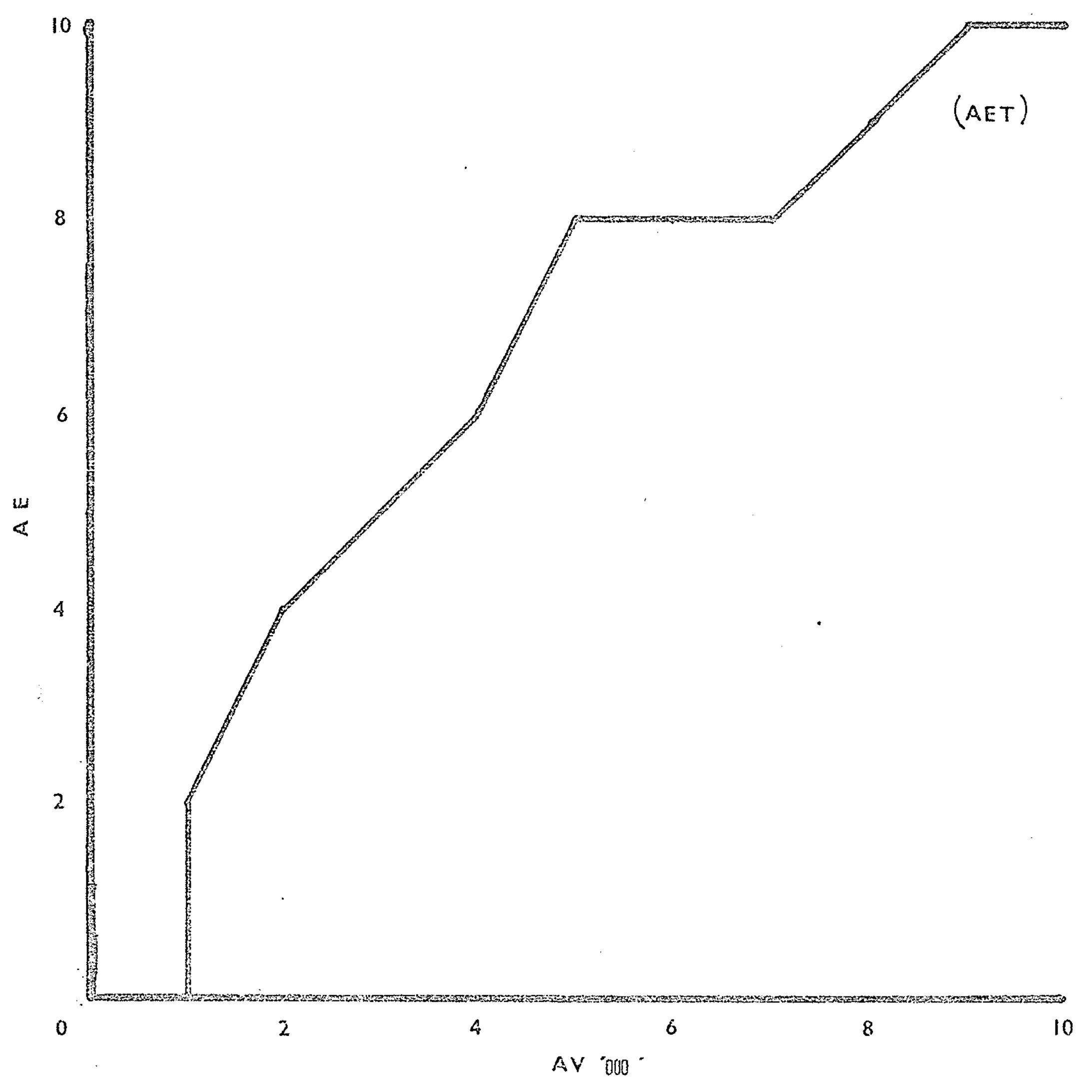
Figure 11 describes the functional relationship existing between distribution expenditures (AV.K) and impulses generated (AE.K), such that a highly positive correlation exists between the two. This is consistent with marketing theory that postulates that for a product in the convenience goods category, widespread distribution is required and excellent shelf position is an important factor. The more money that is pumped into availability will ensure more effective and wider availability of the product. The expenditure was preset at approximately \$6000. which is equivalent to an availability emphasis of approximately 8 on the scale ranging from 0 to ten.

Equation 6 is a multiplier that incorporates all five impulses generated from quality, price, distinctiveness, service and availability.

FIGURE 11

INDEX

VARIABLE	TYPE OF EQUATION	NAME
AE	Auxiliary	Availability Emphasis
AV	Auxiliary	Availability Expenditure ($),000/wk.
AET	Table	Availability Emphasis Table



AVAILABILITY EMPHASIS

FIG. 11

A	SYMM.K	=	(QE.K)(PE.K)(DE.K)(SE.K)(AE.K)	6

SYMM.K	-	Symbolic Stimuli Multiplier	(Units of "Energy")
QE.K	-	Quality Emphasis	(" " ")
PE.K	-	Price Emphasis	(" " ")
DE.K	-	Distinctiveness Emphasis	(" " ")
SE.K	-	Service Emphasis	(" " ")
AE.K	-	Availability Emphasis	(" " ")

The symbolic stimuli multiplier (SYMM.K) is in the form of an auxiliary equation which is multiplicative in nature. As such, a zero or rather an unfavorable value in one of the impulse generators can cause the whole marketing strategy to collapse from a symbolic stimuli viewpoint. Alternatively, a favorable value in one of the impulse generators can highly influence the other factors in a multiplicative fashion. This equation serves to sum the marketing (symbolic) communicative strategy for the firm under consideration into a single factor.

ii) Significative Stimuli: as defined by Howard and Sheth (1969) refer to the stimuli that emanate from the physical brand itself, such as the buyer's perception of it on the supermarket shelf and his experience with the product. Again the source of these stimuli is the firm and its marketing efforts wherein the dollar expenditure on the various parameters will determine the emphasis placed on this variable. The primary distinction, however, lies in the fact that such stimuli will not be available until the consumer physically notices the product on the supermarket shelf, has purchased the product or, alternatively has received it through a sampling program. Refer to Figure 6 for a diagramatic representation of its relationship to other input variables. The explanation of this set of equations will again follow the sequence of the equation numbers.

A QUALA.K = DLINF3(QE.K,5) 7

QUALA.K - Quality Emphasis Average (Units of "Energy")

It is postulated that the quality emphasis, measured in energy or impulses will be roughly equivalent to the quality emphasis average (QUALA.K) in the significative stimuli except for a delay in the receipt of the information. The rationale being that the consumer's perception of the physical brand itself will be delayed somewhat past the original receipt of symbolic stimuli.

It is further postulated that this delay in information will take the form of three cascaded first order exponential delays in information, i.e., it will rise slowly to the final value of the defined variable it is to assume.

Equation 7 specifies that the delay in information will be a third order delay with receipt of information after 5 weeks (time periods). The justification being that quality will not be perceived for some time after purchase and may not occur until the product is utilized several times.

Equations 8, 9, 10 and 11 are based on the same format as equation 7, i.e., each of the symbolic stimuli as defined, after being subjected to a third order delay, will be roughly equivalent to the emphasis, measured in impulses or "energy" to the significative stimuli.

Equation 8 describes the service emphasis average (SEA.K) attributable to a given expenditure on service established by the firm under consideration.

A SERA.K = DLINF3(SE.K,14) 8

SERA.K - Service Emphasis Average (Units of "Energy")
DLINF3 (X,Y - Dynamo macro function creating a third order exponential delay in X with average delay Y

In this instance, however, the delay in information corresponding to service emphasis will be 14 weeks or 3 1/2 months. The justification being that there will be little or no discernable perception of the level of service afforded by a particular firm since there will not be a physical contact between the firm and the consumer. It may be postulated that after 14 weeks the consumer may begin to link the product to a particular manufacturer and inherently establish an image of what he believes to be the service that the firm would offer, should he have any problems with the product.

Equation 9 describes the price emphasis average (PEA.K) attributable to a given price level established by the firm.

A PEA.K = DLINF3(PE.K,3) 9

PEA.K - Price Emphasis Average (Units of "Energy")

Price, in this instance, is immediately perceived by the consumer, but the delay in information is set at 3 weeks. The rationale being that it may take up to 3 weeks for the consumer to establish a frame of reference for the price of this particular product in relation to its other attributes. The actual price is immediately available, but it may take time for the consumer to shift his frame of reference.

Equation 10 describes the distinctiveness emphasis average (DEA.K) which is functionally related to the distinctiveness emphasis established by the firm previously.

A DEA.K = DLINF3(DE.K,4) 10

DEA.K - Distinctiveness Emphasis Average (Units of "Energy")

The delay in information on the product's distinctiveness is set at 4 weeks for much the same reasons as for price. An allowance of 4 weeks is made to allow for the consumer to physically see and/or handle the product and adjust his frame of reference to fit the product.

Equation 11 describes the availability emphasis average (AEA.K) which is functionally related to the availability emphasis established previously.

A	AEA.K	=	DLINF3(AE.K,3)	11
	AEA.K	-	Availability Emphasis Average (Units of "Energy")	

In this instance, the delay in information is established at three weeks, to allow the consumer time to physically see the product after the receipt of information.

The periods or weeks of delay established for each of the variables labelled significative stimuli has been arbitrary to the extent that no factual data exists that can verify such a relationship. The rationale behind each of the variables is logically consistent and as such provides a sound basis for postulation. The time delays may be manipulated subsequently to enable sensitivity analysis of these parameters.

The significative stimuli, very much like the symbolic stimuli, have an impact on the consumer - that is, a function of each of their individual impacts. For this reason equation 12 has been established to reflect their interdependency.

A	SIGM.K	=	(QUALA.K)(PEA.K)(DEA.K)(SERA.K)(AEA.K)	12
	SIGM.K	-	Significative Stimuli Multiplier (Units of "Energy")	

The significative stimuli multiplier (SIGM.K) is in the form of an auxiliary equation which is multiplicative in nature. Again, a zero or unfavourable value for any of the factors can create a null effect in the significative stimuli, and collapse the firm's marketing strategy. Alternatively, a favourable value will serve to reinforce the strategy. This equation thus serves to sum up the marketing (significative) communicative strategy for the firm under consideration into a single element.

iii) The Social Stimuli: as defined by Howard and Sheth (1969) refer to those stimuli which emanate from other people in a face-to-face relation with the buyer. As such, it is "energy" or information transmitted through a secondary source from the primary source - the firm.

This stimuli source has been categorized into three sub-classes labelled the family, the reference group, and social class, all with an impact on the consumer's product awareness. Again, however, the nature of their information transmittal will be such that it is delayed, either due to the fact that the social milieu will not make claims about a given product unless they have physically seen or tried the product, or alternatively, due to the immediacy within which they can physically make their claim to the consumer in question.

As separate entities, the family, the reference group, and the social class to which the consumer belongs, they will have varying impact depending upon those factors which would appear as being of greatest relevance to the consumer in question. The discussion of the social stimuli will again follow the sequence of the equation numbers.

Equation 13 is an auxiliary equation which describes the impact or "energy" generated from the family group.

A FAM.K = NORMRN(SIGM.K, .5E3) 13

FAM.K - Family Emphasis (Units of "Energy")

Equations 13, 14 and 15 are based on a similar format, i.e., it is postulated that the influence of the family, the society or the reference group will be a function of their perception of the physical product. It may be assumed that no claims would be made without sufficient familiarity with the product on the part of the group in question.

The influence of the family (FAM.K) is thus a function of the significative stimuli multiplier (SIGM.K). A normal noise function has been added with a standard deviation of 500 to create distortion or noise in the communication channel. The rationale being that the source will tend to over emphasize or de-emphasize certain factors and there may be a great deal of intermittency in contact with the consumer.

Equation 14 computes the influence of the reference group, or rather establishes its emphasis in relation to the other variables.

A	REF.K	=	NORMRN(SIGM.K,5E3)	14
	REF.K	-	Reference Group Emphasis (Units of "Energy")	

In this instance, the impact of the reference group is again a function of the significative stimuli multiplier, but the standard deviation of the normal noise function is increased to 5,000. This reflects reduced contact and greater distortion with regard to their actual evaluation of the product. Perception may be highly distorted in this instance and as such there should be a greater fluctuation in stimuli generated.

Equation 15 computes the influence of the society measured in "energy" or impulses.

A	SO.K	=	NORMRN(SIGM.K,10E3)	15
	SO.K	-	Society Emphasis (Units of "Energy")	

The influence of Society (SO.K) is, in this instance, a function of the significative stimuli again but distorted with noise having a standard deviation of 10,000. The justification being that society's influence will be more intermittent and less pronounced than that of the family or the reference group.

The social stimuli, very much unlike the two previous stimuli sets, labelled commercial stimuli, have an impact on the consumer which is very much of a function of each of their individual impacts. In this instance the impact of one factor, it is postulated, should not radically alter the outcome of the other two, and as such the relationship may be construed as being an average of the three factors.

A SSM.K = (FAM.K+REF.K+SO.K)/3 16

SSM.K - Social Stimuli Multiplier (Units of "Energy")

The social stimuli multiplier (SSM.K) is thus in the form of an auxiliary equation which is additive in nature. Accordingly a zero in one of the factors may reduce the overall average, but will not radically affect the impact of the social stimuli.

2. The Perceptual Subsystem

The model's perceptual subsystem is diagramatically represented in Figure 12 and basically consists of three major levels and their accompanying rate equations; those being, Overt Search (OVTS), Stimulus Pool (SP) and Stimulus as Coded (SAC).

The Theory of Buyer Behaviour emphasizes explicitly that buyers learn from both experience and information. The theory suggests that attention, overt search, stimulus ambiguity and perceptual bias convert the external event - the stimulus - into a stimulus-as-coded. The s-a-c becoming an input in the learning subsystem.

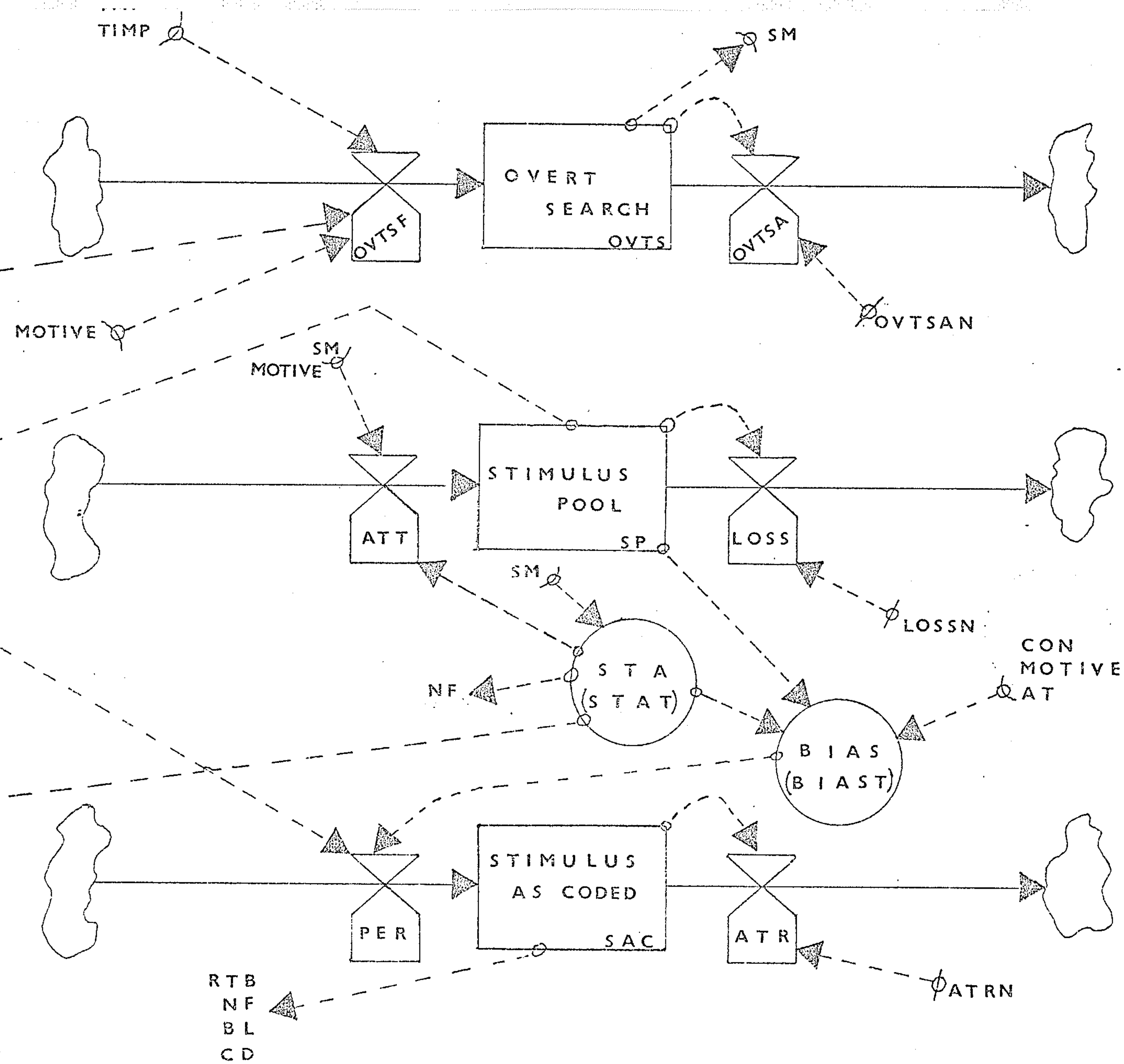
Howard and Sheth (1969) point out that the s-a-c can differ radically from the objective stimulus in that there are mechanisms by which the raw stimulus is tranformed into an s-a-c, and that this effect on the learning subsystem is not a unilateral one. The learning variables also feed back into the perceptual processes to influence the effects of the incoming information. These perceptual constructs explain why an advertisement is "seen" by some people and not by others even though all are exposed to it, and why a given person "sees" it today but not next week even though he is exposed to it both times. Also, the constructs explain why some new products fail and others do not.

Consistent with the model's conceptualization of the theory, the theory succinctly states "So far all of our elements have been entities or state constructs - usually the hypothetical counterparts of variables. Here, however, we encounter two elements that are processes instead of entities." They are referring specifically to perceptual bias (BIAS) and overt search (OVTS).

FIGURE 12

INDEX

VARIABLE	TYPE OF EQUATION	NAME
PERS	Auxiliary	Personality
IMP	Auxiliary	Importance of Purchase
TIMP	Auxiliary	Time Pressure
SM	Auxiliary	Stimulus Multiplier
OVTSF	Rate	Overt Search Formation
OVTS	Level	Overt Search
OVTSA	Rate	Overt Search Attrition
MOTIVE	Level	Motive
OVTSAN	Constant	Overt Search Attrition Norm
ATT	Rate	Attention
SP	Level	Stimulus Pool
LOSS	Rate	Stimulus Loss
NF	Rate	Need Formation
STA	Auxiliary	Stimulus Ambiguity
LOSSN	Constant	Stimulus Loss Normal
BIAS	Auxiliary	Perceptual Bias
CON	Level	Confidence
AT	Level	Attitude
PER	Rate	Perception
SAC	Level	Stimulus as coded
ATR	Rate	s-a-c Attrition
ATRN	Constant	s-a-c Attrition Normal
RTB	Rate	Readiness to Buy
BL	Rate	Brand Loyalty
CD	Rate	Choice Decision



PERCEPTUAL SUBSYSTEM

FIG.12

The model departs here somewhat from the theory in that overt search (OVTS) is conceptualized as a state of the system. But one must recognize the impact on the system from this variable. It is evident from reviewing Figure 12 that the impact of overt search is simply relegated to modulating the stimulus multiplier (SM). Therefore, even though it is diagramatically represented as a state variable its impact is that of a process modulating another variable.

The perceptual process can be seen as regulating the quality and quantity of information disseminated to the consumer. The theory suggests that attention is concerned solely with regulating the flow while perceptual bias, in addition to distorting the information, also seems to regulate the flow to some extent.

The explanation of the perceptual subsystem will follow a discussion of the three major levels according to the sequence of equation numbers.

Overt search is defined as the process by which the buyer selects a particular element of his environment as the stimulus display in order to clarify the descriptive and evaluative cognitions related to a brand or to the product class as well as to satisfy motives such as novelty or to clarify the saliency of motives in a given situation. It involves, at the least, the buyer shifting his head, for example, and extends in the other extreme to seeking out and talking with particular people in order to obtain the information wanted, as well as to formal search effort.

Equation 18 through 18.4 describe the model's formulation of overt search.

```
R  OVTSF.KL  =  (((IMP.K+TIMP.K+PERS.K)/3)*STA.K)*LOGN(MOTIVE.K)
                                                          18
L  OVTS.K    =  OVTS.J+(DT)(OVTS.F.JK-OVTSA.JK)           18.1
N  OVTS      =  0                                         18.2
R  OVTSA.KL  =  (OVTSAN)(OVTS.K)                          18.3
C  OVTSAN    =  .999                                      18.4
   LOGN(X)   -  Dynamo function for natural log of X
   OVTSF     -  Overt Search Formation (Dimensionless)
   OVTS      -  Overt Search           (Dimensionless)
   OVTS      -  Overt Search Initial Condition (Dimensionless)
   OVTSA     -  Overt Search Attrition  (Dimensionless)
   OVTSAN    -  Overt Search Attrition Normal  (Dimensionless)
```

Equation 18 is a rate equation which acts as a decision point in controlling the level of overt search a given consumer exhibits. It is a function of the three exogenous variables of importance of purchase (IMP), time pressure (TIMP) and personality (PERS). The three variables are averaged and modified by the stimulus ambiguity (STA), so as to reflect the fact that these variables are external to the system and must be treated as inputs to the buyer's perceptual processes. The rate of overt search formation, as such, is then modulated by the level of the buyer's need (MOTIVE) so as to encompass shifting need levels. The functional relationship is multiplicative so as to magnify corresponding changes in need levels, since overt search is so inextricably related to needs. The utilization of the natural log of motive is to be construed at this point largely as an experimental parameter which serves to provide a conversion coefficient between internal stimuli and the internal characteristic of the consumer. This parameter will be dealt with more extensively in the testing of the model.

Equation 18.1 is a level equation which accumulates the effect of the incoming rate variable defined in Equation 18 and the effect of the outgoing rate variable defined in Equation 18.3.

Equation 18.2 is an initial condition of the level described in Equation 18.1. It simply serves to initialize the process and in this instance is set at zero.

Equation 18.3 is the rate equation (OVTSA), describing the flow of overt search out of the corresponding level. It is simply the level of overt search (OVTS) at any point in time, multiplied by a normal rate of attrition.

Equation 18.4 describes the normal rate of attrition of overt search and sets it at .999. By this it is implied that little or no search will be maintained at the end of each week; i.e., overt search builds up during the week but at the end of each week it will be almost completely emptied. This again may be construed as an experimental parameter which will be dealt with more extensively under testing of the model.

Equations 19 through 19.4 outline the buyer's attention. Attention is defined by Howard and Sheth as the degree of "openness" of the buyer's sensory receptors for a particular feature of a specified stimulus display and a consequent narrowing of the range of objects to which the buyer is responding in relation to the range to which he is exposed. It is one of the three methods by which the buyer controls the flow of information into his nervous system.

R	ATT.KL	=	(SM.K*STA.K)*LOGN(MOTIVE.K)	19
L	SP.K	=	SP.J+(DT)(ATT.JK-LOSS.JK)	19.1
N	SP	=	240,000	19.2
R	LOSS.KL	=	(SP.K)(LOSSN)	19.3
C	LOSSN	=	.999	19.4

ATT - Attention (Units of "Energy")
SP - Stimulus Pool (Units of "Energy")
SP - Stimulus Pool Initial Condition (Units of "Energy")
LOSS - Stimulus Loss (Units of "Energy")
LOSSN - Normal Loss (Dimensionless)

Equation 19 is a rate equation describing the modified flow of external stimuli flowing into the pool of stimulii that may be potentially received by the consumer. It is a function of the external stimulus display (SM) and the degree of stimulus ambiguity (STA) modulated by the need level (MOTIVE) of the buyer. Again the muliplicative effect of the need level is construed as being a logarithmic function and will be discussed subsequently.

Equation 19.1 is a level equation which accumulates the inflowing stimuli defined in Equation 19 and outgoing stimuli defined in Equation 19.3.

Equation 19.2 is simply an initial condition set for the level equation 19.1 to initialize the processes in the system. It was arbitrarily set at 240,000 to initiate the processes.

Equation 19.3 is a rate equation regulating the outflow of stimuli from the level of stimulus pool (SP). It is described as a function of the level at any point in time multiplied by a corresponding normal loss rate (LOSSN).

Equation 19.4 sets this normal loss rate at .999 so as to reflect little or no carryover of stimulii in the pool from one period to another.

Equations 20 and 20.1 describe the degree of stimulus ambiguity present at any point in time. Howard and Sheth (1969) define stimulus ambiguity as the lack of clarity of the stimulus display in communicating the descriptive and evaluative aspects of the brand and product class and the nature of motives.

```
A   STA.K  =  TABHL(STAT,SM.K,0,800E3,80E3)                      20
T   STAT   =  0/1/.9/.8/.75/.6/.5/.4/.3/.25/.2                   20.1
```

Equations 20 and 20.1 describe a function for determining the amount of stimulus ambiguity (STA) present, given a particular level of external stimuli (SM) directed toward the consumer. The value of STA ranges from zero to 1 to reflect the varying degrees of sensitivity to incoming information. The functional relationship existing between the stimulus display (SM) and the ambiguity (STA) is graphically depicted in Figure 13.

The graphical relationship depicts a direct negative correlation between stimulus ambiguity (STA) and the level of stimulii (SM). The implication being that as the number of stimulii bearing down on the consumer increases there will be a decreasing rate of penetration into the consumer or rather greater stimulus ambiguity. This phenomena being in general correspondence with psychological empirical data.

Equation 20.1 is the table of values which stimulus ambiguity may assume depending on the level of stimulii directed toward the consumer. The values chosen are arbitrary but the general shape of the curve chosen in Figure 13 is the crucial factor in operationalizing the simulation model.

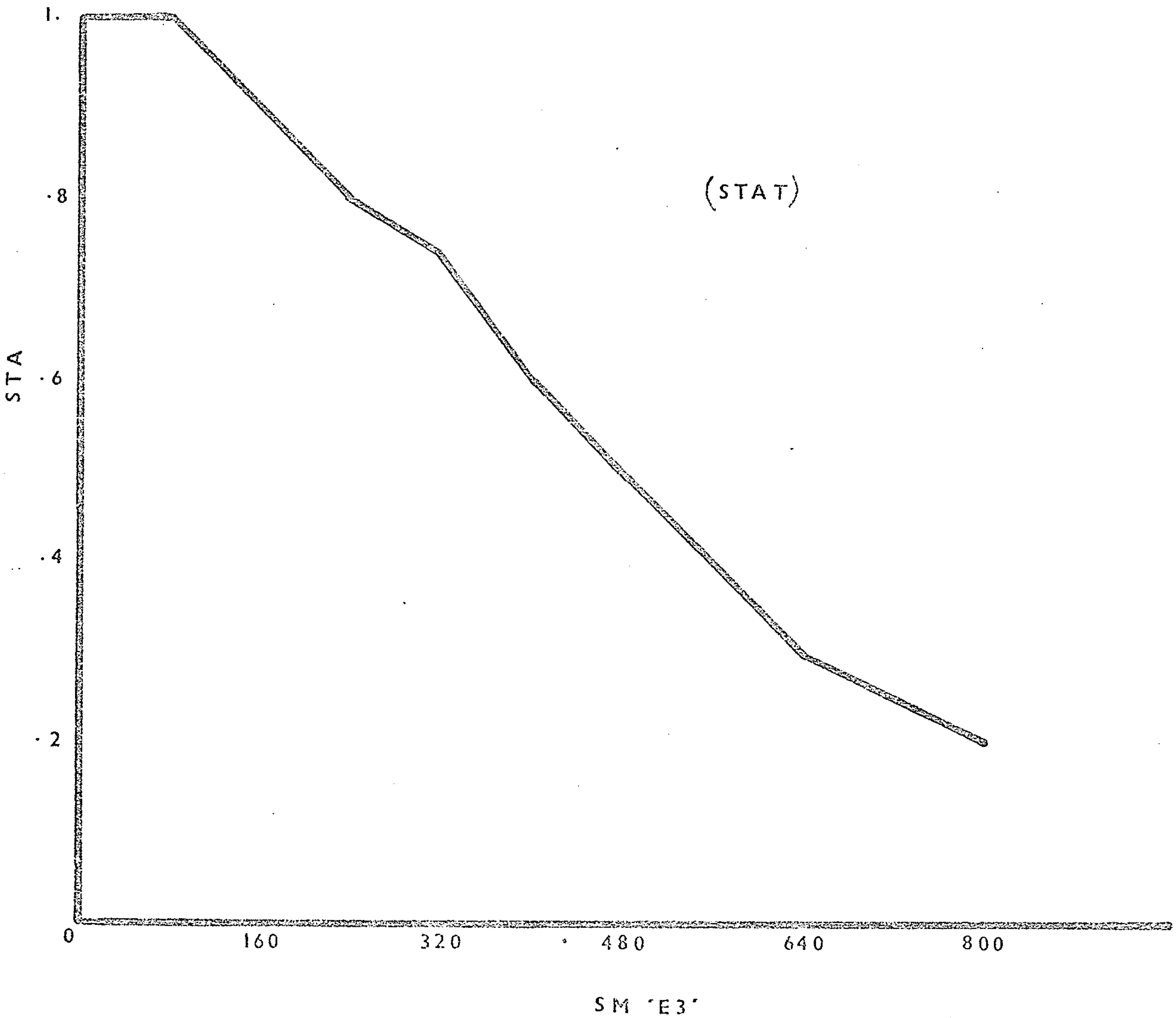
Equations 21 through 21.2 establish the degree of perceptual bias a given consumer will exhibit. Howard and Sheth (1969) define perceptual bias as a complex process consisting of the perceptual and cognitive devices whereby the buyer distorts or changes the meaning of the information he has already taken into his nervous system through attention.

```
A   CONTM  =  (SP.K)(1-STA.K) (LOGN(MOTIVE.K+AT.K+CON.K))   21
A   BIAS.K =  TABHL(BIAST,CONTM.K,0,10E6,1E6)               21.1
T   BIAST  =  1/1/.9/.9/.8/.8/.6/.6/.3/.2/.1                21.2
```

FIGURE 13

INDEX

VARIABLE	TYPE OF EQUATION	NAME
STA	Auxiliary	Stimulus Ambiguity
STAT	Table	Stimulus Ambiguity Table
SM	Auxiliary	Stimulus Multiplier



STIMULUS AMBIGUITY

FIG. 13

CONTM	-	Contingency Multiplier (Dimensionless)
BIAS	-	Perceptual Bias (")
BIAST	-	Perceptual Bias Table (")

Equations 21 and 21.1 describe a function for determining the amount of perceptual bias (BIAS) present, given the state of the contingency multiplier (CONTM). The contingency multiplier has been added to integrate the effect of the internal characteristics of the consumer with the state of the stimulii present in the consumer. In this respect, the stimulus pool (SP) is multiplied by "1-" the state of the stimulus ambiguity (STA) to offset the previous perceptual distortion in the opposite direction. For instance, if the stimulus display (SM) has been subjected to a high degree of ambiguity, the level of stimulii in the pool (SP) will be quite low. In order to ensure that it is not further affected markedly by ambiguity its negative is taken and all or most of the stimuli will be unaffected. To incorporate the state of the internal characteristics of the consumer, the stimulii (SP) multiplied by the negative of the stimulus ambiguity is modulated by the logarithmic summation of need level (MOTIVE), the attitude of the buyer (AT) and the confidence (CON) the buyer exhibits toward the product in question. The additive relationship implying the importance of all three variables. Again, the natural log is used as a conversion coefficient in translating internal stimuli to internal characteristics of the consumer.

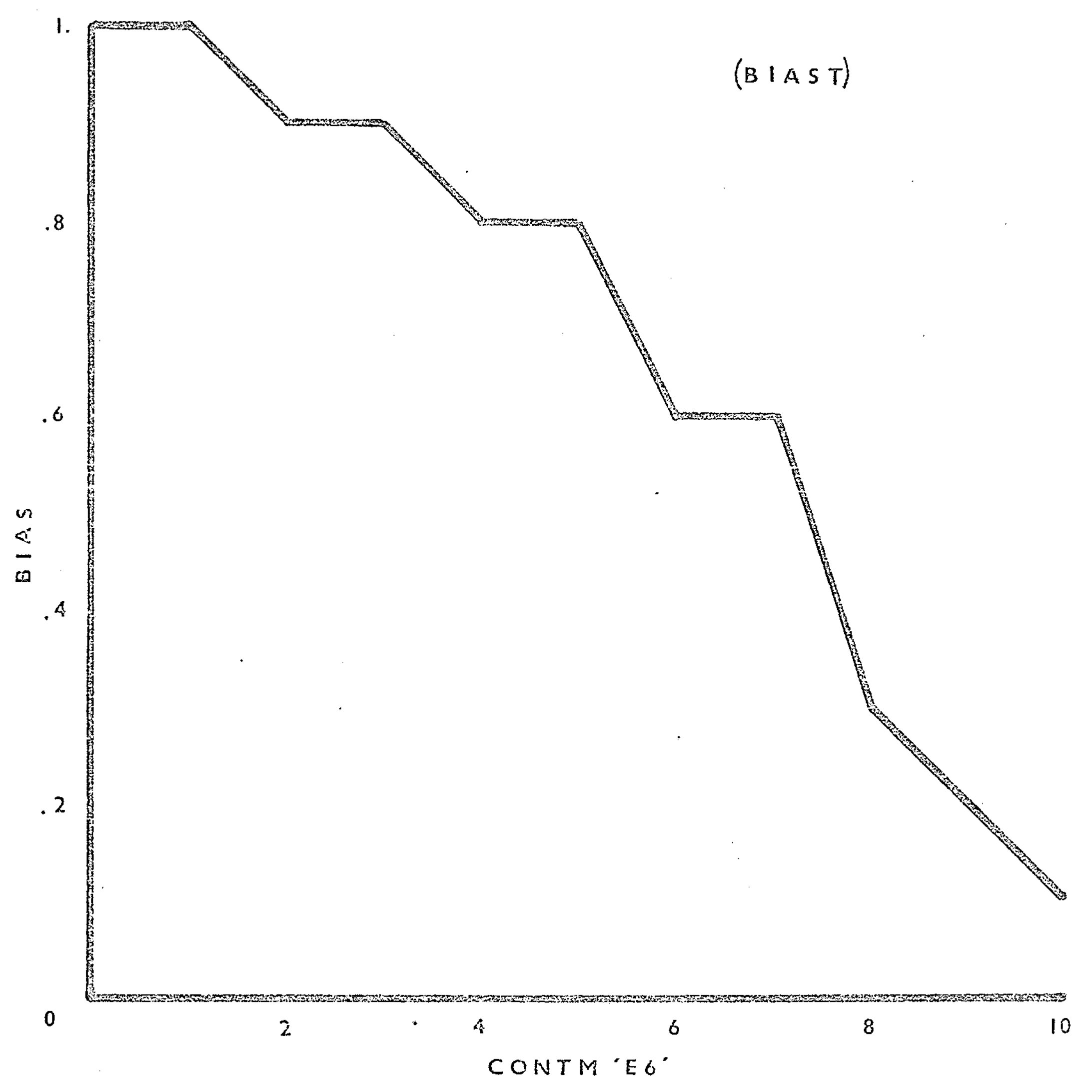
The value of bias ranges from .1 to 1 to reflect the varying degrees of bias toward internal stimuli present in the individual. The functional relationship existing between the contingency multiplier (CONTM) and the perceptual bias (BIAS) is graphically depicted in Figure 14.

The graphical relationship depicts a stepwise negative correlation

FIGURE 14

INDEX

VARIABLE	TYPE OF EQUATION	NAME
BIAS	Auxiliary	Perceptual Bias
CONTM	Auxiliary	Contingency Multiplier
BIAST	Table	Bias Table



PERCEPTUAL BIAS

FIG. 14

between perceptual bias (BIAS) and the contingency multiplier (CONTM) such that as the contingency multiplier increases the information stimulii will be subjected to greater perceptual bias. For instance, as attitude and confidence increase around a given product, the contingency multiplier will increase and internal stimulii will become more biased and distorted, thereby creating habit formation.

Equation 21.2 is the table of values which perceptual bias (BIAS) may assume depending, of course, upon the contingency multiplier (CONTM). Again, the values chosen are arbitrary but are set, however, to reflect present psychological data supporting such phenomena.

Equations 22 through 22.4 perform the function of biasing the internal stimuli (SP) and translating it into a stimulus as coded (SAC). Equation 22.4 is a rate equation which establishes the level of s-a-c in conjunction with 22, the outflow rate equation.

R	ATR.KL	=	SAC.K*ATRN	22
C	ATRN	=	.999	22.1
L	SAC.K	=	SAC.J+(DT)(PER.JK-ATR.JK)	22.2
N	SAC	=	0	22.3
R	PER.KL	=	BIAS.K*SP.K	22.4

ATR - Attrition Rate (Units of "Energy")
ATRN - Attrition Rate Normal (Dimenionless)
SAC - Stimulus as Coded (Units of "Energy")
SAC - Stimulus as coded (initial condition) (Units of "Energy")
PER - Perception (Units of "Energy")

The equations simply compute the level of SAC as a function of the degree of perceptional bias (BIAS) and the level of stimulii in the stimulus pool (SP). Equation 22.1 sets a normal rate for attrition of the stimulii as coded in the pool at .999 so as to empty the level at the end of each week. Equation 22.3 initializes the processes with s-a-c set originally at zero.

The perceptual subsystem is thus designed to filter or magnify incoming external information flows. As previously explained, it takes stimulii emanating from the stimulus display (SM), subjects it to stimulus ambiguity (STA) to create a reservoir of internal stimulii (SP). The internal stimuli are then subjected to perceptual bias (BIAS) and converted into a pool of stimulii as coded (SAC). The s-a-c then becomes internalized stimuli which may prompt activation toward purchase or reinforce the same.

3. Learning Subsystem

The learning subsystem is referred to by Howard and Sheth (1969) as the heart of the theory, the hypothetical constructs. The theory suggests that there are seven basic learning constructs, 1) Motives, 2) Brand Comprehension, 3) Choice Criteria, 4) Attitude, 5) Intention, 6) Confidence, and 7) Satisfaction.

The model utilizes a similar classificatory procedure and identifies each of these constructs as "states" of the system. Figure 15 is a diagrammatic representation of the seven constructs and their interrelationships internally as well as externally with other subsystems.

An attempt will be made here to deal individually with each of the constructs according to the sequence of equation numbers.

Motives: Are defined as the biogenic or psychogenic needs, wants, or desires of the buyer in buying and consuming a product class. They include the consciously sought goals that are considered to determine behaviour.

The model outlines the formulation of motives in equations 23 through 23.4.

```
R   NF.KL      =   (((CULT.K+SOCL.K+PERS.K+FIN.K+SOC.K)/5)*STA.K)
X   *(CON.K+SQRT(SAC.K)+475000                          23
L   MOTIVE.K   =   MOTIVE.J+(DT)(NF.JK-DRJK)            23.1
N   MOTIVE     =   15.1                                 23.2
R   DR.KL      =   (MOTIVE.K)(DRN)+DELAYI(475000,2)     23.3
C   DRN        =   .999                                 23.4

    NF        -  Need Formation (Internal Units of "Energy")
    MOTIVE    -  Motive         (Internal Units of "Energy")
    MOTIVE    -  Motive Initial Condition (Internal Units of "Energy")
    DR        -  Drive Reduction (Internal Units of "Energy")
    DRN       -  Drive Reduction Normal (Dimensionless)
    DELAYI    -  Dynamo macro function creating a first order
                 exponential delay
```

FIGURE 15 (cont.)

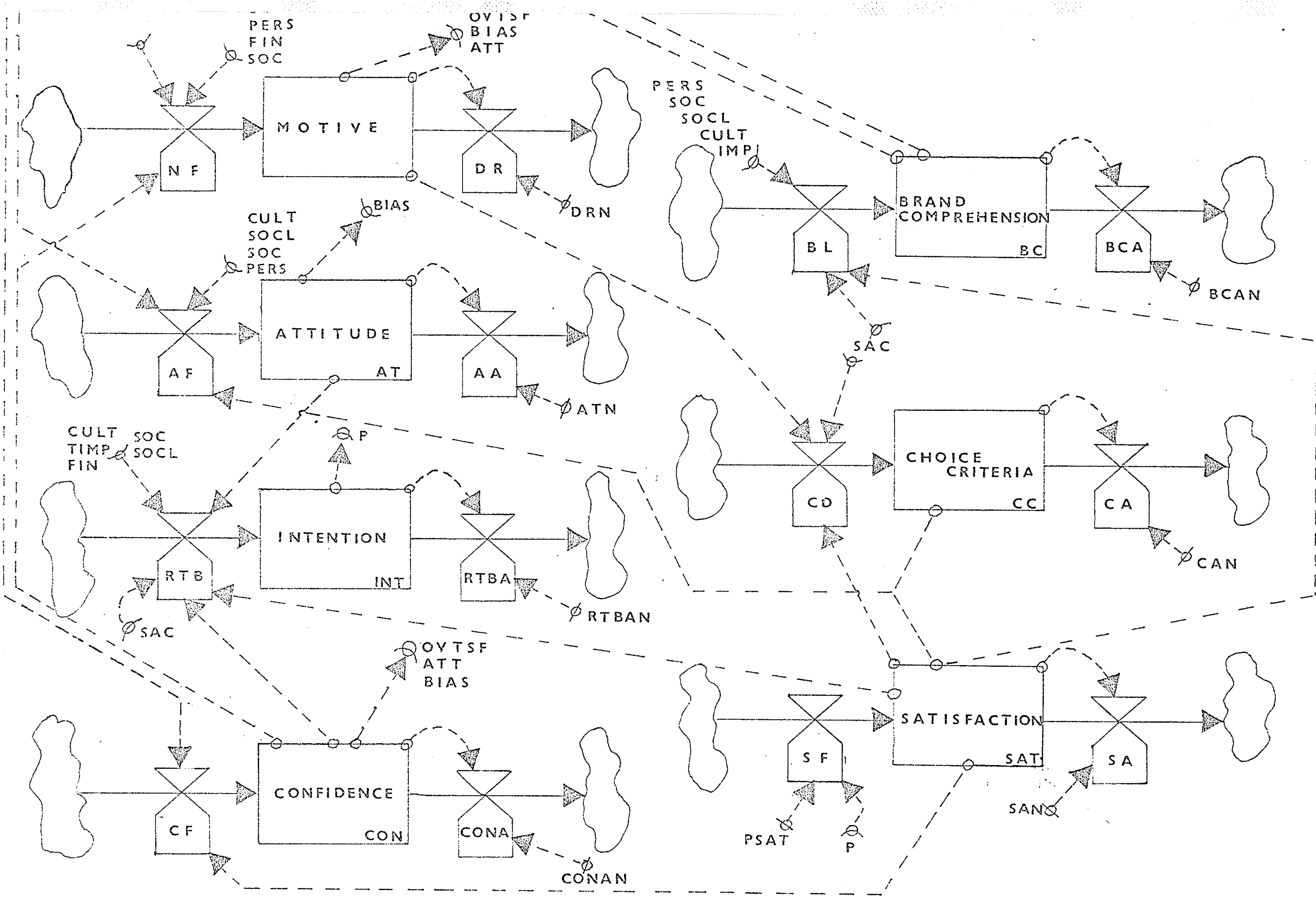
INDEX

VARIABLE	TYPE OF EQUATION	NAME
BCAN	Constant	Brand Comprehension Attrition Normal
CD	Rate	Choice Decision
CC	Level	Choice Criteria
CA	Rate	Choice Attrition
CAN	Constant	Choice Attrition Normal
SF	Rate	Satisfaction Formation
SAT	Level	Satisfaction
SA	Rate	Satisfaction Attrition
SAN	Constant	Satisfaction Attrition Normal
PSAT	Constant	Purchase Satisfaction.

FIGURE 15

INDEX

VARIABLE	TYPE OF EQUATION	NAME
STA	Auxiliary	Stimulus ambiguity
SAC	Level	Stimulus as Coded
CULT	Auxiliary	Culture
SOCL	Auxiliary	Social Class
PERS	Auxiliary	Personality
FIN	Auxiliary	Financial Status
SOC	Auxiliary	Society
OVTSF	Rate	Overt Search Formation
BIAS	Auxiliary	Perceptual Bias
ATT	Rate	Attention
NF	Rate	Need Formation
MOTIVE	Level	Motive
DR	Rate	Drive Reduction
DRN	Constant	Drive Reduction Normal
AF	Rate	Attitude Formation
AT	Level	Attitude
AA	Rate	Attitude Attrition
ATN	Constant	Attitude Attrition Normal
TIMP	Auxiliary	Time Pressure
P	Auxiliary	Purchase
RTB	Rate	Readiness to Buy
INT	Level	Intention to Purchase
RTBA	Rate	Readiness to Buy Attrition
RTBAN	Constant	Readiness to Buy Attrition Normal
CF	Rate	Confidence Formation
CON	Level	Confidence
CONA	Constant	Confidence Attrition Norma
IMP	Auxiliary	Importance of Purchase
BL	Rate	Brand Loyalty
BC	Level	Brand Comprehension
BCA	Rate	Brand Comprehension Attrition



LEARNING SUBSYSTEM

FIG. 15

Equation 23 establishes the level of motive within the learning subsystem. It is the function of several variables. It is the function of the additive average of five exogenous variables of culture (CULT), Social class (SOCL), personality (PERS), financial status (FIN) and society (SOC). Again, they are in a multiplicative relationship with stimulus ambiguity as they represent external factors which must be subjected to ambiguity (STA). These factors are then in a multiplicative relationship with confidence (CON) which will foster habit formation if there is sufficient satisfaction with purchase. For instance, should the consumer exhibit zero confidence in the product, the effect of the exogenous variables will be nullified and the firm must depend on its external information flow to create purchase action.

The internalized stimulus reservoir (SAC) must be translated through a conversion coefficient to provide equalization with the internal characteristics of the consumer. It is for this reason that the experimental parameter function (SQRT) has been utilized. This experimental parameter will be dealt with more extensively under testing of the model. The last factor in equation 23 is a constant of 475,000 units which is added weekly as a normal need formation requirement. As discussed previously, the model deals with a convenience staple good for which a need arises weekly or regularly and it is for this reason that a constant need is added each week.

Equation 23.1 is the level equation which accumulates the rate defined in Equation 23.3. The reduction in Equation 23.3 (drive reduction) is specified as the function of a normal drive reduction rate plus a constant satisfaction factor. The normal drive reduction factor of .999 defined in Equation 23.4 is included to clear out any remaining need at the end of the week. In such a situation, given there is no purchase, there is evidence to suggest that the buyer has shifted to another brand in his evoked set. A first order material delay has been added in reducing the standard routinized arousal of a need. The net effect of this is to provide a lag in the drive reduction and establish a sufficient need level for the buyer without any previous experience with the brand in question.

Choice Criteria: Are defined as a cognitive state of the buyer which reflects those attributes of the brands in the product class that are salient in the buyer's evaluation of a brand and are related to the buyer's motives that are relevant to this product class in the sense that the brands in the product class have the potential for satisfying those motives. Thus, as Howard and Sheth (1969) point out, choice criteria link motives to brands via attitude.

The model outlines the development of choice criteria in equations 24 through 24.4.

R	CD.KL	=	MOTIVE.K*SAT.K*SQRT(SAC.K)	24
L	CC.K	=	CC.J+(DT)(CD.JK-CA.JK)	24.1
R	CA.KL	=	CC.K*CAN	24.2
C	CAN	=	.999	24.3
N	CC	=	0.02E3	24.4

SQRT (X) - Dynamo function generating Square Root of X
CD - Choice Decision (Internal Units of "Energy")
CC - Choice Criteria (Internal Units of "Energy")
CA - Choice Attrition (Internal Units of "Energy")
CAN - Choice Attrition Normal (Dimensionless)
CC - Choice Criteria Initial Condition (Internal Units of "Energy")

Equation 24 is a rate equation describing the formulation of Choice Criteria (CC). It is a function of Motives (MOTIVE) modulated by the level of satisfaction (SAT) with purchase. Choice decision is also influenced by the level of internal stimuli (SAC) which represents processed external information from the perceptual subsystem.

An inexperienced buyer unfamiliar with the product, or a buyer experienced with the product and highly dissatisfied with it, would possess either a very low level of satisfaction (SAT) or none at all. In such a situation satisfaction would modulate motive such that the outcome might be zero if it were not for the effect of the SAC. If the firm was doing a capable job of promotion and marketing the consumer would then have a raised choice criteria (CC) level, and attitude would be favourably affected. However, if the firm was both unable to satisfy the consumer and provide a sound marketing mix, choice criteria (CC) would be unfavourably affected and purchase deterred.

Equation 24.1 simply establishes the level of CC as a function of the inflowing rate defined in Equation 24, and the outflow rate defined in Equation 24.2. Equation 24.2, the choice attrition (CA) rate is the outflow from the level and is purely the function of the level at a specified period of time multiplied by a constant reduction rate. The constant attrition rate (CAN) is set at .999 to empty the level each period and is defined in Equation 24.3. Equation 24.4 initializes the level of choice criteria and provides a starting point for the simulation.

Brand Comprehension: Is defined as a cognitive state of the buyer that reflects the extent to which he has sufficient knowledge to establish well defined criteria for identifying the brands he encounters and to have available the words for discussing a particular brand, but not for evaluating it. Howard and Sheth (1969) suggest that information affects attitude through brand comprehension.

The model has adopted a similar conceptualization of brand comprehension and defines its formulation in equations 25 through 25.4

R	BL.KL	=	((IMP.K+CULT.K+SOCL.K+PERS.K+SOC.K)/5)	25
X			*SAT.K+SQRT(SAC.K)	25
L	BC.K	=	BC.J+(DT)(BL.JK-BCA.JK)	25.1
R	BCA.KL	=	BC.K*BCAN	25.2
C	BCAN	=	.999	25.3
N	BC	=	14.77	25.4

BL - Brand Loyalty (Internal Units of "Energy")
BC - Brand Comprehension (Internal Units of "Energy")
BCA - Brand Comprehension Attrition (Internal Units of "Energy")
BCAN - Brand Comprehension Attrition Normal (Dimensionless)
BC - Brand Comprehension Initial Condition (Internal Units of "Energy")

Equation 25 is a rate equation formulating the level of brand comprehension (BC). Brand loyalty (BL) is a function of the additive average of the five exogenous variables of importance of purchase (IMP), culture (CULT), Social class (SOCL), personality (PERS) and social and organizational setting (SOC), modulated by the level of satisfaction. Again, as in choice criteria, satisfaction (SAT) from purchase may be zero or very close to zero, thereby creating a low level of (or zero) brand loyalty (BL). However, SAC, representing internal stimuli is again added to create sufficient brand loyalty (BL), being contingent upon an effective marketing mix on the part of the firm to provide brand interest on the part of the buyer.

Equation 25.1 is a level equation integrating the effect of the inflowing rate equation defined in Equation 25, as well as the outflowing rate equation defined in Equation 25.2. Brand choice attrition (BCA) defined in Equation 25.2 is simply the level of brand comprehension (BC) at any point in time multiplied by a normal attrition rate. The normal attrition rate is established in Equation 25.3 for BCAN and set at .999. Again, the purpose is to clear out the level at the end of each period, and allow little or no carryover into the next period. Equation 25.4 initializes the level of brand comprehension (BC) and provides a point for establishing the model and simulation trials.

Attitude: is defined as a cognitive state that on a number of dimensions reflects the extent to which the buyer prefers in terms of Motives, each brand, in his evoked set, in relation to other brands in the set. Howard and Sheth (1969) point out that motives give rise to choice criteria; and, brands in the buyer's evoked set, as identified and denotatively described by brand comprehension, are evaluated according to choice criteria to yield attitude. Hence, in attitude these brands are ordered in terms of their potential to satisfy the buyer's motives.

The model is generally consistent with the theory's conceptualization of attitude. However, as was pointed out earlier, the model deals with a single product, and correspondingly attitude in the model refers purely to the cognitive state of the buyer reflecting the extent to which the buyer prefers, in terms of motives, this specific brand in his evoked set

The model develops attitude in Equations 26 through 26.4

R	AF.KL	=	((CULT.K+SOCL.K+SOC.K+PERS.K)/4)*SAT.K+	
X			(BC.K)+(CC.K)/2	26
L	AT.K	=	AT.J+(DT)(AF.JK-AA.JK)	26.1
R	AA.KL	=	AT.K*ATN	26.2
N	AT	=	.001	26.3
C	ATN	=	.999	26.4

AF - Attitude Formation (Internal Units of "Energy")
AT - Attitude (Internal Units of "Energy")
AA - Attitude Attrition (Internal Units of "Energy")
AT - Attitude Initial Condition (Internal Units of "Energy")
ATN - Attitude Attrition Normal (Dimensionless)

Equation 26 is a rate equation which provides a decision point in the creation of attitude. Attitude formation (AF) is the function of the additive average of the five exogenous variables of culture (CULT), social class (SOCL), social and organizational setting (SOC) and personality (PERS) modulated by the level of satisfaction (SAT) from purchase. Again, attitude could easily become zero, should satisfaction be zero or near zero. However, the average of brand comprehension and choice criteria provides a reflection of the current state of the buyer's cognitions concerning the product. That is, even though the consumer has not purchased the product he will possess a level of brand comprehension (BC) and choice criteria (CC) concerning the product(s) which leads to the development of an attitude toward the product. Accordingly, the development of attitude (AT) can be traced from initial recognition to purchase to post purchase stages.

Equation 26.1 is the level equation integrating the effect of the inflowing rate equation 26 and the outflowing rate equation 26.2. Attitude attrition (AA) again merely clears the level at the end of each period through the use of the normal attrition rate (ATN) of .999 defined in Equation 26.4. Equation 26.3 simply initializes the attitude subprocesses and provides a starting point for the simulation.

Intention to Purchase: is defined as a cognitive state that reflects the buyer's plan to buy units of a particular brand in some specified time period. Intention reflects his attitude, his confidence, and his anticipations about certain constraints which inhibit the effects of attitude and confidence. These constraints are elements of his plan, and intention is the uncompleted portion of the plan.

Howard and Sheth (1969) point out that attitude gives direction to purchase behaviour and that intention links attitude to purchase.

The model conceptualizes these processes similarly and outlines the formulation of intention in Equations 27 through 27.5.

A	MEME.K	=	SAT.K*AT.K*CON.K+SQRT(SAC.K)	27
R	RTB.KL	=	((CULT.K+SOCL.K+SOC.K+TIMP.K+FIN.K)/5) *MEME.K	27.1
L	INT.K	=	INT.J+(DT)(RTB.JK-RTBA.JK)	27.2
N	INT	=	500	27.3
R	RTBA.KL	=	INT.K*RTBAN	27.4
C	RTBAN	=	.999	27.5

MEME - Modulator (Internal Units of "Energy")
RTB - Readiness to Buy (Internal Units of "Energy")
INT - Intention to Purchase (Internal Units of "Energy")
INT - Intention Initial Condition (Internal Units of "Energy")
RTBA - Readiness to Buy Attrition (Internal Units of "Energy")
RTBAN - Readiness to Buy Attrition Normal (Dimensionless)

Equation 27 is an auxiliary equation which is essentially a subdivision of the rate equation defined in 27.1. The auxiliary equation (MEME) is a modulator of the rate equation. As defined it is a multiplicative function of satisfaction (SAT), attitude (AT) and confidence (CON). This relation adequately describes the buyer's cognitive state concerning the product at any point in time. Again, it is highly dependent upon purchase satisfaction and correspondingly is highly unstable. To offset the possible negative intention (INT) evident without previous purchase and satisfaction, the SAC is again added to make possible an intention to purchase (INT), without any previous purchase experience, to at least make an initial trial purchase.

The rate equation defined in 27.1 simply multiplies or modulates the effect of the auxiliary equation on the additive average of the inhibitors or inducers to purchase, i.e., the exogenous variables of culture (CULT), social class (SOCL), social and organizational setting (SOC), time pressure (TIMP) and financial status (FIN).

Equation 27.2 is the level equation integrating the effects of the inflowing rate equation Readiness to Buy (RTB) and the outflowing rate equation 27.4 Readiness to Buy Attrition (RTBA). The processes are similar to those previously listed, i.e., the level is reduced each period by a normal outflow of .999 of itself, defined by RTBAN in Equation 27.5. The initial condition for the level is established by INT in Equation 27.3.

Satisfaction: is defined as the buyer's cognitive state of being adequately or inadequately rewarded in a buying situation for the sacrifice he has undergone. Howard and Sheth (1969) point out that satisfaction does not affect purchase directly, as do attitude and intention, but instead is a case of a servomechanistic relation - a purchase and consumption feedback relation. Furthermore, they point out that we must recognize that satisfaction is not necessarily the same as some objective evaluation of reward, for the satisfaction derived from a gift of $10. can vary among people and for a given person over time.

Satisfaction feeds back and reinforces attitude thereby creating habit formation. Thus it may be postulated that satisfaction affects choice criteria and the motor habits of purchase and consumption. Albeit, the causal sequence is from attitude to purchase.

Howard and Sheth (1969) emphasize that a number of elements determine the amount of the effect of satisfaction on attitude - its intensity, the relation between anticipated and actual satisfaction, its certainty, its latency, and its periodicity. They go further to postulate a functional relationship as follows:

$$A_{t+2}=f(S_{t+1}-A_t)+A_t$$

where:

A_t = expectation about the brand before purchase

S_{t+1} = actual satisfaction from purchase

$S_{t+1}-A_t$ = is dependent upon the buyer's anticipated satisfaction (A_t) and his actual satisfaction (S_{t+1}).

A_{t+2} = Attitude, after all effects of satisfaction from this purchase are worked out.

This relationship may hold true, but it only takes into consideration one of the factors listed which are postulated to affect satisfaction, that being the relation between anticipated and actual satisfaction.

The model recognizes that there are many variables which will affect satisfaction from purchase and that they are not at all that well understood. Due to the great difficulty in coordinating and integrating these factors in a simulation model, a more simplistic viewpoint has been taken toward satisfaction. When the model is tested we can then examine the sensitivity of this sub-process within the learning subsystem to determine whether or not greater sophistication is required in detailing the factors involved in satisfaction.

The model treats the development of satisfaction in Equations 28 through 28.5.

A	PSAT.K	=	NORMRN(10,05)	28
R	SF.KL	=	P.K*PSAT.K	28.1
L	SAT.K	=	SAT.J+(DT)(SF.JK-SA.JK)	28.2
N	SAT	=	.001	28.3
R	SA.KL	=	SAT.K*SAN	28.4
C	SAN	=	1.00	28.5

PSAT - Purchase Satisfaction (Internal Units of "Energy")
SF - Satisfaction Formation (Internal Units of "Energy")
SAT - Satisfaction (Internal Units of "Energy")
SAT - Satisfaction Initial Condition (Internal Units of "Energy")
SA - Satisfaction Attrition (Internal Units of "Energy")
SAN - Satisfaction Attrition Normal (Dimensionless)

Equation 28 defines the purchase satisfaction obtainable at a given point in time. In reality this is where the simplification of the theory has taken place. Satisfaction is viewed as a variable event which has a mean of 10 units of satisfaction (SAT) and standard deviation of 5 units. Satisfaction, however, will not be internalized unless a purchase is consumated, as is evident from the rate equation 28.1. The level equation 28.2 integrates the effects of the inflow rate equation (SF), satisfaction formation, and the outflow rate equation 28.4, (SA), satisfaction attrition. The level equation SAT is initialized for the purpose of simulation in Equation 28.3. The reduction or attrition in satisfaction as defined through Equation 28.4 is determined by a normal outflow of 100% of itself each period as per Equation 28.5, Satisfaction Attrition Normal (SAN).

<u>Confidence</u>: The last subprocess in the learning subsystem is defined as the extent to which the buyer believes that he can estimate the net payoff; that is, the reward from buying a given brand.

Howard and Sheth (1969) describe confidence as the central equilibrating construct of the system - when confidence is low, the buyer seeks information and is less likely to purchase. As information is acquired confidence rises and the probability of purchase increases. As confidence increases, however, the buyer's tendency to take in information declines and after purchase confidence may increase further. Confidence may increase as the result of seeking additional information and not necessarily require purchase.

The model has adopted a similar conceptualization of confidence and relates it directly to satisfaction from purchase. If there is no purchase behaviour and no satisfaction (SAT) there will be little or no confidence (CON).

The formulation of confidence is described in Equations 29 through 29.4.

```
R    CF.KL    =  SAT.K*BC.K                         29
L    CON.K    =  CON.J+(DT)(CF.JK-CONA.JK)          29.1
R    CONA.KL  =  CON.K*CONAN                        29.2
N    CON      =  2.0                                29.3
C    CONAN    =  .999                               29.4
     CF       - Confidence Formation (Internal Units of "Energy")
     CON      - Confidence (Internal Units of "Energy")
     CONA     - Confidence Attrition (Internal Units of "Energy")
     CON      - Confidence Initial Condition (Internal Units of
                                               "Energy")
     CONAN    - Confidence Attrition Normal (Dimensionless)
```

Equation 29 is the rate equation establishing the level of confidence. It is defined as a function of satisfaction (SAT) and brand comprehension (BC). The level Equation 29.1 accumulates the effect of the inflow rate equation 29 and the outflow rate equation 29.2. The outflow from the level is set at a normal rate of .999 of itself as established by confidence attrition normal (CONAN). The processes are initialized for the level in Equation 29.3 (CON).

4. The Output Subsystem

The output subsystem as diagramatically represented in Figure 16 is the simplest and smallest of the five subsystems comprising the model. However, its impact (purchase behaviour) is the focal point of the model to a large extent. The Theory of Buyer Behaviour (1969) outlines the output subsystem to include Purchase , Intention', Attitude', Brand Comprehension', and Attention'. Howard and Sheth (1969) refer to these variables as the variables that link the hypothetical constructs to the real world.

The output variables constitute what may be referred to as a hierarchy of effects wherein Attention' leads to Brand Comprehension' which leads to Attitude', which leads to Intention', and which eventually leads to purchase. This causal sequence being somewhat analogous to "AIDA" (the chain of Attention-Interest-Desire-Action).

The model conceptualizes Purchase to be solely related to Intention to Purchase (INT). The model utilizes the concept of a threshold here to characterize the purchase decision. The formulation of the purchase decision is outlined in Equation 40.

```
A    P.K  =  CLIP(1,0,INT.K,X)                        40
     P    -  Purchase (Units of Product)
     X    -  Threshold level of X before purchase occurs (Int.Energy Units)
```

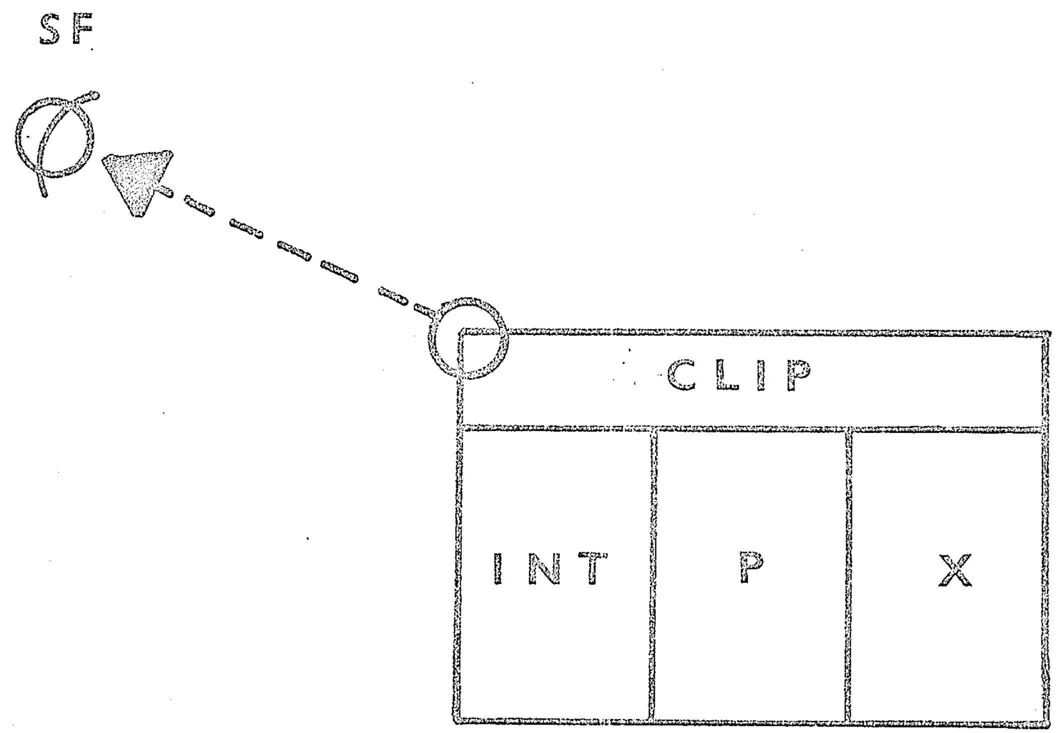
Equation 40 is a function describing purchase (P) as a consequence of Intention (INT). The function states that if Intention (INT) is less than the value X no purchase will occur and contrariwise, if the value of Intention is greater or equal than X, then purchase (P) will assume the value of one.

Again, the model has taken a simplistic threshold viewpoint toward intention to purchase but a wholly realistic one in light of the complexity

FIGURE 16

INDEX

VARIABLE	TYPE OF EQUATION	NAME
INT	Level	Intention to Purchase
P	Auxiliary	Purchase
X	Auxiliary	Purchase Threshold



OUTPUT SUBSYSTEM

FIG. 16

of the model. The value of X has been defined for simulation purposes but it serves little significance to state a point at which purchase must occur at this stage.

It is more realistic, as well as scientific, to refer to the X value as an experimental parameter which will be tested subsequently and dealt with more fully under the testing of the model.

The important point to note is that the model clearly follows the conceptual framework of the theory and that a threshold level has been postulated as the basis for purchase decisions.

5. <u>Exogenous Variables Subsystem</u>

The exogenous variables subsystem is diagramatically represented in Figure 17 and consists of seven basic variables which are postulated to causally determine output behaviour. Primarily the exogenous variables provide an important delimiting function. The exogenous variables represent factors that are environmental or "outside" of the theory. They thus provide a boundary for the theory under consideration as well as provide a tool for communicating the scope of the theory.

Howard and Sheth (1969) describe the exogenous variables:

> "The effects of the history of the buyer - up to the beginning of the researcher's period of observation - can be thought of as being contained in his exogenous variables: the intensity of his valuation of the product class, his personality traits, his social class, his culture, and his reference groups, as well as more current factors, such as the amount of time he has to devote to purchasing his product and his financial status. Exogenous variables thus serve both an error reducing function and the function of classifying people according to fairly permanent characteristics, as in market segmentation."

The seven basic variables comprising the exogenous variables subsystem are: Importance of Purchase, Personality, Time Pressure, Financial Status, Social and Organizational Setting, Reference Group and Social Class.

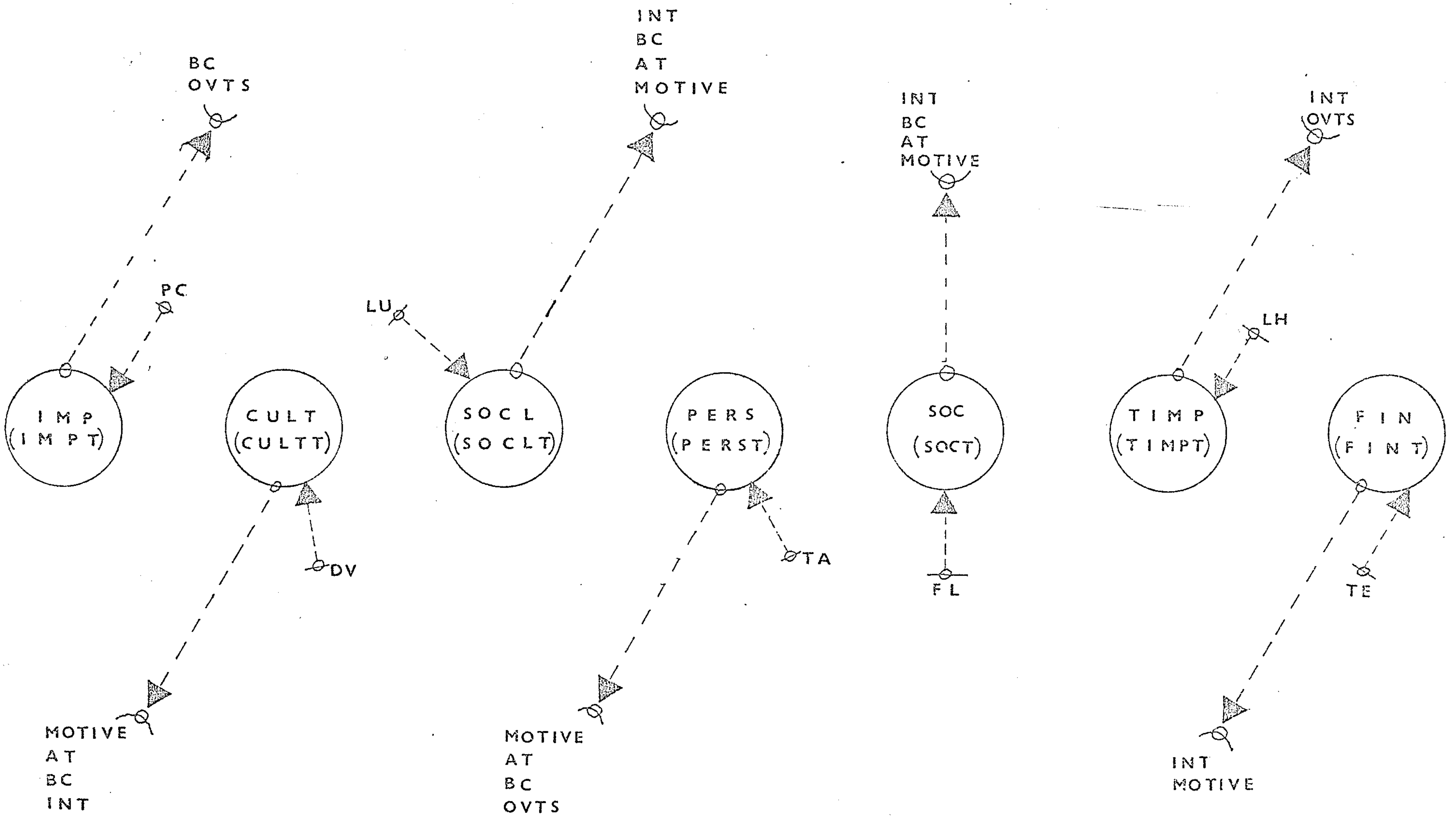
Importance of Purchase is defined as the criteria by which the buyer orders a range of product classes in terms of his needs. Importance of Purchase influences exploratory behaviour as well as the magnitude of the buyer's evoked set.

The model conceptualizes Importance of Purchase as a direct outcome of the consumer goods class to which the product belongs (PC), as perceived by the consumer in question.

FIGURE 17

INDEX

VARIABLE	TYPE OF EQUATION	NAME
IMP	Auxiliary	Importance of Purchase
IMPT	Table	Importance of Purchase Table
CULT	Auxiliary	Culture
CULTT	Table	Culture Table
SOCL	Auxiliary	Social Class
SOCLT	Table	Social Class Table
PERS	Auxiliary	Personality
PERST	Table	Personality Table
SOC	Auxiliary	Social & Organizational Setting
SOCT	Table	Social & Organizational Setting Table
TIMP	Auxiliary	Time Pressure
TIMPT	Table	Time Pressure Table
FIN	Auxiliary	Financial Status
FINT	Table	Financial Status Table
BC	Level	Brand Comprehension
OVTS	Level	Overt Search
PC	Auxiliary	Product Category
INT	Level	Intention to Purchase
AT	Level	Attitude
MOTIVE	Level	Motive
LU	Auxiliary	Lower - Upper
DV	Auxiliary	Degree of Variation from Standard
TA	Auxiliary	Timid - Aggressive
FL	Auxiliary	Follower - Leader
LH	Auxiliary	Low - High
TE	Auxiliary	Tight - Easy



EXOGENOUS VARIABLES SUBSYSTEM

FIG. 17

Equations 50 through 50.2 formulate the exogenous variable Importance of Purchase (IMP).

A	IMP.K	=	TABHL(IMPT,PC.K,0,1.0,.1)	50
T	IMPT	=	.6/.7/.8/.3/.5/.6/.5/.7/.8/.8/1.0	50.1
A	PC.K	=	0	50.2

IMP - Importance of Purchase (Dimensionless)
IMPT - Importance of Purchase Table (Dimensionless)
PC - Product Class (Dimensionless)

Equation 50 describes a function for determining the degree of Importance of Purchase (IMP) according to the associated product class (PC). Equation 50.1 establishes a range of values which IMP may assume depending upon the consumer goods class to which the brand belongs.

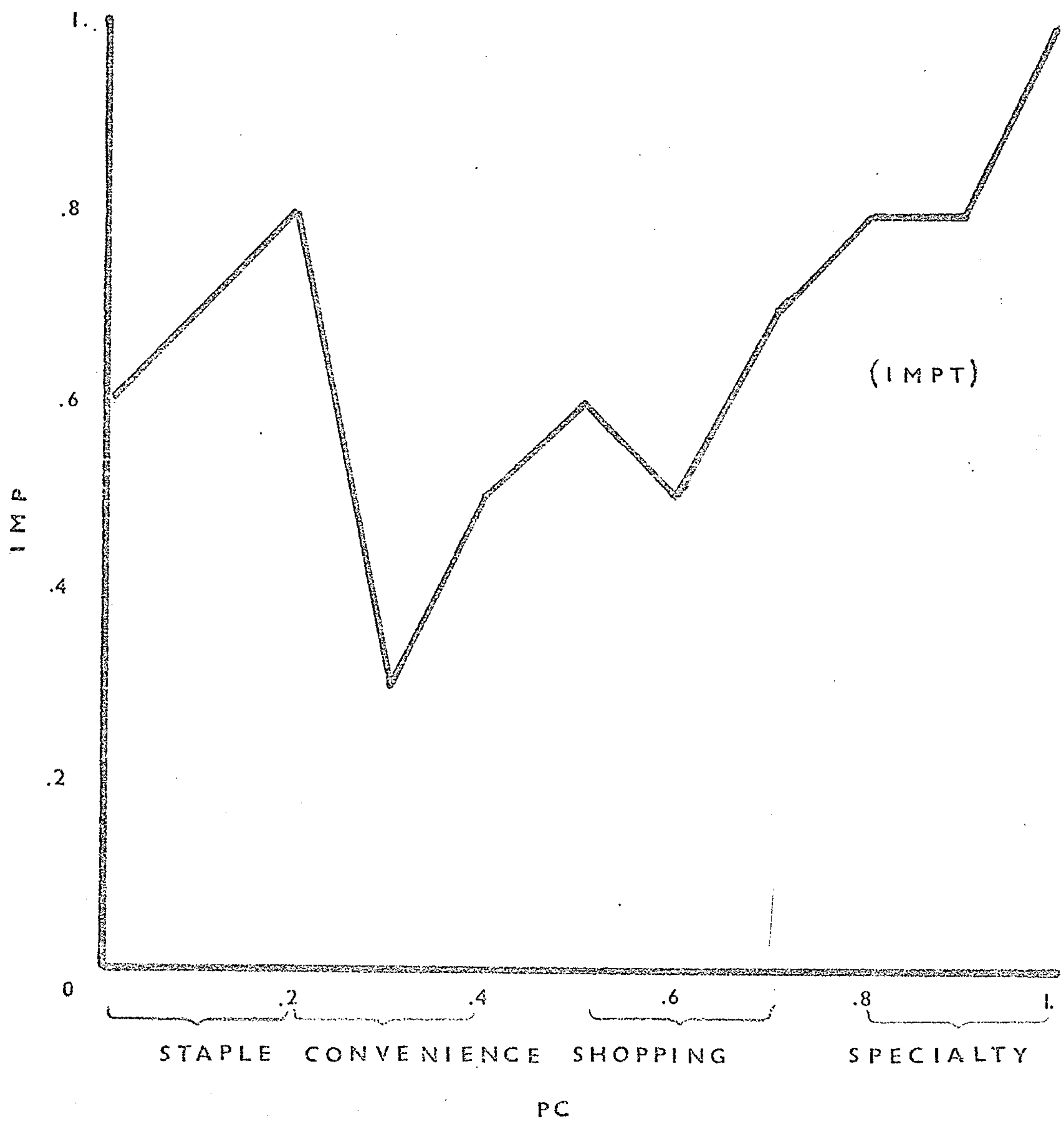
The functional relationship existing between the two variables is graphically depicted in Figure 18. The axis describing product class (PC) is subdivided to outline various applicable consumer goods classes that a product may assume. The values associated with each subdivision on the (PC) axis are arbitrary and merely utilized to establish the appropriate goods classification. The axis defining the variable IMP represents a continium of values which Importance of Purchase may assume irrespective of the product class chosen.

At the low end of each product category, i.e., consumer goods classification, Importance of Purchase (IMP) is depicted to exist at a low level and to increase as it moves toward the next higher goods classification. It is postulated here that the importance of purchase existing at the highest point for a given consumer goods classification will not be less than the lowest point on the following consumer goods class, and may not necessarily increase past the previous high level of Importance of

FIGURE 18

INDEX

VARIABLE	TYPE OF EQUATION	NAME
IMP	Auxiliary	Importance of Purchase
IMPT	Table	Importance of Purchase Tabl
PC	Auxiliary	Product Category



IMPORTANCE OF PURCHASE

FIG. 18

Purchase. The relevent point being that Importance of Purchase (IMP) varies according to the consumer goods classification (PC) and that it will be significant for a staple convenience good and furthermore may be appreciably higher for a specialty good.

The second exogenous variable, Culture, is defined as a selective man-made way of responding to experience, a set of behaviour patterns. The essential core of culture consists of traditional ideas and especially their attached values. The model conceptualizes culture as being primarily a standard mode of behaviour from which deviation occurs. The implication being that the closer an individual is to the standard there will be less inhibition to purchase, and vice versa.

Equations 51 through 51.2 establish the exogenous variable culture (CULT).

```
A   CULT.K   =  TABHL(CULTT,DV.K,0,1.0,.1)                     51
T   CULTT    =  1.0/.9/.25/.2/.15/.1/.09/.075/.05/.025/0       51.1
A   DV.K     =  1

    CULT     -  Culture (Dimensionless)
    CULTT    -  Culture Table (Dimensionless)
    DV       -  Degree of Variation (Dimensionless)
```

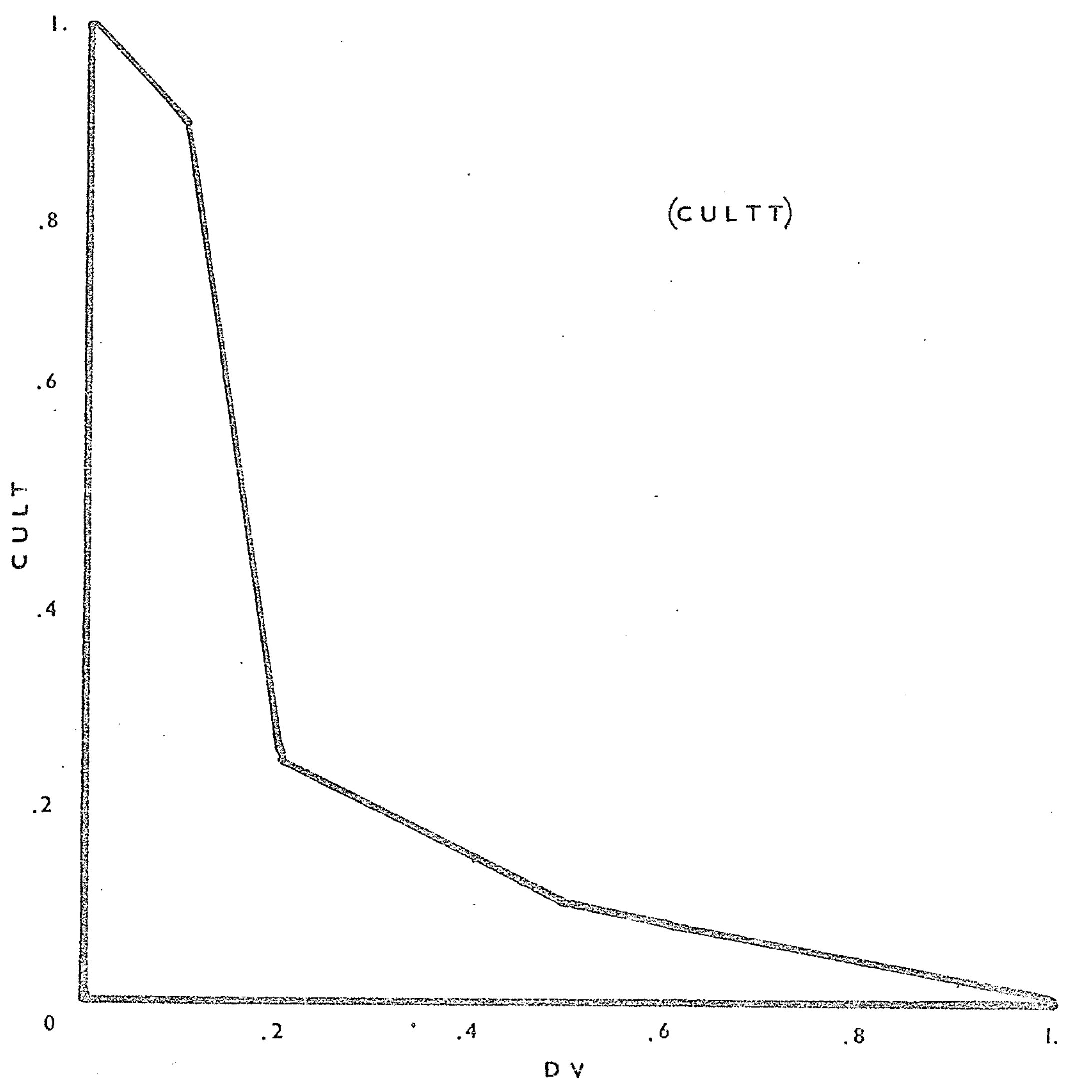
Equation 51 describes a function for determining the intensity of Culture (CULT) according to the associated degree of variation (DV). Equation 51.1 establishes the range of values which CULT may assume depending, of course, on the degree of variation. Equation 51.2 simply establishes the degree of variation (DV) at one and thereby creating a culture intensity of .9.

The functional relationship existing between the two variables is diagramatically represented in Figure 19.

FIGURE 19

INDEX

VARIABLE	TYPE OF EQUATION	NAME
CULT	Auxiliary	Culture
CULTT	Table	Culture Table
DV	Auxiliary	Degree of Variation



CULTURE

FIG. 19

The functional relationship existing is largely asymptotic. A very slight degree of variation (DV) will make a significant change in Culture intensity (CULT), and deter purchase somewhat eventually.

Howard & Sheth (1969) cite empirical evidence from an unpublished doctoral dissertation by L. S. Graham (1951) that in studying social class differences in the acceptance of innovations, there were large variations between Italians and others in their rate of adopting the supermarket as the place of purchase; and in Guatemala, the purchasing habits of Indians differed sharply from those of natives of European descent.

The third exogenous variable, Social Class, is defined as a concept which describes the condition that a society is divided into classes, that some of these classes are viewed by the members of the society as being more important than others, and that in a society the classes can be ranked in a hierarchy based on the views of its members about the value of each class in terms of its contribution to the society as a whole. Howard and Sheth (1969) postulate that a person's social class influences his motives and attitude.

Equations 52 through 52.2 describe the creation of the exogenous variable of Social Class.

A	SOCL.K	=	TABHL(SOCLT,LU.K,0,1.0,.1)	52
T	SOCLT	=	.6/.7/.8/.9/.4/.5/.6/.7/.8/.9/1.0	52.1
A	LU.K	=	.8	52.2

SOCL - Social Class (Dimensionless)
SOCLT - Social Class Table (Dimensionless)
LU - Lower Class - Upper Class (Dimensionless)

Equation 52 describes a function for determining the Social Class emphasis (SOCL) given a particular status (LU) in the continium. Equation 52.1 outlines the range of values which SOCL may assume depending upon the individual place in the social class continium (LU). Equation 52.2 merely establishes the point in the continium at .8.

Figure 20 graphically depicts the functional relationship existing between (SOCL) and (LU). The functional relationship is, for the most part, a positive correlation between the two variables.

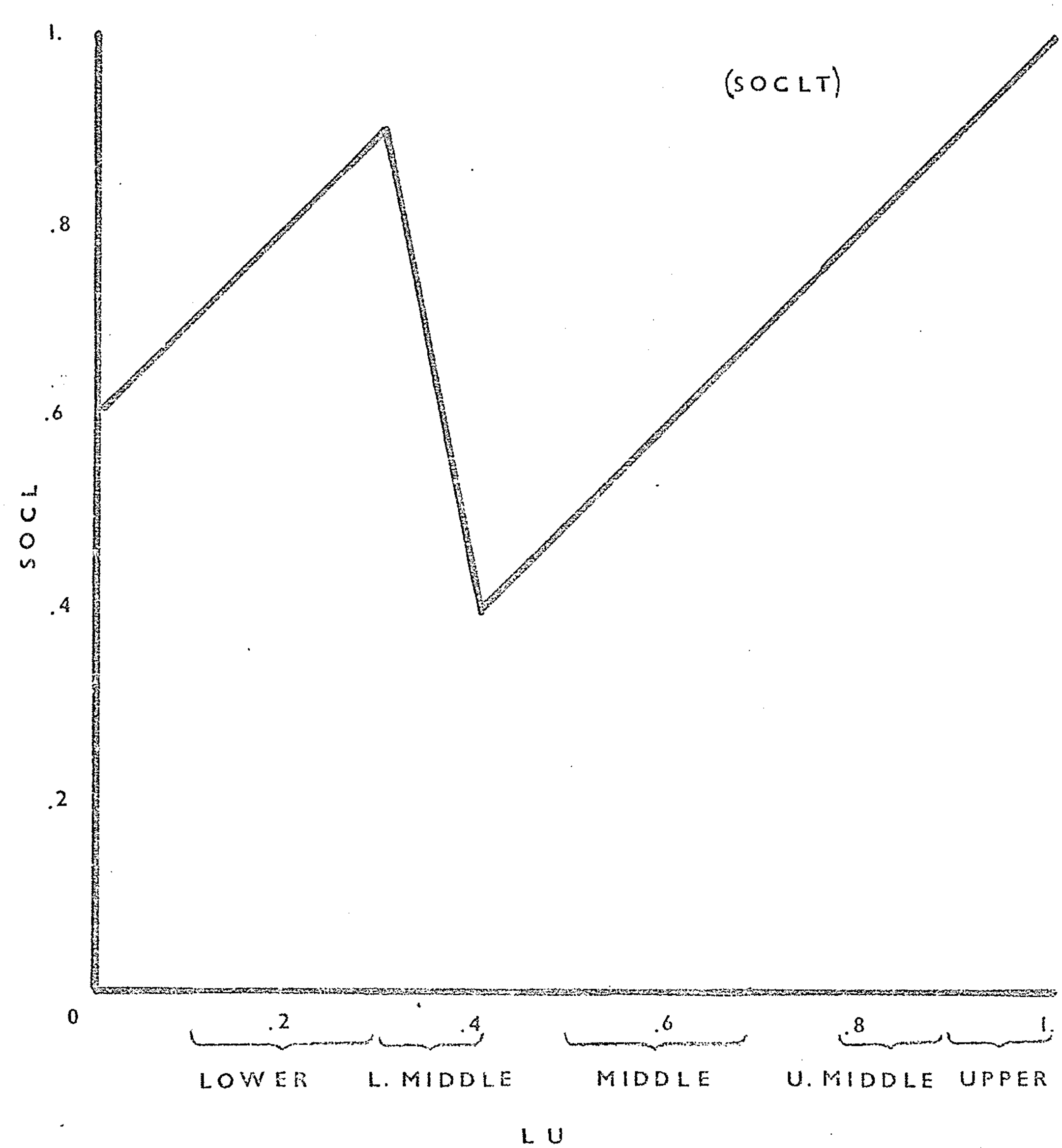
The LU axis has been broken into class distinctions which are purely arbitrary. The purpose of the breakdown was to establish that there will be less inhibition to purchase in the lower classes but as one moves into the middle class there is greater inhibition to purchase. The inhibition, however, is only temporary and becomes less of an inhibitor as one moves into the upper middle and upper class segments.

Howard and Sheth (1969) cite empirical evidence from Bauer (1960) which supports this relationship. Bauer purports that the middle class shops with the greatest intensity - they deliberate and plan more than either the lower or the upper classes.

The fourth exogenous variable, Personality, is defined as an enduring disposition or quality of a person that accounts for his relative consistency in emotional, temperamental and social behaviour. Personality traits represent motive content and accordingly Howard and Sheth (1969) postulate that they affect motives. The model conceptualizes Personality similarly and views personality as a continium stretching from timid to aggressive, with its associated behavioural implications.

Equations 53 through 53.2 outline the development of the exogenous variable Personality (PERS).

A	PERS.K	=	TABHL(PERST, TA.K,0,1.0,.1)	53
T	PERST	=	.1/.1/.2/.2/.3/.3/.4/.4/.5/.7/1.0	53.1
A	TA.K	=	.9	53.2



SOCIAL CLASS

FIG. 20

PERS - Personality (Dimensionless)
PERST - Personality Table (Dimensionless)
TA - Timid Aggressive (Dimensionless)

Equation 53 describes a function for determining the intensity of Personality (PERS) dependent upon the buyer point on a continium of Timidity - Aggressiveness (TA). Equation 53.1 is a table of values which PERS may assume depending on the point chosen on the continium. Equation 53.2 establishes the point on the Timid-Aggressive continium at .9.

Figure 21 graphically depicts the functional relationship existing between PERS and TA. The function is generally a stepwise direct positive relationship between the two variables. As aggressiveness increases, personality intensity (PERS) increases and tends to encourage purchase significantly. There is little empirical evidence to substantiate this relationship. However, by equating timidity to followership traits and aggressiveness to leadership traits, more credence is given to this relationship.

Social and Organizational setting is defined to include an individual reference group and formal organization. They are stated to operate to change the situation and to provide new information during the period of observation. The model characterizes an individual buyer occupying a position in a follower-leader continium in both the reference group and formal organization. For the purpose of this study it is postulated that an individual buyer's position in both organizations will be similar.

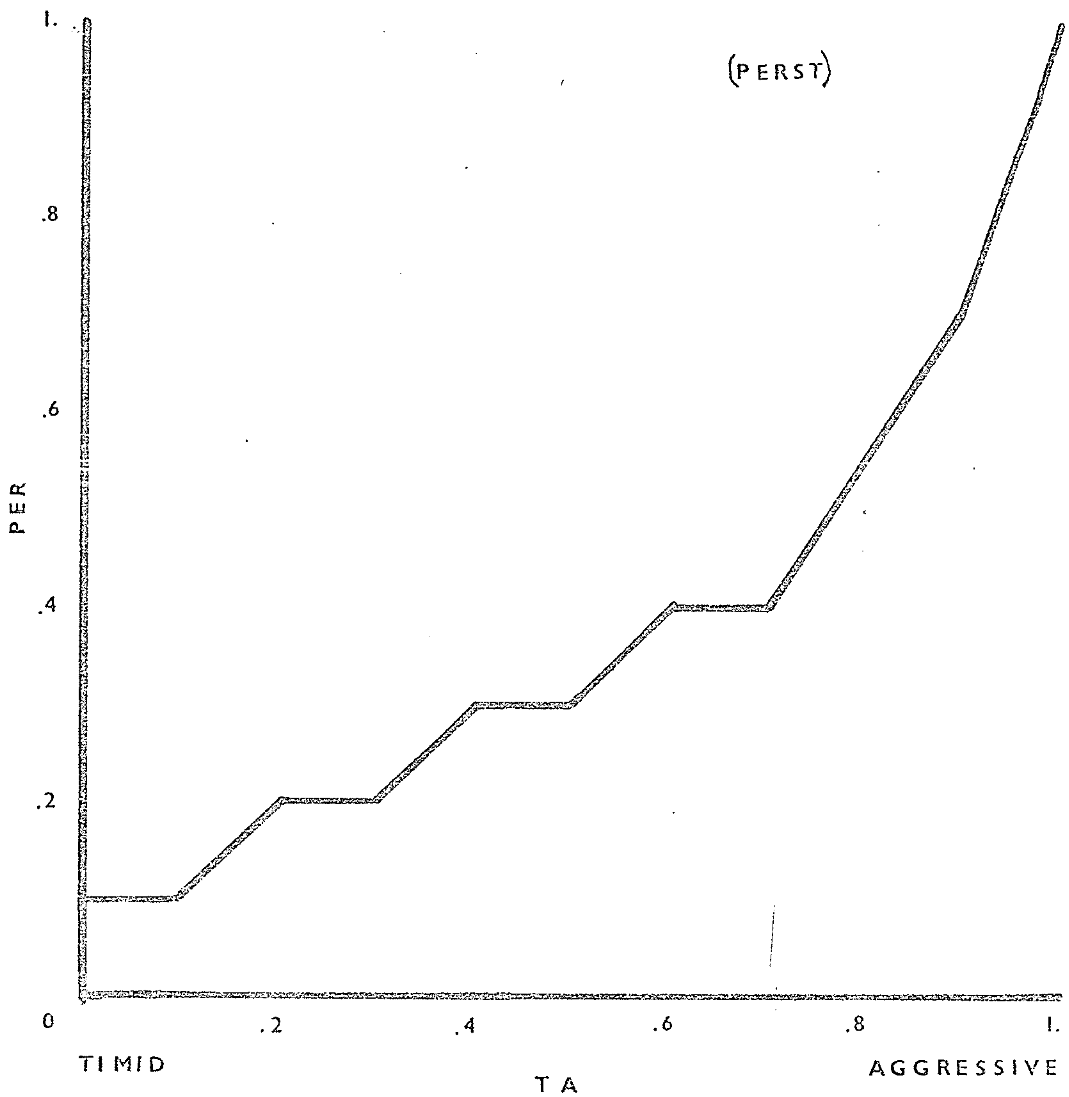
Equations 54 through 54.2 outline the model's definition of Social and organizational setting (SOC).

A	SOC.K	=	TABHL(SOCT,FL.K,0,1.0,.1)	54
T	SOC	=	.3/.4/.5/.5/.6/.7/.4/.6/.8/.9/1.0	54.1
A	FL.K	=	.9	54.2

FIGURE 21

INDEX

VARIABLE	TYPE OF EQUATION	NAME
PERS	Auxiliary	Personality
TA	Auxiliary	Timid-Aggressive
PERST	Table	Personality Table



PERSONALITY

FIG. 21

SOC - Social & Organizational Setting (Dimensionless)
SOCT - Social & Organizational Setting Table (Dimensionless)
FL - Follower-Leader Continium (Dimensionless)

Equation 54 is a function describing the Social and Organizational Setting intensity (SOC) which is dependent upon the buyer's position on the Follower-Leader (FL) continium. Equation 54.1 is the table of values which SOC may assume depending upon the point established on the Follower-Leader continium (FL). Equation 54.2 establishes the point on the FL continium at .9, i.e., a more leadership oriented individual.

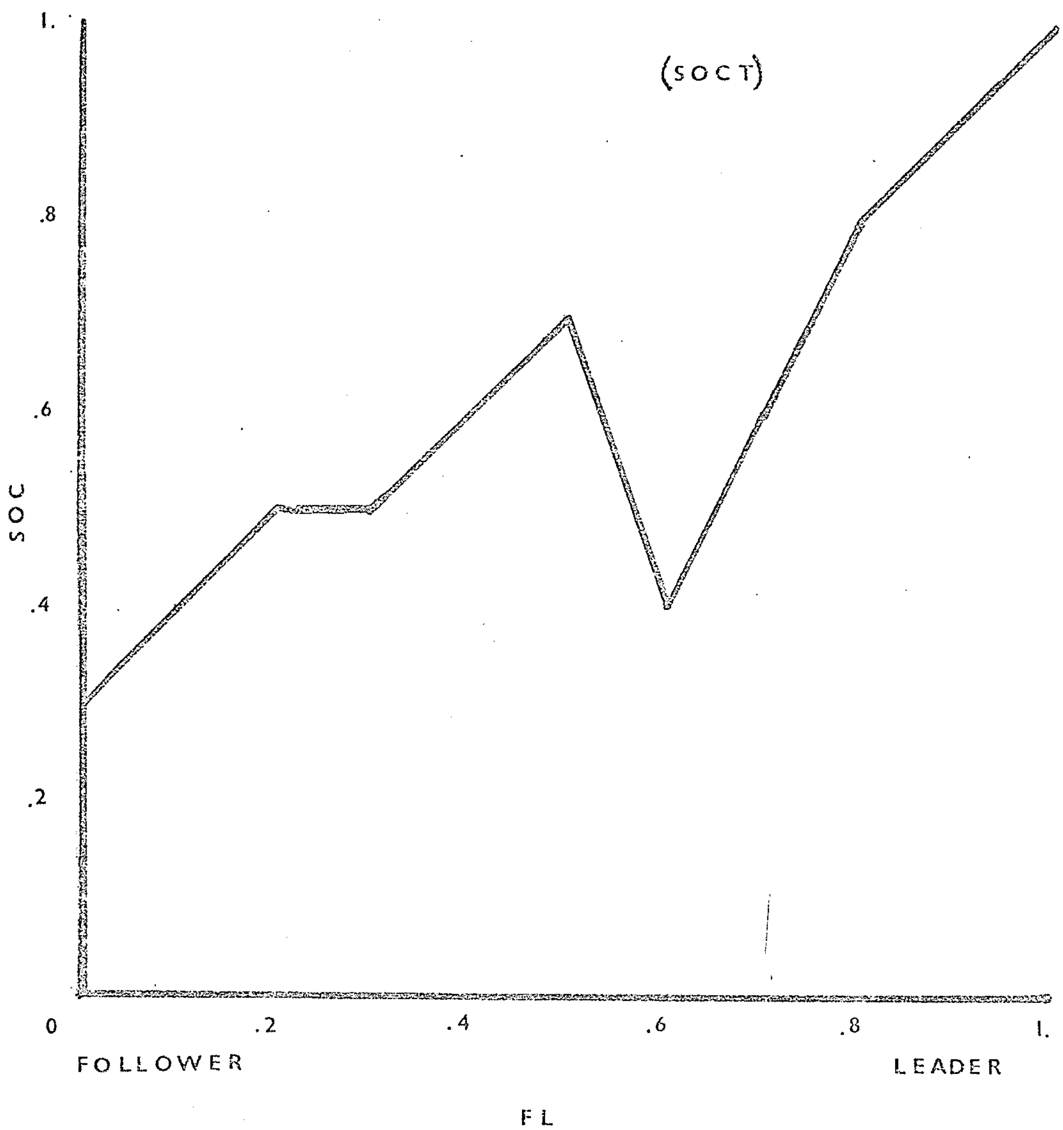
Figure 22 graphically describes the functional relationship existing between SOC and FL. The relationship is largely expressed in the form of a positive correlation between the two variables. In this instance, an increase along the continium toward leadership represents an increase in Social and Organizational intensity (SOC). However, it is postulated that there is a mid range along the continium where the social and organizational intensity is reduced. This would, perhaps, be representative of those individuals who are neither devoted followers nor aggressive leaders, and are somewhat hesitant in the acceptance of new products and ideas.

The exogenous variable, Time Pressure, is defined as the inverse of the amount of time the buyer has available to perform the behaviour required for the acts of purchasing and consumption. It is the amount of time required to perform these acts in relation to the time he has allocated to himself for doing them. It incorporates momentary instead of long term changes in the time available for purchasing. The model utilizes a similar conceptualization of Time Pressure, but views the pressure as a continium stretching from low to high pressure.

FIGURE 22

INDEX

VARIABLE	Type Of Equation	NAME
SOC	Auxiliary	Social & Organizational Setti
SOCT	Table	Social & Organizational Setting Table
FL	Auxiliary	Follower - Leader



SOCIAL & ORGANIZATIONAL

FIG. 22

Equations 55 through 55.2 describe the development of the exogenous variable Time Pressure (TIMP).

A	TIMP.K	=	TABHL(TIMPT,LH.K,0,1.0,.1)	55
T	TIMPT	=	.5/.6/.7/.8/.6/.5/.3/.4/.6/.8/1.0	55.1
A	LHK	=	.9	55.2

TIMP - Time Pressure (Dimensionless)
TIMPT - Time Pressure Table (Dimensionless)
LH - Low - High Pressure (Dimensionless)

Equation 55 describes a function determining the intensity of Time Pressure (TIMP) as related to the Low-High Pressure (LH). Equation 55.1 sets out the table of values which TIMP may assume depending, of course, on the low-high pressure point established. Equation 55.2 establishes the Low-High pressure initially at .9 which is associated with a value of .8 for TIMP.

Figure 23 portrays the functional relationship between the two variables graphically. The correlation is primarily positive with increasing Time Pressure as one moves along the LH axis. However, in the mid-range, a lower level of Time Pressure is emphasized to postulate a phenomena whereby individuals with neither very little pressure or a great deal of pressure lag in their proposed purchase behaviour.

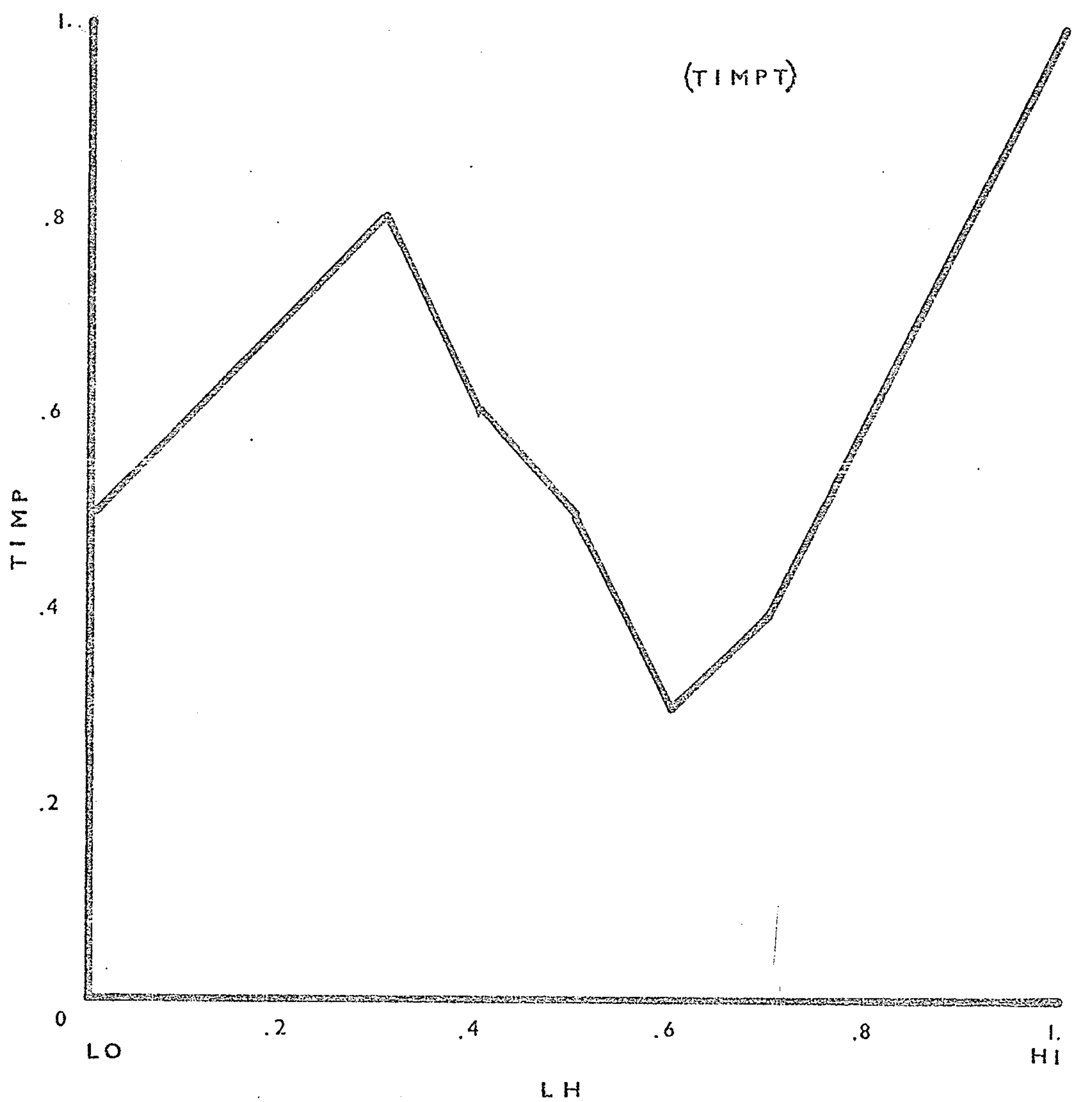
The last exogenous variable, Financial Status, is defined as a more exterior and less stable variable. It refers to the funds available for purchasing goods and services during some specified time period. Howard and Sheth (1969) assume that the funds normally arise from current income or saved past income. Earned income, they state, is probably an appropriate measure for most people, except those with an independent income.

The model has adopted a similar conceptualization of Financial

FIGURE 23

INDEX

VARIABLE	TYPE OF EQUATION	NAME
TIMP	Auxiliary	Time Pressure
TIMPT	Table	Time Pressure Table
LH	Auxiliary	Low-High



TIME PRESSURE

FIG. 23

Status, and has established a continium for such a status extending from tight to easy. It is difficult to use income levels as an indicator of purchase behaviour since individuals vary vastly in their behaviour even within a given income category. It would perhaps be more meaningful to use some multi-dimensional factor to define Financial Status, but for the purpose of this study and for simplicity, it is postulated that all consumers may be typified as being in an easy or tight money situation. For instance, in an easy money situation, a given consumer would be less tightly budgeted and not that concerned with spending an extra five to ten cents on a bar of soap if it met his/her needs more exactly.

Equations 56 through 56.2 are concerned with outlining the Financial Status of the consumer.

A	FIN.K	=	TABHL(FINT,TE.K,0,1.0,.1)	56
T	FINT	=	.1/.3/.6/.5/.5/.6/.7/.8/1.0/.9/.8	56.1
A	TE.K	=	.8	56.2

FIN - Financial Status (Dimensionless)
FINT - Financial Status Table (Dimensionless)
TE - Tight - Easy (Dimensionless)

Equation 56 is an auxiliary function defining the value of Financial Status (FIN) given the consumer's point on the Tight-Easy (TE) continium.

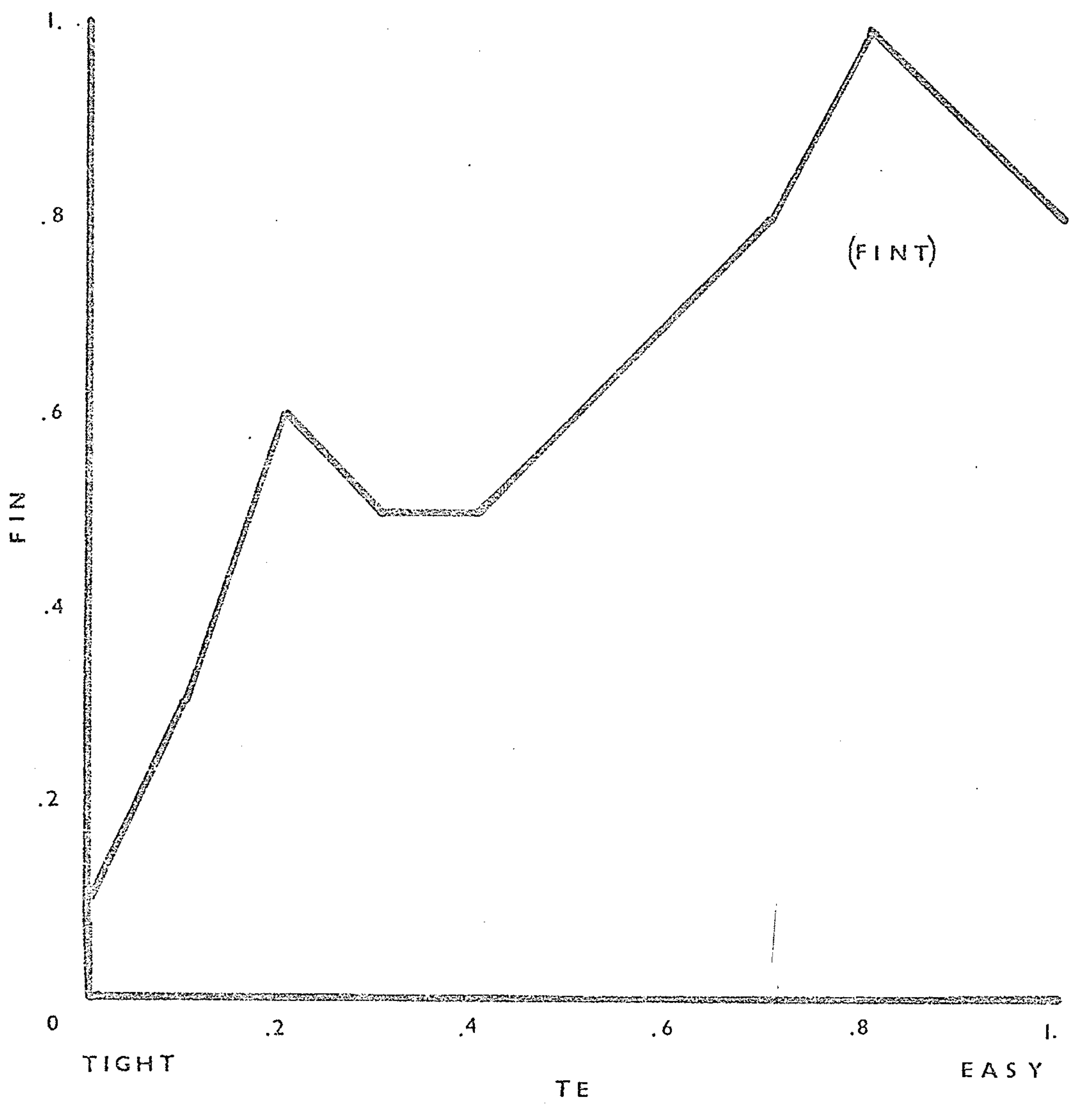
Equation 56.1 is the table of values which FIN may assume depending upon the point established on the Tight-Easy continium. Equation 56.2 is the point initially chosen on the TE continium, which is equated to a value of .9 of Financial Status.

Figure 24 is a graphical representation of the functional relationship between the two variables. The relationship portrayed is generally that of a positive correlation between the two variables. Under the tight money

FIGURE 24

INDEX

VARIABLE	TYPE OF EQUATION	NAME
FIN	Auxiliary	Financial Situation
FINT	Table	Financial Situation Table
TE	Auxiliary	Tight - Easy



FINANCIAL SITUATION

FIG. 24

situation Financial Status (FIN) is suppressed and purchase behaviour is somewhat deterred. However, as money becomes easier there is less suppression of purchase behaviour and FIN increases rapidly, but levels off and eventually declines when money becomes very easy. This is to reflect the fact that those individuals with a surplus of income become more cautious and conservative in their purchase behaviour.

This section has been designed to outline the seven exogenous variables and their internal functioning. It is important to note, however, that these variables are exogenous to the system and are, in fact, constant for the purpose of the simulation. Functional relationships have been established and outlined solely for the purpose of providing meaningful and logical relationships between the exogenous variable as well as suitable criteria for manipulation in testing the model.

As previously outlined, initial conditions have been established for each category, and correspondingly market segmentation data has been initialized for the model. In essence, a consumer with seven characteristics has been established. The consumer may be described as follows:

Variable	Value	Characteristic
Importance of Purchase	.6	Above Average
Culture	.9	Very close to average ind.
Social Class	.8	Upper middle
Personality	.8	Aggressive
Social & Organizational Setting	.9	Leader
Time Pressure	.8	High Pressure
Financial Status	1.0	Easy Money situation

This chapter has been devoted to the modelling of the subsystems in relation to the Theory of Buyer Behaviour (1969), according to the Systems Dynamics Methodology. Specific postulations and assumptions have been made within a logical framework to provide an operationalized model and to prepare the model for computer simulation. The next chapter is devoted to the description and analysis of the output behaviour of the simulation model as previously described.

CHAPTER V.

BEHAVIOUR OF THE MODEL

The basic model of the consumer, presented in the previous chapter, was a Systems Dynamics characterization or conceptualization of the Howard and Sheth (1969) Theory of Buyer Behaviour. The Theory of Buyer Behaviour as diagramatically represented in Figure 1 was redefined to outline the processes and feedback relationships more precisely. The outcome of this redefinition was pictorally represented in Figure 3. This then served as the baseline for establishing a model of the theory. In building this model certain assumptions and postulations were made concerning interrelationships between variables within the model. Furthermore, it was assumed that many purchase situations have some basic common characteristics.

The model has been presented in terms of precise mathematical relationships between variables in order to concretely define the processes and feedback behaviour involved. Excluding the postulations and assumptions made, the model represents a functional translation of The Theory of Buyer Behaviour, and for that reason little elaboration was made concerning the exact nature of the psychological, sociological, and social psychological ramifications of the theory on the model. At those points where assumptions and postulations were necessary, elaboration was made but merely for the purpose of providing a consistent and logical framework for the construction of the model, based on the theory as presented in The Theory of Buyer Behaviour (1969).

The purpose of this chapter is to present behavioural data output from the model on a subsystems as well as integrated basis. To obtain a better understanding of the exact working of the integrated model as well as to facilitate model building, the model was broken down and constructed on a subsystem basis. It is imperative then to examine the behaviour mode of each subsystem in advance of attempting to analyze the integrated model.

The simulation is designed to monitor the consumer's behaviour over a full year (52 weeks). In some cases equilibrium occurs earlier and the simulation is terminated at that point.

A. Input Subsystem

The input subsystem, as previously defined, can be thought of as the sum of all marketing efforts and social influences to which a given buyer is exposed. The key factor development within this subsystem surrounds that of the Stimulus Display, labelled (SM) within the simulation model. The mathematical relationships describing this subsystem are listed as follows:

A	QE.K	=	TABHL(QET,QUAL.K,0,10E3,1E3)	1
T	QET	=	0/0/0/1/3/4/6/7/8/8/8	1.1
A	QUAL.K	=	NORMRN(8E3,.1E3)	1.2
A	PE.K	=	TABHL(PET,PRICE.K,0,.5,.05)	2
T	PET	=	0/0/0/8/8/7/7/6/3/2/3	2.1
A	PRICE.K	=	NORMRN(.28,.02)	2.2
A	DE.K	=	TABHL(DET,DIS.K,0,10E3,1E3)	3
T	DET	=	0/1/1/1/2/4/6/8/9/10/10	3.1
A	DIS.K	=	NORMRN(8E3,.1E3)	3.2
A	SE.K	=	TABHL(SET,SER.K,0,10E3,1E3)	4
T	SET	=	0/4/5/5/5/5/5/5/5/6/6	4.1
A	SER.K	=	NORMRN(2E3,.5E3)	4.2
A	AE.K	=	TABHL(AET,AV.K,0,10E3,1E3)	5
T	AET	=	0/2/4/5/6/8/8/8/9/10/10	5.1
A	AV.K	=	NORMRN(6E3,.25E3)	5.2
A	SYMM.K	=	(QE.K)(PE.K)(DE.K)(SE.K)(AE.K)	6
A	QUALA.K	=	DLINF3(QE.K,5)	7
A	SERA.K	=	DLINF3(SE.K,14)	8
A	PEA.K	=	DLINF3(PE.K,3)	9

```
A   DEA.K   =   DLINF3(DE.K,4)                                    10
A   AEA.K   =   DLINF3(AE.K,3)                                    11
A   SIGM.K  =   (QUALA.K)(PEA.K)(DEA.K)(SERA.K)(AEA.K)            12
A   FAM.K   =   NORMRN(SIGM.K,.5E3)                               13
A   REF.K   =   NORMRN(SIGM.K,5E3)                                14
A   SO.K    =   NORMRN(SIGM.K,10E3)                               15
A   SSM.K   =   (FAM.K+REF.K+SO.K)/3                              16
A   SM.K    =   (SYMM.K+SIGM.K+SSM.K)*OVTS.K                      17
C   OVTS    =   5                                                 -
```

QE - Quality Emphasis (Units of "Energy")
QET - Quality Emphasis Table (Dimensionless)
QUAL - Quality Expenditure (Dollars)
PE - Price Emphasis (Units of "Energy")
PET - Price Emphasis Table (Dimensionless)
PRICE - Price level (cents)
DE - Distinctiveness Emphasis (Units of "Energy")
DET - Distinctiveness Emphasis Table (Dimensionless)
DIS - Distinctiveness Expenditure (Dollars)
SE - Service Emphasis (Units of "Energy")
SET - Service Emphasis Table (Dimensionless)
SER - Service Expenditure (Dollars)
AE - Availability Emphasis (Units of "Energy")
AET - Availability Emphasis Table (Dimensionless)
AV - Availability Expenditure (Dollars)
SYMM - Symbolic Stimuli Multiplier (Units of "Energy")
QUALA - Quality Emphasis Average (Units of "Energy")
SERA - Service Emphasis Average (Units of "Energy")
PEA - Price Emphasis Average (Units of "Energy")
DEA - Distinctiveness Emphasis Average (Units of "Energy")
AEA - Availability Emphasis Average (Units of "Energy")
SIGM - Significative Stimuli Multiplier (Units of "Energy")
FAM - Family Emphasis (Units of "Energy")
REF - Reference Group Emphasis (Units of "Energy")
SO - Society Emphasis (Units of "Energy")
SSM - Social Stimuli Multiplier (Units of "Energy")
SM - Stimulus Multiplier (Units of "Energy")
OVTS - Overt Search (Dimensionless)

Overt search is represented as a constant within the input subsystem since it is utilized within this subsystem and not defined within it. In reality it is a variable modulator of the stimulus multiplier but for the purposes of simulating a single subsystem it is assumed constant.

The behaviour mode characteristic of the model is characterized by numerical tables and graphical plots. For the purpose of describing the subsystems only numerical tables are utilized however, since only a few variables are involved and little fluctuation is evident.

The major variables and parameters within the Input Subsystem are numerically tabulated over a 50-week period as follows:

The Input Subsystem

TIME E+00	SYMM E+03	SIGM E+03	SSM E+03	SM E+03
.0	20.536	16.891	23.636	305.31
1.	20.260	16.906	18.680	279.23
2.	20.037	16.899	19.922	284.29
3.	19.503	16.904	24.805	306.06
4.	19.949	16.928	10.737	238.07
5.	20.309	17.006	21.829	295.72
6.	17.130	17.168	16.925	256.12
7.	20.259	17.294	18.382	279.67
8.	19.213	17.405	14.897	257.58
9.	17.629	17.547	19.526	273.51
10.	20.132	17.684	20.118	289.67
11.	20.374	17.842	18.800	285.08
12.	20.012	17.976	19.852	289.20
13.	18.128	18.128	20.515	283.85
14.	19.941	18.292	20.683	294.58
15.	20.218	18.483	20.815	297.58
16.	17.945	18.564	14.284	253.96
17.	20.238	18.627	18.058	284.61
18.	19.977	18.708	14.222	264.54
19.	19.280	18.742	21.603	298.12
20.	19.724	18.734	21.644	300.51
21.	18.932	18.655	22.777	301.83
22.	19.323	18.672	20.095	290.45
23.	18.540	18.674	22.729	299.71
24.	20.346	18.751	21.413	302.55
25.	17.676	18.878	17.210	268.82

TIME E*00	SYMM E*03	SIGM E*03	SSM E*03	SM E*03
26.	19.159	19.012	18.181	281.76
27.	18.393	19.029	22.885	301.53
28.	19.744	19.052	24.751	317.74
29.	18.312	19.175	17.921	277.04
30.	20.635	19.291	18.966	294.46
31.	18.341	19.276	20.767	291.92
32.	20.111	19.242	15.426	273.90
33.	13.765	19.220	14.483	237.34
34.	20.969	19.178	14.177	271.62
35.	20.142	19.097	16.210	277.25
36.	19.937	19.120	19.508	292.82
37.	19.929	19.150	16.719	278.99
38.	17.375	19.168	18.965	277.54
39.	20.808	19.180	16.571	282.80
40.	20.239	19.218	15.226	273.41
41.	20.518	19.250	18.915	293.42
42.	18.191	19.211	18.909	281.56
43.	19.512	19.229	23.791	312.66
44.	20.158	19.183	15.604	274.72
45.	19.711	19.141	17.494	281.72
46.	20.308	19.085	19.894	296.44
47.	16.899	19.066	22.411	291.88
48.	20.638	19.117	28.773	342.64
49.	13.908	19.128	19.992	265.14
50.	18.448	19.148	23.894	307.45

The four major factors of, SYMM, SIGM, SSM, and SM within the Input Subsystem exhibit very little variation under the period under consideration.

SYMM represents the symbolic stimuli communicated by the firm to the consumer. The variation is in fact due to the noise within the channel of communication and the shifting levels of the firm's expenditure on each of the factors comprising the symbolic stimuli.

SIGM represents the significative stimuli to which the buyer is exposed - specifically, brand contact itself. As would be expected, there is a build-up from approximately 16,000 units of "energy" to approximately 19,000 units as the buyer becomes more familiar with the product. There is some variation but on the whole the growth in familiarity overshadows the variation.

SSM represents the social stimuli multiplier, or rather the social influences converging on the buyer. Again, as would be logically expected, the buyer gains more information from social contact - "more" in the sense that he regards such information as relatively more valid and reliable. However, such information suffers from much distortion and the channel is often interrupted. The high degree of variation represented in SSM evidences this fact.

SM represents the stimulus display to which the buyer is exposed, it is the sum of the effects of its three components - SIGM, SYMM, and SSM. The SM is much higher in value than any of its components and exhibits a significant amount of fluctuation. It is important to note that SM is modulated by the level of Overt Search (OVTS), within the perceptual subsystem, but has been assumed constant in this instance. Thus it would be logical to assume that the variation would be magnified somewhat more, once the subsystems are interlocked.

In sum, this subsystem establishing the external stimuli communicated to the buyer is logical and consistent within expected buyer behaviour theories and is an adequate representation of the processes involved.

B. Perceptual Subsystem

The perceptual subsystem as previously outlined, is concerned with translating the external stimulus, the Stimulus Display (SM) into a stimulus as coded (SAC) which then becomes an input into the learning subsystem. The key factor developed within this subsystem is thus the stimulus as coded (SAC). The mathematical relationships describing this subsystem are listed as follows:

R	OVTSF.KL	=	(((IMP.K+TIMP.K+PERS.K)/3)*STA.K)*LOGN(MOTIVE.K)	18
L	OVTS.K	=	OVTS.J+(DT)(OVTSF.JK-OVTSA.JK)	18.1
N	OVTS	=	0	18.2
R	OVTSA.KL	=	(OVTSAN)(OVTS.K)	18.3
C	OVTSAN	=	.999	18.4
R	ATT.KL	=	(SM.K*STA.K)*LOGN(MOTIVE.K)	19
L	SP.K	=	SP.J+(DT)(ATT.JK-LOSS.JK)	19.1
N	SP	=	240000	19.2
R	LOSS.KL	=	(SP.K)(LOSSN)	19.3
C	LOSSN	=	.999	19.4
A	STA.K	=	TABHL(STAT,SM.K,0,800E3,80E3)	20
T	STAT	=	0/1/.9/.8/.75/.6/.5/.4/.3/.25/.2	20.1
A	CONTM.K	=	(SP.K)(1-STA.K)(LOGN(MOTIVE.K+AT.K+CON.K))	21
A	BIAS.K	=	TABHL(BIAST,CONTM.K,0,010E6,01E6)	21.1
T	BIAST	=	1/1/.9/.9/.8/.8/.6/.6/.3/.2/.1	21.2
R	ATR.KL	=	SAC.K*ATRN	22
C	ATTRN	=	.999	22.1
L	SAC.K	=	SAC.J+(DT)(PER.JK-ATR.JK)	22.2
N	SAC	=	0	22.3
R	PER.KL	=	BIAS.K*SP.K	22.4
C	AT	=	100	
C	SM	=	275000	
C	CON	=	10000	
C	MOTIVE	=	4500	

OVTSF - Overt Search Formation (Dimensionless)
OVTS - Overt Search (Dimensionless)
OVTSA - Overt Search Attrition (Dimensionless)

OVTSAN - Overt Search Attrition Normal (Dimensionless)
ATT - Attention (Units of "Energy")
SP - Stimulus Pool (Units of "Energy")
LOSS - Loss of Stimuli (Units of "Energy")
LOSSN - Stimuli Loss Normal (Dimensionless)
STA - Stimulus Ambiguity (Dimensionless)
STAT - Stimulus Ambiguity Table (Dimensionless)
CONTM - Contingency Multiplier (Dimensionless)
BIAS - Perceptual Bias (Dimensionless)
BIAST - Perceptual Bias Table (Dimensionless)
ATR - Attrition Rate (Units of "Energy")
ATRN - Attrition Rate Normal (Dimensionless)
SAC - Stimulus As Coded (Units of "Energy")
PER - Perception (Units of "Energy")
AT - Attitude (Internal Units of "Energy")
SM - Stimulus Multiplier (Units of "Energy")
CON - Confidence (Internal Units of "Energy")
MOTIVE - Motive (Internal Units of "Energy")

Attitude (AT), Stimulus Multiplier (SM), Confidence (CON), and Motives (MOTIVE) are represented as constants within the perceptual subsystem. They are formulated outside of this subsystem and correspondingly must be viewed as constants for the purpose of the simulation trials.

The behaviour mode characteristic of the perceptual subsystem is represented by a numerical table outlining the major variables of Overt Search (OVTS), Stimulus Pool (SP), Stimulus Ambiguity (STA), Contingency Multiplier (CONTM), Perceptual Bias (BIAS) and Stimulus As Coded (SAC), as follows:

Perceptual Subsystem

TIME E+00	OVTS E+00	SP E+03	STA E+00	CONTM E+03	BIAS E+00	SAC E+03
.0	.0000	240.0	.77812	510.6	1.0000	.0
1.	3.1333	1307.0	.77812	2780.6	.9000	524.4
2.	4.1260	1645.0	.77812	3499.8	.8500	1063.8
3.	4.4405	1752.1	.77812	3727.7	.8272	1313.1
4.	4.5402	1786.1	.77812	3799.9	.8200	1413.1
5.	4.5718	1796.8	.77812	3822.7	.8177	1451.1
6.	4.5818	1800.2	.77812	3830.0	.8170	1465.1
7.	4.5849	1801.3	.77812	3832.3	.8168	1470.2
8.	4.5859	1801.6	.77812	3833.0	.8167	1472.0

TIME E+00	OVTS E+00	SP E+03	STA E+00	CONTM E+03	BIAS E+00	SAC E+03
9.	4.5863	1801.8	.77812	3833.2	.8167	1472.6
10.	4.5864	1801.8	.77812	3833.3	.8167	1472.8
11.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
12.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
13.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
14.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
15.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
16.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
17.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
18.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
19.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
20.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
21.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
22.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
23.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
24.	4,5864	1801.8	.77812	3833.3	.8167	1472.9
25.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
26.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
27.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
28.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
29.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
30.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
31.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
32.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
33.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
34.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
35.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
36.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
37.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
38.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
39.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
40.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
41.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
42.	4.5864	1801.8	.77812	3833.3	.8167	1472.9

TIME E+00	OVTS E+00	SP E+03	STA E+00	CONTM E+03	BIAS E+00	SAC E+03
43.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
44.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
45.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
46.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
47.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
48.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
49.	4.5864	1801.8	.77812	3833.3	.8167	1472.9
50.	4.5864	1801.8	.77812	3833.3	.8167	1472.9

The variables as represented show no significant variation at all. This is logical and expected behaviour for this subsystem when viewed as separate and distinct from the other subsystems.

First of all it serves an information processing function for the individual and when it has a single constant input of information, (i.e., the stimulus multiplier (SM), one can expect little processing variation to occur.

Secondly, this subsystem is a modulator as well as a processor of information, i.e., as Needs (MOTIVE), Attitude (AT) and Confidence (CON) change, this subsystem reacts to either reduce or increase the flow of information into the individual. Since we have assumed the other variables as constants from the other subsystems, no variation is to be expected.

The only variation which occurs is to stabilize the variables from their initial starting conditions which is accomplished almost immediately.

Overt search (OVTS) stabilizes at 4.58 which is analogous to an individual being moderately staged for receiving information. The Stimulus Pool (SP) has reached equilibrium at 1.8 million units of "energy". Stimulus Ambiguity (STA) is quite high due to a high level of stimuli being communicated to the individual, i.e., very little of the display (SM) is actually reaching the individual. The Contingency Multiplier (CONTM) is quite high evidencing a high need level and attitude formation on the part of the consumer. This is indicative of a habit situation being enjoyed by the consumer, the result of which is a high level of Perceptual Bias (BIAS) further distorting the level of the Stimulus Pool (SP). The consequent mode of behaviour of the Stimulus As Coded (SAC) is thus logically expected to be low and correspondingly not of any great impact on the learning subsystem.

In total, this subsystem acts logically according to expected patterns of behaviour - i.e., with no fluctuations, and represents a logical and consistent conceptualization of the perceptual processes involved.

C. Learning Subsystem

The learning subsystem as previously defined is referred to as the heart of the theory - the idealistic hypothetical constructs. It is primarily concerned with the development of the internal characteristics of the consumer, which is accomplished both through the effects of the stimulus as coded (SAC) and through purchase and habit formation. The key factor developed within this subsystem is the variable Intention to Purchase (INT), as it is most closely related to purchase behaviour. The mathematical relationships describing this subsystem are listed as follows:

```
R   NF.KL     =  (((CULT.K+SOCL.K+PERS.K+FIN.K+SOC.K)/5)*STA.K)*(CON.K)
X                   +SQRT(SAC.K)+475000                                   23
L   MOTIVE.K  =  MOTIVE.J+(DT)(NF.JK-DR.JK)                               23.1
N   MOTIVE    =  15.1                                                     23.2
R   DR.KL     =  (MOTIVE.K)(DRN)+DELAY1(475000,2)                         23.3
C   DRN       =  .999                                                     23.4
R   CD.KL     =  MOTIVE.K*SAT.K+SQRT(SAC.K)                               24
L   CC.K      =  CC.J+(DT)(CD.JK-CA.JK)                                   24.1
R   CA.KL     =  CC.K*CAN                                                 24.2
C   CAN       =  .999                                                     24.3
N   CC        =  0.02E3                                                   24.4
R   BL.KL     =  ((IMP.K+CULT.K+SOCL.K+PERS.K+SOC.K)/5)                   25
X                  *SAT.K+SQRT(SAC.K)                                     25
L   BC.K      =  BC.J+(DT)(BL.JK-BCA.JK)                                  25.1
R   BCA.KL    =  BC.K*BCAN                                                25.2
C   BCAN      =  .999                                                     25.3
N   BC        =  14.77                                                    25.4
R   AF.KL     =  ((CULT.K+SOCL.K+SOC.K+PERS.K)/4*SAT.K+
X                  (BC.K)+(CC.K)/2                                        26
L   AT.K      =  AT.J+(DT)(AF.JK-AA.JK)                                   26.1
R   AA.KL     =  AT.K*ATN                                                 26.2
N   AT        =  .001                                                     26.3
C   ATN       =  .999                                                     26.4
```

A	MEME.K	=	SAT.K*AT.K*CON.K+SQRT(SAC.K)	27
R	RTB.KL	=	((CULT.K+SOCL.K+SOC.K+TIMP.K+FIN.K)/5)*MEME.K	27.1
L	INT.K	=	INT.J+(DT)(RTB.JK-RTBA.JK)	27.2
N	INT	=	500	27.3
R	RTBA.KL	=	INT.K*RTBAN	27.4
C	RTBAN	=	.999	27.5
A	PSAT.K	=	NORMRN(10,05)	28
R	SF.KL	=	P.K*PSAT.K	28.1
L	SAT.K	=	SAT.J+(DT)(SF.JK-SA.JK)	28.2
N	SAT	=	.001	28.3
R	SA.KL	=	SAT.K*SAN	28.4
C	SAN	=	1.00	28.5
R	CF.KL	=	SAT.K*BC.K	29
L	CON.K	=	CON.J+(DT)(CF.JK-CONA.JK)	29.1
R	CONA.KL	=	CON.K*CONAN	29.2
N	CON	=	2.0	29.3
C	CONAN	=	.999	29.4
C	STA	=	.778	-
C	SAC	=	1.4E6	-
C	P	=	1	-

NF	-	Need Formation (Internal Units of "Energy")
MOTIVE	-	Motive Level (" " " ")
DR	-	Drive Reduction (" " " ")
DRN	-	Drive Reduction Normal (Dimensionless)
CD	-	Choice Decision (Internal Units of "Energy")
CC	-	Choice Criteria (" " " "
CA	-	Choice Attrition (" " " ")
CAN	-	Choice Attrition Normal (Dimensionless)
BL	-	Brand Loyalty (Internal Units of "Energy")
BC	-	Brand Comprehension (" " " ")
BCA	-	Brand Comprehension Attrition (Internal Units of "Energy")
BCAN	-	Brand Comprehension Attrition Normal (Dimensionless)
AF	-	Attitude Formation (Internal Units of "Energy")
AT	-	Attitude Level (" " " ")
AA	-	Attitude Attrition (" " " ")
ATN	-	Attitude Attrition Normal (Dimensionless)
MEME	-	Modulator (")
RTB	-	Readiness to Buy (Internal Units of "Energy")
INT	-	Intention Level (" " " ")
RTBA	-	Readiness to Buy Attrition (" " " ")
RTBAN	-	Readiness to Buy Attrition Normal (Dimensionless)
PSAT	-	Purchase Satisfaction (Internal Units of "Energy")

SF	-	Satisfaction Formation	(Internal Units of "Energy")
SAT	-	Satisfaction Level	(" " " ")
SA	-	Satisfaction Attrition	(" " " ")
SAN	-	Satisfaction Attrition Normal	(Dimensionless)
CF	-	Confidence Formation	(Internal Units of "Energy")
CON	-	Confidence Level	(" " " ")
CONA	-	Confidence Attrition	(" " " ")
CONAN	-	Confidence Attrition Normal	(Dimensionless)
STA	-	Stimulus Ambiguity	(")
SAC	-	Stimulus as Coded	(Units of "Energy")
P	-	Purchase	(Units of Product)

The variables of Stimulus Ambiguity (STA), Stimulus As Coded (SAC) and Purchase (P) have been included as constants with this subsystem since they are defined outside. For the purpose of simulation, purchase was set at zero, so as to stabilize the system at an equilibrium level. The output behaviour of the Learning Subsystem is tabulated as follows:

The Learning Subsystem

TIME E+00	MOTIVE E+00	CC E+00	BC E+00	AT E+00	MEME E+00	INT E+00	SAT E-03	CON E+00	P E+00
.0	15.1	20.0	14.8	.0	1183.2	500.0	1.0000	2.0000	0.
1.	814.5	815.6	813.8	317.1	1183.4	870.5	.3164	.7959	0.
2.	1067.5	1067.7	1067.0	754.3	1183.3	987.9	.1001	.3765	0.
3.	1147.5	1147.5	1147.2	999.5	1183.2	1025.1	.0317	.1659	0.
4.	1172.8	1172.7	1172.6	1111.0	1183.2	1036.8	.0100	.0681	0.
5.	1180.7	1180.7	1180.7	1157.0	1183.2	1040.5	.0032	.0265	0.
6.	1183.2	1183.2	1183.2	1174.9	1183.2	1041.7	.0010	.0100	0.
7.	1184.0	1184.0	1184.0	1181.7	1183.2	1042.1	.0003	.0037	0.
8.	1184.3	1184.3	1184.3	1184.2	1183.2	1042.2	.0001	.0013	0.
9.	1184.4	1184.4	1184.4	1185.1	1183.2	1042.3	.0000	.0005	0.
10.	1184.4	1184.4	1184.4	1185.4	1183.2	1042.3	.0000	.0002	0.
11.	1184.4	1184.4	1184.4	1185.5	1183.2	1042.3	.0000	.0001	0.
12.	1184.4	1184.4	1184.4	1185.5	1183.2	1042.3	.0000	.0000	0.
13.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
14.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
15.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.

TIME E+00	MOTIVE E+00	CC E+00	BC E+00	AT E+00	MEME E+00	INT E+00	SAT E-03	CON E+00	P E+00
16.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
17.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
18.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
19.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
20.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
21.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
22.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
23.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
24.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
25.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
26.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
27.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
28.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
29.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.
30.	1184.4	1184.4	1184.4	1185.6	1183.2	1042.3	.0000	.0000	0.

The variables as presented, and within the framework of a single sub-system, show little or no variation. This is a logical conclusion, given that there is no fluctuation in the incoming stimuli (SAC) and no repeat purchase behaviour possible. The variables merely reorient themselves from their initial condition and establish equilibrium.

The level of Motives (MOTIVE) sets the pace for all other variables. The incoming stimuli (SAC) is the only factor developing Brand Comprehension (BC), Choice Criteria (CC), Attitude (AT), and Intention (INT).

As can be easily seen, with no purchase behaviour, Purchase Satisfaction (SAT) and Confidence (CON) quickly fall to zero. The impact of these two variables completely inhibits the learning processes and it is solely up to the incoming stimuli to initiate a trial purchase.

Intention (INT), Motives (MOTIVE), Attitude (AT), Choice Criteria (CC), and Brand Comprehension (BC) are all at a somewhat similar level. This is a reflection of the missing links - the purchase and the variation in incoming information. All these internal characteristics exhibited by the buyer logically would not differ either in reality. The level of need the buyer has toward a particular product, his cognitions toward the product class and the brand itself, would not differ - all he displays is what he receives by way of incoming stimulii - the SAC.

The behaviour mode characteristic of the Learning Subsystem, given the factors held constant, is a realistic characterization of the situation confronting a given buyer. In sum, this subsystem represents a logically consistent framework viewing consumer behaviour and learning.

D. Output Subsystem

The output subsystem as previously described is the simplest and smallest of all subsystems yet it contains the key to the dynamic characteristics of buyer behaviour - purchase. Through purchase behaviour and potential resultant satisfaction, habit formation may occur thus creating purchase cycles and reducing the flow of external information reaching the consumer.

As previously outlined, the model treats purchase behaviour as a threshold concept, whereby if insufficient intention to purchase (INT) is available a purchase will not occur.

The output subsystem is described in Equation 40.

$$P.K = CLIP(1,0.INT.K,X) \qquad 40$$

P - Purchase (Units of Product)
INT - Intention to Purchase (Units of Internal "Energy")
X - Purchase Threshold (Units of Internal "Energy")

The output behaviour mode for this subsystem is not shown due to the size and nature of the data. The output data for purchase would be a zero or a one, depending upon the level of intention to purchase (INT) on the part of the consumer.

A one or a zero for purchase behaviour has been utilized to maintain consistency with the nature of the product as previously described. Generally speaking, the paper is concerned with a consumer staple or convenience good which is bought regularly, such as a carton of milk or a bar of soap. The focus or concern of this paper primarily is with purchase or non-purchase behaviour as opposed to quantity purchases versus single item purchases, associated lags, increased consumption rates, and so forth.

The output intervening variables of Attention', Brand Comprehension', Attitude', and Intention' are widely used in marketing research as dependent variables. For the purpose of this paper, as regards defining interaction between the firm and the consumer as outside the boundary of the system under consideration, these intervening variables have been omitted; their counterparts, existing as hypothetical constructs within the learning subsystem, reflect adequately the hierarchy of effects discussed previously.

The threshold parameter X, outlined heretofore, as an experimental parameter, sets an arbitrary level which intention to purchase (INT) must equal or surpass before purchase behaviour may occur. The following chapter will deal more closely and analyze the impact of this experimental parameter.

E. Exogenous Variables Subsystem

The exogenous variables subsystem, as previously defined, serves the important function of delimiting the area of discourse, reducing error, and enhancing communication effectiveness. The exogenous variables as described, thereby establish the characteristics of the consumer under consideration, that is, they provide market segmentation data on the consumer.

The exogenous variables are, as defined within the Systems Dynamics Methodology, external to the system under consideration. They do not interact or feed back to the variables within the system, but are merely impinging forces from outside the system.

The modelling of the exogenous variables subsystem described a set of seven variables which were treated as independent variables functionally related to another set of dependent variables. In essence, for the purpose of the simulation trials, they act solely as constants. However, for the purposes of testing and analysis, a logical and consistent framework for their development was provided in order to aid in the understanding of their intricate relationship with the system under consideration and link them more closely with marketing principles and theory.

The mathematical equations formulating and describing the exogenous variables subsystem are listed as follows:

```
A   IMP.K    =  TABHL(IMPT,PC.K,0,1.0,.1)                    50
T   IMPT     =  .6/.7/.8/.3/.5/.6/.5/.7/.8/.8/1.0            50.1
A   PC.K     =  0                                            50.2
A   CULT.K   =  TABHL(CULTT,DV.K,0,1.0,.1)                   51
T   CULTT    =  1.0/.9/.25/.2/.15/.1/.09/.075/.05/.025/0     51.1
A   DV.K     =  .1                                           51.2
```

```
A   SOCL.K   =  TABHL(SOCLT,LU.K,0,1.0,.1)                 52
T   SOCLT    =  .6/.7/.8/.9/.4/.5/.6/.7/.8/.9/1.0          52.1
A   LU.K     =  .8                                         52.2
A   PERS.K   =  TABHL(PERST,TA.K,0,1.0,.1)                 53
T   PERST    =  .1/.1/.2/.2/.3/.3/.4/.4/.5/.7/1.0          53.1
A   TA.K     =  .9                                         53.2
A   SOC.K    =  TABHL(SOCT,FL.K,0,1.0,.1)                  54
T   SOCT     =  .3/.4/.5/.5/.6/.7/.4/.6/.8/.9/1.0          54.1
A   FL.K     =  .9                                         54.2
A   TIMP.K   =  TABHL(TIMPT,LH.K,0,1.0,.1)                 55
T   TIMPT    =  .5/.6/.7/.8/.6/.5/.3/.4/.6/.8/1.0          55.1
A   LH.K     =  .9                                         55.2
A   FIN.K    =  TABHL(FINT,TE.K,0,1.0,.1)                  56
T   FINT     =  .1/.3/.6/.5/.5/.6/.7/.8/1.0/.9/.8          56.1
A   TE.K     =  .8                                         56.2
```

This subsystem is related to the other subsystems quite closely and due to the nature of its output behaviour, i.e., constant, it was included in the simulation trials for the individual subsystems. The logic being that, had this subsystem not been included, they would have had to be assumed as constants, which, in reality they are.

The output behaviour of this subsystem, given the nature of the consumer market segmentation data as previously specified, is as follows:

<u>The Exogenous Variables Subsystem</u>

TIME E+00	IMP E+00	CULT E+00	SOCL E+00	SOC E+00	TIMP E+00	FIN E+00	PERS E+00
.0	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
1.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
2.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
3.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
4.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
5.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000

TIME E+00	IMP E+00	CULT E+00	SOCL E+00	SOC E+00	TIMP E+00	FIN E+00	PERS E+00
6.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
7.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
8.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
9.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000
10.	.60000	.90000	.80000	.90000	.80000	1.0000	.70000

The output data was terminated after ten weeks to avoid unnecessary duplication of constant data output. Each variable is expressed as a constant, having no interaction within the system and assuming no interaction with its associated exogenous variables except as specified by the researcher compiling the input data.

The segmentation data specified by the researcher do not necessarily have to be a rigidly constant set but must at least conform to some logical interrelationships between variables. For instance, it would be somewhat illogical to assume a consumer characterized as timid on the variable Personality (PERS) and leader on the Social or Organizational Setting (SOC) variable.

The important point to note within this subsystem is that the variables described represent segmentation data specifying the characteristics of the consumer. They do not have an exacting set of interrelationships but should at least be specified according to a logical framework. The exogenous variables are to be construed as being external to the system and correspondingly constants thoughout the simulation trials. Should a model be developed whereby the purpose is to describe and analyze the changing nature of a consumer's behaviour over a specified life span, then these variables must be considered as constructs within the system and interacting and feeding back within and between each other.

F. The Integrated Model

The behaviour mode of the integrated model is a complex manifestation of the behaviour of each of the five subsystems of Input, Perception, Learning, Exogenous Variables and Output. Each of these subsystems, as previously described, behaved in a very static, non-fluctuative manner when viewed as separate and distinct entities.

The behaviour of the integrated model should essentially fall into one of two categories, growth, or stagnation and equilibrium. No attempt at this point has been made, however, to provide either standard model. Rather, a situation has been described wherein a firm expends X-number of dollars to establish its marketing mix, a consumer is faced with a given social situation, and the consumer is described as having certain characteristics. The interplay of these variables within the perceptual, learning, and purchase subsystems then constitutes the behaviour mode characteristic of the model.

The set of mathematical equations, describing the entire model are listed in full in Appendix A. As may be evident, no longer are any constants assumed, all factors representing constructs within the model are formulated through interaction and feedback relationships.

The behaviour mode in this situation is best portrayed both by numerical tables and graphical plots. The numerical tables are outlined in Table I. The graphical plots are accordingly outlined in Figures 25, 26, 27, 28, 29 and 30. To simplify discussion and analysis of the behaviour of the model, the graphical plots will be used most extensively with only minor references to the tables.

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TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	CVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03 / E+09	E+03 / E+06	E+03 / E+00	E+03 / E+03	E+00 / E+00	E+03	E+00	E+03	E+00	E+03	E+03	E+03	E+00	E+03
.0	20.536	16.891	23.636	305.31	5.0000	240.0	.75918	164.1	1.0000	1400.0	.015	.02	14.8	.000
	.000	.0	.001	.002	.0000									
1.	19.022	16.906	22.899	227.50	3.8673	746.6	.81562	966.5	1.0000	768.6	.684	.68	682.9	.436
	.000	.0	.000	.001	.0000									
2.	19.673	16.942	23.901	224.80	3.8800	1035.7	.80649	1495.6	.9504	862.1	.825	.83	825.0	.916
	.000	.0	.000	.000	.0000									
3.	20.158	16.965	13.648	200.58	3.9508	1135.8	.84927	1309.9	.9690	1004.8	.920	.92	919.7	1.184
	.000	.0	.000	.000	.0000									
4.	18.043	16.926	16.336	205.55	4.0064	1182.5	.84307	1440.0	.9560	1074.8	.989	.99	989.0	1.355
	.000	.0	.000	.000	.0000									
5.	19.872	16.969	18.538	225.85	4.0782	1180.5	.81768	1683.4	.9317	1125.7	1.029	1.03	1028.7	1.465
	.000	.0	.000	.000	.0000									
6.	19.958	17.024	18.395	224.55	4.0548	1224.3	.81932	1738.0	.9262	1131.9	1.052	1.05	1051.6	1.532
	.000	.0	.000	.000	.0000									
7.	18.360	17.139	11.542	188.26	4.0020	1272.0	.86468	1355.5	.9644	1144.1	1.061	1.06	1061.5	1.570
	.000	.0	.000	.000	.0000									
8.	17.629	17.223	19.207	216.97	4.0132	1272.4	.82879	1718.3	.9282	1156.1	1.072	1.07	1071.9	1.592
	.000	.0	.000	.000	.0000									
9.	20.195	17.382	17.220	222.14	4.0538	1252.1	.82233	1756.4	.9244	1173.6	1.078	1.08	1077.6	1.607
	.000	.0	.000	.000	.0000									
10.	18.336	17.618	18.609	225.36	4.1302	1205.4	.81830	1762.3	.9238	1176.0	1.084	1.51	1084.1	1.618
	.003	.0	4.190	.422	1.0000									
11.	19.014	17.861	12.735	205.17	4.1356	1298.5	.84354	1815.8	.9184	1144.2	1.982	5.43	1080.6	2.317
	.052	9.7	6.748	3.314	1.0000									
12.	17.464	18.064	22.935	259.16	4.4290	1397.1	.78803	2900.4	.9000	1189.8	4.103	21.63	1084.9	5.474
	.549	125.9	12.005	8.348	1.0000									
13.	20.031	18.202	20.897	273.97	4.6333	1643.6	.77877	3763.0	.8237	1278.0	6.506	48.75	1109.3	13.679
	1.815	637.7	12.019	11.039	1.0000									
14.	20.199	18.326	14.337	253.52	4.7913	1814.7	.79155	4081.3	.8000	1369.6	8.410	80.74	1142.4	26.821
	4.512	2041.2	12.658	13.290	1.0000									
15.	19.493	18.429	13.476	251.15	4.8862	1942.9	.79303	4417.5	.8000	1450.1	9.322	80.12	1176.9	38.586
	3.705	2849.5	8.631	11.124	1.0000									
16.	19.977	18.531	14.046	258.47	4.9181	1981.1	.78846	4633.5	.8000	1512.8	8.968	92.14	1212.2	42.144
	5.003	3821.1	9.712	12.222	1.0000									

THE INTEGRATED MODEL

TABLE I

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TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	CVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
17.	19.722	18.621	19.936	287.19	4.9278	2000.1	.77051	5129.9	.7740	1541.3	9.568	107.71	1235.8	47.574
	8.064	5513.8	11.886	14.261	1.0000									
18.	17.742	18.707	20.501	282.09	4.9533	2033.6	.77370	5177.1	.7646	1523.3	10.236	107.93	1246.8	52.995
	5.893	6301.1	8.186	13.585	1.0000									
19.	19.857	18.781	17.775	280.98	4.9808	2025.3	.77439	5136.0	.7728	1538.4	9.929	106.23	1247.7	53.093
	7.633	6219.6	10.985	13.087	1.0000									
20.	19.283	18.772	18.089	279.41	4.9767	2030.2	.77537	5128.1	.7744	1525.3	9.884	104.68	1251.1	53.635
	7.739	6281.7	11.148	12.943	1.0000									
21.	20.051	18.746	10.652	247.20	4.9991	1997.8	.79550	4608.5	.8000	1561.4	10.129	114.30	1251.8	54.903
	9.529	7153.2	12.220	14.203	1.0000									
22.	18.769	18.790	20.480	289.49	4.9878	2039.7	.76907	5326.9	.7346	1513.1	10.412	113.96	1252.8	57.331
	8.532	7433.3	10.781	13.804	1.0000									
23.	19.740	18.904	20.820	296.63	4.9885	2048.5	.76460	5443.1	.7114	1505.1	10.249	102.51	1244.1	57.363
	4.936	6682.5	7.029	12.244	1.0000									
24.	18.393	18.992	22.848	298.72	4.9594	2050.5	.76330	5417.8	.7164	1507.8	9.146	85.03	1239.9	50.846
	5.526	4964.2	10.400	10.451	1.0000									
25.	19.977	19.085	21.465	297.79	4.9199	2030.8	.76388	5333.4	.7333	1524.1	8.870	87.32	1235.3	47.182
	5.833	4819.5	10.644	11.615	1.0000									
26.	20.325	19.151	18.970	289.86	4.9595	1963.9	.76884	5074.9	.7850	1562.2	9.474	104.86	1246.7	47.949
	7.863	5948.8	11.582	14.159	1.0000									
27.	18.668	19.233	18.144	279.64	4.9892	1986.3	.77522	5043.4	.7913	1566.6	10.614	120.98	1256.6	54.514
	10.999	7635.4	13.119	15.379	1.0000									
28.	17.723	19.280	24.832	309.08	4.9984	2038.9	.75683	5638.3	.6723	1514.1	11.130	125.42	1248.6	60.921
	8.359	8579.8	9.266	14.807	1.0000									
29.	19.591	19.300	20.347	255.32	4.9852	2088.2	.76543	5543.4	.6913	1458.4	10.398	104.48	1230.3	59.835
	7.104	6980.8	9.915	11.974	1.0000									
30.	16.471	19.370	20.827	280.68	4.9531	2079.3	.77457	5247.3	.7505	1463.0	9.285	83.63	1221.5	53.532
	3.247	5132.8	6.121	9.910	1.0000									
31.	19.539	19.371	17.852	279.17	4.9183	2016.6	.77552	4957.7	.8000	1540.2	7.634	60.23	1230.5	41.560
	2.583	3000.5	7.907	7.860	1.0000									
32.	19.937	19.306	19.693	287.40	4.8765	1933.2	.77038	4816.1	.8000	1564.9	7.270	60.63	1248.4	34.850
	3.176	2559.2	9.700	9.396	1.0000									
33.	20.433	19.246	17.893	276.93	4.8101	1992.3	.77692	4839.7	.8000	1553.8	7.858	71.13	1251.8	34.190
	4.197	2954.5	10.624	11.556	1.0000									
34.	20.219	19.154	25.191	316.86	4.9078	1929.5	.75196	5274.8	.7450	1561.7	9.117	87.49	1258.2	38.842
	6.285	3954.2	12.245	12.213	1.0000									

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TIME	SYMM	SIGM	SSM	SM	CVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CCN	P									
35.	20.368	19.125	15.072	267.01	4.8935	2045.2	.78312	4949.8	.8000	1504.4	9.978	102.03	1255.5	46.366
	8.140	5226.9	12.660	13.867	1.0000									
36.	18.480	19.147	13.762	254.49	4.9523	2054.7	.79094	4858.5	.8000	1507.3	10.798	126.98	1252.7	55.092
	12.226	7646.2	14.065	15.778	1.0000									
37.	19.911	19.130	12.513	257.91	5.0028	2060.6	.78881	4976.6	.8000	1488.5	11.623	139.45	1245.9	64.987
	10.550	9897.4	10.178	15.949	1.0000									
38.	20.198	19.056	20.775	299.38	4.9872	2094.5	.76289	5666.1	.6668	1444.8	11.057	117.36	1242.2	66.288
	7.116	8497.1	8.379	12.810	1.0000									
39.	17.779	19.043	19.331	280.90	5.0023	2050.6	.77444	5222.6	.7555	1492.5	9.790	99.40	1227.0	59.015
	6.113	6615.3	9.176	11.289	1.0000									
40.	19.711	18.963	17.316	275.98	4.9292	2072.6	.77751	5162.1	.7676	1471.8	9.057	90.57	1232.4	52.488
	6.013	5557.4	10.228	11.200	1.0000									
41.	16.753	18.966	22.526	287.17	4.9303	2017.7	.77052	5166.5	.7667	1533.2	9.021	94.40	1232.1	48.683
	6.319	5502.8	10.426	12.450	1.0000									
42.	17.669	19.021	21.855	287.63	4.9130	2043.2	.77023	5256.6	.7487	1517.4	9.486	106.53	1243.5	49.332
	9.900	6262.0	14.232	14.100	1.0000									
43.	19.456	19.080	14.424	261.72	4.9418	2058.9	.78643	4980.5	.8000	1500.2	10.644	129.58	1241.6	56.127
	13.537	8554.6	14.865	16.225	1.0000									
44.	19.488	19.185	20.626	298.38	5.0318	2028.1	.76351	5478.4	.7043	1538.2	11.559	134.32	1246.1	64.400
	10.502	9749.9	10.604	15.378	1.0000									
45.	20.790	19.206	20.298	304.06	5.0429	2050.5	.75996	5620.6	.6759	1508.6	11.117	128.13	1240.3	65.830
	9.073	9347.2	9.753	14.133	1.0000									
46.	19.640	19.152	20.829	294.94	4.9469	2119.8	.76566	5647.5	.6705	1398.9	10.355	113.57	1231.4	63.519
	7.566	8133.4	9.351	12.737	1.0000									
47.	15.624	19.210	24.437	294.11	4.9621	2068.0	.76618	5456.8	.7086	1454.7	9.703	101.93	1207.7	57.972
	6.696	6895.2	9.656	11.961	1.0000									
48.	19.275	19.188	14.577	261.83	4.9365	2055.6	.78635	4921.1	.8000	1479.2	9.207	93.98	1213.9	52.715
	5.997	5879.1	9.814	11.592	1.0000									
49.	20.446	19.129	21.212	298.62	4.9125	2050.1	.76337	5414.6	.7171	1496.3	9.026	93.74	1229.3	49.212
	7.092	5482.1	11.879	12.131	1.0000									
50.	18.936	19.085	23.190	302.88	4.9480	1999.3	.76070	5355.7	.7289	1542.4	9.539	102.36	1237.8	49.806
	9.072	6037.7	13.601	13.392	1.0000									

Figure 25 outlines the behaviour of the three variables comprising the stimulus display, SYMM, SIGM and SSM. The behaviour of these variables outlined previously, is highly independent of the working of the consumer inasmuch as they could be treated as exogenous variables rather than inputs.

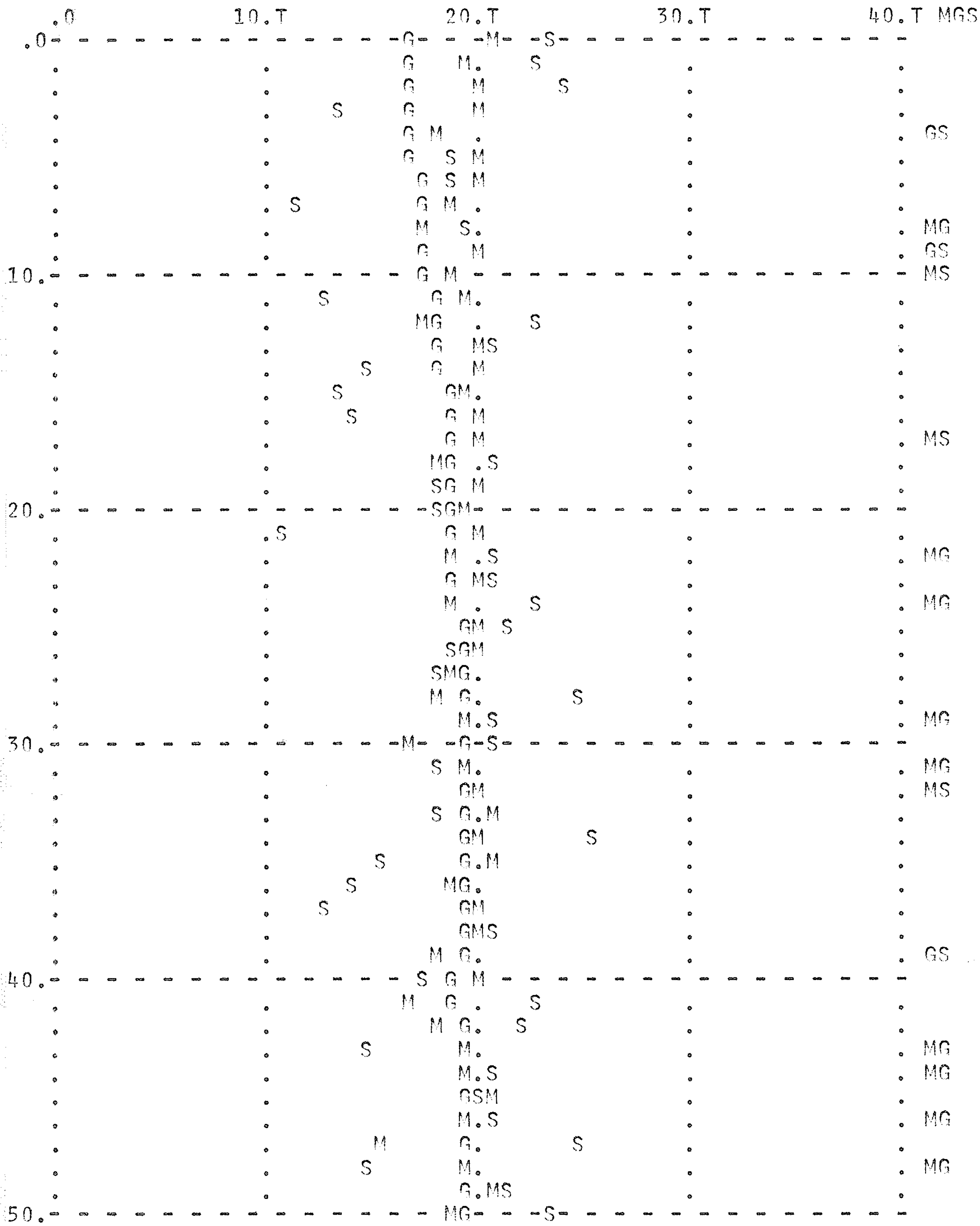
As is graphically displayed, these variables maintain a mean of approximately 20 thousand units of "energy" with SSM displaying the largest deviation around the mean. The behaviour evident here is an exact replica of its behaviour when viewed as a separate and distinct entity.

Figure 26 outlines the behaviour of OVTS, STA, BIAS, P, and SAT. Overt Search (OVTS) increases slightly from approximately 4 to 5 after a Purchase (P) occurs in the 10th week. This reflects increased Motive levels after purchase has occurred. It is important to note, however, that no marked increase occurs thereafter, i.e., it stabilizes at approximately 5. Satisfaction (SAT) is shown to be nonexistant until the purchase has occurred, where it fluctuates with a mean of ten units of internal "energy" and a standard deviation of 5 units. The point being that satisfaction is contingent upon the purchase and fluctuates thereafter. Stimulus Ambiguity (STA) may be seen more clearly in Table I. STA reaches a high of approximately.86 before purchase occurs and thereafter remains at a value less than .8. This reflects a reduced level of stimuli in the display and a consequent narrowing of the stimuli actually reaching the consumer. It is in the first 9 weeks of pre-purchase that the consumer is deluged with information and that the stimulus ambiguity is greatest.

Perceptual Bias (BIAS) is least during the first 16 weeks, i.e., a great deal of information is allowed through to eventually become an s-a-c. The tapering off occurs, however, after purchase in the 10th week and con-

1/22/73 APPLE

M,SIGM=G,SSM=S



THE INTEGRATED MODEL

FIG. 25

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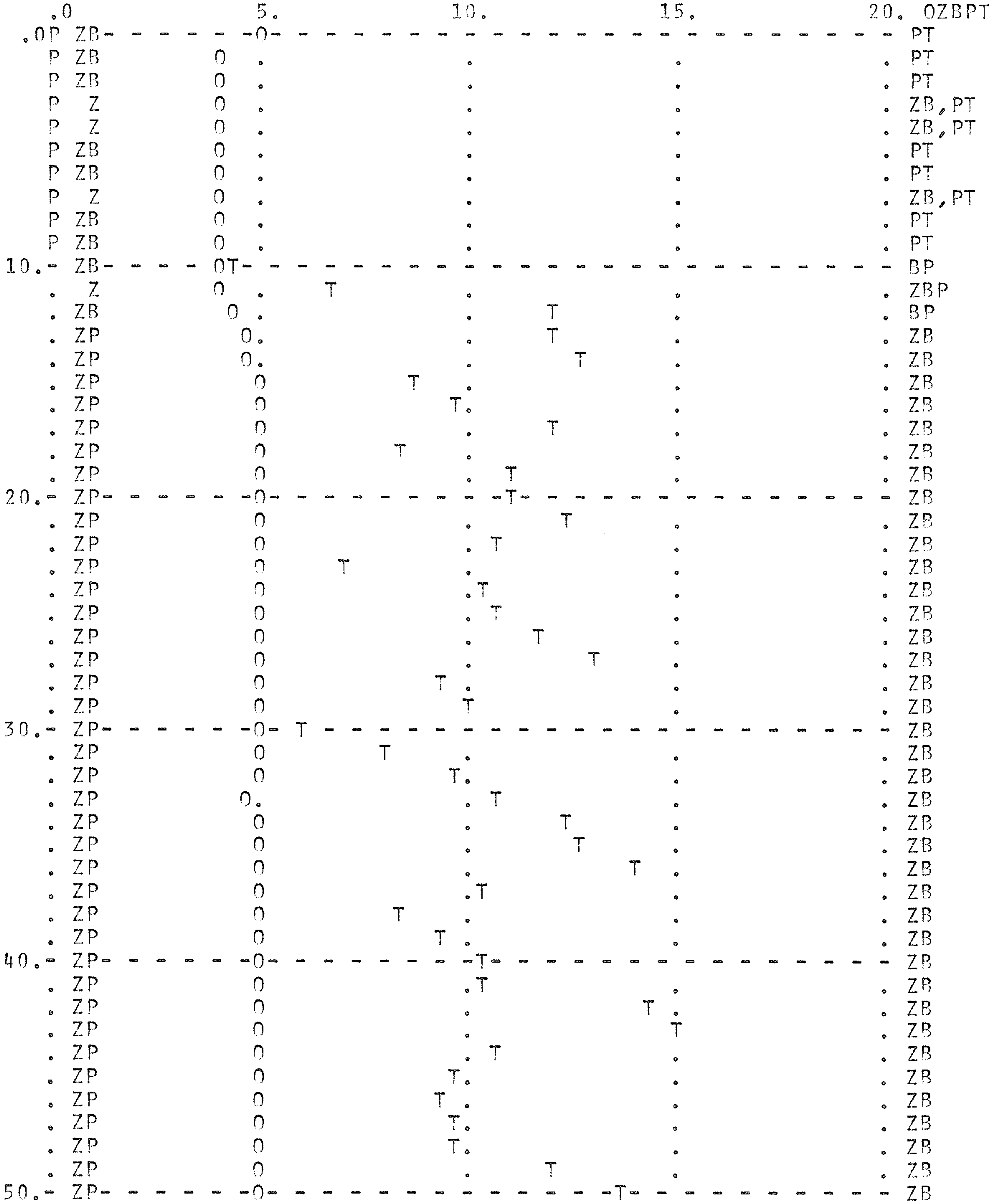
=0,STA=Z,BIAS=B,P=P,SAT=T



THE INTEGRATED MODEL

FIG. 26

tinues dropping, reaching somewhat of an equilibrium with some variation occuring. Perceptual Bias is inextricably related to the level of the contingency multiplier, and as the multiplier increases through the formation of Motives, Attitude, and Confidence, more bias is introduced into the system allowing less stimuli to finally be internalized.

Figure 27 traces the behaviour of MOTIVE, CC, BC, AT, and CON. For the first ten weeks before purchase all these state variables exhibit such a minimal degree of existence that they are at the bottom of the scale in Figure 25. Choice Criteria (CC) is the first variable to establish itself after purchase, followed closely by Attitude (AT). Choice Criteria and Attitude follow a similar pattern in their behaviour mode - they establish themselves, reach equilibrium, and fluctuate around this level. Motive, Brand Comprehension and Confidence also follow the same pattern but exhibiting, however, a lower level of internal units of "energy".

Figure 28 traces the development of Intention (INT), the main factor leading to purchase behaviour. The graph shows a very low level of intention before the tenth week. Intention slowly builds up until the tenth week when a purchase is established and intention stabilizes at a very high level with significant fluctuation, but insufficient to reverse the purchase habit and cause stagnation.

Figure 29 traces the behaviour of the Stimulus Multiplier (SM) or Stimulus Display to which the consumer is exposed. It is somewhat counter-intuitive to notice that the level of stimuli to which the consumer is exposed actually increases after the purchase in the tenth week. One would logically assume that the consumer would attempt to avoid any and all such stimuli. The factor which crucially determined the increase here was the

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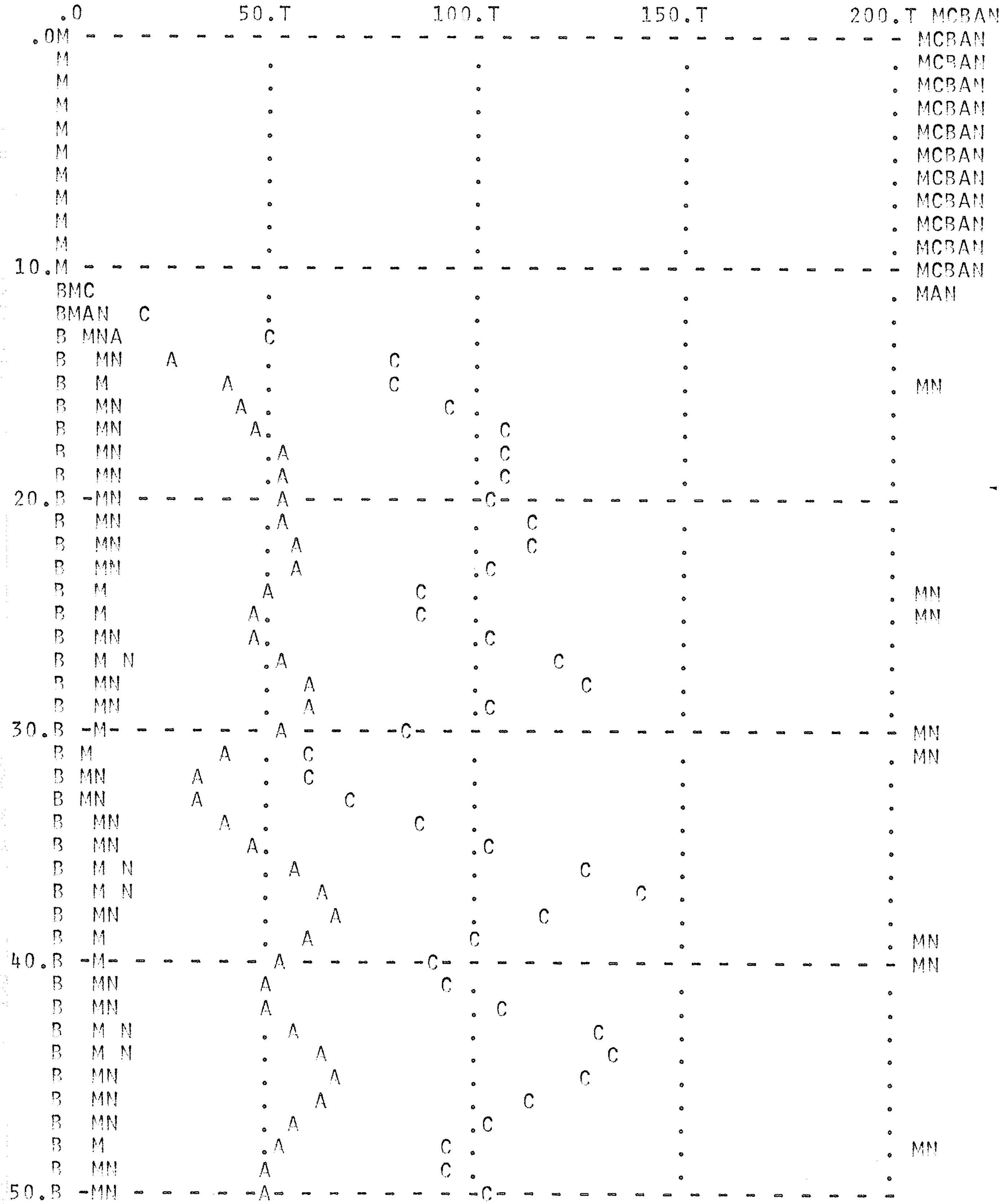
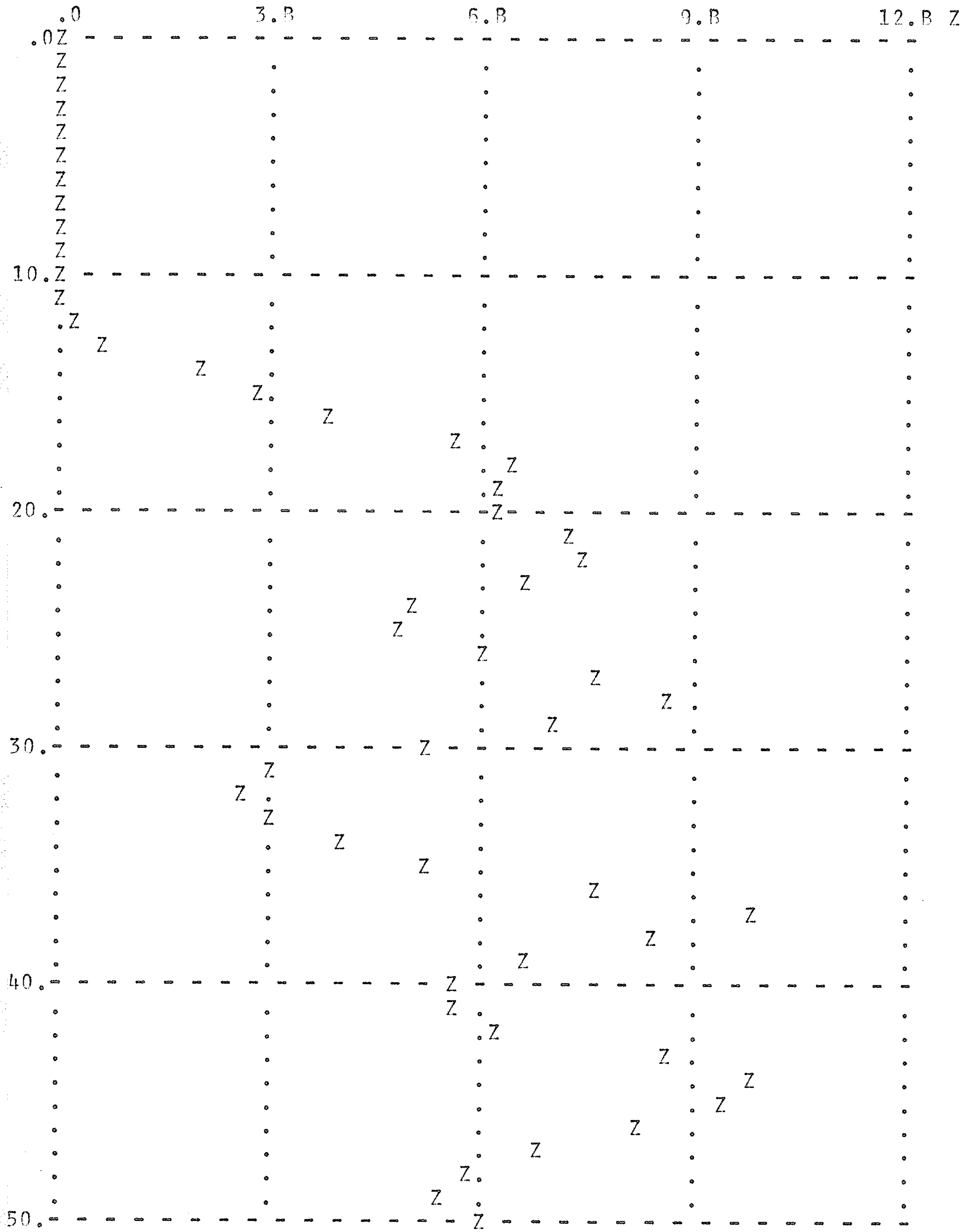
VE=M,CC=C,BC=B,AT=A,CON=N



THE INTEGRATED MODEL

FIG. 27

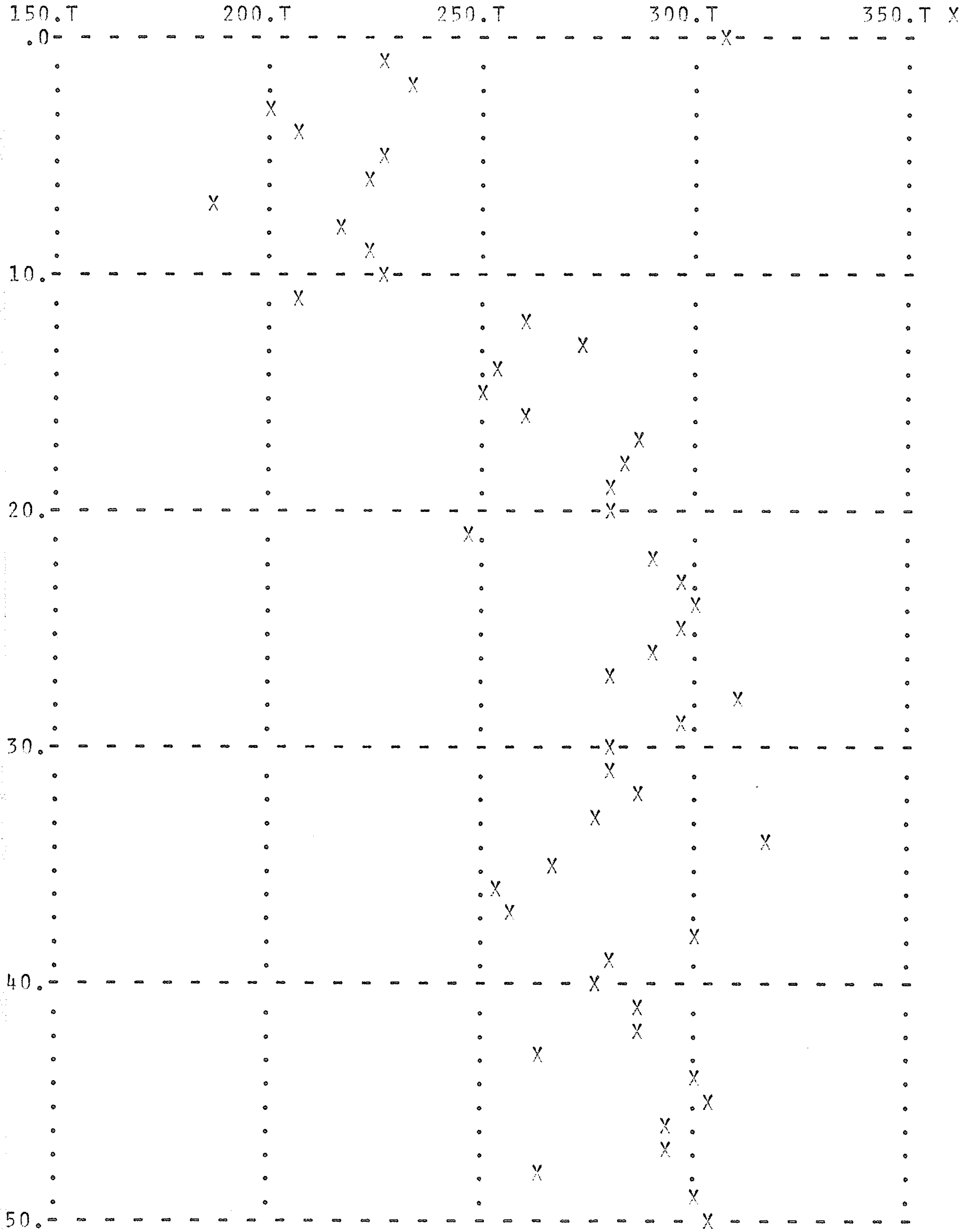
1/22/73 APPLE



THE INTEGRATED MODEL

FIG. 28

1/22/73 APPLE



THE INTEGRATED MODEL

FIG. 29

level of Overt Search (OVTS). As needs and attitude rose, so did the level of overt search and correspondingly the stimulus display centred on the consumer.

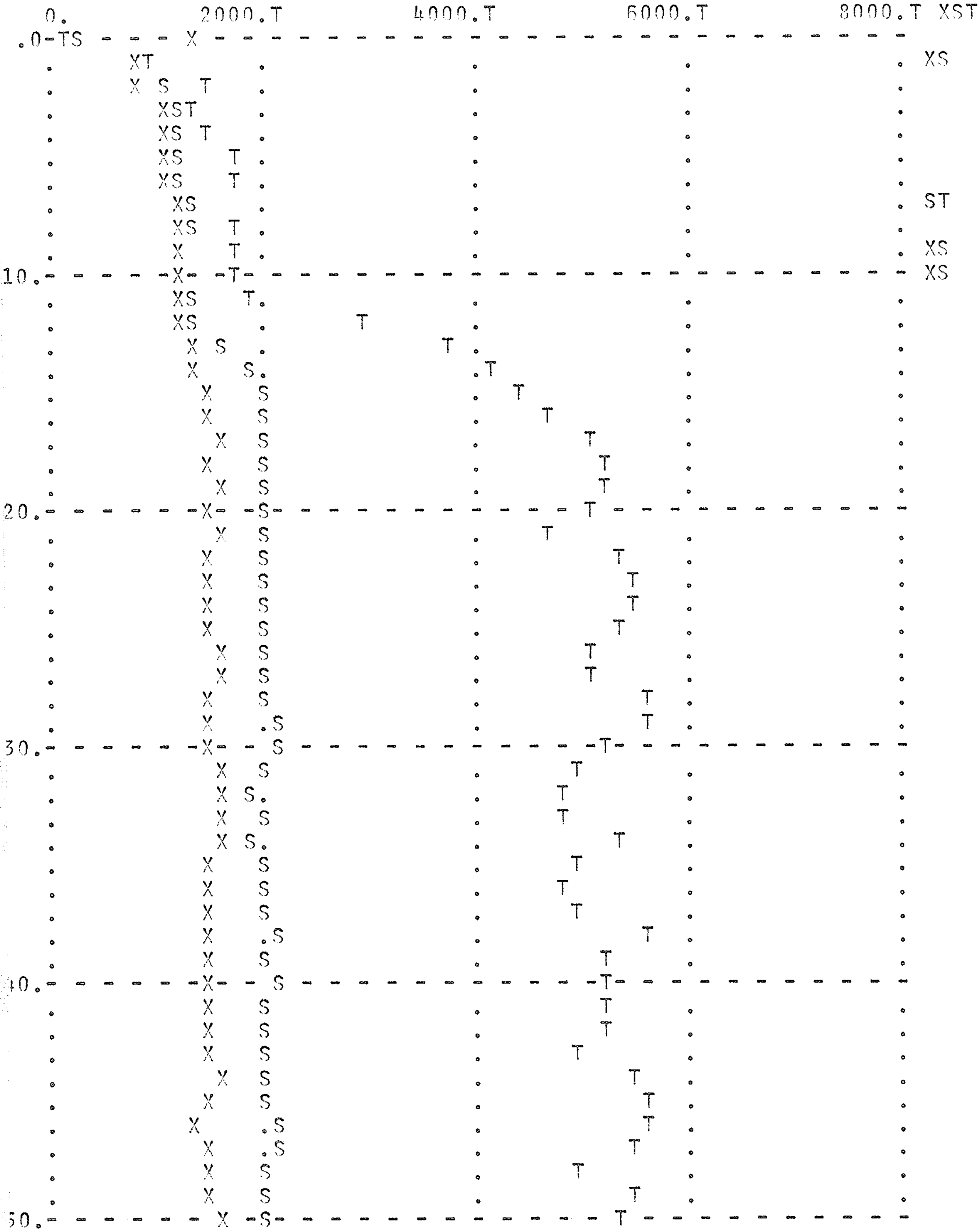
Figure 30 depicts the behaviour of the SAC, the SP, and the CONTM. The increases evidenced previously in the Stimulus Display (SM) are not carried through to internally affect the consumer. There is only a marginal increase in the s-a-c after purchase, and at times it drops below its most previous level. The stimulus pool (SP) increases somewhat, but again not as markedly as the increases in the SM. The effect of stimulus ambiguity and perceptual bias thus serve to offset the effects of the heightened need, attitude, and confidence levels. The contingency multiplier (CONTM) increases significantly after purchase in response to increased levels of Motive, Attitude and Confidence for the individual. Its effect is felt most markedly by Perceptual Bias (BIAS), as previously described.

The behaviour mode characteristic of the integrated model, as heretofore described, may be generally understood as intuitive and logical from a marketing and consumer behaviour standpoint.

A consumer with no product purchase experience, but having received previously some minimal information concerning this product, is confronted with a great magnitude of stimulii emanating from the firm. The individual processes the information through his perceptual subsystem and develops increasing intention to purchase. Choice criteria, brand comprehension and attitude toward the product increase simultaneously. After several weeks the consumer reaches a point where sufficient interest has been stimulated to engender a trial purchase. The purchase occurs and the consumer is satisfied. Immediately brand comprehension, attitude, satisfaction, confi-

1/22/73 APPLE

,SP=S,CONTM=T



THE INTEGRATED MODEL

FIG. 30

dence, choice criteria and satisfaction increase. Overt search is stimulated, perhaps to provide reinforcement for purchase and reduce post purchase dissonance. Some increased internal stimuli (s-a-c) activity is evident but no marked increases occur. A habit has been created. The consumer purchases the product on a weekly basis and he regularly attains satisfaction. The satisfaction fluctuates causing fluctuation in the other learning constructs. However, the variation in satisfaction is insufficient to break the purchase habit cycle. An external event must be created to move the consumer out of this cycle.

This chapter has primarily focused on the individual behaviour modes of each subsystem with a short glance at the integrated model's behaviour. It appears to logically follow a pattern consistent with marketing and consumer behaviour theories, postulations, and assumptions. To further establish the credence of the model it is necessary to subject it to additional testing and analysis. This is the purpose of the next chapter - to delve into the validity of the simulation model as presented.

CHAPTER VI.

TESTING OF THE MODEL

The fundamental purpose of a model is to replicate, as closely as possible, the actual working of its real world counterpart. The purpose being most crucial when the objective is to explain or predict future behaviour. In validating the model we are attempting to prove that it measures what it purports to measure.

The underlying thesis upon which modelling is built, and on which this model is formulated, is that when reality or the system represented becomes very complex, simulation models provide a viable and useful tool for analysis and evaluation.

The problem in validating a model is, what measures of reality are to be utilized? And, are these inputs in fact "reality"? As Perry (1968) points out, "Just as the simulation model is an approximation of 'reality' so are the estimates of variables, parameters, or relationships drawn from the observable universe by interviews, questionnaires, surveys, statistical analysis, or any other method".

This gives rise to several other complications in modelling such as, equivalence of input data sets, and levels of significance for testing. It would appear then that the actual rejection-non-rejection of hypotheses is somewhat misleading. Perry (1968) cites Popper (1959) who suggests ... "to concentrate on the <u>degree</u> of confirmation of a model rather than whether or not the model has been verified. If in a series of empirical tests of a model, the number of cases of fit increases then the confidence in the model will grow step by step".

Perry (1968) looks at the problem of "how" to compare the data sets and outlines seven basic criteria which could be utilized for validation:

1) Face Validity (consistency) - Face validity is a surface or initial impression of a simulation realism.

2) Dynamic Validity (viability) - Dynamic validity demonstrates the ability of the simulation model to replicate processes which are changed over time.

3) Static Validity (stability) - There are some variables or processes in the real world that are known to be stable, or that have reached a steady state.

4) Internal Validity (reliability) - A reliability of a simulation model is measured by the variation between successive runs of the simulation with all properties held constant.

5) Hypothesis Validity (observation) - In this approach, hypothesized relationships became the validity criteria.

6) Event Validity (prediction) - The ability of the model to predict actual events in the real world.

7) Variable-Parameter Validity (sensitivity) - This involves the comparison of the simulation's variables and parameters with their counterparts in the observed reality. Sensitivity analysis is a feature of variable parameter validity. In repeated runs of a simulation model the setting of a parameter or the range of values assigned a variable are systematically arranged to determine what difference, if any, the alteration has on the operation of the model.

Perry (1968) also points out:

"The use of simulation variables and parameters introduces the problem of comparing them with definitions for their real world counterparts. This task can be particularly troublesome when the definitions must correspond to a simulation variable or parameter that is either an analogue or a prototype intended to combine numerous features of the reference system".

Thus there is great difficulty in the process of validating a simulation model. The individual strengths and weaknesses of each of the approaches listed suggest that a combination of them would be most fruitful in validating the model described in this paper.

Accordingly, sensitivity analysis or variable parameter validity was utilized in conjunction with a cross between Face and Dynamic validity through the use of a theoretical example.

A. Sensitivity Testing

The output of the simulation at each run is, in fact, an indicator of the relative significance of each of the variables and its impact on the comprehensive model. Six tests in all were conducted. The results of these tests are included in Appendices B, C, D, E, F, and G.

Appendix B describes the output behaviour mode of the model when alterations are conducted on the Input Subsystem.

The Input Subsystem, as previously described, is concerned with the external stimuli forces impinging on the consumer emanating from the commercial and social environment. The sensitivity test focused on the commercial environment consisting of the symbolic and significative stimuli.

The changes tested were made directly on the symbolic stimuli. However, due to the nature of their interaction with the other variables within this subsystem, the change indirectly influenced all three categories of stimuli.

The test was to drop the firm's inputs (in dollars of expenditure) by one half of its original amount. The firm's expenditures were thus:

Quality Expenditure	$4000/week
Price	.14¢/unit
Distinctiveness Expenditure	$4000/week
Service Expenditure	$1000/week
Availability Expenditure	$3000/week

The behaviour of the model in response to these changes is tabulated and graphically represented in Appendix B.

The behaviour is highly counterintuitive in this instance, i.e., one might expect that it would merely take longer for the consumer to make an initial trial purchase. The units of "energy" actually emitted by the dollar expenditure listed is substantially reduced in all three categories of stimuli. The influencing factor appears to be the functional relationships defined between the variables within this subsystem with particular reference to the emphasis - expenditure functional relationships, as previously outlined.

The net result of this substantial reduction in stimuli was a dramatic fall-off of stimuli being eventually internalized by the consumer. The results of which was a diminuation of motive, attitude and confidence, as well as all other constructs within the learning subsystem. Overt search plummetted to zero, as did all other variables within the system.

This is, in fact, counterintuitive behaviour that would not normally be expected. However, the behaviour exhibited becomes more acceptable when one considers the multitude of stimuli regularly reaching a given individual in any one week. Should a firm cut its expenditures by one-half it would be logical and reasonable to conclude that a great many consumers would no longer perceive the stimuli communicated, given that all other firms maintained their same levels of expenditure. The behaviour of the model in response to the change may be somewhat exaggerated but, in essence, it conveys the impact of 50% reduction in input expenditures.

The second test of the model involved the manipulation of the exogenous variables describing the characteristics of the consumer. A consumer was previously described to have certain characteristics for the standard simulation run in the previous chapter. The consumer has been modified as follows:

Variable	Value	Characteristic
Product category	1	Specialty Good
Culture	.9	High degree of variation from standard
Social class	.1	Lower class
Personality	.1	Highly timid
Social & Organizational setting	.1	Follower oriented
Time pressure	.3	Moderately low pressure
Financial status	.2	Tight money situation

The behaviour of the model in response to the changes list is tabulated and graphically depicted in Appendix C.

The Input Subsystem behaved normally but somewhat lower than the standard integrated model due to a lower level of overt search for the consumer. Motives and attitude toward the product rose and stabilized but at a much lower level than previously. Choice criteria, brand comprehension and confidence exhibited very low levels of existence. The consumer's intention to purchase rose and stabilized at a low level, with no purchase consummated during the year. There were very few stimuli internalized by the individual due to his low level of overt search. Whatever stimuli did reach him, however, were largely unambiguous and unbiased by his perceptual processes. This is perhaps the most logical and acceptable behaviour mode output that would be expected, given the nature of the consumer. The consumer being very much follower-oriented and in a tight money situation exhibits very little search behaviour and diminishes the overall level of the system - the result being, no purchase behaviour. It would appear that the exogenous variables subsystem does have a significant impact on the behaviour of the model, as defined.

The third test of the model involved the experimental parameter SQRT (Square Root) used as a conversion coefficient within the Learning Subsystem. As previously outlined it was used to translate an "energy" unit from the Input and Perceptual Subsystem to an internal unit of "energy" within the Learning Subsystem. It may be suggested that the "energy" or impulses existing in neurological fact would vary between the two subsystems but the conversion coefficient is a difficult and unanswerable problem at this point. The apparent solution is to experimentally set a coefficient and test its snesitivity to variation, thereby determining whether such a coefficient is of consequence or not, to the model's behaviour.

The model's coefficient was altered to a value of .001 from the function SQRT (Square Root). The behaviour of the model in response to this change is listed in Appendix D.

The Input Subsystem was largely unaffected by this change, with somewhat of an increase in stimulii encountered in the stimulus display (SM). The reason being a slight increase in the level of overt search by the consumer. Most variables behaved in a very similar manner to that expressed in the standard or integrated model presented in the previous chapter. The only major variation was that a trial purchase occurred in the sixth period, somewhat sooner than previously encountered.

The general conclusion from this test is that the model is sensitive to the conversion coefficient utilized, but as long as it maintains a value very close to .001 or SQRT there will be little variation in the behaviour of the model.

The fourth test involved the experimental parameter LOGN (natural log) which was utilized as a conversion coefficient between "energy" units within the Perceptual Subsystem and actual states of the system within the Learning Subsystem (measured in units of "internal energy"). This is very similar to the previous test, but involves a conversion in the opposite direction. It may be postulated at this point that the factors are different in the two directions and as such would significantly affect the output behaviour of the model.

The behaviour of the model in response to the change in the coefficient from LOGN to .003 is listed in Appendix E.

The behaviour of the Input Subsystem is unaffected by the change, excluding the stimulus multiplier which plummets to zero within 15 weeks. All other variables and parameters, excluding perceptual bias, reach zero within 20 weeks. It appears that an insufficient conversion is made, i.e., the effects of the Learning Subsystem are minimized, creating a low level of overt search, shutting off the creation of stimuli, and moving the system into a high speed downward spiral.

The point being, that adequate compensation must be given to learning in influencing and modulating the Perceptual Subsystem. Accordingly, it would appear that a value approximating SQRT must be utilized to operationalize the model and provide logically consistent output.

The fifth test involved the normal attrition rates assumed in each of the outflow rates. The system assumed a level or state variable for all major factors within the model, with a rate determining the flow in, and a rate determining the flow out. It was postulated that at the end of each week there would be little or no retention of words, symbols, material, etc. attained during the week. This appears to be somewhat of a far-sighted postulation. However, as previously outlined it was viewed much like an experimental parameter for testing purposes.

The test involved the manipulation of the normal rate from .999 to .75. This would reflect a retention of 25% of all data stored during the week in question. The 25% rate is consistent with psychological empirical data on forgetting curves postulated by psychologists.

The behaviour of the model in response to these changes is listed in Appendix F. The Input Subsystem was unaffected largely by the change; only the stimulus display exhibited an increase in "energy" units communicated. The reason again being a higher level of overt search centered around approx. 6. The model, in sum, behaved very much like the standard model, but only at a somewhat higher level. The increase in all levels and states of the system was most evident in the initial purchase behaviour which occurred after the first week.

The behaviour of the model in response to the change is indicative of heightened sensitivity on the part of the consumer, and an accentuation in behaviour patterns exhibited. This would suggest that the attrition rates are a critical factor but not a crucial factor in the operationalization of the model. Once more empirical data is available, to establish some approximate or standard rate of attrition, a value of between .75 to 1.00 would appear to be satisfactory.

The last test involved the setting of the threshold for purchase (X). Under the conditions established in the standard model, the threshold was set at 950 units of "internal energy". This test involved doubling the level to 1900 units. As was previously postulated, a threshold level may exist that will either cause or prevent purchase behaviour.

The behaviour of the model in response to the raised threshold level is tabulated and graphically depicted in Appendix G.

The Input Subsystem was again largely unaffected excepting a slight increase in "energy" units communicated through the stimulus display. Overt search again being the key factor determining the level of stimuli communicated.

Motive levels and attitude increased similarily, as in previous simulations, as did intention to purchase. However, intention to purchase stabilized at approximately 960 units of internal "energy", i.e., 10 units over the previously set threshold. No greater level of intention to purchase could be fostered without a trial purchase consummated, or an increase in stimulii presented on the part of the firm. As such, the system stabilized at a high level with no purchase occurring. In essence, the system is in a very unstable position with a high preponderance of intention, but too high a threshold for purchase to occur.

The threshold concept may be an acceptable criterion for purchase but it would seem logical to conclude that the threshold could fluctuate somewhat; perhaps establishing a particular functional relationship with time. In such an instance, the threshold might be low for an initial purchase, raised thereafter to a higher and higher level until intention could not reach that particular level. This would be analogous to the cyclical behaviour of the consumer postulated such that an initial trial is made, a habit is formed, routinization occurs, and the consumer then again tries to complicate his purchase decision.

The problem, however, is whether or not the fluctuation occurs in the threshold established or the fluctuation is in the satisfaction achievable, or both.

It may then be concluded from the foregoing outcomes that the simulation model, as presented and defined in its integrated state, provides some confidence and credence in the model and the theory from which it was extracted.

B. A Theoretical Test of the Model

A theoretical test of the model involves, essentially, a cross between two validation criteria - that of Face and Dynamic Validation.

The simulation model presented in this paper represents a "first cut" at the topic or rather one of the preliminary degrees toward eventual validation of a consumer behaviour model. The model's objective not being to establish ultimate validity lends credence to the use of face validity, since its advantages are unique primarily to the early stages of model building. Dynamic validity, on the other hand, is concerned with the ability of the model to replicate processes which are changed over time. This is a validation criteria which becomes more meaningful during the later stages of validation. As such, a theoretical example with dynamic properties provides an excellent standard against which these two criteria can be matched.

An empirical test, using real world input data, would be most difficult for reasons pointed out previously by Perry (1968), as well as the fact that no data could be accurately and adequately matched to this model without primary research investigations. As Farley & Ring (1970) pointed out in their empirical test of the Howard & Sheth model, even the large banks of data available to them through Howard and Sheth's (1969) previous field work, was not fine-grained enough for concrete validation purposes.

The theoretical example chosen for the test is a generally accepted study by Gosta Mickwitz (included in Kotler, P. Marketing Management; Analysis, Planning and Control: Prentice Hall, 1967) analyzing the elasticity of different marketing (instruments) mix elements at different stages in the product life cycle. Mickwitz (1967) proposes that the competitive instruments are, product quality, advertising, price, service and quasi-quality, and that their effectiveness will vary according to the stage at which the product is, within its life cycle.

Mickwitz identifies 5 stages of the product life cycle; introduction, growth, maturity, saturation and decline, and makes postulations concerning the utilization of the marketing instruments as follows:

Introduction: Quality of the product is the most important factor in establishing the product on the market. The remaining factors, in order of their importance, are advertising, price, and service.

Growth: By this stage Mickwitz suggests that early adopters have purchased the product and the firm must focus on meeting buyer resistance through advertising. The remaining factors in order of importance, are quality, price, and service.

Maturity: Now that the price insensitive buyers have tried the product new firms have entered and competition is tougher, based on price. The remaining factors being, advertising, quality, and service.

Saturation: Price competition has led to lower prices and firms must differentiate their products through quasi-quality. The remaining factors in order of importance are advertising, service, quality and price.

Decline: Now, little is to be gained through differentiation, and the firm must find new product uses and advertise them. The remaining factors, in order of their importance, are service and quality, quasi-quality and price.

The five variables of quality, price, distinctiveness, service and availability identified as factors within the buyer's commerical environment for the simulation model are somewhat analogous to the instruments which Mickwitz refers to, as follows:

Marketing Instrument	Simulation Variable
Quality	Quality
Price	Price
Service	Service
Quasi-quality	Availability
Advertising	Distinctiveness

The variable relationships are perhaps not direct equivalents but sufficiently analogous to provide a theoretical example for testing purposes. It may then be hypothesized that if the simulation variables are manipulated according to Mickwitz's postulations, and the output behaviour is at least as good as under previous conditions, greater credence will be given to the simulation model, and Mickwitz's postulations.

The criteria for determining the efficiency of the hypothesized behaviour may be established through the behaviour mode previously established by the integrated model. The behaviour previously evident was as follows:

	Sales	40 units @ approx. .28/unit	= $11.20
Expenditure	Quality	8000/wk x 50 wks.	= $400,000
	Distinctiveness	8000/wk x 50 wks.	= $400,000
	Service	2000/wk x 50 wks.	= $100,000
	Availability	6000/wk x 50 wks	= $300,000
			$1,200,000

The simulation model was then tested to examine its comparable behaviour. A product life cycle was assumed for the product covering 50 weeks, each stage covering a 10-week period.

The results of the simulation trials are numerically tabulated and graphically depicted in Appendix H - Tests #1 and #2.

Test #1 was designed specifically to follow Mickwitz's postulations. The values chosen for each variable according to the stage of the product life cycle were as follows:

Expenditure/Wk.

	Quality	Price	Distinctiveness	Service	Availability
Introduction	$11,000	.35	$ 9,000	$3000	$2000
Growth	9,000	.30	11,000	3000	2000
Maturity	3,000	.20	9,000	3000	2000
Saturation	3,000	.25	9,000	5000	11000
Decline	5,000	.25	11,000	5000	5000

The results of the simulation trials were highly unexpected. The input subsystem was only able to emit approximately 10,000 units of "energy" from each of its three components. The stimulus display began to develop quite adequately, but there was insufficient internal stimuli generated to raise the level of overt search enough to increase the external stimuli flowing into the stimulus pool. All variables began to establish themselves well with Intention to Purchase rising to approximately 900. However, as the external stimuli fell, the system began to collapse and quickly all variables dropped to zero. Throughout the simulation, stimulus ambiguity and perceptual bias were negligible, resulting in little or no stimulus distortion to compound the problems of low levels of stimuli externally generated. The core of the problem appeared to be existing in an insufficient level of input stimuli externally generated.

The second test of the theory was attempted, utilizing a higher level of input stimuli. The values chosen for each variable according to the stage of the product life cycle were as follows:

Expenditure/Wk.

	Quality	Price	Distinctiveness	Service	Availability
Introduction	$12,000	.35	$10,000	$8,000	$ 6,000
Growth	10,000	.30	12,000	8,000	6,000
Maturity	4,000	.20	10,000	8,000	6,000
Saturation	4,000	.25	10,000	10,000	15,000
Decline	6,000	.25	12,000	10,000	9,000

The values chosen for the variables in the Introduction stage of the product life cycle are appreciably higher in this test. The results of the simulation were somewhat better this time with the first initial purchase occurring in the tenth week. Generally, the results of this simulation resemble the behaviour mode characteristic of the integrated model previously described. The only major difference being a greater degree of fluctuation in some of the variables. The fluctuation appears to have been the result of the stepwise increases and decreases in stimuli created over the product life cycle. A diminuation in stimuli or units of "energy" communicated is evident from the 21st through to the 41st. week. The result of which was a higher than normal degree of fluctuation. The fluctuation in Intention to Purchase, however, was again insufficient to break the consumer out of the habit cycle.

The behaviour of the simulation model in response to the two tests administered, based on Mickwitz's theory, would appear, on first impressions, an unequivocable threat to the validity of the model. The behaviour under the second test, when compared to that of the criteria established for validation, is disappointing.

Sales			
	1 x .35	=	.35
	10 x .30	=	3.00
	10 x .20	=	2.00
	20 x .25	=	5.00
			$10.35

Expenditures

Quality	$ 360,000
Distinctiveness	540,000
Service	440,000
Availability	420,000
	$1,760,000

The results indicate a lower total sales level, accompanied by a higher level of expenditures, in fact quite unsatisfactory.

The problem then is to determine whether or not the model is an inadequate representation of reality or whether the theory postulated by Mickwitz is valid itself. It may be suggested at this point that the problem perhaps is a delicate balance between the two alternatives.

Recently, marketing theory stresses the importance of the "push" versus the "pull" campaign during the early stages of the product life cycle, i.e., with reference to pushing or pulling the product through the channel. This is in direct contrast to the Mickwitz theory which suggests that during the early stages of the product life cycle quality is the key and most important factor. Mickwitz's theory was deduced through theory and casual observation and no evidence exists to support his propositions.

The simulation model, on the other hand, presents some formidable problems also. An approximation was utilized to equate Mickwitz's quasi-quality marketing instrument to the availability variable within the simulation model. In light of the marketing theory suggesting the importance of availability, it is perhaps stretching the quasi-quality factor too far to include availability and vice versa.

Another important factor neglected was the fact that the simulation model, in determining the units of "energy" or impulses generated for a given dollar expenditure, established functional relationships between the variables in a non-linear fashion; i.e., an increase in dollar expenditure would not necessarily result in a direct linear increase in associated units of "energy". This has substantial ramifications for marketers who blindly increase expenditures without thought to diminishing returns to scale. The point being that the optimal product cycle marketing mix is simply not just the specifying of a rank ordering of the elements involved but rather a careful analysis of the behaviour of the variable over time and in relation to the characteristics of the consumer as well as the other elements within the marketing mix.

It is difficult to draw any precise conclusions from the foregoing and it is perhaps best to generally conclude that the model is no less or no more valid with respect to degree than previously stated.

This chapter has dealt primarily with the testing and analysis of the model under experimental conditions. The purpose being to lend greater credence to the model and establish some degree of validity in its existence. Some degree of validation has been forthcoming but no conclusive evidence was established for the model's validity. The next chapter will attempt to draw some conclusions and outline recommendations for future areas of concern.

CHAPTER VII.

CONCLUSIONS AND RECOMMENDATIONS

This paper has been concerned with the design, development, operationalization and simulation of a model based on the Howard and Sheth (1969) Theory of Buyer Behaviour. This study was designed to provide a systematic perspective, or framework, for viewing consumer behaviour, that is, to view it as a true system incorporating levels, rates, feedback loops and delays. As a pioneering study it represents a "first cut" at the problem of viewing buyer behaviour as a true system. No conclusive validation of the model or its supporting theory was established, however some insights and conclusions with regard to the model, the theory, and consumer behaviour are apparent.

Consumer behaviour, in the first instance, is a very non-mechanistic type of behaviour; it is highly variable and highly dependent upon the characteristics of the consumer in question. Computerization and simulation of consumer behaviour is at the very best a very general approximation of the processes involved. A great deal of refinement is required before a conclusively valid model could be established. It is suggested that modelling of consumer behaviour is both achievable and attainable but requires considerable painstaking and laborious research efforts to compile and establish both input data sets and a model which, through continuous refinements, can meet exacting criteria for validation.

The Theory of Buyer Behaviour (1969) is undoubtedly a highly refined and sophisticated theory of static consumer behaviour but, as it presently exists, possesses many and diverse fragmentary interconnections between processes and variables. The interrelationships postulated in Figures 1 and 3 represent the diagramatic interpretation of the theory. As a flow system it is perhaps a reasonable model of the processes involved in buyer behaviour. As a static model it appears to gain its greatest acceptability, since little data is available to explain or predict future behaviour patterns based on the model.

The Input Subsystem, for instance, is a striking example of a well formulated static model of the real-world processes. However, there are gaps in the relationships between the three categories of stimulii and in their mutual development of a stimulus display. Furthermore, no indication is given of the dimensions of the stimuli postulated to exist, nor of their dynamic properties over time.

The Perceptual Subsystem encounters similar difficulties in the explanation of time varying behaviour. The perceptual subsystem again, is soundly conceived as a static model of the processes involved. Difficulties regarding the translation of an external stimuli into an internal stimulus-as-coded presents further problems. Little evidence is given to establish relationships existing between stimulus ambiguity and perceptual bias and how they vary over time. Furthermore, little can be said concerning the magnitude of the effect of internal characteristics of the consumer on the perceptual subsystem, other than that these forces do exist.

The Learning Subsystem is perhaps even more ambiguous in its interrelationships since it represents the greatest deviation from reality - the hypothetical constructs. One is at a loss again to determine the effect of the stimulus-as-coded, communicated from within the individual, upon construct formulation and eventual purchase behaviour. There are also many gaps in the theory concerning the timing, magnitude, and development of satisfaction.

The drawbacks, difficulties, and problems previously outlined are innate not only to the theory, but also to the model so defined. The model has consequently made certain postulations and assumptions concerning the interrelationships and time-varying behaviour, in order to establish operationalization.

The model, from the testing and analysis, appears to be an adequate representation of the processes involved in consumer behaviour, and generally a concrete static translation of the Howard and Sheth (1969) Theory of Buyer Behaviour. At this point the hypothesis concerning the validity of the model must be tentatively rejected. However, some credence has been given to the existence of the model and to some degree Face Validation of the model has occurred. No conclusions can be firmly established concerning the validity of the model - only through further empirical evidence, testing, and further refinement, can validation be established.

This model, as previously outlined, was a "first cut" at the problem of the dynamics of consumer behaviour; some validation occurred and some tentative conclusions may be drawn, as follows:

1. The Input Subsystem is highly sensitive to variable changes, and marketers must be careful to avoid increasing or decreasing expenditures with the expectation of linear output behaviour.

2. The Exogenous Variables Subsystem is crucial for defining the characteristics of the consumer and is a highly important set of factors influencing purchase behaviour and habit formation.

3. It is essential for the marketer to establish a high level of stimuli communicated to the consumer during the early stages of the product life cycle.

Recommendations concerning future investigations and improvements of the present model focus on two possible directions, breaking the model down again into its elements and examining each element separately, and providing better input data.

The model represents a complex system of relationships between variables both from a static and dynamic viewpoint. Some of the functional relationships may be valid while others not, some critical and some not so critical. The sensitivity testing accomplished thus far has been only cursory and deeper investigations are required to establish new and more meaningful relationships between the variables postulated by the theory.

The analysis of the elements of the model should be done piecemeal, gathering both secondary and primary data on the relationships; then each functional relationship defining the element should be statistically tested by a technique such as regression analysis. The next step would be to again interlock the elements gradually, again simulating and testing their behaviour on a subsystem basis. The model could then be reestablished with a network of interlocking relationships, re-simulated and tested to outline again areas of ambiguity and concern. The process then begins afresh, breaking the model apart and re-examining its elements.

The provision of better input data is the second major area of concern. The model as defined incorporates many assumptions and postulations regarding input data sets. For instance, the number of units of "energy" emitted from a given expenditure on quality was assumed arbitrarily in the absence of available data. Although all attempts were made to establish consistency within and between variables and parameters' functional relationships, it is imperative that empirical data be utilized to establish validity for the model.

Areas of concern for future research may be outlined as follows:

1) The magnitude and dynamic behaviour of the "energy" emitted by the commercial and social environment of the buyer. Also, their interrelationships and cumulative effect on a total stimulus display.

2) The conversion coefficients perhaps existing in neurological fact, dictating the translation of internal units of "energy" to "energy" units within the Input and Perceptual Subsystems.

3) The relationships between Stimulus Ambiguity and Perceptual Bias, both statically and dynamically.

4) The effect of an s-a-c on the Learning Subsystem, and eventual purchase behaviour.

5) The behaviour of Brand Comprehension, and Choice Criteria in determining the cognitive state of the buyer.

6) The dynamic relationships between all learning constructs.

7) The magnitude and functional relationships existing between purchase behaviour and satisfaction.

8) The threshold concept of purchase and its functional relationship to intention to purchase.

9) The functional relationship existing between the marketing mix employed by the firm and the characteristics of the consumer over time and in response to changes in the product life cycle.

10) The movement out of a purchase cycle and its impact upon the learning constructs over time.

To summarize, the purpose of building and operationalizing the present simulation model was to provide a systematic framework for the analysis of the dynamics of buyer behaviour, and furthermore, to gain insight into the validity and reliability of <u>The Theory of Buyer Behaviour</u> (1969).

These goals were basically accomplished by this study. This does not connote, however, that the model was proved to be a valid indicator of buyer behaviour, but rather that consumer behaviour may be conceptualized as a true system utilizing a Systems Dynamics Methodology, and furthermore that such behaviour may be evaluated through computer simulation. To eventually validate this model, more studies and greater empirical evidence will be required.

The computer model has been utilized here as a tool to probe into the depths of consumer behaviour. It has aided in the development of a dynamic model of buyer behaviour through which future research and investigation may be directed. It has provided fruitful insights into the problems of consumer behaviour modelling and simulation.

Again, it must be established that this model represents a "first cut" at the problem of the dynamics of buyer behaviour. Face validity for the model has been established but no predilections have been made concerning its conclusive validity nor its applicability to use in the day-to-day operations of marketing management.

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APPENDIX A

APPENDIX A

A COMPLETE LIST OF THE MODEL

The Dynamics of Buyer Behaviour -

A Simulation of the Howard & Sheth Model

*Apple

The Input Subsystem

A	QE.K	=	TABHL(QET,QUAL.K,0,10E3,1E3)
T	QET	=	0/0/0/1/3/4/7/7/8/8/8
A	QUAL.K	=	NORMRN(8E3,.1E3)
A	PE.K	=	TABHL(PET,PRICE.K,0,.5,.05)
T	PET	=	0/0/0/8/8/7/7/6/3/2/3
A	PRICE.K	=	NORMRN(.28,.02)
A	DE.K	=	TABHL(DET,DIS.K,0,10E3,1E3)
T	DET	=	0/1/1/1/2/4/6/8/9/10/10
A	DIS.K	=	NORMRN(8E3,.1E3)
A	SE.K	=	TABHL(SET,SER.K,0,10E3,1E3)
T	SET	=	0/4/5/5/5/5/5/5/5/6/6
A	SER.K	=	NORMRN(2E3,.5E3)
A	AE.K	=	TABHL(AET,AV.K,0,10E3,1E3)
T	AET	=	0/2/4/5/6/8/8/8/9/10/10
A	AV.K	=	NORMRN(6E3,.25E3)
A	SYMM.K	=	(QE.K)(PE.K)(DE.K)(SE.K)(AE.K)
A	QUALA.K	=	DLINF3(QE.K,5)
A	SERA.K	=	DLINF3(SE.K,14)
A	PEA.K	=	DLINF3(PE.K,3)
A	DEA.K	=	DLINF3(DE.K,4)
A	AEA.K	=	DLINF3(AE.K,3)
A	SIGM.K	=	(QUALA.K)(PEA.K)(DEA.K)(SERA.K)(AEA.K)
A	FAM.K	=	NORMRN(SIGM.K,.5E3)
A	REF.K	=	NORMRN(SIGM.K,5E3)
A	SO.K	=	NORMRN(SIGM.K,10E3)
A	SSM.K	=	(FAM.K+REF.K+SO.K)/3
A	SM.K	=	(SYMM.K+SIGM.K+SSM.K)*OVTS.K

The Perceptual Subsystem

```
R   OVTSF.KL =  (((IMP.K+TIMP.K+PERS.K)/3)*STA.K)*LOGN(MOTIVE.K)
L   OVTS.K   =  OVTS.J+(DT)(OVTSF.JK-OVTSA.JK)
N   OVTS     =  0
R   OVTSA.KL =  (OVTSAN)(OVTS.K)
C   OVTSAN   =  .999
R   ATT.KL   =  (SM.K*STA.K)*LOGN(MOTIVE.K)
L   SP.K     =  SP.J+(DT)(ATT.JK-LOSS.JK)
N   SP       =  240000
R   LOSS.KL  =  (SP.K)(LOSSN)
C   LOSSN    =  .999
A   STA.K    =  TABHL(STAT,SM.K,0,800E3,80E3)
T   STAT     =  0/1/.9/.8/.75/.6/.5/.4/.3/.25/.2
A   CONTM.K  =  (SP.K)(1-STA.K)(LOGN(MOTIVE.K+AT.K+CON.K))
A   BIAS.K   =  TABHL(BIAST,CONTM.K,0,050E6,05E6)
T   BIAST    =  1/1/.9/.9/.8/.8/.6/.6/.3/.2/.1
R   ATR.KL   =  SAC.K*ATRN
C   ATRN     =  .999
L   SAC.K    = SAC.J+(DT)(PER.JK-ATR.JK)
N   SAC      =  0
R   PER.KL   =  BIAS.K*SP.K
```

The Learning Subsystem

```
R   NF.KL     =  (((CULT.K+SOCL.K+PERS.K+FIN.K+SOC.K)/5)*STA.K)*(CON.K)
X                  +LOGN(SAC.K)
L   MOTIVE.K  =  MOTIVE.J+(DT)(NF.JK-DR.JK)
N   MOTIVE    =  250
R   DR.KL     =  (MOTIVE.K)(DRN)
C   DRN       =  .999
R   CD.KL     =  MOTIVE.K*SAT.K+LOGN(SAC.K)
L   CC.K      =  CC.J+(DT)(CD.JK-CA.JK)
R   CA.KL     =  CC.K*CAN
C   CAN       =  .999
N   CC        =  360
R   BL.KL     =  ((IMP.K+CULT.K+SOCL.K+PERS.K+SOC.K)/5)
X                  *SAT.K+LOGN(SAC.K)
L   BC.K      =  BC.J+(DT)(BL.JK-BCA.JK)
R   BCA.KL    =  BC.K*BCAN
C   BCAN      =  .999
N   BC        =  370
R   AF.KL     =  ((CULT.K+SOCL.K+SOC.K+PERS.K)/4)*SAT.K*
X                  (BC.K)+(CC.K)/2
L   AT.K      =  AT.J+(DT)(AF.JK-AA.JK)
R   AA.KL     =  AT.K*ATN
N   AT        =  210
C   ATN       =  .999
A   MEME.K    =  SAT.K*AT.K*CON.K+LOGN(SAC.K)
R   RTB.KL    =  ((CULT.K+SOCL.K+SOC.K+TIMP.K+FIN.K)/5*MEME.K
L   INT.K     =  INT.J+(DT)(RTB.JK-RTBA.JK)
N   INT       =  200
R   RTBA.KL   =  INT.K*RTBAN
C   RTBAN     =  .999
C   PSAT      =  100
R   SF.KL     =  P.K*PSAT
L   SAT.K     =  SAT.J+(DT)(SF.JK-SA.JK)
N   SAT       =  100
R   SA.KL     =  SAT.K*SAN
C   SAN       =  1.00
R   CF.KL     =  SAT.K*BC.K
L   CON.K     =  CON.J+(DT)(CF.JK-CONA.JK)
R   CONA.KL   =  CON.K*CONAN
N   CON       =  340
C   CONAN     =  .999
```

The Exogenous Variables Subsystem

```
A    IMP.K     =  TABHL(IMPT,PC.K,0,1.0,.1)
T    IMPT      =  .6/.7/.8/.3/.5/.6/.5/.7/.8/.8/1.0
A    PC.K      =  0
A    CULT.K    =  TABHL(CULTT,DV.K,0,1.0,.1)
T    CULTT     =  1.0/.9/.25/.2/.15/.1/.09/.075/.05/.025/0
A    DV.K      =  .1
A    SOCL.K    =  TABHL(SOCLT,LU.K,0,1.0,.1)
T    SOCLT     =  .6/.7/.8/.9/.4/.5/.6/.7/.8/.9/1.0
A    LU.K      =  .8
A    PERS.K    =  TABHL(PERST,TA.K,0,1.0,.1)
T    PERST     =  .1/.1/.2/.2/.3/.3/.4/.4/.5/.7/1.0
A    TA.K      =  .9
A    SOC.K     =  TABHL(SOCT,FL.K,0,1.0,.1)
T    SOCT      =  .3/.4/.5/.5/.6/.7/.4/.6/.8/.9/1.0
A    FL.K      =  .9
A    TIMP.K    =  TABHL(TIMPT,LH.K,0,1.0,.1)
T    TIMPT     =  .5/.6/.7/.8/.6/.5/.3/.4/.6/.8/1.0
A    LH.K      =  .9
A    FIN.K     =  TABHL(FINT,TE.K,0,1.0,.1)
T    FINT      =  .1/.3/.6/.5/.5/.6/.7/.8/1.0/.9/.8
A    TE.K      =  .8
```

The Output Subsystem

```
A    P.K       =  CLIP(1,0,INT.K,50000)
```

NOTE: **Special Cards**

```
PRINT SYMM, SIGM, SSM, SM,
PLOT  SYMM=M, SIGM=G, SSM=S
PRINT OVTS,SP,STA,CONTM,BIAS,SAC
PLOT  OVTS=0,  SAT=T
PRINT  MOTIVE,CC,BC,AT,MEME,INT,SAT,CON,P
PLOT MOTIVE=M, CC=C, BC=B, AT=A, CON=N
PLOT  INT=Z
PLOT  SM = X
PLOT  SAC=X,SP=S,CONTM=T
PLOT  STA=Z,BIAS=B,P=P
SPEC  DT=.25/LENGTH=50/PRTPER=1/PLTPER=1
RUN  APPLE
```

APPENDIX B

B

1/23/73 APPLE

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CCN	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+00	E+00	E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+00	E+00	E+00
	E+00	E+00	E-03	E+00	E+00									
.0	.0	34.12	6779.9	34.070	5.0000	240.00	.42588	391.20	1.0000	1400.0	15.10	20.00	14.77	.00
	1133.2	500.00	1.0000	2.0000	0.									
1.	721.3	35.28	6027.8	11.327	1.6696	80.20	.14159	481.94	1.0000	548.8	662.57	664.19	662.38	433.97
	140.9	737.23	.3164	.7835	0.									
2.	1060.1	51.55	7009.7	5.365	.6606	26.70	.06706	181.15	1.0000	208.9	619.01	619.60	618.94	821.84
	457.1	593.60	.1001	.3375	0.									
3.	541.8	90.25	-3227.0	-.666	.2567	8.74	.00000	62.39	1.0000	77.7	447.24	447.44	447.21	815.32
	278.8	409.06	.0317	.1304	0.									
4.	366.6	134.38	-455.6	.004	.0843	2.77	.00005	18.94	1.0000	28.3	294.19	294.25	294.17	640.71
	168.3	263.78	.0100	.0465	0.									
5.	333.9	171.50	1740.5	.077	.0282	.88	.00097	5.66	1.0000	10.1	184.90	184.91	184.88	449.03
	100.7	164.25	.0032	.0158	0.									
6.	477.4	205.59	1577.0	.021	.0095	.28	.00027	1.67	1.0000	3.6	113.29	113.29	113.28	295.05
	59.9	100.18	.0010	.0052	0.									
7.	706.2	234.63	-5362.4	-.016	.0036	.09	.00000	.49	1.0000	1.3	68.35	68.34	68.33	186.42
	35.4	60.29	.0003	.0017	0.									
8.	197.2	262.69	2241.6	.004	.0013	.03	.00004	.14	1.0000	.4	40.79	40.80	40.80	114.86
	20.8	35.95	.0001	.0005	0.									
9.	926.4	289.56	127.6	.001	.0004	.01	.00001	.04	1.0000	.1	24.18	24.18	24.18	69.59
	12.2	21.29	.0000	.0002	0.									
10.	275.8	301.02	1292.1	.000	.0001	.00	.00000	.01	1.0000	.1	14.24	14.25	14.25	41.68
	7.1	12.55	.0000	.0001	0.									
11.	943.2	334.71	-4792.2	.000	.0000	.00	.00000	.00	1.0000	.0	8.37	8.36	8.36	24.75
	4.2	7.36	.0000	.0000	0.									
12.	195.2	403.02	5323.9	.000	.0000	.00	.00000	.00	1.0000	.0	4.90	4.89	4.89	14.61
	2.4	4.31	.0000	.0000	0.									
13.	719.5	445.39	3141.0	.000	.0000	.00	.00000	.00	1.0000	.0	2.83	2.85	2.85	8.58
	1.4	2.51	.0000	.0000	0.									
14.	865.7	454.99	-3434.2	.000	.0000	.00	.00000	.00	1.0000	.0	1.65	1.66	1.66	5.02
	.8	1.46	.0000	.0000	0.									
15.	362.5	449.76	-4503.6	.000	.0000	.00	.00000	.00	1.0000	.0	.94	.96	.96	2.93
	.5	.85	.0000	.0000	0.									
16.	1068.5	416.80	-4068.4	.000	.0000	.00	.00000	.00	1.0000	.0	.55	.56	.56	1.71
	.3	.49	.0000	.0000	0.									

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TIME	SYMM	SIGM	SSM	SM	CVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CCN	P									
17.	955.9	420.86	1736.1	.000	.0000	.00	.00000	.00	1.0000	.0	.32	.32	.32	.99
	.2	.28	.0000	.0000	0.									
18.	178.8	443.76	2238.6	.000	.0000	.00	.00000	.00	1.0000	.0	.18	.19	.19	.57
	.1	.16	.0000	.0000	0.									
19.	1058.1	502.87	-502.8	.000	.0000	.00	.00000	.00	1.0000	.0	.10	.11	.11	.33
	.1	.09	.0000	.0000	0.									
20.	1105.3	570.03	-113.2	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.06	.06	.19
	.0	.05	.0000	.0000	0.									
21.	1026.1	637.59	-7457.1	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.04	.04	.11
	.0	.03	.0000	.0000	0.									
22.	414.2	653.41	2343.4	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.02	.02	.06
	.0	.02	.0000	.0000	0.									
23.	909.3	652.88	2569.5	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.01	.01	.04
	.0	.01	.0000	.0000	0.									
24.	373.3	656.00	4512.0	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.01	.01	.02
	.0	.01	.0000	.0000	0.									
25.	1064.5	679.91	3059.3	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.01
	.0	.00	.0000	.0000	0.									
26.	561.7	687.13	505.2	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.01
	.0	.00	.0000	.0000	0.									
27.	442.6	634.95	-459.3	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
28.	147.2	622.29	6174.8	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
29.	463.3	575.05	1622.3	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
30.	254.1	508.92	1965.7	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
31.	590.6	466.31	-1053.1	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
32.	416.0	475.32	863.1	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
33.	1007.9	525.44	-827.8	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
34.	1008.4	547.29	6584.5	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									

TIME	SYMM	SIGM	SSM	SM	CVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CCN	P									
35.	537.6	551.40	-3461.8	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
36.	711.5	630.67	-4754.4	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
37.	650.8	675.47	-5941.5	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
38.	1062.8	720.68	2439.7	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
39.	503.2	723.33	1021.1	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
40.	1225.7	745.39	-901.6	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
41.	128.5	744.43	4304.7	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
42.	376.3	701.52	3535.7	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
43.	810.6	630.12	-4025.6	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
44.	1012.4	575.37	2016.1	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
45.	.0	533.14	1625.2	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
46.	746.2	546.21	2222.9	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
47.	144.4	526.90	5754.0	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
48.	178.3	565.39	-4045.5	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
49.	926.6	545.98	2628.6	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
50.	719.5	529.62	4634.7	.000	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									

1/23/73   APPLE

=M,SIGM=G,SSM=S


```
  -10.T          -5.T           .0            5.T           10.T MGS
   .0- - - - - - - - - - - - - - - - M - - - - - - - - - S - - - - - MG
     .              .              G M            .  S           .
     .              .              G  M           .     S        .
     .              .    S         G M            .              .
     .              .             SGM             .              .
     .              .              .G M S         .              .
     .              .              .M   S         .              . MG
     .             S.              .GM            .              .
     .              .              .M     S       .              . MG
     .              .              SG M           .              .
 10.- - - - - - - - - - - - - - - -M- S - - - - - - - - - - - - - MG
     .              .S             .G M           .              .
     .              .              .M             .S             . MG
     .              .              .GM      S     .              .
     .              .    S         .G M           .              .
     .              .S             .M             .              . MG
     .              .  S           .G M           .              .
     .              .              .G M S         .              .
     .              .              .M     S       .              . MG
     .              .            S . GM           .              .
 20.- - - - - - - - - - - - - - - - S GM- - - - - - - - - - - - -
     .       S      .              . GM           .              .
     .              .              .MG    S       .              .
     .              .              . GM    S      .              .
     .              .              .MG           S.              .
     .              .              . GM     S     .              .
     .              .              . M            .              . MGS
     .              .             S.MG            .              .
     .              .              M G            .   S          .
     .              .              .MG  S         .              .
 30.- - - - - - - - - - - - - - - -MG - S - - - - - - - - - - - -
     .              .           S  .GM            .              .
     .              .              .M S           .              . MG
     .              .            S . GM           .              .
     .              .              . GM           .    S         .
     .              .    S         . GM           .              .
     .              .S             . M            .              . MG
     .           S  .              . GM           .              .
     .              .              . GM   S       .              .
     .              .              . MS           .              . MG
 40.- - - - - - - - - - - - - - -S- - G M - - - - - - - - - - - -
     .              .              M G          S .              .
     .              .              .MG        S   .              .
     .              .  S           . M            .              . MG
     .              .              . GM  S        .              .
     .              .              M G  S         .              .
     .              .              . M    S       .              . MG
     .              .              M G            . S            .
     .              .  S           .MG            .              .
     .              .              . GM    S      .              .
 50.- - - - - - - - - - - - - - - - - M - - - - - S - - - - - - - MG
```

S=C,SAT=T

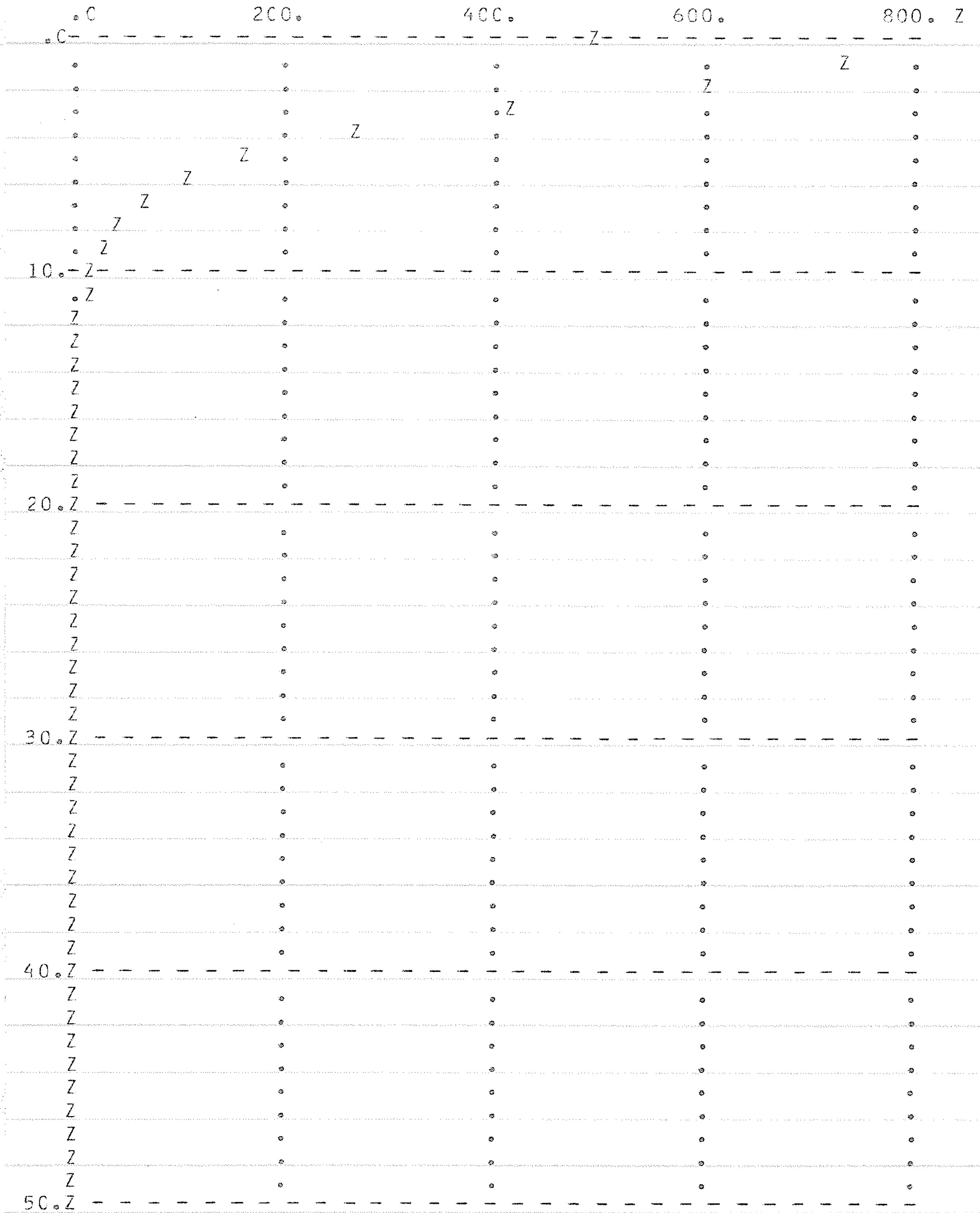

```
   .0                   2.                  4.                  6.                  8. OT
  .CT - - - - - - - - - - - - - - - - - - - - - - - -O- - - - - - - - - - - - - - - -
    T                O  .                   .                   .                   .
    T      O            .                   .                   .                   .
    T  C                .                   .                   .                   .
    TO                  .                   .                   .                   .
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
 10.C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
 20.C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
 30.C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
 40.C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
    C                   .                   .                   .                   . OT
 50.C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - OT
```

1/23/73 APPLE

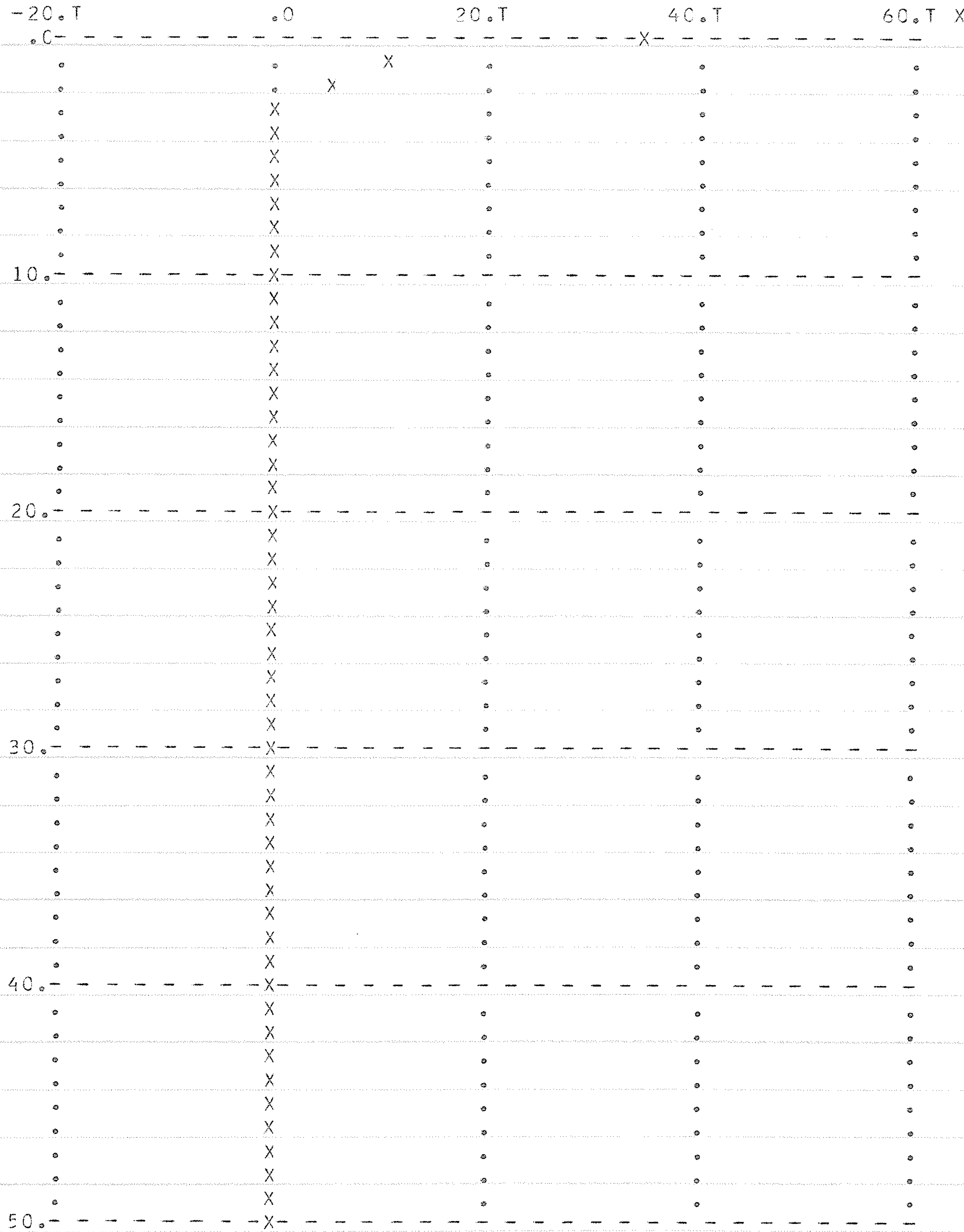
IVE=M,CC=C,BC=B,AT=A,CCN=N


```
   0.            300.            600.            900.            1200. MCBAN
  .CAM- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCB,AN
   N               .      A      .   M           .               .  MCB
   N               .             .M         A    .               .  MCB
   N               .      M      .          A    .               .  MCB
   N               M             .  A            .               .  MCB
   N           M   .      A      .               .               .  MCB
   N      M        A             .               .               .  MCB
   N  M        A   .             .               .               .  MCB
   N M    A        .             .               .               .  MCB
   NM A            .             .               .               .  MCB
 10.NMA - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCB
   MA              .             .               .               .  MCBN
   MA              .             .               .               .  MCBN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
 20.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
 30.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
 40.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
   M               .             .               .               .  MCBAN
 50.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
```

=Z



X



=X,SP=S,CONTM=T


```
-500.T            0.               500.T            1000.T           1500.T XST
   .O- - - - - - - - - - - - S - -T- - - - - - - - - - - - - - - -X- -
    .               . S            T.X               .                .
    .               .S    TX        .                .                .
    .               S X             .                .                . XT
    .               SX              .                .                . XT
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
 10.- - - - - - - - X- - - - - - - - - - - - - - - - - - - - - - - - - XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
 20.- - - - - - - - X- - - - - - - - - - - - - - - - - - - - - - - - - XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
 30.- - - - - - - - X- - - - - - - - - - - - - - - - - - - - - - - - - XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
 40.- - - - - - - - X- - - - - - - - - - - - - - - - - - - - - - - - - XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
    .               X               .                .                . XST
 50.- - - - - - - - X- - - - - - - - - - - - - - - - - - - - - - - - - XST
```

=Z,BIAS=C,P=P


```
      .C               .5                1.                1.5               2. ZBP
   .CP - - - - - -Z- - - - - - - - - - - B - - - - - - - - - - - - - - - - - - -
     P    Z             .                B                 .                 .
     P  Z               .                B                 .                 .
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
  10.Z - - - - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - - - -  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
  20.Z - - - - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - - - -  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
  30.Z - - - - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - - - -  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
  40.Z - - - - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - - - -  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
     Z                  .                B                 .                 .  ZP
  50.Z - - - - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - - - -  ZP
```

APPENDIX C

1/23/73 APPLE

C

TIME	SYMM	SIGM	SSM	SM	OVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CON	P									
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+00	E+00	E+00
	E+00	E+00	E-03	E+00	E+00									
.0	20.536	16.891	23.636	305.31	5.0000	240.0	.75918	164.1	1.0000	1400.0	15.1	20.0	14.8	.0
	1183.2	500.00	1.0000	2.0000	0.									
1.	19.022	16.906	22.829	215.66	3.6660	733.9	.83042	873.8	1.0000	766.8	683.3	684.7	682.9	435.8
	375.8	568.75	.3164	.7840	0.									
2.	19.673	16.942	23.901	218.45	3.6097	996.6	.82694	1286.7	.9713	849.9	822.6	822.9	822.3	915.0
	921.9	546.79	.1001	.3478	0.									
3.	20.158	16.965	13.648	185.75	3.6585	1081.8	.86782	1093.3	.9907	984.6	913.6	913.7	913.5	1178.7
	992.3	568.28	.0317	.1464	0.									
4.	18.043	16.926	16.336	190.15	3.7062	1120.8	.86231	1196.2	.9804	1048.4	979.2	979.2	979.1	1345.2
	1023.9	597.34	.0100	.0590	0.									
5.	19.872	16.969	18.538	208.67	3.7680	1116.1	.83916	1402.1	.9598	1092.8	1016.4	1016.4	1016.4	1450.4
	1045.4	616.47	.0032	.0229	0.									
6.	19.958	17.024	18.395	207.65	3.7498	1157.4	.84043	1448.7	.9551	1100.4	1037.3	1037.3	1037.3	1513.6
	1049.0	628.04	.0010	.0086	0.									
7.	18.360	17.139	11.542	174.31	3.7056	1204.6	.88211	1116.4	.9884	1116.0	1047.3	1047.3	1047.3	1548.9
	1056.4	633.76	.0003	.0032	0.									
8.	17.629	17.228	19.207	200.88	3.7156	1205.0	.84890	1433.7	.9566	1128.2	1058.1	1058.1	1058.1	1570.9
	1062.2	640.22	.0001	.0011	0.									
9.	20.195	17.382	17.220	205.49	3.7500	1184.9	.84313	1465.1	.9535	1144.6	1064.3	1064.3	1064.3	1586.2
	1069.9	643.90	.0000	.0004	0.									
10.	18.336	17.618	18.609	208.16	3.8151	1138.2	.83979	1438.5	.9562	1143.3	1069.9	1069.9	1069.9	1596.9
	1069.2	647.28	.0000	.0001	0.									
11.	19.014	17.861	12.735	185.66	3.7424	1196.4	.86793	1246.5	.9753	1122.8	1065.1	1065.1	1065.1	1601.9
	1059.6	644.38	.0000	.0001	0.									
12.	17.464	18.064	22.985	220.63	3.7705	1174.4	.82422	1628.4	.9372	1139.9	1064.9	1064.9	1064.9	1599.4
	1067.6	644.29	.0000	.0000	0.									
13.	20.031	18.202	20.897	219.04	3.7044	1223.4	.82620	1677.3	.9323	1130.8	1065.9	1065.9	1065.9	1599.7
	1063.4	644.86	.0000	.0000	0.									
14.	20.199	18.326	14.387	195.16	3.6884	1234.9	.85605	1402.2	.9598	1155.7	1066.3	1066.3	1066.3	1599.8
	1075.0	645.14	.0000	.0000	0.									
15.	19.493	18.429	13.476	138.86	3.6745	1247.1	.86392	1339.5	.9660	1151.7	1073.4	1073.4	1073.4	1605.2
	1073.2	649.43	.0000	.0000	0.									
16.	19.977	18.531	14.046	193.62	3.6841	1242.5	.85798	1393.4	.9607	1153.8	1076.4	1076.4	1076.4	1611.4
	1074.1	651.24	.0000	.0000	0.									

1/23/73 APPLE

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	OVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
17.	19.722	18.621	19.936	214.80	3.6857	1242.7	.83150	1653.8	.9346	1158.2	1076.8	1076.8	1076.8	1614.9
	1076.2	651.48	.0000	.0000	0.									
18.	17.742	18.707	20.501	209.52	3.6790	1248.1	.83810	1596.2	.9404	1158.2	1078.1	1078.1	1078.1	1616.9
	1076.2	652.22	.0000	.0000	0.									
19.	19.857	18.781	17.775	208.55	3.6969	1236.0	.83931	1569.0	.9431	1163.6	1079.0	1079.0	1079.0	1618.6
	1078.7	652.81	.0000	.0000	0.									
20.	19.283	18.772	18.089	207.42	3.6944	1238.0	.84073	1557.9	.9442	1156.1	1079.8	1079.8	1079.8	1620.4
	1075.2	653.29	.0000	.0000	0.									
21.	20.051	18.746	10.652	183.89	3.7188	1220.8	.87013	1252.6	.9747	1162.9	1079.0	1079.0	1079.0	1620.0
	1078.4	652.78	.0000	.0000	0.									
22.	18.769	18.790	20.480	214.29	3.6921	1239.5	.83214	1643.8	.9356	1149.4	1077.8	1077.8	1077.8	1620.3
	1072.1	652.06	.0000	.0000	0.									
23.	19.740	18.904	20.820	219.37	3.6892	1240.5	.82578	1707.1	.9293	1156.2	1077.0	1077.0	1077.0	1617.5
	1075.3	651.59	.0000	.0000	0.									
24.	18.393	18.992	22.848	221.75	3.6816	1246.3	.82281	1744.4	.9256	1157.4	1078.0	1078.0	1078.0	1617.2
	1075.8	652.20	.0000	.0000	0.									
25.	19.977	19.085	21.465	222.75	3.6801	1248.0	.82156	1759.1	.9241	1167.5	1077.6	1077.6	1077.6	1617.8
	1080.5	651.96	.0000	.0000	0.									
26.	20.325	19.151	18.970	217.56	3.7225	1217.7	.82804	1654.6	.9345	1170.9	1081.7	1081.7	1081.7	1619.7
	1082.1	654.42	.0000	.0000	0.									
27.	18.668	19.238	18.144	208.34	3.7170	1223.1	.83957	1550.5	.9449	1161.3	1080.6	1080.7	1080.7	1622.3
	1077.6	653.80	.0000	.0000	0.									
28.	17.723	19.280	24.832	228.46	3.6947	1238.8	.81442	1816.3	.9184	1160.8	1077.6	1077.6	1077.6	1621.1
	1077.4	651.97	.0000	.0000	0.									
29.	19.591	19.300	20.347	217.45	3.6707	1255.4	.82819	1703.8	.9296	1163.8	1077.5	1077.5	1077.5	1618.9
	1078.8	651.90	.0000	.0000	0.									
30.	16.471	19.370	20.827	207.37	3.6682	1256.8	.84017	1587.2	.9413	1165.1	1080.4	1080.4	1080.4	1619.3
	1079.4	653.62	.0000	.0000	0.									
31.	19.539	19.371	17.852	209.45	3.6900	1242.5	.83818	1588.9	.9411	1166.2	1082.2	1082.2	1082.2	1621.9
	1079.9	654.75	.0000	.0000	0.									
32.	19.937	19.306	19.693	218.99	3.7157	1223.7	.82626	1680.2	.9320	1167.7	1082.1	1082.2	1082.2	1623.4
	1080.6	654.70	.0000	.0000	0.									
33.	20.433	19.246	17.893	210.36	3.6539	1267.6	.83705	1632.0	.9368	1159.0	1078.0	1078.0	1078.0	1623.1
	1076.6	652.18	.0000	.0000	0.									
34.	20.219	19.154	25.191	239.77	3.7138	1224.4	.80028	1932.4	.9068	1173.4	1081.6	1081.7	1081.7	1621.0
	1083.3	654.40	.0000	.0000	0.									

1/23/73 APPLE

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CCN	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	20.368	19.125	15.072	199.18	3.6504	1269.8	.85103	1494.8	.9505	1156.0	1080.6	1080.6	1080.6	1622.6
	1075.2	653.76	.0000	.0000	0.									
36.	18.480	19.147	13.762	188.52	3.6685	1257.1	.86435	1347.6	.9652	1161.3	1081.3	1081.3	1081.3	1622.5
	1077.6	654.20	.0000	.0000	0.									
37.	19.911	19.130	12.513	189.99	3.6854	1244.6	.86251	1352.3	.9648	1162.7	1080.9	1080.9	1080.9	1623.6
	1078.3	653.95	.0000	.0000	0.									
38.	20.198	19.056	20.775	220.30	3.6699	1256.9	.82462	1741.9	.9258	1150.0	1081.1	1081.1	1081.1	1623.4
	1072.4	654.04	.0000	.0000	0.									
39.	17.779	19.043	19.331	207.70	3.6987	1235.4	.84038	1558.1	.9442	1164.8	1079.4	1079.4	1079.4	1621.4
	1079.2	653.05	.0000	.0000	0.									
40.	19.711	18.963	17.316	205.11	3.6633	1260.7	.84362	1557.7	.9442	1153.5	1079.3	1079.3	1079.3	1621.3
	1074.0	653.00	.0000	.0000	0.									
41.	16.753	18.966	22.526	214.92	3.6900	1241.7	.83135	1654.4	.9346	1170.0	1078.9	1078.9	1078.9	1620.1
	1081.7	652.74	.0000	.0000	0.									
42.	17.669	19.021	21.855	214.70	3.6673	1258.6	.83162	1674.5	.9325	1162.5	1080.3	1080.3	1080.3	1621.2
	1078.2	653.59	.0000	.0000	0.									
43.	19.456	19.080	14.424	194.23	3.6675	1258.7	.85721	1420.1	.9580	1168.8	1080.3	1080.3	1080.3	1621.8
	1081.1	653.57	.0000	.0000	0.									
44.	19.488	19.185	20.626	220.12	3.7120	1227.1	.82485	1698.8	.9301	1170.7	1083.0	1083.0	1083.0	1623.7
	1082.0	655.23	.0000	.0000	0.									
45.	20.790	19.206	20.298	223.65	3.7092	1229.5	.82044	1744.8	.9255	1166.2	1081.3	1081.3	1081.3	1624.5
	1079.9	654.21	.0000	.0000	0.									
46.	19.640	19.152	20.829	217.37	3.6459	1272.1	.82828	1726.1	.9274	1148.2	1079.6	1079.6	1079.6	1623.5
	1071.6	653.14	.0000	.0000	0.									
47.	15.624	19.210	24.437	218.01	3.6781	1249.8	.82749	1703.4	.9297	1172.9	1078.6	1078.6	1078.6	1620.2
	1083.0	652.55	.0000	.0000	0.									
48.	19.275	19.188	14.577	194.92	3.6749	1252.9	.85635	1422.2	.9578	1170.6	1081.1	1081.1	1081.1	1621.7
	1082.0	654.07	.0000	.0000	0.									
49.	20.446	19.129	21.212	222.90	3.6669	1258.9	.82138	1777.2	.9223	1162.7	1081.9	1081.9	1081.9	1624.1
	1078.3	654.57	.0000	.0000	0.									
50.	18.936	19.085	23.190	226.55	3.7010	1234.1	.81682	1786.7	.9213	1168.5	1082.6	1082.7	1082.7	1624.1
	1081.0	655.01	.0000	.0000	0.									

```
        .0             10.T           20.T           30.T           40.T MGS
      .0- - - - - - - - - - - - -G- - -M- -S- - - - - - - - - - - - - -
        .              .         G   M.   S          .              .
        .              .         G    M     S        .              .
        .              .    S    G    M              .              .
        .              .         G M  .              .              . GS
        .              .         G  S M              .              .
        .              .          G S M              .              .
        .              . S        G M .              .              .
        .              .          M  S.              .              . MG
        .              .          G   M              .              . GS
    10.- - - - - - - - - - - - - G M - - - - - - - - - - - - - - - - MS
        .              .   S       G M.              .              .
        .              .          MG  .   S          .              .
        .              .           G  MS             .              .
        .              .      S    G  M              .              .
        .              .    S       GM.              .              .
        .              .     S      G M              .              .
        .              .            G M              .              . MS
        .              .           MG .S             .              .
        .              .           SG M              .              .
    20.- - - - - - - - - - - - - -SGM- - - - - - - - - - - - - - - -
        .              .S           G M              .              .
        .              .            M .S             .              . MG
        .              .            G MS             .              .
        .              .            M .   S          .              . MG
        .              .             GM S            .              .
        .              .            SGM              .              .
        .              .           SMG.              .              .
        .              .           M G.      S       .              .
        .              .             M.S             .              . MG
    30.- - - - - - - - - - - - -M- -G-S- - - - - - - - - - - - - - -
        .              .           S M.              .              . MG
        .              .             GM              .              . MS
        .              .           S G.M             .              .
        .              .             GM       S      .              .
        .              .       S     G.M             .              .
        .              .     S      MG.              .              .
        .              .   S         GM              .              .
        .              .             GMS             .              .
        .              .           M G.              .              . GS
    40.- - - - - - - - - - - - - S G M - - - - - - - - - - - - - - -
        .              .         M  G .   S          .              .
        .              .           M G.  S           .              .
        .              .      S      M.              .              . MG
        .              .             M.S             .              . MG
        .              .             GSM             .              .
        .              .             M.S             .              . MG
        .              .       M     G.      S       .              .
        .              .      S      M.              .              . MG
        .              .             G.MS            .              .
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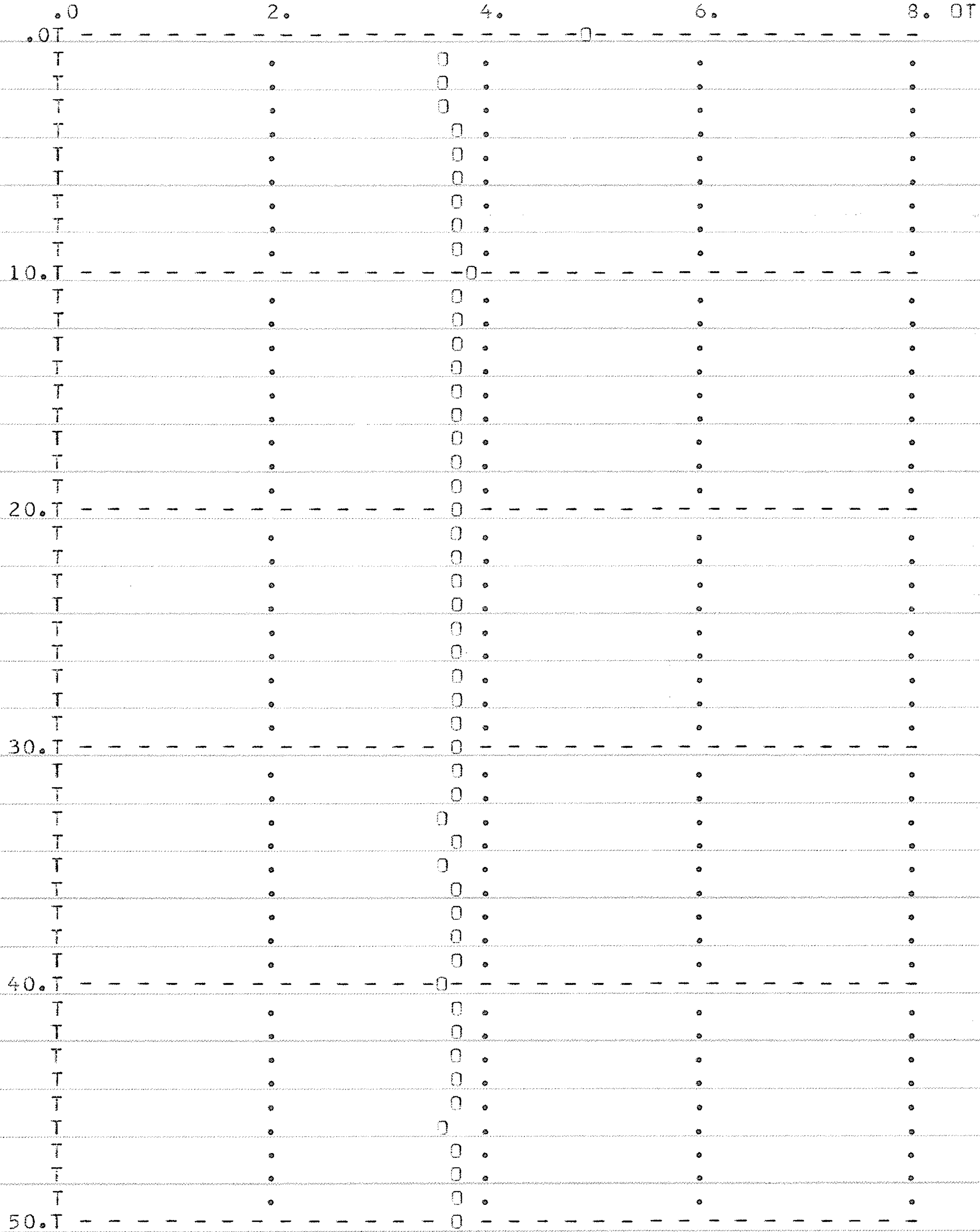

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        N            A .     MC       .              .              . MB
        N              .         M A  .              .              . MCB
        N              .           M  .    A         .              . MCB
        N              .             M.         A    .              . MCB
        N              .              M             A.              . MCB
        N              .              .M             A              . MCB
        N              .              .M             .A             . MCB
        N              .              . M            . A            . MCB
        N              .              . M            .  A           . MCB
     10.N - - - - - - - - - - - - - - - M - - - - - - - A - - - - - - MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .  A           . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
     20.N - - - - - - - - - - - - - - - M - - - - - - - -A- - - - - - MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
     30.N - - - - - - - - - - - - - - - M - - - - - - - -A- - - - - - MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
     40.N - - - - - - - - - - - - - - - M - - - - - - - -A- - - - - - MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
        N              .              . M            .   A          . MCB
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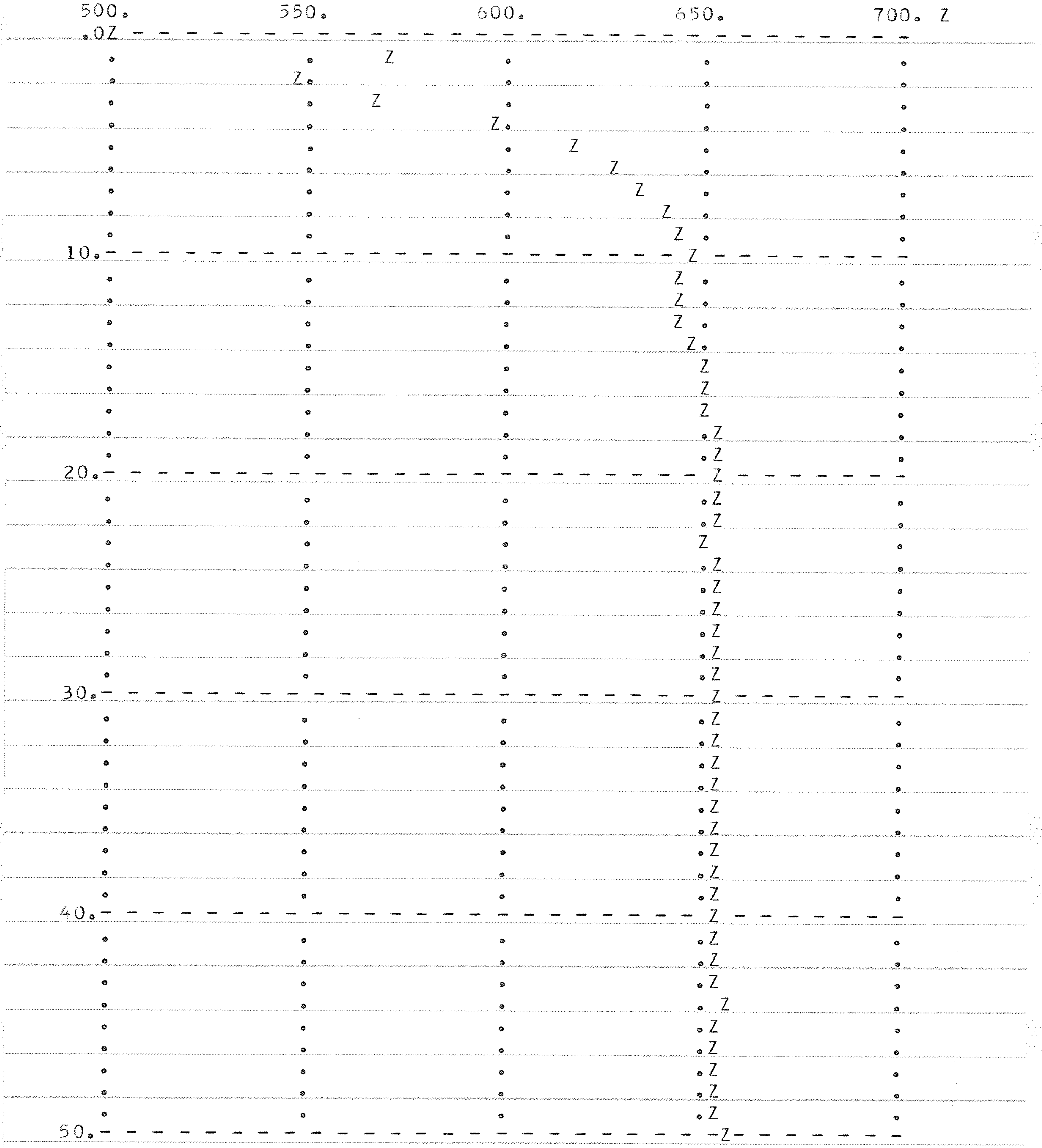

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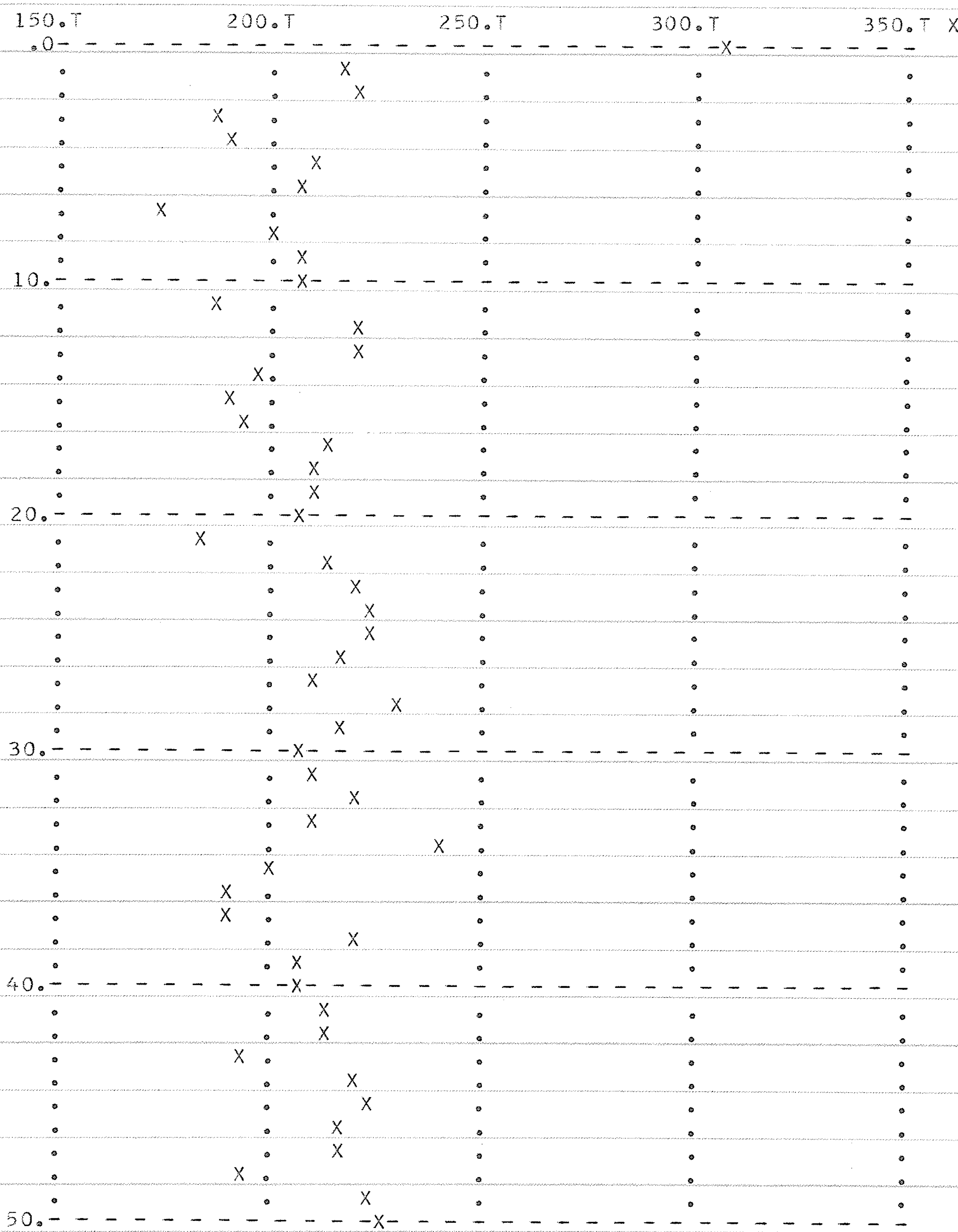

SAC=X,SP=S,CONTM=T

```
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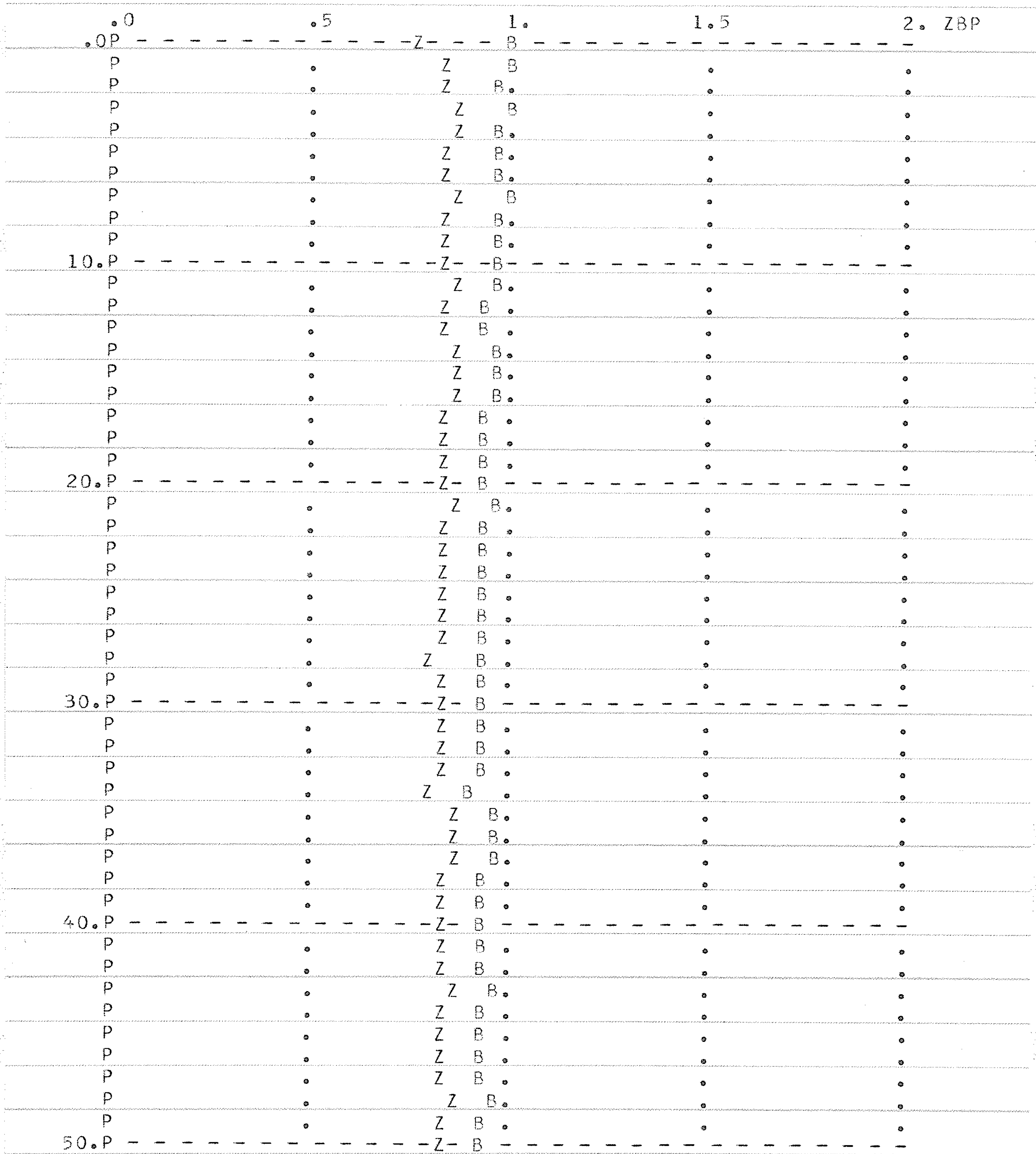
        .              .      SX  T   .              .              .
        .              .         X    S        T     .              .
        .              .              X ST           .              .
        .              .              .X  S T        .              .
        .              .              .  X        T  .              . XS
        .              .              .  X S       T .              .
        .              .              .  X  S        .              . XT
        .              .              .   X S      T .              .
        .              .              .   X S       T.              .
     10.- - - - - - - - - - - - - - - - - X - - - -T- - - - - - - - - - - XS
        .              .              .   X ST       .              .
        .              .              .   XS         .   T          .
        .              .              .   X  S       .    T         .
        .              .              .    X S    T  .              .
        .              .              .    X S  T    .              .
        .              .              .    X S    T  .              .
        .              .              .    X S       .    T         .
        .              .              .    X S       .  T           .
        .              .              .    X S       . T            .
     20.- - - - - - - - - - - - - - - - - -X-S- - - - -T- - - - - - -
        .              .              .    X ST      .              .
        .              .              .   X  S       .   T          .
        .              .              .    X S       .     T        .
        .              .              .    X S       .      T       .
        .              .              .    X S       .       T      .
        .              .              .    X S       .    T         .
        .              .              .    X S       . T            .
        .              .              .    X S       .        T     .
        .              .              .    X  S      .     T        .
     30.- - - - - - - - - - - - - - - - - -X-  S - - - - T - - - - -
        .              .              .    X S       .  T           .
        .              .              .    X S       .    T         .
        .              .              .    X  S      .   T          .
        .              .              .    X S       .            T .
        .              .              .    X  S      T              .
        .              .              .    X  S T    .              .
        .              .              .    X S   T   .              .
        .              .              .    X  S      .      T       .
        .              .              .    X S       . T            .
     40.- - - - - - - - - - - - - - - - - -X-  S - - - -T- - - - - - -
        .              .              .    X S       .    T         .
        .              .              .    X  S      .    T         .
        .              .              .    X  S    T .              .
        .              .              .    X S       .     T        .
        .              .              .    X S       .      T       .
        .              .              .   X   S      .      T       .
        .              .              .    X S       .     T        .
        .              .              .    X  S    T .              .
        .              .              .    X  S      .       T      .
     50.- - - - - - - - - - - - - - - - - -X-S- - - - - - - - T - - -
```

1/23/73 APPLE

STA=Z,BIAS=B,P=P



APPENDIX D

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1/23/73 APPLE

D

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CCN	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+03	E+03	E+00	E+03
	E+09	E+09	E+00	E+03	E+00									
.0	20.536	16.891	23.636	305.31	5.0000	240.0	.75918	164.1	1.0000	1400.0	.015	.02	14.8	.000
	.000	.000	.001	.002	.0000									
1.	19.022	16.906	22.899	229.22	3.8965	758.4	.81348	998.1	1.0000	772.6	.685	.69	684.5	.474
	.000	.000	.000	.001	.0000									
2.	19.673	16.942	23.901	234.01	3.8669	1034.8	.80748	1476.3	.9524	868.1	.763	.76	762.9	.889
	.000	.000	.000	.000	.0000									
3.	20.158	16.965	13.648	199.24	3.9243	1124.3	.85095	1273.3	.9727	1004.3	.878	.88	878.1	1.117
	.000	.000	.000	.000	.0000									
4.	18.043	16.926	16.336	204.87	3.9931	1173.0	.84392	1417.2	.9583	1069.8	.988	.99	987.8	1.311
	.000	.000	.000	.000	.0000									
5.	19.872	16.969	18.538	226.00	4.0809	1178.2	.81750	1684.4	.9316	1121.0	1.058	1.06	1057.8	1.466
	.000	.000	.000	.000	.0000									
6.	19.958	17.024	18.395	225.33	4.0690	1229.4	.81834	1793.3	.9207	1130.3	1.103	1.50	1103.1	1.574
	.002	.000	2.788	.393	1.0000									
7.	18.360	17.139	11.542	193.00	4.1027	1312.3	.85875	1676.1	.9324	1141.3	2.057	6.31	1126.6	2.364
	.064	.013	6.705	4.037	1.0000									
8.	17.629	17.228	19.207	237.42	4.3914	1452.3	.80323	2782.3	.9000	1197.8	4.123	19.10	1157.6	5.410
	.348	.102	8.705	7.382	1.0000									
9.	20.195	17.382	17.220	256.15	4.6745	1585.6	.78990	3413.4	.8587	1306.4	6.202	39.78	1223.7	12.076
	1.409	.439	11.778	9.909	1.0000									
10.	18.336	17.618	18.609	268.56	4.9220	1649.2	.78215	3846.8	.8153	1385.8	8.419	69.40	1318.0	23.295
	3.361	1.487	11.121	12.973	1.0000									
11.	19.014	17.861	12.735	246.06	4.9598	1850.2	.79622	4118.5	.8000	1400.1	9.500	76.06	1365.7	33.977
	3.640	2.363	8.941	11.982	1.0000									
12.	17.464	18.064	22.985	294.22	5.0282	1866.7	.76611	4841.6	.8000	1463.6	9.981	98.49	1417.9	41.030
	7.535	3.977	12.699	14.461	1.0000									
13.	20.031	18.202	20.897	295.98	5.0057	1996.6	.76501	5279.6	.7441	1493.0	11.005	116.17	1471.9	50.005
	9.839	6.084	12.239	16.076	1.0000									
14.	20.199	18.326	14.387	265.93	5.0261	2057.6	.78379	5077.3	.7845	1489.3	12.208	139.13	1476.6	60.126
	13.871	9.168	12.727	18.127	1.0000									
15.	19.493	18.429	13.476	259.68	5.0523	2114.6	.78770	5142.4	.7715	1443.0	12.649	121.03	1494.8	67.023
	8.517	8.792	8.653	14.686	1.0000									
16.	19.977	18.531	14.046	265.52	5.0523	2111.2	.78405	5207.9	.7584	1441.9	11.681	127.21	1487.0	64.189
	9.676	8.933	9.719	15.509	1.0000									

1/23/73 APPLE

TIME	SYMM	SIGM	SSM	SM	OVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CON	P									
17.	19.722	18.621	19.936	293.79	5.0411	2105.5	.76638	5640.9	.6718	1437.7	11.986	140.60	1470.4	66.169
	13.738	10.618	11.888	17.465	1.0000									
18.	17.742	18.707	20.501	287.55	5.0492	2122.0	.77028	5602.8	.6794	1416.2	12.431	135.56	1458.1	69.462
	9.222	10.803	8.186	16.217	1.0000									
19.	19.857	18.781	17.775	285.71	5.0647	2100.4	.77143	5497.8	.7004	1438.6	11.801	129.44	1447.4	66.902
	11.282	9.843	10.985	15.351	1.0000									
20.	19.283	18.772	18.089	283.62	5.0516	2096.2	.77274	5446.1	.7108	1448.1	11.594	124.83	1466.5	65.543
	11.034	9.369	11.148	15.102	1.0000									
21.	20.051	18.746	10.652	250.70	5.0699	2057.4	.79331	4869.8	.8000	1492.3	11.841	134.48	1474.2	65.638
	13.340	10.262	12.220	16.631	1.0000									
22.	18.769	18.790	20.480	293.49	5.0568	2097.8	.76657	5619.0	.6762	1450.5	12.213	133.64	1494.3	67.695
	11.911	10.462	10.781	16.321	1.0000									
23.	19.740	18.904	20.820	300.80	5.0586	2106.6	.76200	5741.3	.6517	1437.2	12.076	120.39	1470.9	67.446
	6.876	9.355	7.029	14.505	1.0000									
24.	18.393	18.992	22.848	303.00	5.0305	2109.4	.76063	5718.5	.6563	1431.8	10.775	100.07	1456.7	59.779
	7.664	6.923	10.400	12.328	1.0000									
25.	19.977	19.085	21.465	302.08	4.9907	2089.5	.76120	5630.3	.6739	1445.3	10.406	102.71	1437.7	55.504
	8.046	6.687	10.644	13.620	1.0000									
26.	20.325	19.151	18.970	293.99	5.0302	2020.4	.76625	5354.7	.7291	1536.3	11.091	122.98	1478.4	56.338
	10.806	8.197	11.582	16.561	1.0000									
27.	18.668	19.238	18.144	283.60	5.0596	2042.9	.77275	5320.0	.7360	1526.3	12.504	141.93	1519.7	63.972
	15.366	10.562	13.119	18.308	1.0000									
28.	17.723	19.280	24.832	313.27	5.0662	2094.2	.75421	5939.6	.6121	1460.5	13.230	147.97	1500.4	71.631
	11.823	12.013	9.266	17.813	1.0000									
29.	19.591	19.300	20.347	299.68	5.0588	2148.5	.76270	5856.1	.6288	1379.8	12.385	123.97	1441.6	70.657
	10.027	9.838	9.915	14.312	1.0000									
30.	16.471	19.370	20.827	284.87	5.0270	2141.2	.77196	5548.0	.6904	1376.0	10.966	99.25	1405.9	63.419
	4.515	7.215	6.121	11.632	1.0000									
31.	19.539	19.371	17.852	283.23	4.9898	2076.1	.77298	5239.0	.7522	1460.3	8.929	71.07	1424.4	49.201
	3.545	4.186	7.907	9.113	1.0000									
32.	19.937	19.306	19.693	291.49	4.9460	1989.1	.76782	5085.1	.7830	1543.9	8.478	71.01	1479.6	41.068
	4.362	3.532	9.700	10.951	1.0000									
33.	20.433	19.246	17.893	280.86	4.8734	2049.4	.77446	5109.2	.7782	1512.8	9.250	83.33	1513.7	40.131
	5.880	4.090	10.624	13.791	1.0000									
34.	20.219	19.154	25.191	321.68	4.9824	1987.2	.74686	5630.2	.6740	1575.2	10.901	103.47	1546.0	45.688
	8.936	5.551	12.245	15.972	1.0000									

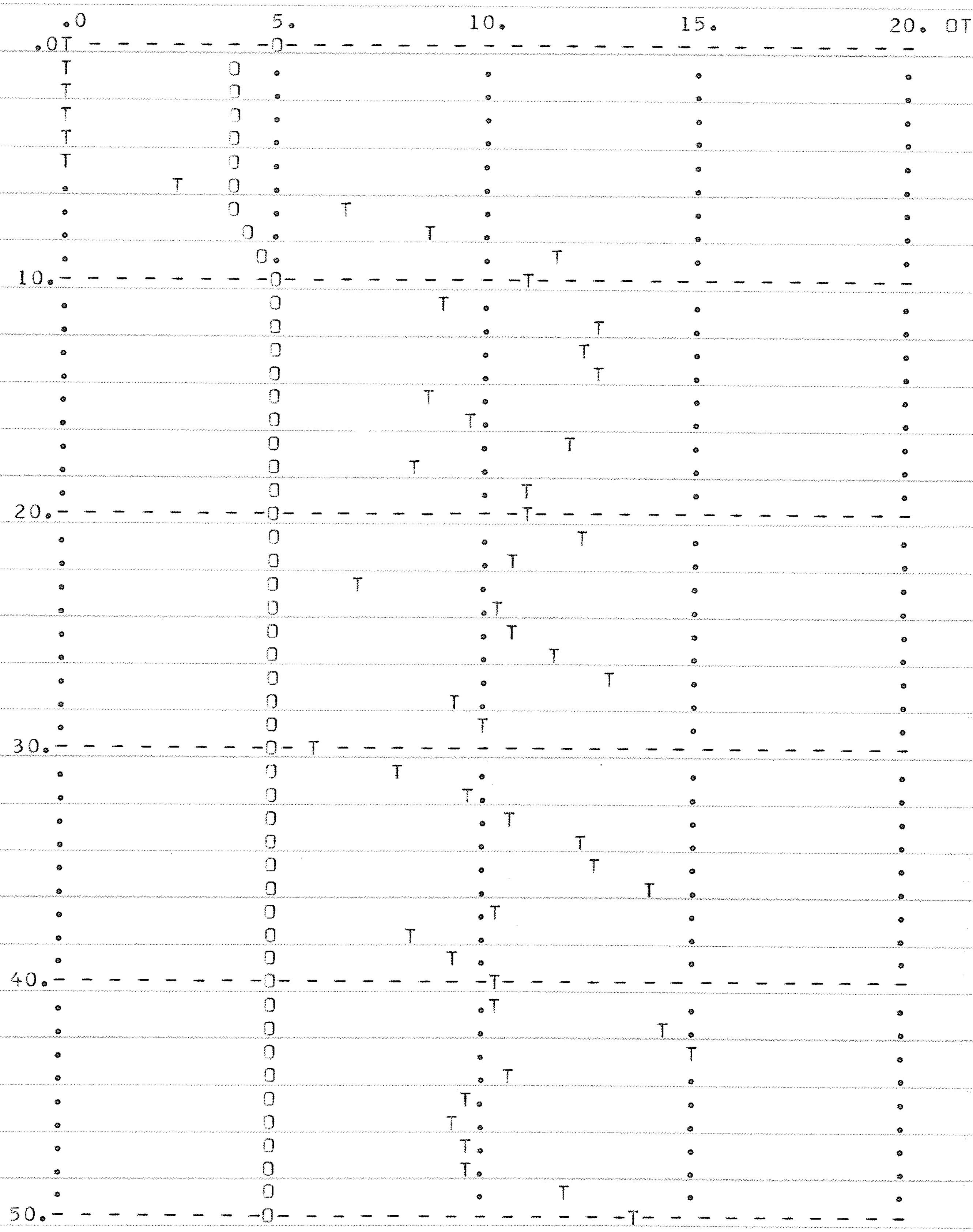
1/23/73 APPLE

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	20.368	19.125	15.072	270.63	4.9598	2103.4	.78086	5226.7	.7547	1452.0	12.047	122.12	1540.6	55.035
	11.833	7.477	12.660	16.984	1.0000									
36.	18.480	19.147	13.762	258.57	5.0315	2118.8	.78840	5154.3	.7691	1442.9	13.102	153.35	1511.8	66.033
	17.840	11.101	14.065	19.209	1.0000									
37.	19.911	19.130	12.513	261.73	5.0770	2122.9	.78642	5270.0	.7460	1429.7	14.012	168.67	1485.7	78.411
	15.343	14.408	10.178	19.225	1.0000									
38.	20.198	19.056	20.775	303.37	5.0538	2154.4	.76039	5985.4	.6029	1400.3	13.219	141.41	1468.5	80.010
	10.259	12.334	8.379	15.302	1.0000									
39.	17.779	19.043	19.331	285.08	5.0768	2111.4	.77182	5526.7	.6947	1419.1	11.618	118.93	1432.6	70.985
	8.686	9.531	9.176	13.335	1.0000									
40.	19.711	18.963	17.316	280.03	5.0016	2134.0	.77498	5458.9	.7082	1387.3	10.650	107.50	1434.6	62.748
	8.417	7.903	10.228	13.114	1.0000									
41.	16.753	18.966	22.526	291.24	5.0003	2076.1	.76797	5454.6	.7091	1452.5	10.520	110.97	1424.7	57.735
	8.707	7.704	10.426	14.465	1.0000									
42.	17.669	19.021	21.855	291.53	4.9795	2100.0	.76780	5537.2	.6926	1439.1	11.017	124.31	1452.5	58.003
	13.537	8.635	14.232	16.399	1.0000									
43.	19.456	19.080	14.424	265.17	5.0069	2114.3	.78427	5236.6	.7527	1422.1	12.365	150.68	1446.7	65.538
	18.441	11.704	14.865	18.929	1.0000									
44.	19.488	19.185	20.626	302.31	5.0981	2082.2	.76105	5758.7	.6483	1467.3	13.451	156.19	1462.3	74.966
	14.274	13.277	10.604	17.956	1.0000									
45.	20.790	19.206	20.298	308.07	5.1095	2104.9	.75745	5908.1	.6184	1434.3	12.958	149.14	1449.8	76.603
	12.362	12.728	9.753	16.548	1.0000									
46.	19.640	19.152	20.829	297.98	4.9979	2168.3	.76376	5901.8	.6196	1371.6	12.043	132.30	1435.8	73.954
	10.290	11.074	9.351	14.879	1.0000									
47.	15.624	19.210	24.437	297.81	5.0246	2118.9	.76387	5722.3	.6555	1394.3	11.276	118.61	1393.3	67.490
	9.069	9.375	9.656	13.916	1.0000									
48.	19.275	19.188	14.577	265.23	5.0006	2108.4	.78423	5165.7	.7669	1408.3	10.661	109.16	1399.1	61.315
	8.072	7.958	9.814	13.415	1.0000									
49.	20.446	19.129	21.212	302.47	4.9759	2103.1	.76096	5686.1	.6628	1428.2	10.439	108.61	1434.7	57.141
	9.550	7.386	11.879	14.069	1.0000									
50.	18.936	19.085	23.190	306.82	5.0125	2051.5	.75324	5626.2	.6748	1490.7	11.075	118.58	1461.2	57.734
	12.271	8.141	13.601	15.626	1.0000									

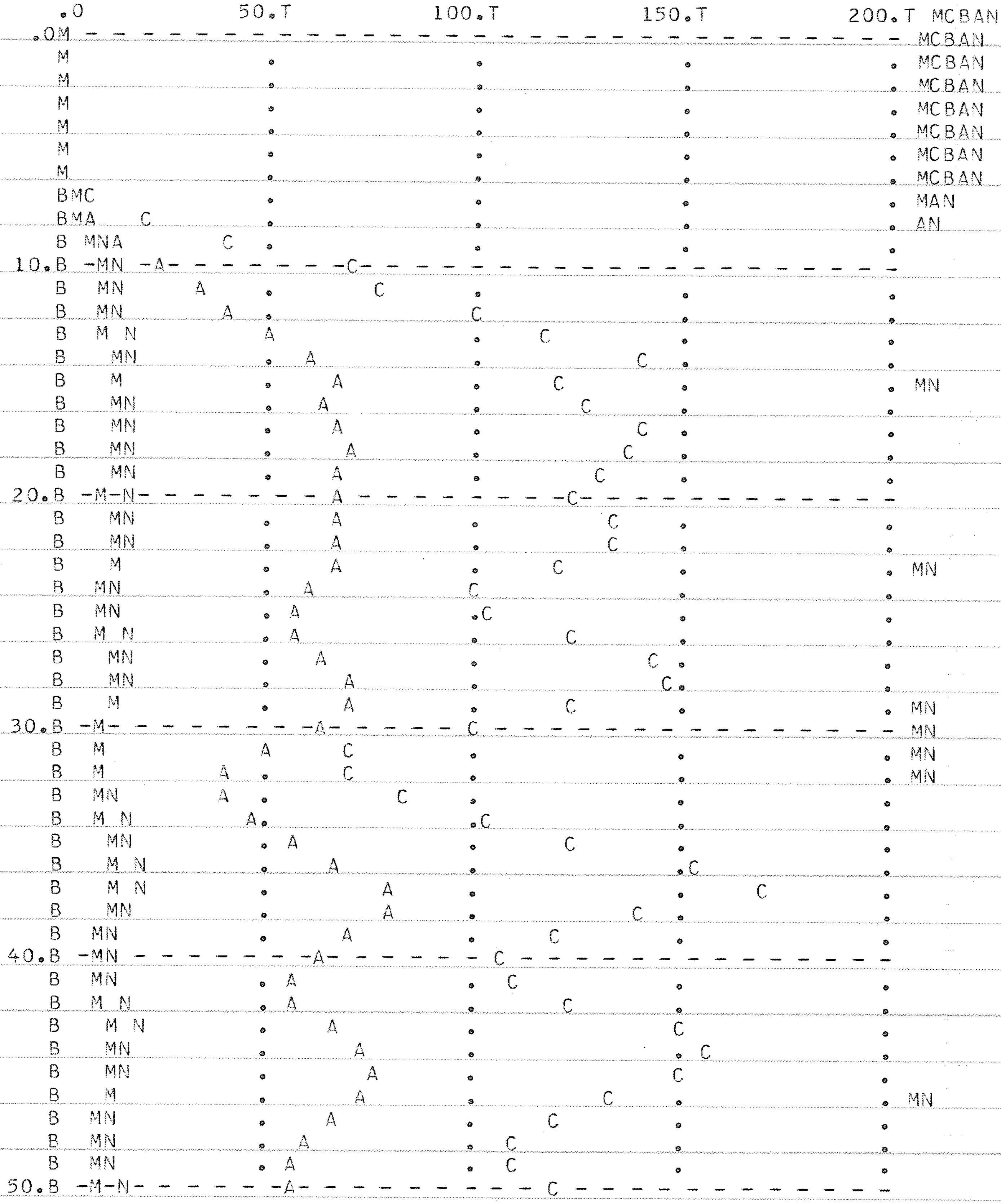
```
SYMM=M,SIGM=G,SSM=S                                                  216

         .0           10.T           20.T            30.T           40.T MGS
       .0- - - - - - - - - - - - - - -G- - -M- -S- - - - - - - - - - - - - -
         .              .         G   M.    S          .              .
         .              .         G    M      S        .              .
         .              .    S    G    M               .              .
         .              .         G  M .               .              .  GS
         .              .         G  S M               .              .
         .              .          G S M               .              .
         .              . S        G M .               .              .
         .              .          M  S.               .              .  MG
         .              .          G   M               .              .  GS
      10.- - - - - - - - - - - - - G M - - - - - - - - - - - - - - - - -  MS
         .              .   S       G M.               .              .
         .              .          MG  .    S          .              .
         .              .           G  MS              .              .
         .              .      S    G  M               .              .
         .              .    S       GM.               .              .
         .              .     S      G M               .              .
         .              .            G M               .              .  MS
         .              .           MG .S              .              .
         .              .           SG M               .              .
      20.- - - - - - - - - - - - - -SGM- - - - - - - - - - - - - - - - -
         .              .S           G M               .              .
         .              .            M .S              .              .  MG
         .              .            G MS              .              .
         .              .            M .   S           .              .  MG
         .              .             GM S             .              .
         .              .            SGM               .              .
         .              .           SMG.               .              .
         .              .           M G.      S        .              .
         .              .             M.S              .              .  MG
      30.- - - - - - - - - - - - -M- -G-S- - - - - - - - - - - - - - - -
         .              .           S M.               .              .  MG
         .              .             GM               .              .  MS
         .              .           S G.M              .              .
         .              .             GM       S       .              .
         .              .       S     G.M              .              .
         .              .     S      MG.               .              .
         .              .   S         GM               .              .
         .              .             GMS              .              .
         .              .           M G.               .              .  GS
      40.- - - - - - - - - - - - - - S G M - - - - - - - - - - - - - - -
         .              .         M  G .   S           .              .
         .              .           M G.  S            .              .
         .              .      S      M.               .              .  MG
         .              .             M.S              .              .  MG
         .              .             GSM              .              .
         .              .             M.S              .              .  MG
         .              .       M     G.      S        .              .
         .              .      S      M.               .              .  MG
         .              .             G.MS             .              .
      50.- - - - - - - - - - - - - - MG- - -S- - - - - - - - - - - - - -
```

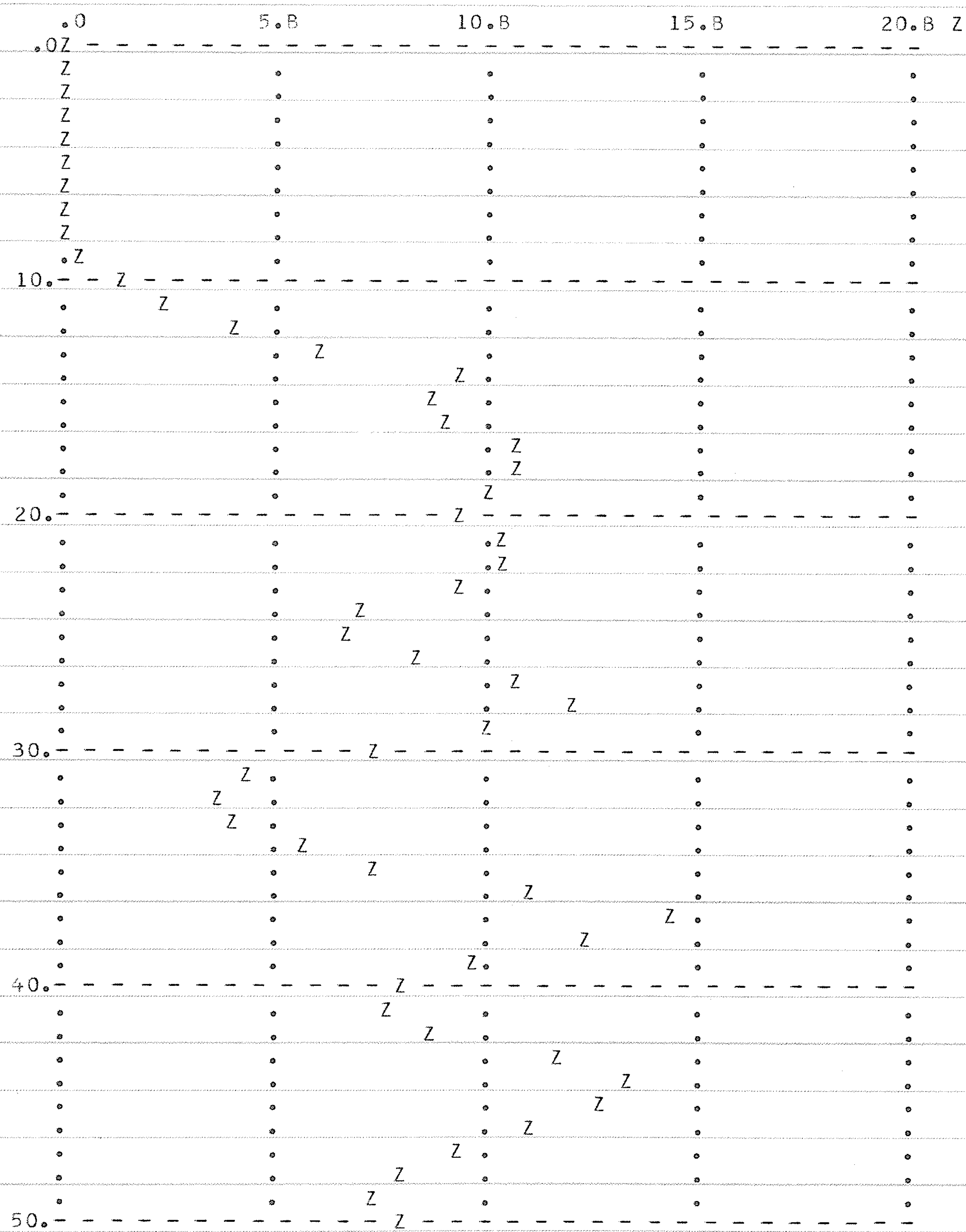
OVTS=O,SAT=T



MOTIVE=M,CC=C,BC=B,AT=A,CON=N

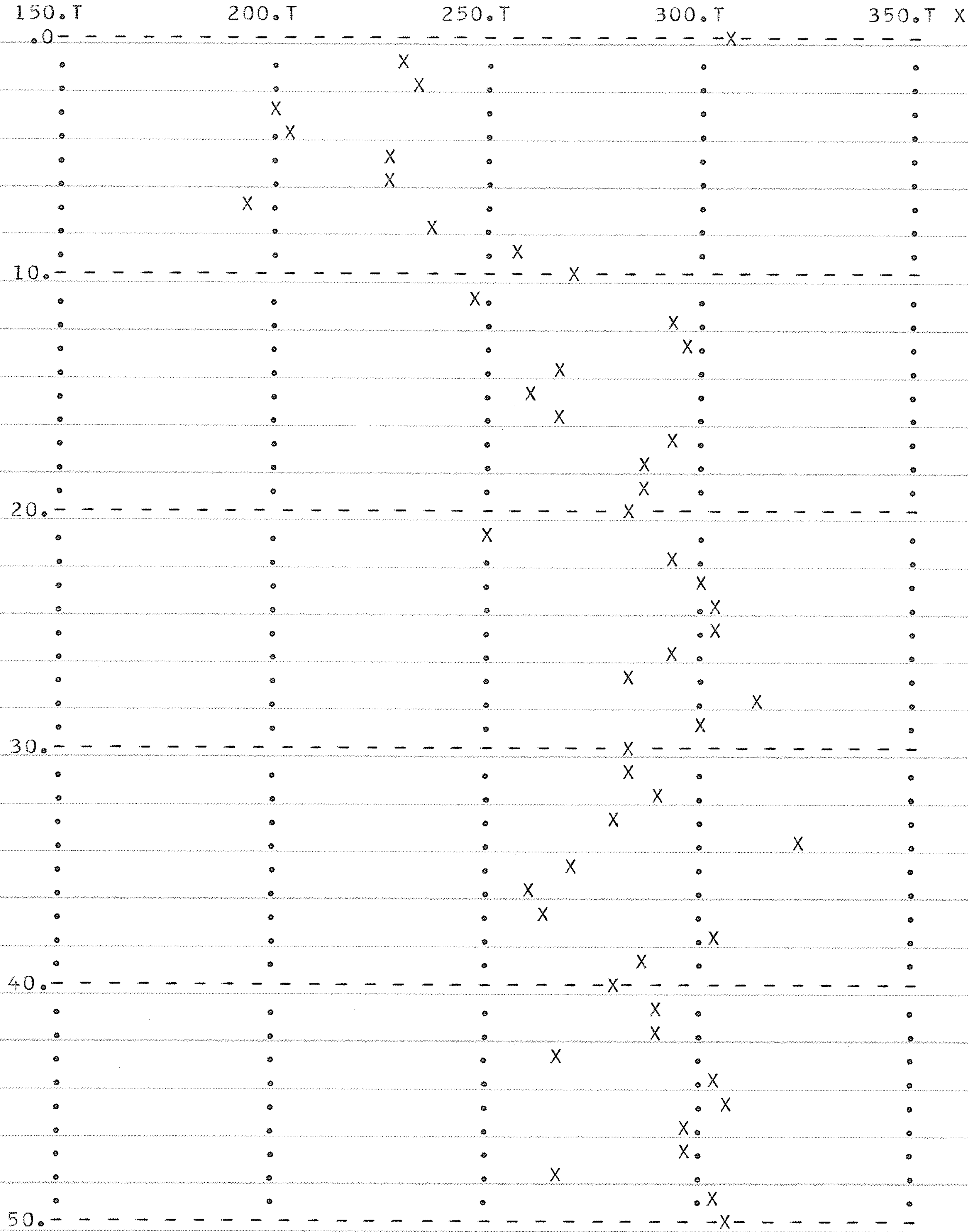


INT=Z



1/23/73 APPLE

SM=X



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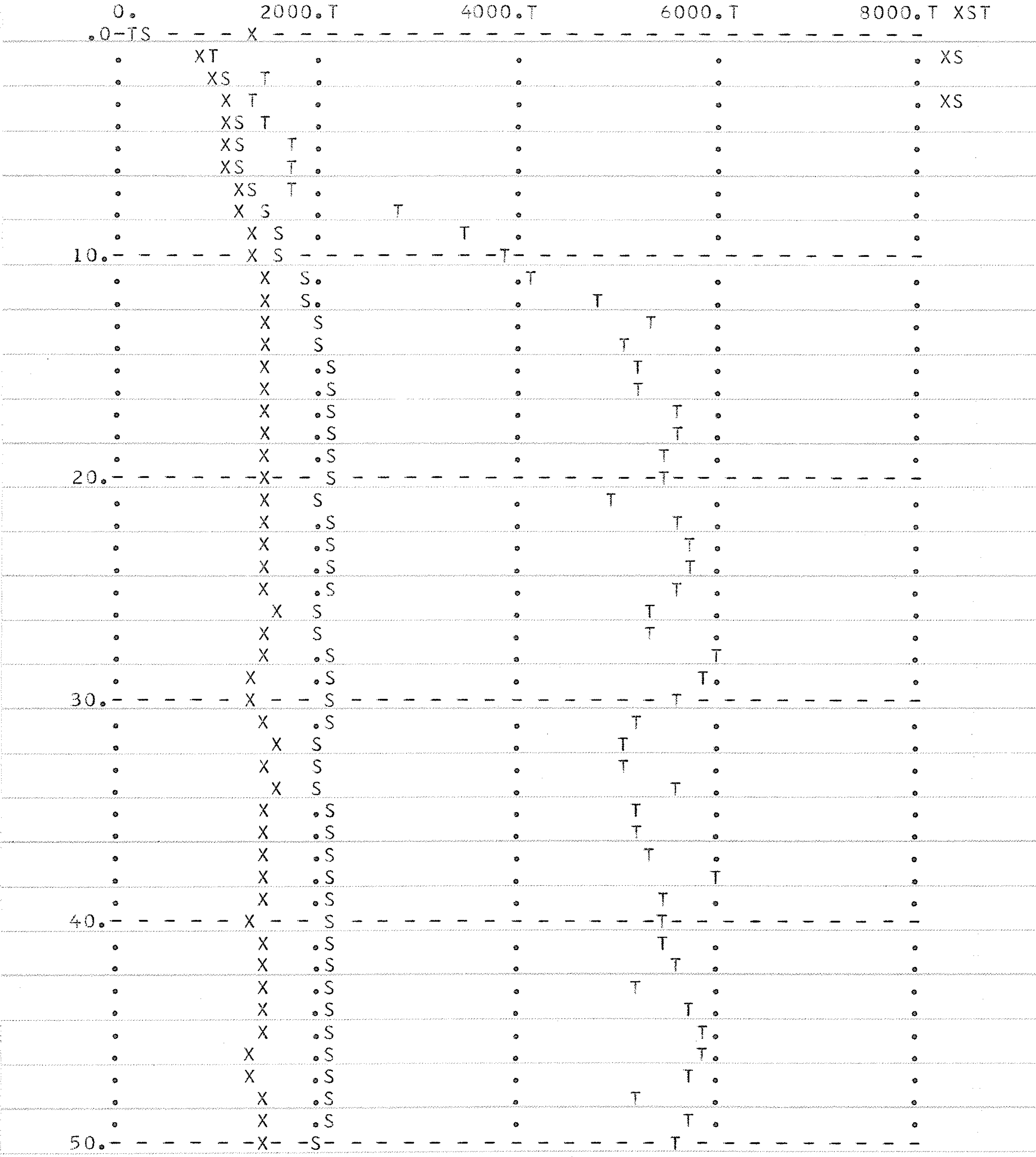
SAC=X,SP=S,CONTM=T



STA=Z,BIAS=B,P=P   222

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     .0             .5             1.            1.5            2. ZBP
   .0P - - - - - - - - - - -Z- - - B - - - - - - - - - - - - - - -
     P              .        Z     B              .              .
     P              .        Z    B.              .              .
     P              .          Z  B.              .              .
     P              .         Z   B.              .              .
     P              .         Z  B .              .              .
     .              .         Z  B P              .              .
     .              .          Z B P              .              .
     .              .        Z  B  P              .              .
     .              .        Z B   P              .              .
  10.- - - - - - - - - - - -ZB - - P - - - - - - - - - - - - - - -
     .              .        Z     P              .              . ZB
     .              .       ZB     P              .              .
     .              .      BZ      P              .              .
     .              .        Z     P              .              . ZB
     .              .       BZ     P              .              .
     .              .       BZ     P              .              .
     .              .    B  Z      P              .              .
     .              .    B  Z      P              .              .
     .              .     B Z      P              .              .
  20.- - - - - - - - - - -B-Z- - - P - - - - - - - - - - - - - - -
     .              .        Z     P              .              . ZB
     .              .    B  Z      P              .              .
     .              .    B  Z      P              .              .
     .              .    B  Z      P              .              .
     .              .    B  Z      P              .              .
     .              .      BZ      P              .              .
     .              .      BZ      P              .              .
     .              .  B    Z      P              .              .
     .              .   B   Z      P              .              .
  30.- - - - - - - - - - -B-Z- - - P - - - - - - - - - - - - - - -
     .              .       Z      P              .              . ZB
     .              .       Z      P              .              . ZB
     .              .       Z      P              .              . ZB
     .              .    B Z       P              .              .
     .              .       Z      P              .              . ZB
     .              .       BZ     P              .              .
     .              .      B Z     P              .              .
     .              .  B    Z      P              .              .
     .              .     B Z      P              .              .
  40.- - - - - - - - - - -B-Z- - - P - - - - - - - - - - - - - - -
     .              .     B Z      P              .              .
     .              .     B Z      P              .              .
     .              .       BZ     P              .              .
     .              .   B   Z      P              .              .
     .              .   B   Z      P              .              .
     .              .   B   Z      P              .              .
     .              .    B  Z      P              .              .
     .              .       BZ     P              .              .
     .              .    B  Z      P              .              .
  50.- - - - - - - - - B -Z- - - P - - - - - - - - - - - - - - -
```

APPENDIX E

1/23/73 APPLE

E

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03 E+00	E+03 E+00	E+03 E-03	E+03 E+00	E+00 E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+00	E+00	E+00
.0	20.536	16.891	23.636	305.31	5.0000	240.00	.75918	2.97	1.0000	1400.0	15.10	20.00	14.77	.00
	1183.2	500.00	1.0000	2.0000	0.									
1.	19.022	16.906	22.899	126.11	2.1437	189.34	.94237	35.97	1.0000	572.5	664.04	665.08	663.28	433.91
	756.7	738.02	.3164	.7835	0.									
2.	19.673	16.942	23.901	98.63	1.6298	197.41	.97671	20.58	1.0000	318.5	656.93	657.02	656.36	834.83
	564.4	626.53	.1001	.3388	0.									
3.	20.158	16.965	13.648	68.90	1.3571	161.00	.86125	97.68	1.0000	228.5	563.80	563.75	563.51	893.57
	478.0	511.40	.0317	.1336	0.									
4.	18.043	16.926	16.336	52.74	1.0280	105.41	.65927	140.58	1.0000	164.4	482.65	482.59	482.51	821.94
	405.5	429.53	.0100	.0494	0.									
5.	19.872	16.969	18.538	37.65	.6799	56.33	.47068	100.68	1.0000	108.2	406.22	406.19	406.16	719.18
	328.9	359.98	.0032	.0176	0.									
6.	19.958	17.024	13.395	22.78	.4114	26.28	.28475	52.78	1.0000	62.4	328.29	328.26	328.25	607.69
	249.8	289.36	.0010	.0061	0.									
7.	18.360	17.139	11.542	10.64	.2261	10.88	.13296	21.07	1.0000	32.2	251.80	251.77	251.77	492.47
	179.4	221.71	.0003	.0021	0.									
8.	17.629	17.228	19.207	5.79	.1071	3.92	.07240	6.15	1.0000	15.0	183.65	183.63	183.63	380.96
	122.6	161.64	.0001	.0007	0.									
9.	20.195	17.382	17.220	2.49	.0454	1.31	.03109	1.56	1.0000	6.5	127.80	127.82	127.82	281.36
	80.4	112.49	.0000	.0002	0.									
10.	18.336	17.618	18.609	.95	.0173	.42	.01183	.36	1.0000	2.6	85.49	85.48	85.48	198.97
	51.0	75.23	.0000	.0001	0.									
11.	19.014	17.861	12.735	.31	.0063	.13	.00391	.08	1.0000	1.0	55.37	55.36	55.36	135.43
	31.7	48.72	.0000	.0000	0.									
12.	17.464	18.064	22.985	.13	.0022	.04	.00159	.02	1.0000	.4	34.97	34.97	34.97	89.27
	19.4	30.77	.0000	.0000	0.									
13.	20.031	18.202	20.897	.04	.0007	.01	.00054	.00	1.0000	.1	21.68	21.68	21.68	57.32
	11.7	19.08	.0000	.0000	0.									
14.	20.199	18.326	14.387	.01	.0002	.00	.00016	.00	1.0000	.0	13.26	13.25	13.25	36.04
	7.0	11.66	.0000	.0000	0.									
15.	19.493	18.429	13.476	.00	.0001	.00	.00005	.00	1.0000	.0	8.01	8.00	8.00	22.29
	4.2	7.04	.0000	.0000	0.									
16.	19.977	18.531	14.046	.00	.0000	.00	.00002	.00	1.0000	.0	4.79	4.79	4.79	13.61
	2.5	4.22	.0000	.0000	0.									

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
17.	19.722	18.621	19.936	.00	.0000	.00	.00001	.00	1.0000	.0	2.85	2.85	2.85	8.22
	1.5	2.51	.0000	.0000	0.									
18.	17.742	18.707	20.501	.00	.0000	.00	.00000	.00	1.0000	.0	1.68	1.69	1.69	4.92
	.9	1.49	.0000	.0000	0.									
19.	19.857	18.781	17.775	.00	.0000	.00	.00000	.00	1.0000	.0	.99	.99	.99	2.93
	.5	.87	.0000	.0000	0.									
20.	19.283	18.772	18.089	.00	.0000	.00	.00000	.00	1.0000	.0	.58	.58	.58	1.73
	.3	.51	.0000	.0000	0.									
21.	20.051	18.746	10.652	.00	.0000	.00	.00000	.00	1.0000	.0	.33	.34	.34	1.02
	.2	.30	.0000	.0000	0.									
22.	18.769	18.790	20.480	.00	.0000	.00	.00000	.00	1.0000	.0	.19	.20	.20	.60
	.1	.18	.0000	.0000	0.									
23.	19.740	18.904	20.820	.00	.0000	.00	.00000	.00	1.0000	.0	.12	.12	.12	.35
	.1	.10	.0000	.0000	0.									
24.	18.393	18.992	22.848	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.07	.07	.20
	.0	.06	.0000	.0000	0.									
25.	19.977	19.085	21.465	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.04	.04	.12
	.0	.03	.0000	.0000	0.									
26.	20.325	19.151	18.970	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.02	.02	.07
	.0	.02	.0000	.0000	0.									
27.	18.668	19.238	18.144	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.01	.01	.04
	.0	.01	.0000	.0000	0.									
28.	17.723	19.280	24.832	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.01	.01	.02
	.0	.01	.0000	.0000	0.									
29.	19.591	19.300	20.347	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.01
	.0	.00	.0000	.0000	0.									
30.	16.471	19.370	20.827	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.01
	.0	.00	.0000	.0000	0.									
31.	19.539	19.371	17.852	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
32.	19.937	19.306	19.693	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
33.	20.433	19.246	17.893	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
34.	20.219	19.154	25.191	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									

1/23/73 APPLE

TIME	SYMM	SIGM	SSM	SM	OVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEMS	INT	SAT	CON	P									
35.	20.368	19.125	15.072	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
36.	18.480	19.147	13.762	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
37.	19.911	19.130	12.513	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
38.	20.198	19.056	20.775	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
39.	17.779	19.043	19.331	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
40.	19.711	18.963	17.316	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
41.	16.753	18.966	22.526	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
42.	17.669	19.021	21.855	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
43.	19.456	19.080	14.424	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
44.	19.488	19.185	20.626	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
45.	20.790	19.206	20.298	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
46.	19.640	19.152	20.829	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
47.	15.624	19.210	24.437	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
48.	19.275	19.188	14.577	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
49.	20.446	19.129	21.212	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									
50.	18.936	19.085	23.190	.00	.0000	.00	.00000	.00	1.0000	.0	.05	.00	.00	.00
	.0	.00	.0000	.0000	0.									

```
1/23/73   APPLE

SYMM=M,SIGM=G,SSM=S

    .0           10.T           20.T           30.T           40.T MGS
  .0- - - - - - - - - - - - -G- - -M- -S- - - - - - - - - - - - -
    .              .         G   M.   S          .              .
    .              .         G    M     S        .              .
    .              .    S    G    M              .              .
    .              .         G M  .              .              . GS
    .              .         G  S M              .              .
    .              .          G S M              .              .
    .              . S        G M .              .              .
    .              .          M  S.              .              . MG
    .              .          G   M              .              . GS
 10.- - - - - - - - - - - - - G M - - - - - - - - - - - - - - - - MS
    .              .   S       G M.              .              .
    .              .          MG  .   S          .              .
    .              .           G  MS             .              .
    .              .      S    G  M              .              .
    .              .    S       GM.              .              .
    .              .     S      G M              .              .
    .              .            G M              .              . MS
    .              .           MG .S             .              .
    .              .           SG M              .              .
 20.- - - - - - - - - - - - - -SGM- - - - - - - - - - - - - - - -
    .              .S           G M              .              .
    .              .            M .S             .              . MG
    .              .            G MS             .              .
    .              .            M .   S          .              . MG
    .              .             GM S            .              .
    .              .            SGM              .              .
    .              .           SMG.              .              .
    .              .           M G.      S       .              .
    .              .             M.S             .              . MG
 30.- - - - - - - - - - - - -M- -G-S- - - - - - - - - - - - - - -
    .              .           S M.              .              . MG
    .              .             GM              .              . MS
    .              .           S G.M             .              .
    .              .             GM       S      .              .
    .              .       S     G.M             .              .
    .              .     S      MG.              .              .
    .              .   S         GM              .              .
    .              .             GMS             .              .
    .              .           M G.              .              . GS
 40.- - - - - - - - - - - - - S G M - - - - - - - - - - - - - - -
    .              .         M  G .   S          .              .
    .              .           M G.  S           .              .
    .              .      S      M.              .              . MG
    .              .             M.S             .              . MG
    .              .             GSM             .              .
    .              .             M.S             .              . MG
    .              .       M     G.      S       .              .
    .              .      S      M.              .              . MG
    .              .             G.MS            .              .
 50.- - - - - - - - - - - - - - MG- - -S- - - - - - - - - - - - -
```

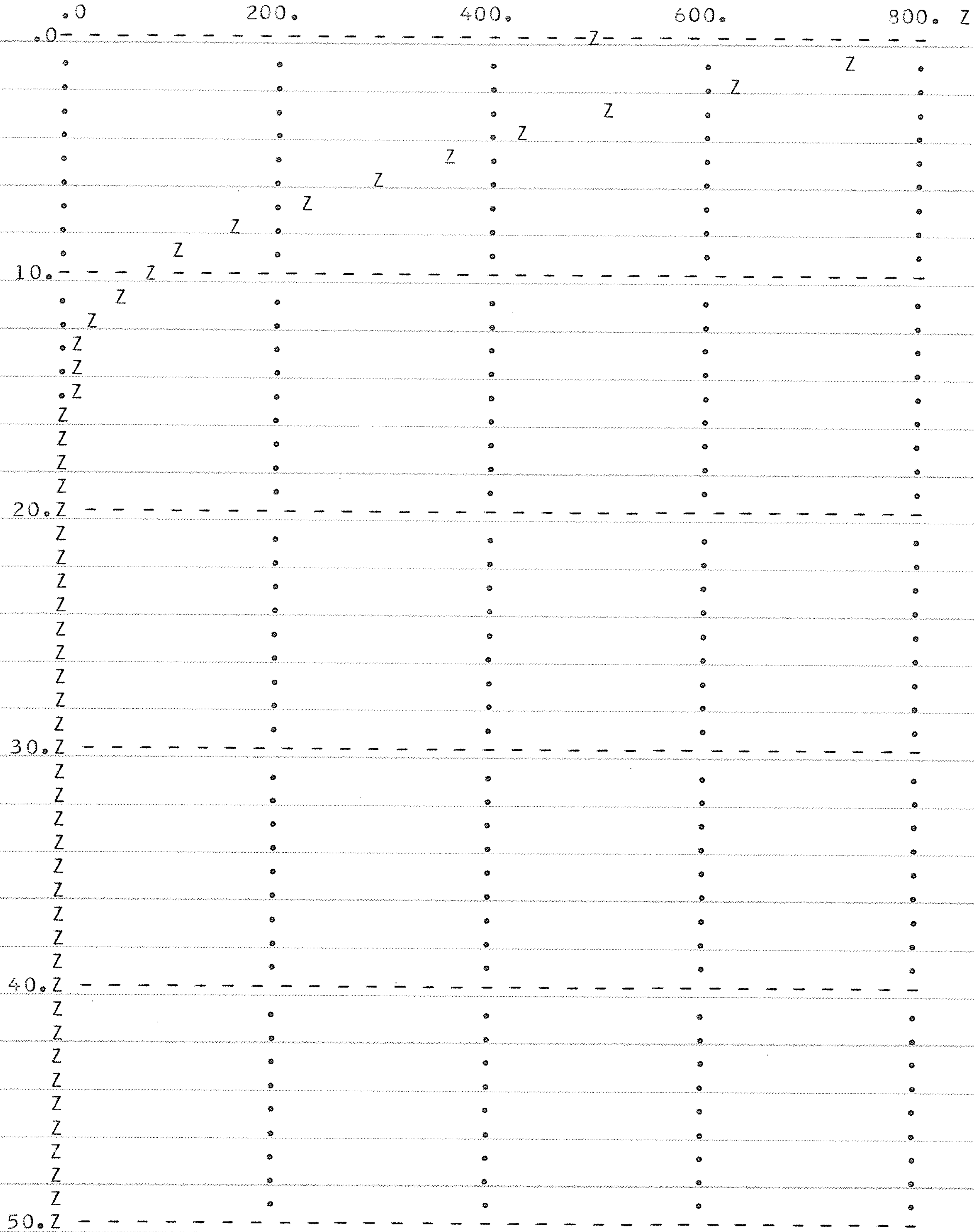
OVTS=0,SAT=T


```
          .0             2.             4.             6.             8. 0T
       .0T - - - - - - - - - - - - - - - - - -0- - - - - - - - - - - -
          T              .0             .              .              .
          T           0  .              .              .              .
          T         0    .              .              .              .
          T       0      .              .              .              .
          T    0         .              .              .              .
          T  0           .              .              .              .
          T 0            .              .              .              .
          T0             .              .              .              .
          0              .              .              .              . 0T
      10.0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
      20.0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
      30.0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
      40.0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
          0              .              .              .              . 0T
      50.0 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 0T
```

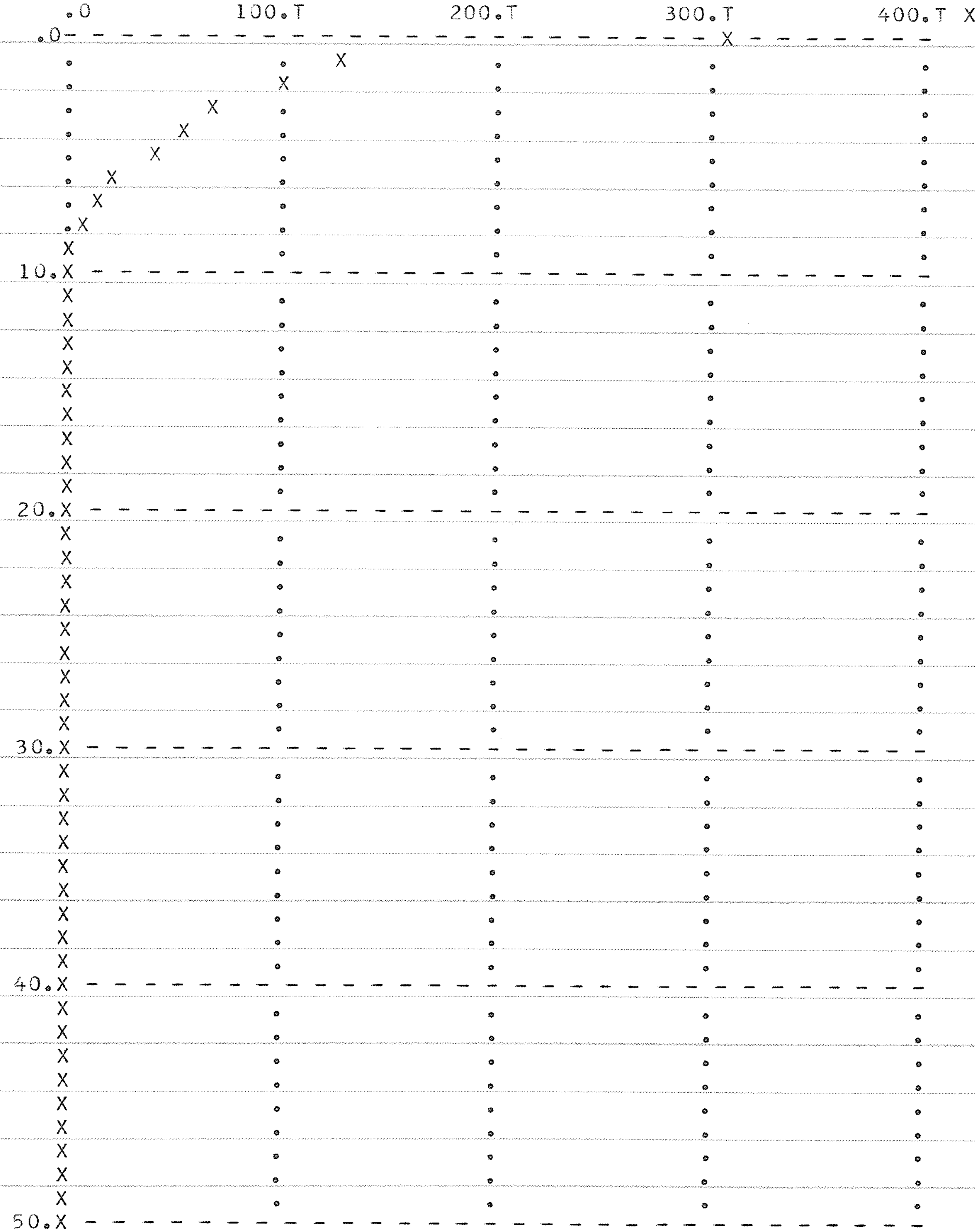
MOTIVE=M,CC=C,BC=B,AT=A,CON=N


```
    0.          300.           600.           900.          1200. MCBAN
  .0AM- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCB,AN
    N              .      A       .  M           .              . MCB
    N              .              .  M        A  .              . MCB
    N              .            M .              A              . MCB
    N              .        M     .          A   .              . MCB
    N              .    M         .     A        .              . MCB
    N              .M             A              .              . MCB
    N            M .         A    .              .              . MCB
    N        M     .   A          .              .              . MCB
    N     M       A.              .              .              . MCB
 10.N - M - - A - - - - - - - - - - - - - - - - - - - - - - - - - MCB
    N  M   A       .              .              .              . MCB
    N M A          .              .              .              . MCB
    NM A           .              .              .              . MCB
    NMA            .              .              .              . MCB
    MA             .              .              .              . MCBN
    MA             .              .              .              . MCBN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
 20.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
 30.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
 40.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
 50.M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
```

INT=Z



SM=X



SAC=X,SP=S,CONTM=T

```
         0.          500.T        1000.T        1500.T        2000.T XST
      .0T - - -S- - - - - - - - - - - - - - - - - X - - - - - - - - - -
         .T     S     . X         .             .             .
         .T     S    X.           .             .             .
         .  T S X     .           .             .             .
         .  STX       .           .             .             .
         . SX         .           .             .             . XT
         .SX          .           .             .             . XT
         SX           .           .             .             . XT
         X            .           .             .             . XST
         X            .           .             .             . XST
     10. X - - - - - - - - - - - - - - - - - - - - - - - - - - - XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
     20. X - - - - - - - - - - - - - - - - - - - - - - - - - - - XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
     30. X - - - - - - - - - - - - - - - - - - - - - - - - - - - XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
     40. X - - - - - - - - - - - - - - - - - - - - - - - - - - - XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
         X            .           .             .             . XST
     50. X - - - - - - - - - - - - - - - - - - - - - - - - - - - XST
```

STA=Z,BIAS=B,P=P

```
     .0             .5              1.             1.5            2. ZBP
    .0P - - - - - - - - - - -Z- - - B - - - - - - - - - - - - - - -
      P              .            Z B              .              .
      P              .             ZB              .              .
      P              .          Z   B              .              .
      P              .    Z         B              .              .
      P             Z.              B              .              .
      P        Z     .              B              .              .
      P   Z          .              B              .              .
      P Z            .              B              .              .
      PZ             .              B              .              .
   10.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
   20.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
   30.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
   40.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
      Z              .              B              .              . ZP
   50.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - ZP
```

APPENDIX F

1/23/73 APPLE

F

235

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+06	E+00	E+03	E+03	E+03	E+00	E+03
	E+09	E+09	E+00	E+03	E+00									
.0	20.536	16.891	23.636	305.31	5.0000	240.0	.75918	.164	1.0000	1400.0	.015	.02	14.8	.00
	.000	.000	.001	.002	.0000									
1.	19.022	16.906	22.899	269.61	4.5831	895.5	.73149	1.403	.9597	993.0	.806	.81	804.7	.50
	.000	.000	.000	.001	.0000									
2.	19.673	16.942	23.901	293.43	4.8488	1439.8	.76661	2.822	.9000	1239.9	1.271	2.90	1132.4	1.40
	.013	.001	5.185	1.766	1.0000									
3.	20.158	16.965	13.648	266.15	5.2421	1822.4	.78366	3.828	.8172	1612.8	3.683	15.71	1389.8	4.11
	.342	.068	9.608	8.657	1.0000									
4.	18.043	16.926	16.336	296.43	5.7778	2231.1	.76473	5.534	.6933	1891.7	8.389	53.46	1602.4	13.88
	2.921	.689	13.482	15.605	1.0000									
5.	19.872	16.969	18.538	344.27	6.2165	2551.5	.70449	8.477	.2523	1874.9	14.091	128.22	1739.1	39.35
	13.557	4.216	15.029	22.923	1.0000									
6.	19.958	17.024	18.395	354.49	6.4013	2875.0	.63534	10.630	.1000	1312.9	18.957	203.40	1725.7	82.02
	21.756	13.128	10.269	25.830	1.0000									
7.	18.360	17.139	11.542	296.78	6.3090	3057.7	.76451	8.654	.2346	795.3	20.082	247.89	1526.4	121.11
	32.459	23.647	10.910	24.566	1.0000									
8.	17.629	17.228	19.207	342.90	6.3426	3124.3	.70706	11.155	.1000	633.2	20.025	284.24	1323.8	153.22
	42.381	34.873	11.999	23.050	1.0000									
9.	20.195	17.382	17.220	354.97	6.4778	3159.4	.63443	12.267	.1000	524.2	19.638	311.40	1153.2	179.19
	58.288	45.896	14.962	21.741	1.0000									
10.	18.336	17.618	18.609	364.11	6.6733	3130.7	.66729	12.927	.1000	545.3	19.598	352.83	1064.6	204.13
	64.936	60.573	14.649	21.716	1.0000									
11.	19.014	17.861	12.735	317.45	6.3990	3164.9	.75159	9.797	.1203	474.6	18.125	327.46	1007.6	221.04
	50.702	61.952	12.107	18.946	1.0000									
12.	17.464	18.064	22.985	380.45	6.5019	3151.6	.63666	14.260	.1000	453.1	17.136	333.45	963.2	219.91
	67.368	66.170	16.177	18.938	1.0000									
13.	20.031	18.202	20.897	368.37	6.2298	3145.6	.63931	13.351	.1000	434.4	16.099	336.21	929.7	222.14
	67.502	70.926	15.938	19.066	1.0000									
14.	20.199	18.326	14.387	326.78	6.1760	3129.8	.73729	10.256	.1000	425.5	16.041	345.61	908.3	225.35
	74.958	78.782	16.756	19.852	1.0000									
15.	19.493	18.429	13.476	314.34	6.1158	3130.8	.75353	9.619	.1381	420.8	15.854	307.91	892.7	226.16
	47.522	71.743	12.093	17.376	1.0000									
16.	19.977	18.531	14.046	322.17	6.1303	3119.9	.74592	9.833	.1167	434.2	14.880	298.30	895.7	212.15
	47.595	65.631	13.212	16.981	1.0000									

1/23/73 APPLE

TIME	SYMM	SIGM	SSM	SM	OVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CCN	P									
17.	19.722	18.621	19.936	356.86	6.1233	3108.2	.68088	12.280	.1000	430.3	14.603	306.73	897.2	205.25
	58.558	66.409	15.729	18.138	1.0000									
18.	17.742	18.707	20.501	347.25	6.0975	3104.6	.69891	11.566	.1000	422.0	14.774	295.62	890.7	204.05
	42.803	64.479	11.874	17.667	1.0000									
19.	19.857	18.781	17.775	347.60	6.1617	3101.3	.69826	11.544	.1000	417.3	14.538	281.59	883.5	196.37
	48.042	59.009	14.512	16.858	1.0000									
20.	19.283	18.772	18.089	344.46	6.1354	3091.6	.70413	11.259	.1000	444.3	14.220	273.84	892.2	190.84
	46.089	55.290	14.621	16.518	1.0000									
21.	20.051	18.746	10.652	307.98	6.2282	3090.4	.75751	9.218	.1782	428.4	14.397	284.31	894.6	187.84
	52.505	56.483	15.949	17.525	1.0000									
22.	18.769	18.790	20.430	355.30	6.1217	3084.6	.68381	12.005	.1000	450.7	14.455	283.94	910.2	189.81
	48.046	56.633	14.449	17.519	1.0000									
23.	19.740	18.904	20.820	364.05	6.1222	3085.8	.66741	12.625	.1000	463.5	14.505	265.90	910.9	188.92
	32.324	52.980	10.332	16.481	1.0000									
24.	18.393	18.992	22.848	367.00	6.0930	3088.7	.66188	12.774	.1000	434.4	13.662	232.72	907.2	176.85
	34.445	43.678	13.317	14.626	1.0000									
25.	19.977	19.085	21.465	367.77	6.0760	3078.7	.66044	12.730	.1000	421.4	13.108	230.82	895.0	166.05
	34.621	41.069	13.768	15.144	1.0000									
26.	20.325	19.151	18.970	363.21	6.2144	3061.5	.66899	12.336	.1000	454.6	13.534	256.10	904.2	162.81
	42.503	44.684	15.255	17.112	1.0000									
27.	18.668	19.238	18.144	347.79	6.2049	3073.5	.69790	11.360	.1000	431.5	14.454	284.55	904.2	172.54
	55.316	52.055	17.113	18.734	1.0000									
28.	17.723	19.280	24.832	380.12	6.1473	3086.1	.63728	13.771	.1000	419.6	15.139	297.24	893.9	186.20
	46.045	57.695	13.191	18.746	1.0000									
29.	19.591	19.300	20.347	359.86	6.0747	3101.4	.67527	12.392	.1000	415.6	14.774	268.60	882.8	189.44
	41.104	52.431	13.247	16.379	1.0000									
30.	16.471	19.370	20.827	343.06	6.0539	3097.6	.70677	11.125	.1000	414.5	13.807	233.25	875.6	180.66
	22.976	43.645	8.969	14.179	1.0000									
31.	19.539	19.371	17.852	346.38	6.1023	3082.0	.70053	11.174	.1000	413.2	12.213	182.81	870.3	157.29
	18.456	30.706	10.200	11.503	1.0000									
32.	19.937	19.306	19.693	361.39	6.1320	3032.2	.67239	11.900	.1000	479.2	11.156	172.51	884.3	136.33
	19.886	25.411	12.232	11.926	1.0000									
33.	20.433	19.246	17.893	340.19	5.9089	3015.3	.71215	10.348	.1000	436.4	10.814	179.25	901.6	125.94
	23.609	25.060	13.607	13.777	1.0000									
34.	20.219	19.154	25.191	396.16	6.1360	3009.3	.60720	14.122	.1000	494.2	12.143	201.30	913.1	126.52
	31.101	28.473	15.641	15.717	1.0000									

1/23/73 APPLE

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	20.368	19.125	15.072	323.48	5.9285	3024.1	.74347	9.330	.1670	442.2	12.876	227.77	921.0	137.15
	33.328	33.833	16.271	17.175	1.0000									
36.	18.480	19.147	13.762	309.70	6.0265	3050.4	.75644	9.023	.1977	470.4	14.243	275.90	934.0	154.45
	54.412	44.600	18.141	19.420	1.0000									
37.	19.911	19.130	12.513	315.09	6.1119	3068.0	.75307	9.306	.1694	474.4	15.741	313.97	949.4	179.90
	53.199	57.199	14.376	20.570	1.0000									
38.	20.198	19.056	20.775	364.53	6.0725	3096.2	.66651	12.749	.1000	466.9	15.951	298.25	948.4	196.03
	42.978	57.377	11.940	18.362	1.0000									
39.	17.779	19.043	19.331	347.12	6.1816	3102.6	.69916	11.506	.1000	468.8	15.327	272.25	940.3	193.95
	39.461	52.175	12.344	16.482	1.0000									
40.	19.711	18.963	17.316	337.93	6.0356	3104.5	.71639	10.813	.1000	438.0	14.134	256.37	923.3	185.71
	39.065	47.344	13.319	15.793	1.0000									
41.	16.753	18.966	22.526	356.82	6.1263	3092.6	.68095	12.080	.1000	424.0	13.824	255.77	904.3	177.30
	39.778	47.102	13.754	16.312	1.0000									
42.	17.669	19.021	21.855	353.17	6.0324	3089.3	.68780	11.801	.1000	417.3	13.676	270.11	891.0	174.82
	54.605	49.945	17.918	17.433	1.0000									
43.	19.456	19.080	14.424	320.03	6.0429	3089.5	.74994	9.495	.1505	414.2	14.477	304.34	883.7	183.59
	67.910	59.922	19.063	19.404	1.0000									
44.	19.488	19.185	20.626	369.01	6.2229	3100.1	.65810	13.104	.1000	434.0	15.790	319.85	893.2	198.93
	56.647	66.491	14.711	19.357	1.0000									
45.	20.790	19.206	20.298	375.13	6.2216	3113.8	.64663	13.634	.1000	422.9	15.766	315.30	890.2	206.50
	51.565	66.441	13.586	18.380	1.0000									
46.	19.640	19.152	20.829	356.32	5.9765	3100.3	.68190	12.211	.1000	442.1	14.787	295.28	894.9	206.61
	45.282	61.945	12.863	17.038	1.0000									
47.	15.624	19.210	24.437	361.66	6.1018	3101.1	.67189	12.554	.1000	426.1	14.393	271.14	893.2	197.67
	41.441	55.962	12.979	16.153	1.0000									
48.	19.275	19.188	14.577	322.05	6.0719	3093.8	.74615	9.643	.1357	418.9	13.725	252.83	885.6	185.77
	37.616	50.053	13.034	15.536	1.0000									
49.	20.446	19.129	21.212	366.16	6.0237	3080.6	.66344	12.676	.1000	429.5	13.221	246.63	889.9	175.16
	41.606	46.438	15.178	15.650	1.0000									
50.	18.936	19.085	23.190	374.87	6.1241	3053.8	.64712	13.162	.1000	474.8	13.590	256.50	912.3	171.26
	49.268	47.543	17.170	16.755	1.0000									

```
SYMM=M,SIGM=G,SSM=S

        .0           10.T           20.T           30.T           40.T MGS
      .0- - - - - - - - - - - - -G- - -M- -S- - - - - - - - - - - - -
        .              .         G   M.   S          .              .
        .              .         G    M     S        .              .
        .              .    S    G    M              .              .
        .              .         G M  .              .              . GS
        .              .         G  S M              .              .
        .              .          G S M              .              .
        .              . S        G M .              .              .
        .              .          M  S.              .              . MG
        .              .          G   M              .              . GS
     10.- - - - - - - - - - - - - G M - - - - - - - - - - - - - - - - MS
        .              .   S       G M.              .              .
        .              .          MG  .   S          .              .
        .              .           G  MS             .              .
        .              .      S    G  M              .              .
        .              .    S       GM.              .              .
        .              .     S      G M              .              .
        .              .            G M              .              . MS
        .              .           MG .S             .              .
        .              .           SG M              .              .
     20.- - - - - - - - - - - - - -SGM- - - - - - - - - - - - - - - -
        .              .S           G M              .              .
        .              .            M .S             .              . MG
        .              .            G MS             .              .
        .              .            M .   S          .              . MG
        .              .             GM S            .              .
        .              .            SGM              .              .
        .              .           SMG.              .              .
        .              .           M G.      S       .              .
        .              .             M.S             .              . MG
     30.- - - - - - - - - - - - -M- -G-S- - - - - - - - - - - - - - -
        .              .           S M.              .              . MG
        .              .             GM              .              . MS
        .              .           S G.M             .              .
        .              .             GM       S      .              .
        .              .       S     G.M             .              .
        .              .     S      MG.              .              .
        .              .   S         GM              .              .
        .              .             GMS             .              .
        .              .           M G.              .              . GS
     40.- - - - - - - - - - - - - S G M - - - - - - - - - - - - - - -
        .              .         M  G .   S          .              .
        .              .           M G.  S           .              .
        .              .      S      M.              .              . MG
        .              .             M.S             .              . MG
        .              .             GSM             .              .
        .              .             M.S             .              . MG
        .              .       M     G.      S       .              .
        .              .      S      M.              .              . MG
        .              .             G.MS            .              .
     50.- - - - - - - - - - - - - - MG- - -S- - - - - - - - - - - - -
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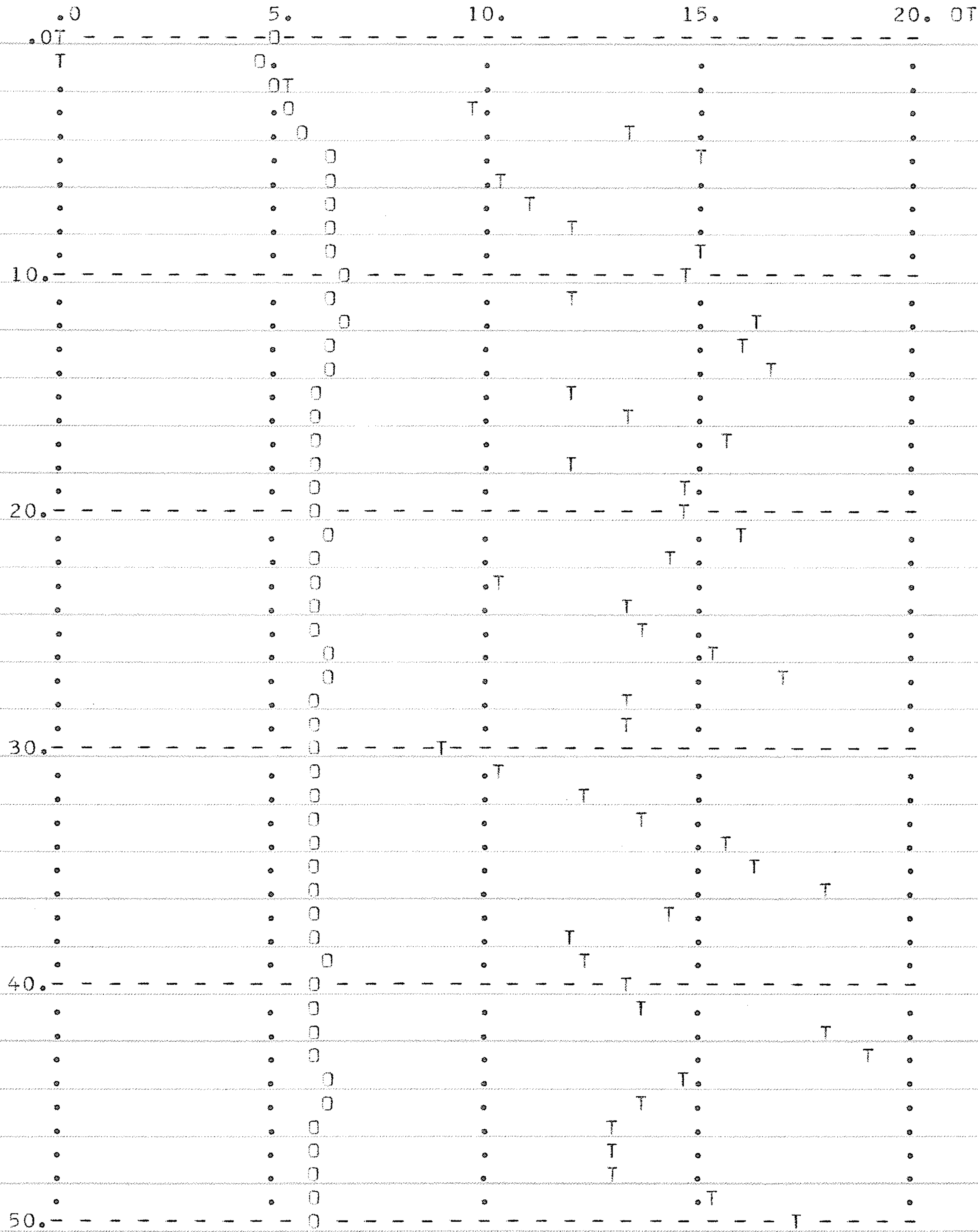
OVTS=O,SAT=T



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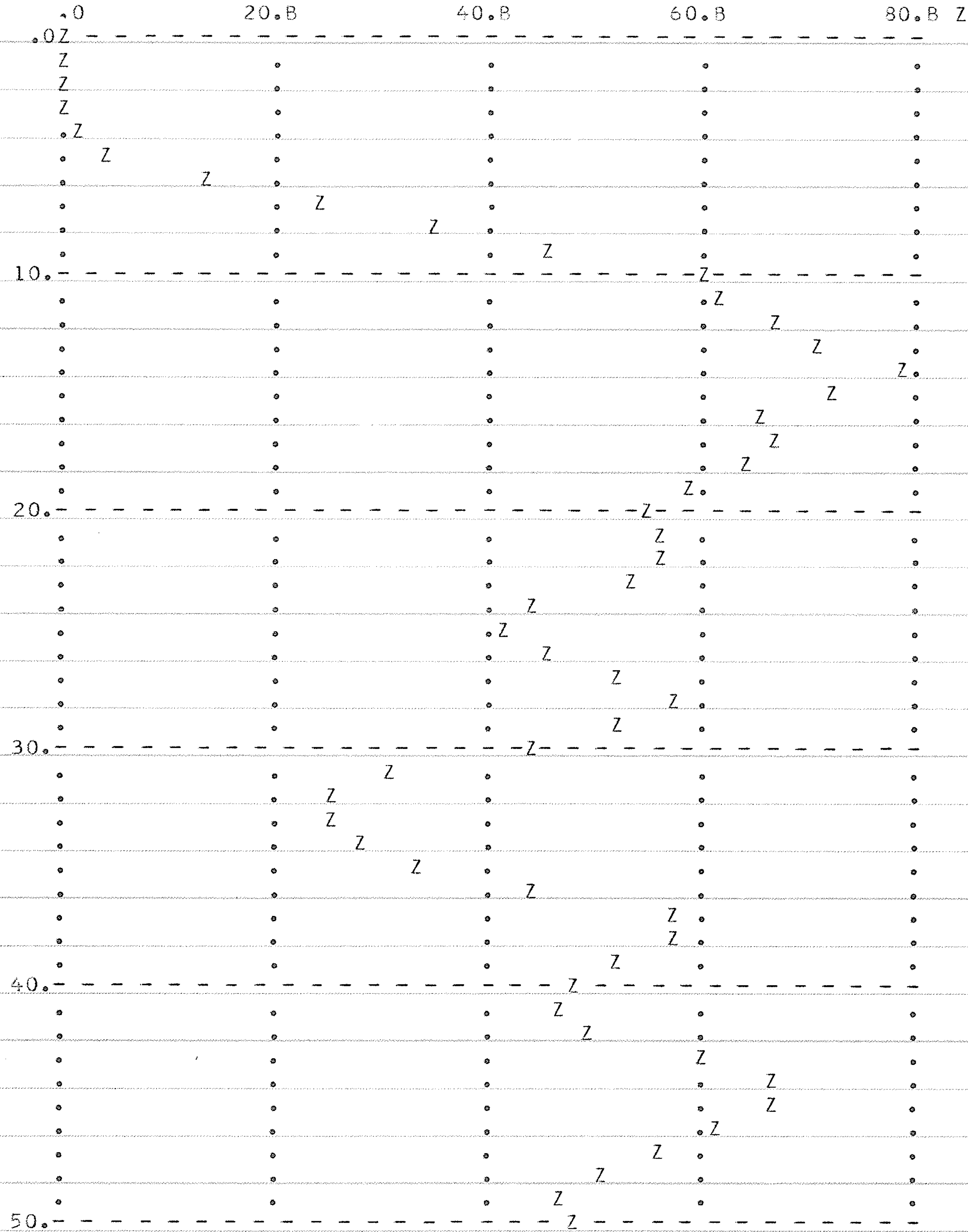
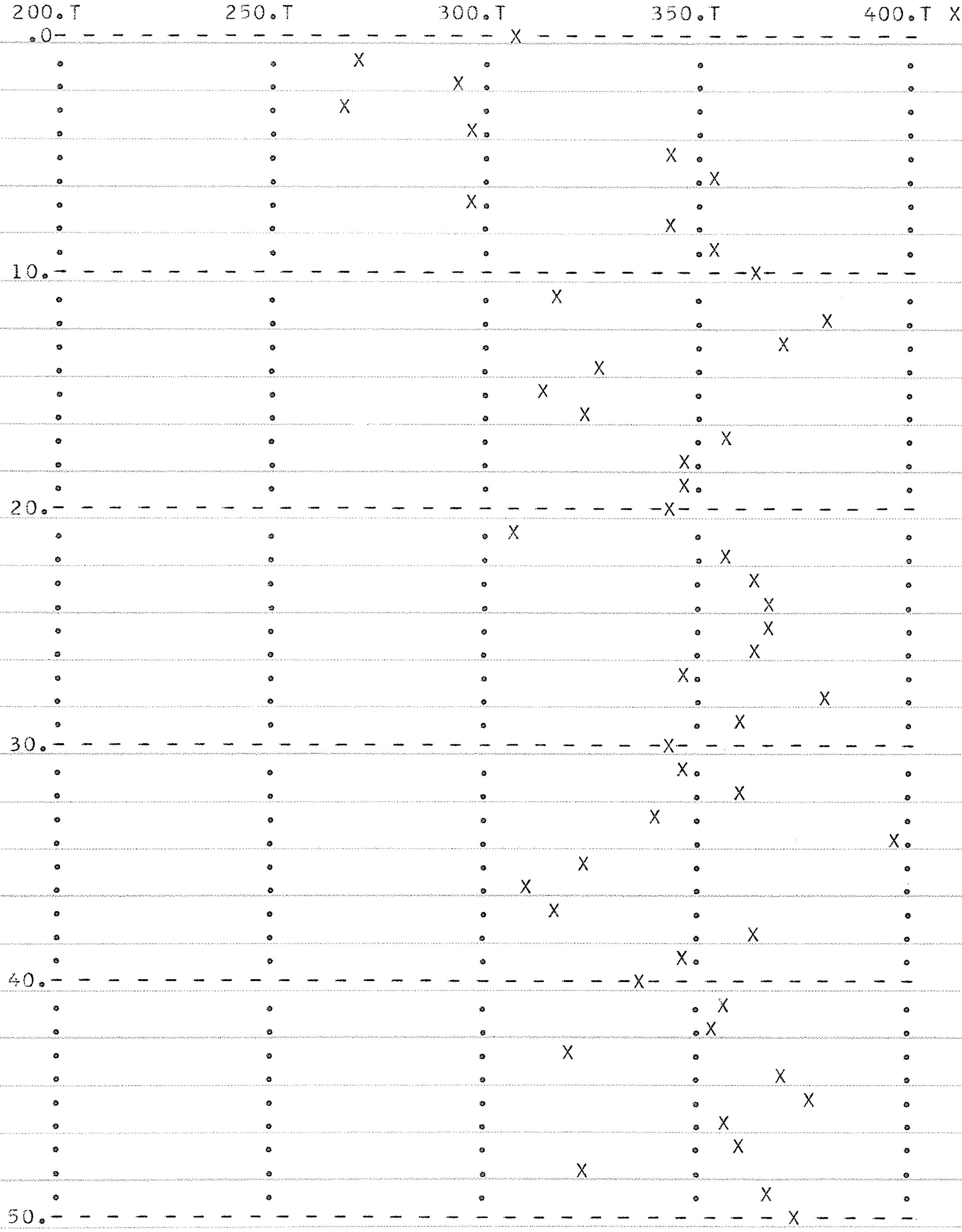
MOTIVE=M,CC=C,BC=B,AT=A,CON=N

    .0            100.T          200.T          300.T          400.T MCBAN
  .0M - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
    M              .              .              .              . MCBAN
    M              .              .              .              . MCBAN
    BMC            .              .              .              . MAN
    BMA     C      .              .              .              . AN
    B MN  A        .   C          .              .              .
    B  MN       A  .              .C             .              .
    B  MN          .  A           .      C       .              .
    B  M           .       A      .            C .              . MN
    B  M           .           A  .              . C            . MN
 10.B -M- - - - - - - - - - - - - -A- - - - - - - - - - -C- - - - MN
    B  M           .              .  A           .   C          . MN
    B  M           .              .  A           .    C         . MN
    B MN           .              .  A           .    C         .
    B MN           .              .   A          .      C       .
    B MN           .              .   A          .C             .
    B MN           .              . A            C              .
    B MN           .              .A             .C             .
    B MN           .              .A            C.              .
    B MN           .             A.           C  .              .
 20.B M - - - - - - - - - - - - -A- - - - - -C- - - - - - - - - - MN
    B MN           .            A .            C .              .
    B MN           .            A .            C .              .
    B M            .            A .         C    .              . MN
    B M            .           A  .    C         .              . MN
    B M            .         A    .    C         .              . MN
    B MN           .        A     .       C      .              .
    B MN           .          A   .            C .              .
    B MN           .            A .              C              .
    B M            .            A .         C    .              . MN
 30.B M - - - - - - - - - - - -A- - - -C- - - - - - - - - - - - - MN
    B M            .        A  C  .              .              . MN
    B M            .    A     C   .              .              . MN
    B M            .   A       C  .              .              . MN
    B M            .   A          C              .              . MN
    B MN           .     A        .   C          .              .
    B MN           .       A      .          C   .              .
    B MN           .           A  .              . C            .
    B MN           .             A.              C              .
    B M            .             A.          C   .              . MN
 40.B M - - - - - - - - - - - - A - - - - C - - - - - - - - - - - MN
    B M            .           A  .       C      .              . MN
    B MN           .          A   .          C   .              .
    B MN           .            A .              .C             .
    B MN           .              A              .  C           .
    B MN           .              .A             . C            .
    B MN           .              .A            C.              .
    B M            .              A          C   .              . MN
    B M            .            A .       C      .              . MN
    B M            .          A   .      C       .              . MN
 50.B MN- - - - - - - - - - - A - - - - - C - - - - - - - - - - -
```

INT=Z



SM=X

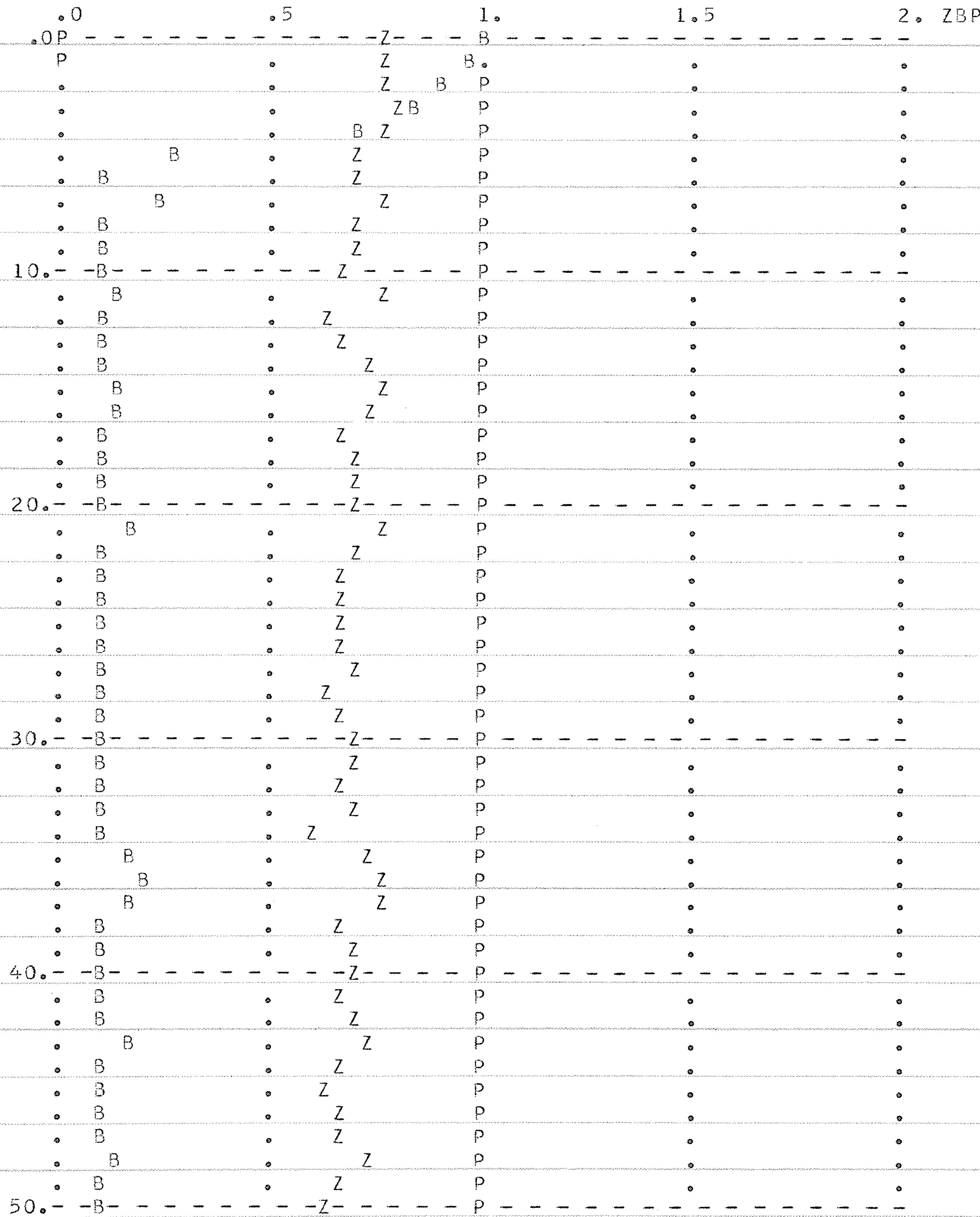


SAC=X,SP=S,CCNTM=T

```
        .0            5.M           10.M           15.M           20.M XST
      .0TS- X - - - - - - - - - - - - - - - - - - - - - - - - - - - -
        .  XT          .              .              .              .  XS
        .   X   T      .              .              .              .  XS
        .    X     T   .              .              .              .  XS
        .     XS       . T            .              .              .
        .     X S      .         T    .              .              .
        .   X    S     .              . T            .              .
        . X      S     .          T   .              .              .
        . X      S     .              .  T           .              .
        . X      S     .              .      T       .              .
     10.- X - - -S- - - - - - - - - - - - - - -T- - - - - - - - - - -
        .X       S     .             T.              .              .
        .X       S     .              .            T .              .
        .X       S     .              .         T    .              .
        .X       S     .              .T             .              .
        .X       S     .             T.              .              .
        .X       S     .             T.              .              .
        .X       S     .              .      T       .              .
        .X       S     .              .    T         .              .
        .X       S     .              .    T         .              .
     20.-X- - - -S- - - - - - - - - - - - T - - - - - - - - - - - - -
        .X       S     .            T .              .              .
        .X       S     .              .     T        .              .
        .X       S     .              .       T      .              .
        .X       S     .              .       T      .              .
        .X       S     .              .       T      .              .
        .X       S     .              .      T       .              .
        .X       S     .              .   T          .              .
        .X       S     .              .          T   .              .
        .X       S     .              .      T       .              .
     30.-X- - - -S- - - - - - - - - - - -T- - - - - - - - - - - - - -
        .X       S     .              .   T          .              .
        .X       S     .              .     T        .              .
        .X       S     .              .T             .              .
        .X       S     .              .           T  .              .
        .X       S     .            T .              .              .
        .X       S     .           T  .              .              .
        .X       S     .            T .              .              .
        .X       S     .              .       T      .              .
        .X       S     .              .    T         .              .
     40.-X- - - -S- - - - - - - - - - - T - - - - - - - - - - - - - -
        .X       S     .              .     T        .              .
        .X       S     .              .    T         .              .
        .X       S     .            T .              .              .
        .X       S     .              .        T     .              .
        .X       S     .              .          T   .              .
        .X       S     .              .      T       .              .
        .X       S     .              .       T      .              .
        .X       S     .             T.              .              .
        .X       S     .              .       T      .              .
     50.-X- - - -S- - - - - - - - - - - - - - -T- - - - - - - - - - -
```

1/23/73 APPLE

STA=Z,BIAS=B,P=P



APPENDIX G

246

1/23/73 APPLE

G

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	OVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+00	E+00	E+00
	E+00	E+00	E-03	E+00	E+00									
.0	20.536	16.891	23.636	305.31	5.0000	240.0	.75918	164.1	1.0000	1400.0	15.1	20.0	14.8	.0
	1183.2	500.00	1.0000	2.0000	0.									
1.	19.022	16.906	22.899	227.50	3.8673	746.6	.81562	966.5	1.0000	768.6	683.7	684.7	682.9	435.8
	876.8	755.31	.3164	.7840	0.									
2.	19.673	16.942	23.901	234.80	3.8800	1035.7	.80649	1495.6	.9504	862.1	825.5	825.6	825.0	916.0
	928.5	774.91	.1001	.3479	0.									
3.	20.158	16.965	13.648	200.58	3.9508	1135.8	.84927	1309.9	.9690	1004.8	920.0	920.0	919.7	1183.6
	1002.4	824.88	.0317	.1466	0.									
4.	18.043	16.926	16.336	205.55	4.0064	1182.5	.84307	1440.0	.9560	1074.8	989.2	989.1	989.0	1355.0
	1036.7	875.27	.0100	.0591	0.									
5.	19.872	16.969	18.538	225.85	4.0782	1180.5	.81768	1683.4	.9317	1125.7	1028.8	1028.8	1028.7	1465.0
	1061.0	906.85	.0032	.0230	0.									
6.	19.958	17.024	18.395	224.55	4.0548	1224.3	.81932	1738.0	.9262	1131.9	1051.6	1051.6	1051.6	1532.0
	1063.9	925.88	.0010	.0087	0.									
7.	18.360	17.139	11.542	188.26	4.0020	1272.0	.86468	1355.5	.9644	1144.1	1061.5	1061.5	1061.5	1569.6
	1069.6	934.26	.0003	.0032	0.									
8.	17.629	17.228	19.207	216.97	4.0132	1272.4	.82879	1718.3	.9282	1156.1	1072.0	1071.9	1071.9	1591.8
	1075.2	943.35	.0001	.0012	0.									
9.	20.195	17.382	17.220	222.14	4.0538	1252.1	.82233	1756.4	.9244	1173.6	1077.6	1077.6	1077.6	1606.7
	1083.3	948.33	.0000	.0004	0.									
10.	18.336	17.618	18.609	225.36	4.1302	1205.4	.81830	1730.5	.9269	1176.0	1083.8	1083.8	1083.8	1617.2
	1084.4	953.72	.0000	.0001	0.									
11.	19.014	17.861	12.735	200.58	4.0432	1264.5	.84927	1506.0	.9494	1152.3	1079.5	1079.5	1079.5	1623.0
	1073.4	949.93	.0000	.0001	0.									
12.	17.464	18.064	22.985	238.59	4.0775	1242.0	.80176	1945.3	.9055	1170.4	1079.0	1079.0	1079.0	1620.6
	1081.8	949.52	.0000	.0000	0.									
13.	20.031	18.202	20.897	236.66	4.0024	1292.3	.80418	1999.5	.9001	1159.4	1079.6	1079.5	1079.5	1620.7
	1076.8	949.99	.0000	.0000	0.									
14.	20.199	18.326	14.387	210.92	3.9864	1304.9	.83635	1687.3	.9313	1186.0	1080.2	1080.2	1080.2	1620.5
	1089.0	950.61	.0000	.0000	0.									
15.	19.493	18.429	13.476	203.95	3.9681	1316.8	.84506	1613.0	.9387	1181.7	1087.3	1087.3	1087.3	1626.0
	1087.1	955.85	.0000	.0000	0.									
16.	19.977	18.531	14.046	208.96	3.9760	1310.6	.83880	1670.9	.9329	1181.4	1090.0	1090.0	1090.0	1632.2
	1086.9	959.18	.0000	.0000	0.									

1/23/73 APPLE

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	OVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
17.	19.722	18.621	19.936	231.94	3.9798	1311.5	.81008	1970.4	.9030	1185.4	1090.2	1090.2	1090.2	1635.2
	1088.8	959.39	.0000	.0000	0.									
18.	17.742	18.707	20.501	226.22	3.9722	1316.9	.81723	1904.2	.9096	1185.9	1090.9	1090.9	1090.9	1636.7
	1089.0	960.03	.0000	.0000	0.									
19.	19.857	18.781	17.775	225.25	3.9930	1304.5	.81843	1874.0	.9126	1191.4	1091.8	1091.8	1091.8	1638.0
	1091.5	960.82	.0000	.0000	0.									
20.	19.283	18.772	18.039	223.97	3.9891	1306.5	.82004	1860.4	.9140	1183.2	1092.7	1092.7	1092.7	1639.6
	1087.7	961.56	.0000	.0000	0.									
21.	20.051	18.746	10.652	198.60	4.0163	1288.3	.85175	1511.1	.9489	1189.0	1091.3	1091.4	1091.4	1639.1
	1090.4	960.40	.0000	.0000	0.									
22.	18.769	18.790	20.480	231.32	3.9855	1307.8	.81085	1957.0	.9043	1176.3	1090.3	1090.3	1090.3	1639.1
	1084.6	959.48	.0000	.0000	0.									
23.	19.740	18.904	20.820	236.95	3.9848	1308.9	.80381	2031.3	.9000	1184.0	1089.2	1089.2	1089.2	1636.1
	1088.1	958.48	.0000	.0000	0.									
24.	18.393	18.992	22.848	239.52	3.9765	1315.1	.80060	2074.4	.9000	1185.9	1090.3	1090.3	1090.3	1635.7
	1089.0	959.49	.0000	.0000	0.									
25.	19.977	19.085	21.465	240.39	3.9716	1315.3	.79976	2083.6	.9000	1195.0	1090.5	1090.5	1090.5	1636.6
	1093.1	959.65	.0000	.0000	0.									
26.	20.325	19.151	18.970	235.00	4.0209	1284.7	.80625	1969.7	.9030	1198.1	1094.6	1094.6	1094.6	1638.9
	1094.6	963.22	.0000	.0000	0.									
27.	18.668	19.238	18.144	224.96	4.0135	1290.0	.81880	1849.8	.9150	1186.6	1092.9	1092.9	1092.9	1641.4
	1089.3	961.75	.0000	.0000	0.									
28.	17.723	19.280	24.832	246.95	3.9937	1309.5	.79566	2117.2	.9000	1190.5	1090.8	1090.8	1090.8	1639.7
	1091.1	959.88	.0000	.0000	0.									
29.	19.591	19.300	20.347	234.72	3.9623	1324.7	.80660	2027.1	.9000	1192.9	1091.5	1091.5	1091.5	1638.7
	1092.2	960.52	.0000	.0000	0.									
30.	16.471	19.370	20.827	224.53	3.9622	1326.2	.81934	1895.9	.9104	1195.5	1093.6	1093.6	1093.6	1639.6
	1093.4	962.40	.0000	.0000	0.									
31.	19.539	19.371	17.852	226.10	3.9832	1310.5	.81738	1894.2	.9106	1193.0	1095.3	1095.3	1095.3	1642.0
	1092.2	963.87	.0000	.0000	0.									
32.	19.937	19.306	19.693	236.48	4.0125	1290.8	.80440	1998.3	.9002	1194.3	1094.7	1094.7	1094.7	1642.9
	1092.8	963.38	.0000	.0000	0.									
33.	20.433	19.246	17.893	227.41	3.9501	1340.0	.81573	1954.0	.9046	1193.4	1091.9	1091.9	1091.9	1642.2
	1092.4	960.84	.0000	.0000	0.									
34.	20.219	19.154	25.191	259.10	4.0131	1293.8	.78806	2170.3	.9000	1202.9	1095.9	1095.9	1095.9	1641.7
	1096.8	964.42	.0000	.0000	0.									

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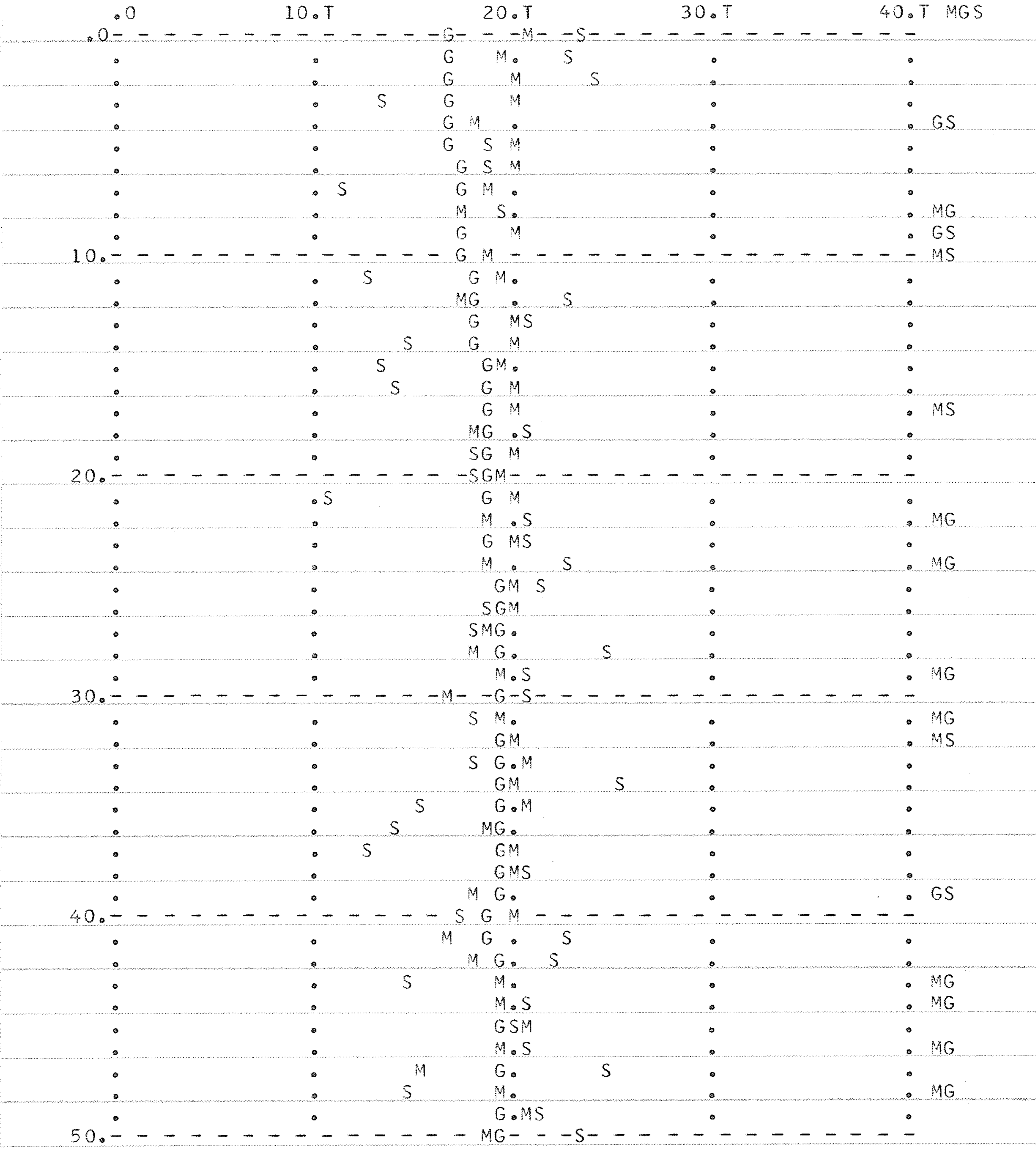
TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	20.368	19.125	15.072	215.79	3.9548	1346.2	.83027	1808.7	.9191	1195.3	1095.4	1095.4	1095.4	1644.1
	1093.3	963.98	.0000	.0000	0.									
36.	18.480	19.147	13.762	203.81	3.9659	1330.3	.84524	1629.8	.9370	1198.1	1097.4	1097.5	1097.5	1645.5
	1094.6	965.76	.0000	.0000	0.									
37.	19.911	19.130	12.513	205.63	3.9888	1319.0	.84296	1640.0	.9360	1199.1	1097.6	1097.6	1097.6	1647.6
	1095.0	965.87	.0000	.0000	0.									
38.	20.198	19.056	20.775	238.65	3.9756	1333.0	.80168	2093.1	.9000	1188.7	1097.0	1097.0	1097.0	1648.0
	1090.3	965.39	.0000	.0000	0.									
39.	17.779	19.043	19.331	224.44	3.9970	1306.7	.81944	1867.8	.9132	1197.5	1096.0	1096.0	1096.0	1646.2
	1094.3	964.50	.0000	.0000	0.									
40.	19.711	18.963	17.316	221.68	3.9594	1332.3	.82290	1867.7	.9132	1187.2	1094.2	1094.2	1094.2	1645.4
	1089.6	962.92	.0000	.0000	0.									
41.	16.753	18.966	22.526	232.19	3.9864	1311.5	.80977	1974.6	.9025	1200.1	1093.9	1093.9	1093.9	1643.1
	1095.5	962.60	.0000	.0000	0.									
42.	17.669	19.021	21.855	231.62	3.9562	1326.6	.81047	1990.0	.9010	1190.9	1093.9	1093.9	1093.9	1643.2
	1091.3	962.59	.0000	.0000	0.									
43.	19.456	19.080	14.424	209.66	3.9588	1326.8	.83793	1701.9	.9298	1196.0	1093.2	1093.2	1093.2	1642.2
	1093.6	962.01	.0000	.0000	0.									
44.	19.488	19.185	20.626	237.71	4.0086	1294.5	.80286	2020.0	.9000	1196.5	1095.5	1095.5	1095.5	1643.2
	1093.9	964.03	.0000	.0000	0.									
45.	20.790	19.206	20.298	241.45	4.0044	1296.4	.79910	2061.3	.9000	1191.5	1093.3	1093.3	1093.3	1643.2
	1091.5	962.11	.0000	.0000	0.									
46.	19.640	19.152	20.829	235.66	3.9528	1348.5	.80542	2076.5	.9000	1188.1	1092.4	1092.5	1092.5	1641.7
	1090.0	961.36	.0000	.0000	0.									
47.	15.624	19.210	24.437	235.53	3.9738	1321.0	.80559	2032.4	.9000	1205.9	1094.3	1094.3	1094.3	1641.1
	1098.1	962.99	.0000	.0000	0.									
48.	19.275	19.188	14.577	210.60	3.9706	1323.5	.83675	1710.2	.9290	1202.0	1096.1	1096.1	1096.1	1644.0
	1096.3	964.58	.0000	.0000	0.									
49.	20.446	19.129	21.212	240.94	3.9637	1331.0	.79941	2113.7	.9000	1196.1	1096.7	1096.7	1096.7	1646.2
	1093.7	965.09	.0000	.0000	0.									
50.	18.936	19.085	23.190	244.70	3.9977	1303.4	.79706	2094.3	.9000	1198.3	1097.7	1097.7	1097.7	1646.6
	1094.7	966.00	.0000	.0000	0.									

1/23/73 APPLE

SYMM=M,SIGM=G,SSM=S



```
OVTS=O,SAT=T

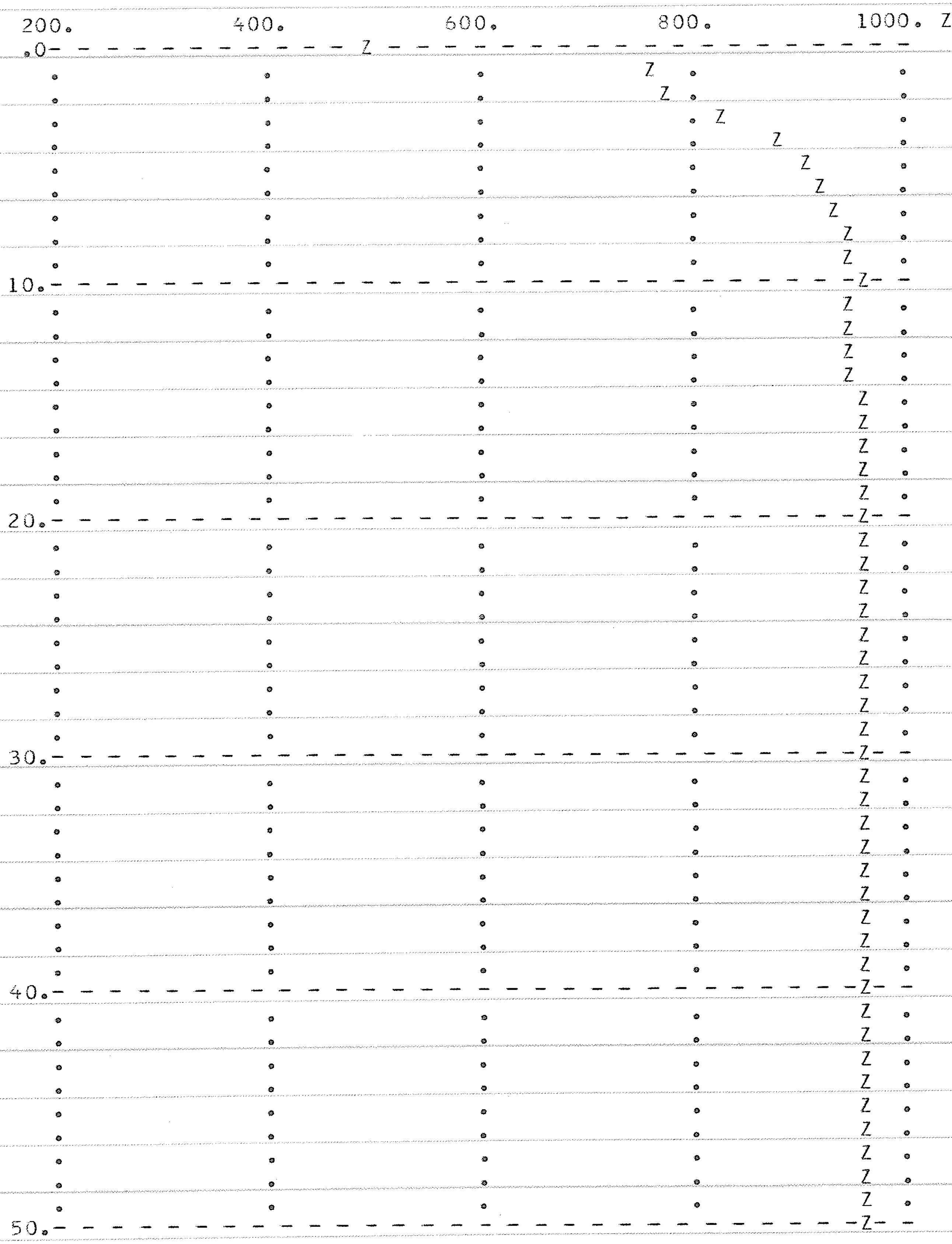
         .0             2.             4.             6.             8. OT
       .OT - - - - - - - - - - - - - - - - - - -O- - - - - - - - - - - - -
          T              .             O.             .              .
          T              .             O.             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              .O            .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
       10.T - - - - - - - - - - - - - - -O- - - - - - - - - - - - - - - -
          T              .              O             .              .
          T              .              .O            .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
       20.T - - - - - - - - - - - - - - O - - - - - - - - - - - - - - - -
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
       30.T - - - - - - - - - - - - - - O - - - - - - - - - - - - - - - -
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
       40.T - - - - - - - - - - - - - - O - - - - - - - - - - - - - - - -
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
          T              .              O             .              .
       50.T - - - - - - - - - - - - - - O - - - - - - - - - - - - - - - -
```

```
MOTIVE=M,CC=C,BC=B,AT=A,CON=N

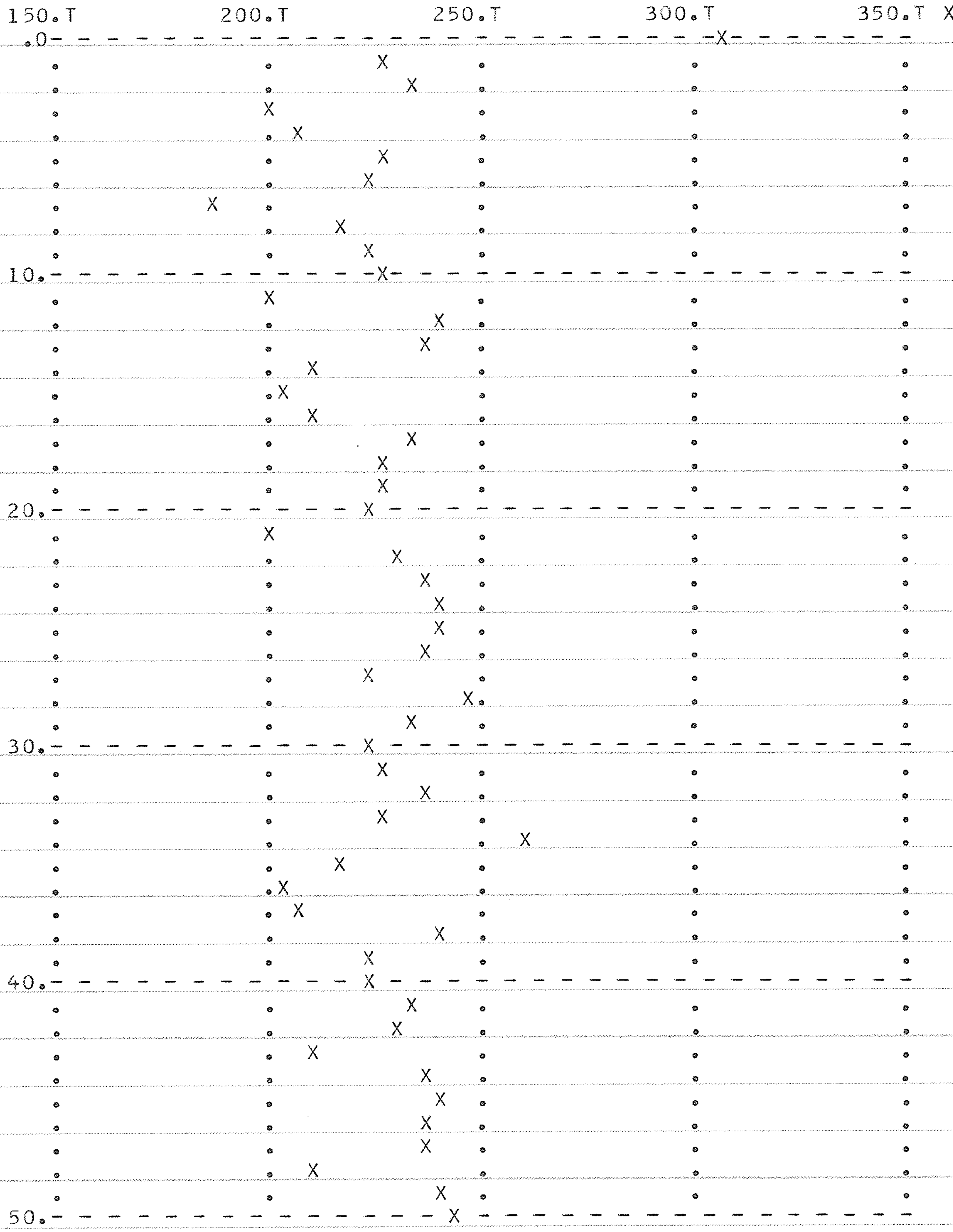
         0.           500.          1000.          1500.          2000. MCBAN
       .0MC- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MBAN
         N            A .    BM        .               .              . MC
         N              .         M A  .               .              . MCB
         N              .            M .      A        .              . MCB
         N              .              M           A   .              . MCB
         N              .              .M             A.              . MCB
         N              .              . M             .A             . MCB
         N              .              . M             . A            . MCB
         N              .              . M             .  A           . MCB
         N              .              . M             .  A           . MCB
      10.N - - - - - - - - - - - - - - - -M- - - - - - - -A- - - - - - MCB
         N              .              . M             .   A          . MCB
         N              .              . M             .   A          . MCB
         N              .              . M             .   A          . MCB
         N              .              . M             .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
      20.N - - - - - - - - - - - - - - - -M- - - - - - - -A- - - - - - MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
      30.N - - - - - - - - - - - - - - - -M- - - - - - - -A- - - - - - MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
      40.N - - - - - - - - - - - - - - - -M- - - - - - - -A- - - - - - MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
         N              .              .  M            .   A          . MCB
      50.N - - - - - - - - - - - - - - - -M- - - - - - - -A- - - - - - MCB
```

1/23/73 APPLE

INT=Z



SM=X



```
SAC=X,SP=S,CCNTM=T

         0.         1000.T         2000.T         3000.T         4000.T XST
       .0- T S - - - - - - - -X- - - - - - - - - - - - - - - - - - - -
         .          SX T.              .              .              .
         .            X .S     T       .              .              .
         .              X S  T         .              .              .
         .              .X S   T       .              .              .
         .              . XS      T    .              .              .
         .              . XS       T   .              .              .
         .              . X ST         .              .              .
         .              . X S      T   .              .              .
         .              .  XS      T   .              .              .
      10.- - - - - - - - X - - - T - - - - - - - - - - - - - - - - - - XS
         .              . X S   T      .              .              .
         .              .  XS         T.              .              .
         .              . X S          T              .              .
         .              .  X S    T    .              .              .
         .              .  X S   T     .              .              .
         .              .  X S    T    .              .              .
         .              .  X S         T              .              .
         .              .  X S        T.              .              .
         .              .  X S       T .              .              .
      20.- - - - - - - - X S - - - T - - - - - - - - - - - - - - - -
         .              .  XS   T      .              .              .
         .              .  X S        T.              .              .
         .              .  X S         T              .              .
         .              .  X S         .T             .              .
         .              .  X S         .T             .              .
         .              .  XS          T              .              .
         .              .  XS        T .              .              .
         .              .  X S         . T            .              .
         .              .  X S         T              .              .
      30.- - - - - - - - X S - - - T - - - - - - - - - - - - - - - -
         .              .  X S       T .              .              .
         .              .  XS          T              .              .
         .              .  X S        T.              .              .
         .              .  XS          .  T           .              .
         .              .  X S      T  .              .              .
         .              .  X S   T     .              .              .
         .              .  X S    T    .              .              .
         .              .  X S         .T             .              .
         .              .  X S       T .              .              .
      40.- - - - - - - - X S - - - T - - - - - - - - - - - - - - - -
         .              .  X S         T              .              .
         .              .  X S         T              .              .
         .              .  X S     T   .              .              .
         .              .  XS          T              .              .
         .              .  XS          .T             .              .
         .              .  X S         .T             .              .
         .              .  X S         T              .              .
         .              .  X S     T   .              .              .
         .              .  X S         . T            .              .
      50.- - - - - - - - X S - - - - -T- - - - - - - - - - - - - - -
```

```
STA=Z,BIAS=B,P=P

          .0             .5             1.             1.5            2. ZBP
        .0P - - - - - - - - - - -Z- - - B - - - - - - - - - - - - - - -
          P              .        Z     B              .              .
          P              .        Z    B.              .              .
          P              .         Z   B.              .              .
          P              .         Z   B.              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
          P              .          Z  B.              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
       10.P - - - - - - - - - - - -Z- B - - - - - - - - - - - - - - - -
          P              .         Z  B .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
          P              .        Z  B  .              .              .
          P              .         Z B  .              .              .
          P              .         Z B  .              .              .
       20.P - - - - - - - - - - - -Z-B- - - - - - - - - - - - - - - - -
          P              .          Z B .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .         Z B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
       30.P - - - - - - - - - - - -Z-B- - - - - - - - - - - - - - - - -
          P              .         Z B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
          P              .         Z  B .              .              .
          P              .        Z  B  .              .              .
          P              .         Z B  .              .              .
       40.P - - - - - - - - - - - -Z-B- - - - - - - - - - - - - - - - -
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .         Z  B .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .        Z  B  .              .              .
          P              .         Z  B .              .              .
          P              .        Z  B  .              .              .
       50.P - - - - - - - - - - - Z -B- - - - - - - - - - - - - - - - -
```

APPENDIX H

1/25/73 APPLE

TEST I

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CCN	CVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+00	E+00	E+00	E+00
	E+00	E+00	E-03	E+00	E+00									
.0	8.062	11.513	18.259	189.17	5.0000	240.00	.86353	93.0	1.0000	1400.0	15.10	20.00	14.77	.0
	1183.2	500.00	1.0000	2.0000	0.									
1.	9.461	11.338	17.331	157.32	4.1259	536.63	.90335	363.8	1.0000	695.1	676.93	677.95	676.14	435.2
	833.8	749.34	.3164	.7838	0.									
2.	6.204	10.759	17.717	147.19	4.2443	738.72	.91601	460.0	1.0000	670.3	770.41	770.54	769.87	888.1
	818.7	726.43	.1001	.3448	0.									
3.	7.764	9.899	6.582	106.20	4.3805	751.79	.96725	186.0	1.0000	745.1	818.62	818.56	818.31	1094.5
	863.2	735.63	.0317	.1425	0.									
4.	9.233	8.904	8.314	118.11	4.4653	746.56	.95236	271.3	1.0000	743.3	849.49	849.43	849.34	1204.3
	862.2	752.34	.0100	.0563	0.									
5.	10.681	8.376	9.945	128.91	4.4447	682.53	.93887	319.5	1.0000	750.7	859.74	859.72	859.69	1258.4
	866.4	758.08	.0032	.0214	0.									
6.	10.917	8.352	9.724	130.30	4.4941	730.47	.93713	352.2	1.0000	724.0	858.02	858.00	857.99	1281.0
	850.9	755.53	.0010	.0079	0.									
7.	5.946	8.714	3.117	79.45	4.4692	780.86	.99309	41.4	1.0000	748.3	857.32	857.31	857.30	1284.2
	865.0	754.58	.0003	.0029	0.									
8.	10.298	8.659	10.638	131.90	4.4568	797.46	.93512	397.1	1.0000	758.8	863.94	863.94	863.94	1290.3
	871.1	760.31	.0001	.0010	0.									
9.	9.278	8.820	8.658	120.39	4.4994	769.49	.94951	298.6	1.0000	789.3	875.65	875.64	875.64	1300.0
	888.4	770.58	.0000	.0004	0.									
10.	8.334	9.185	10.176	127.39	4.5997	685.79	.94077	312.6	1.0000	751.7	880.83	880.85	880.85	1314.7
	867.0	775.15	.0000	.0001	0.									
11.	10.834	9.224	4.097	108.70	4.5001	778.46	.96413	214.6	1.0000	736.3	865.32	865.32	865.32	1312.5
	858.1	761.48	.0000	.0000	0.									
12.	8.713	9.318	14.239	145.77	4.5173	757.16	.91778	478.2	1.0000	768.8	867.24	867.23	867.23	1302.6
	876.8	763.17	.0000	.0000	0.									
13.	12.330	9.796	12.492	152.42	4.4028	860.51	.90948	598.9	1.0000	790.3	876.40	876.39	876.39	1306.4
	889.0	771.22	.0000	.0000	0.									
14.	9.457	10.326	6.387	114.70	4.3827	886.60	.95663	296.3	1.0000	863.4	898.66	898.66	898.66	1321.5
	929.2	790.82	.0000	.0000	0.									
15.	8.970	10.673	5.719	111.05	4.3798	905.86	.96118	271.8	1.0000	871.9	920.80	920.80	920.80	1353.4
	933.8	810.30	.0000	.0000	0.									
16.	12.105	10.651	6.166	126.09	4.3597	933.57	.94239	416.6	1.0000	885.1	931.72	931.71	931.71	1379.6
	940.8	819.91	.0000	.0000	0.									

1/25/73 APPLE

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CCN	CVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
17.	12.115	10.765	12.080	153.52	4.3912	918.10	.90810	654.6	1.0000	910.2	943.71	943.70	943.70	1398.4
	954.0	830.45	.0000	.0000	0.									
18.	10.031	10.936	12.731	148.01	4.3922	926.16	.91499	611.8	1.0000	918.0	952.65	952.64	952.64	1416.0
	958.1	838.32	.0000	.0000	0.									
19.	11.043	10.934	9.928	140.99	4.4190	909.78	.92376	539.4	1.0000	921.1	957.69	957.70	957.70	1428.7
	959.8	842.77	.0000	.0000	0.									
20.	10.991	10.678	9.995	140.45	4.4359	898.26	.92443	528.1	1.0000	903.9	956.83	956.84	956.84	1435.8
	950.7	842.01	.0000	.0000	0.									
21.	2.113	10.470	2.376	66.80	4.4654	872.56	.83494	1120.2	.9880	893.2	952.69	952.71	952.71	1434.2
	945.1	838.39	.0000	.0000	0.									
22.	1.523	10.462	12.152	109.06	4.5185	726.49	.96367	205.0	1.0000	802.5	934.37	934.38	934.38	1426.4
	895.8	822.25	.0000	.0000	0.									
23.	1.773	9.981	11.897	108.54	4.5890	708.44	.96433	195.5	1.0000	742.2	897.68	897.67	897.67	1392.4
	861.5	789.95	.0000	.0000	0.									
24.	1.580	8.625	12.481	104.89	4.6233	672.77	.96889	161.2	1.0000	703.3	867.63	867.63	867.63	1346.7
	838.6	763.52	.0000	.0000	0.									
25.	2.080	7.184	9.563	84.42	4.4843	595.05	.99447	25.2	1.0000	680.9	844.05	844.06	844.06	1304.3
	825.2	742.77	.0000	.0000	0.									
26.	1.538	5.879	5.697	45.84	3.4958	355.08	.57304	1158.2	.9842	548.3	811.79	811.80	811.80	1267.6
	740.5	714.38	.0000	.0000	0.									
27.	2.296	4.709	3.615	26.07	2.4547	183.85	.32585	936.7	1.0000	359.4	720.05	720.05	720.05	1195.4
	599.5	633.65	.0000	.0000	0.									
28.	1.522	3.767	9.319	25.15	1.7219	94.83	.31444	481.7	1.0000	210.5	591.93	591.91	591.91	1057.9
	458.8	520.88	.0000	.0000	0.									
29.	1.522	3.062	4.109	9.75	1.1215	43.76	.12186	276.7	1.0000	114.9	462.18	462.15	462.15	879.9
	339.0	406.70	.0000	.0000	0.									
30.	1.589	2.556	4.012	4.96	.6082	17.00	.06202	110.8	1.0000	56.6	345.01	344.99	344.99	695.8
	239.0	303.59	.0000	.0000	0.									
31.	3.019	2.178	.659	1.67	.2852	5.79	.02087	37.7	1.0000	25.4	245.82	245.81	245.81	525.4
	159.3	216.31	.0000	.0000	0.									
32.	3.410	2.069	2.457	.99	.1249	1.91	.01239	11.9	1.0000	10.5	167.60	167.61	167.61	379.5
	102.6	147.49	.0000	.0000	0.									
33.	3.495	2.546	1.193	.54	.0741	.67	.00670	3.9	1.0000	4.2	110.26	110.25	110.25	263.2
	64.6	97.02	.0000	.0000	0.									
34.	4.272	3.021	9.059	.53	.0326	.22	.00667	1.2	1.0000	1.6	70.69	70.69	70.69	176.3
	40.1	62.20	.0000	.0000	0.									

1/25/73 APPLE

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CON	CVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	3.791	3.306	-.747	.12	.0187	.07	.00149	.4	1.0000	.6	44.46	44.45	44.45	114.9
	24.5	39.11	.0000	.0000	0.									
36.	2.689	3.457	-1.928	.04	.0087	.02	.00046	.1	1.0000	.2	27.54	27.53	27.53	73.3
	14.9	24.23	.0000	.0000	0.									
37.	4.046	3.537	-3.081	.02	.0039	.01	.00022	.0	1.0000	.1	16.85	16.86	16.86	45.9
	9.0	14.83	.0000	.0000	0.									
38.	3.398	3.570	5.289	.02	.0017	.00	.00026	.0	1.0000	.0	10.21	10.22	10.22	28.4
	5.4	8.99	.0000	.0000	0.									
39.	3.312	3.587	3.874	.01	.0007	.00	.00010	.0	1.0000	.0	6.15	6.14	6.14	17.4
	3.2	5.41	.0000	.0000	0.									
40.	3.964	3.584	1.937	.00	.0003	.00	.00003	.0	1.0000	.0	3.68	3.67	3.67	10.5
	1.9	3.23	.0000	.0000	0.									
41.	11.302	3.568	7.128	.00	.0001	.00	.00003	.0	1.0000	.0	2.19	2.18	2.18	6.3
	1.1	1.92	.0000	.0000	0.									
42.	11.042	3.683	6.517	.00	.0000	.00	.00001	.0	1.0000	.0	1.29	1.29	1.29	3.8
	.6	1.13	.0000	.0000	0.									
43.	10.865	4.436	-.220	.00	.0000	.00	.00000	.0	1.0000	.0	.76	.76	.76	2.2
	.4	.67	.0000	.0000	0.									
44.	10.966	5.677	7.118	.00	.0000	.00	.00000	.0	1.0000	.0	.44	.44	.44	1.3
	.2	.39	.0000	.0000	0.									
45.	13.140	7.056	8.148	.00	.0000	.00	.00000	.0	1.0000	.0	.26	.26	.26	.8
	.1	.23	.0000	.0000	0.									
46.	10.981	8.215	9.892	.00	.0000	.00	.00000	.0	1.0000	.0	.15	.15	.15	.5
	.1	.13	.0000	.0000	0.									
47.	10.463	9.213	14.440	.00	.0000	.00	.00000	.0	1.0000	.0	.08	.09	.09	.3
	.0	.08	.0000	.0000	0.									
48.	11.931	9.860	5.249	.00	.0000	.00	.00000	.0	1.0000	.0	.05	.05	.05	.2
	.0	.04	.0000	.0000	0.									
49.	12.706	10.370	12.453	.00	.0000	.00	.00000	.0	1.0000	.0	.05	.03	.03	.1
	.0	.03	.0000	.0000	0.									
50.	11.774	10.641	14.746	.00	.0000	.00	.00000	.0	1.0000	.0	.05	.02	.02	.1
	.0	.02	.0000	.0000	0.									

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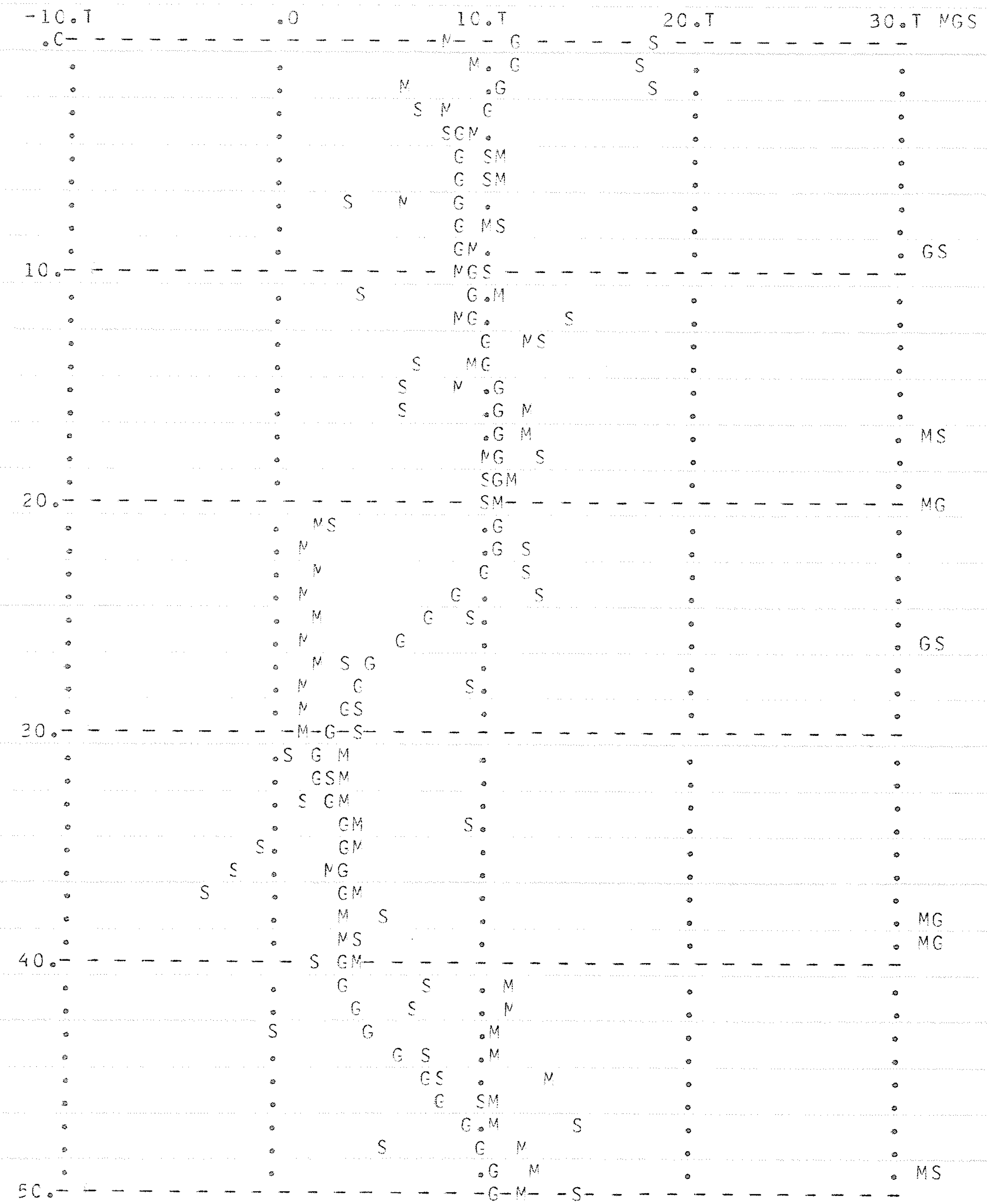

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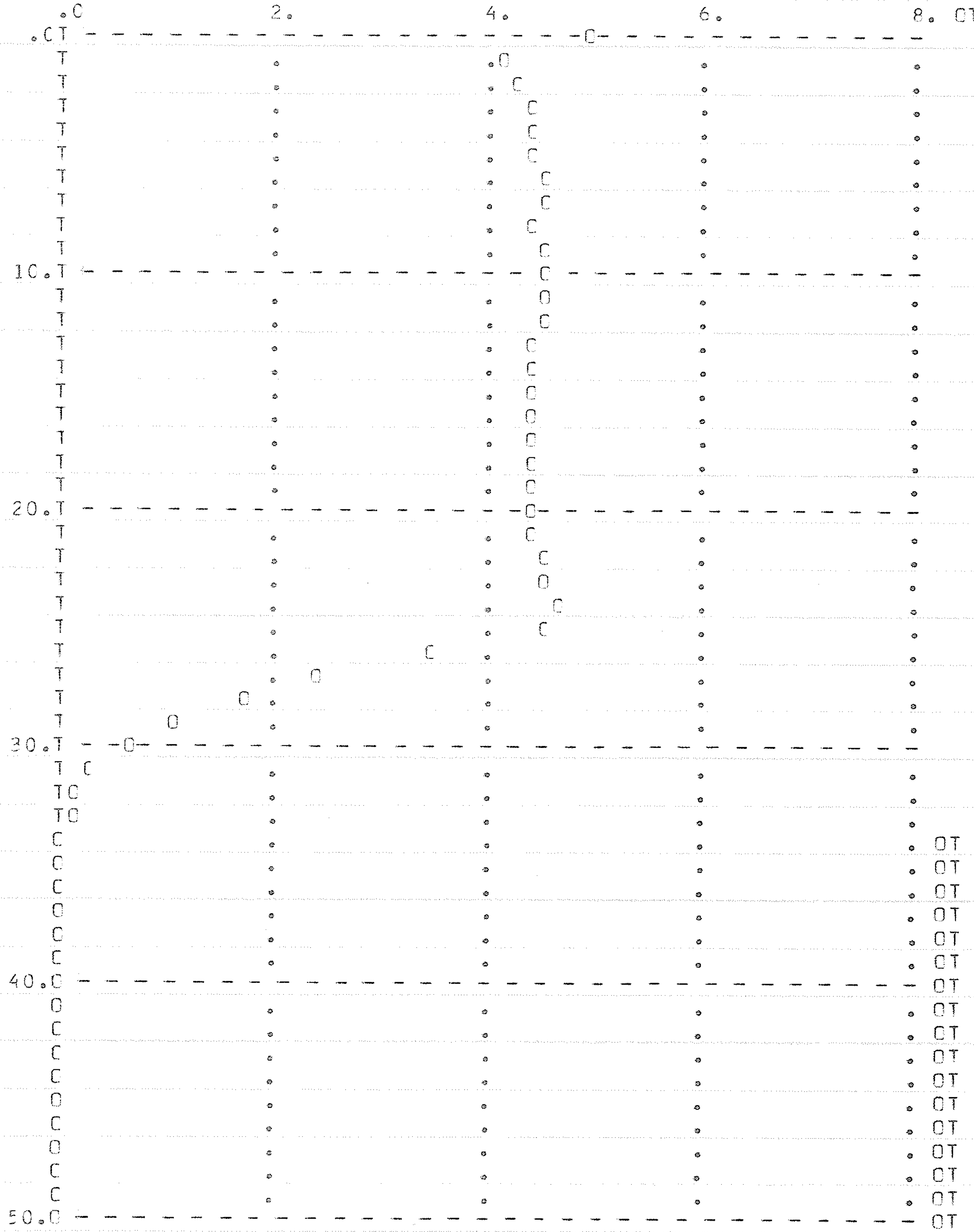

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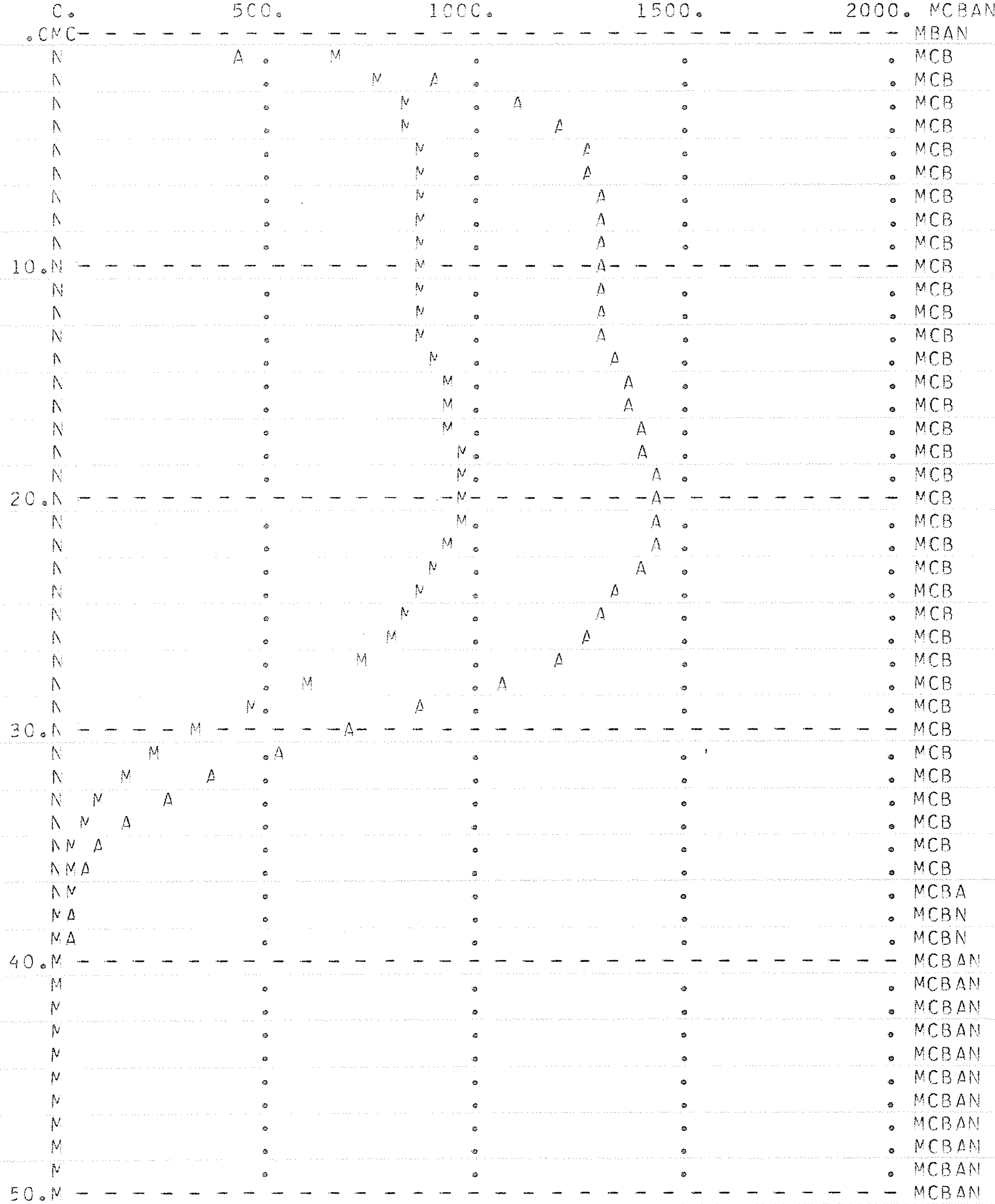

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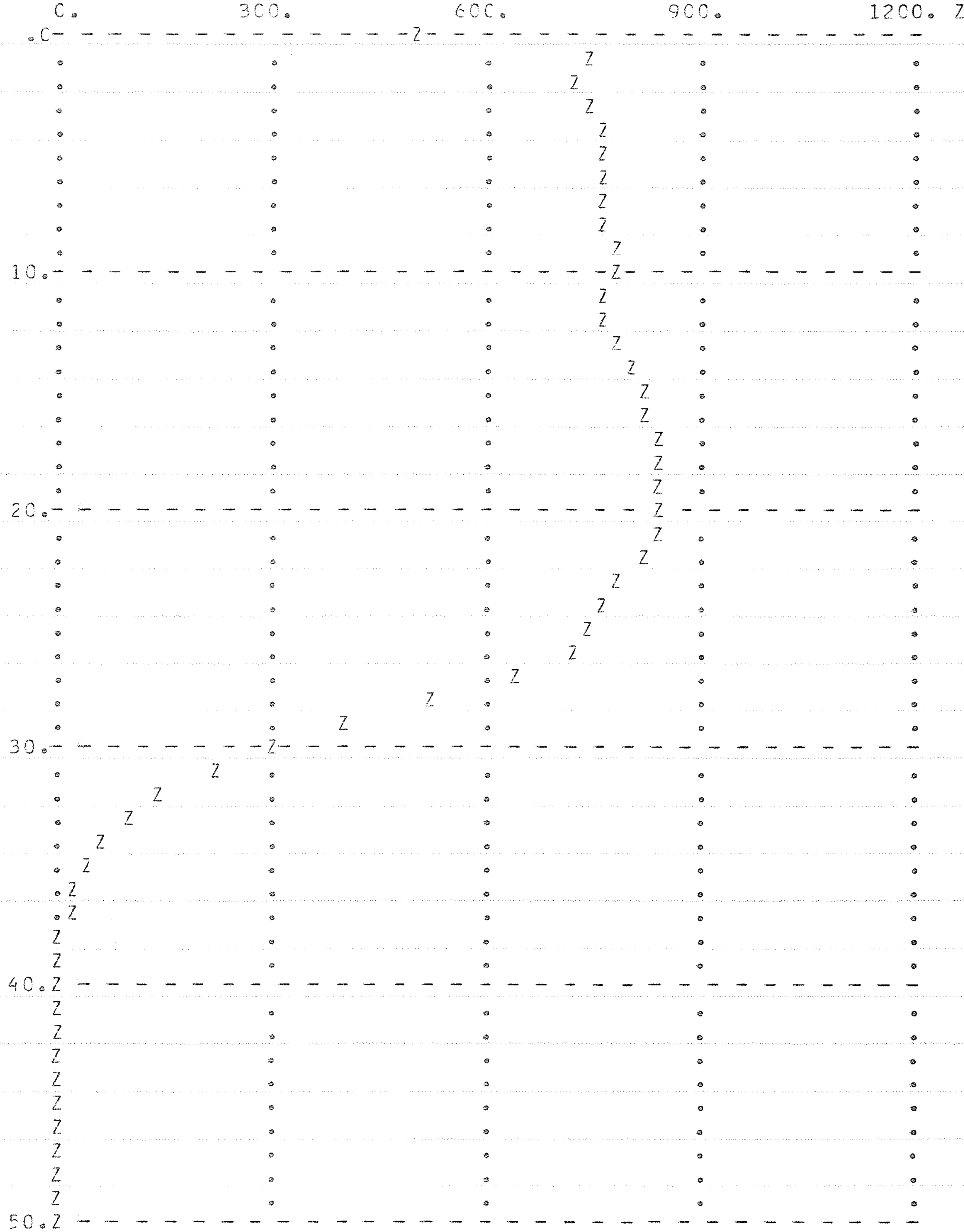

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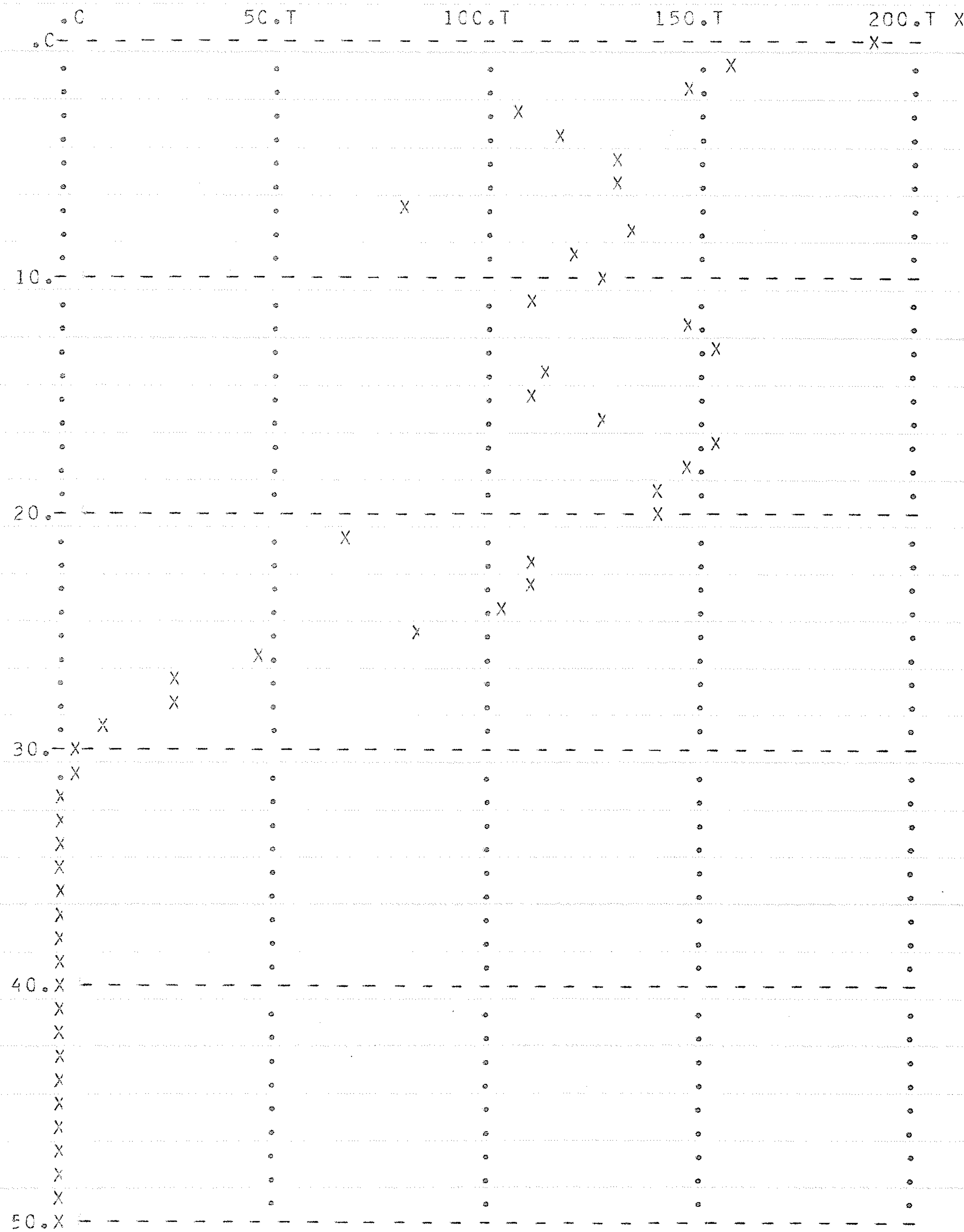

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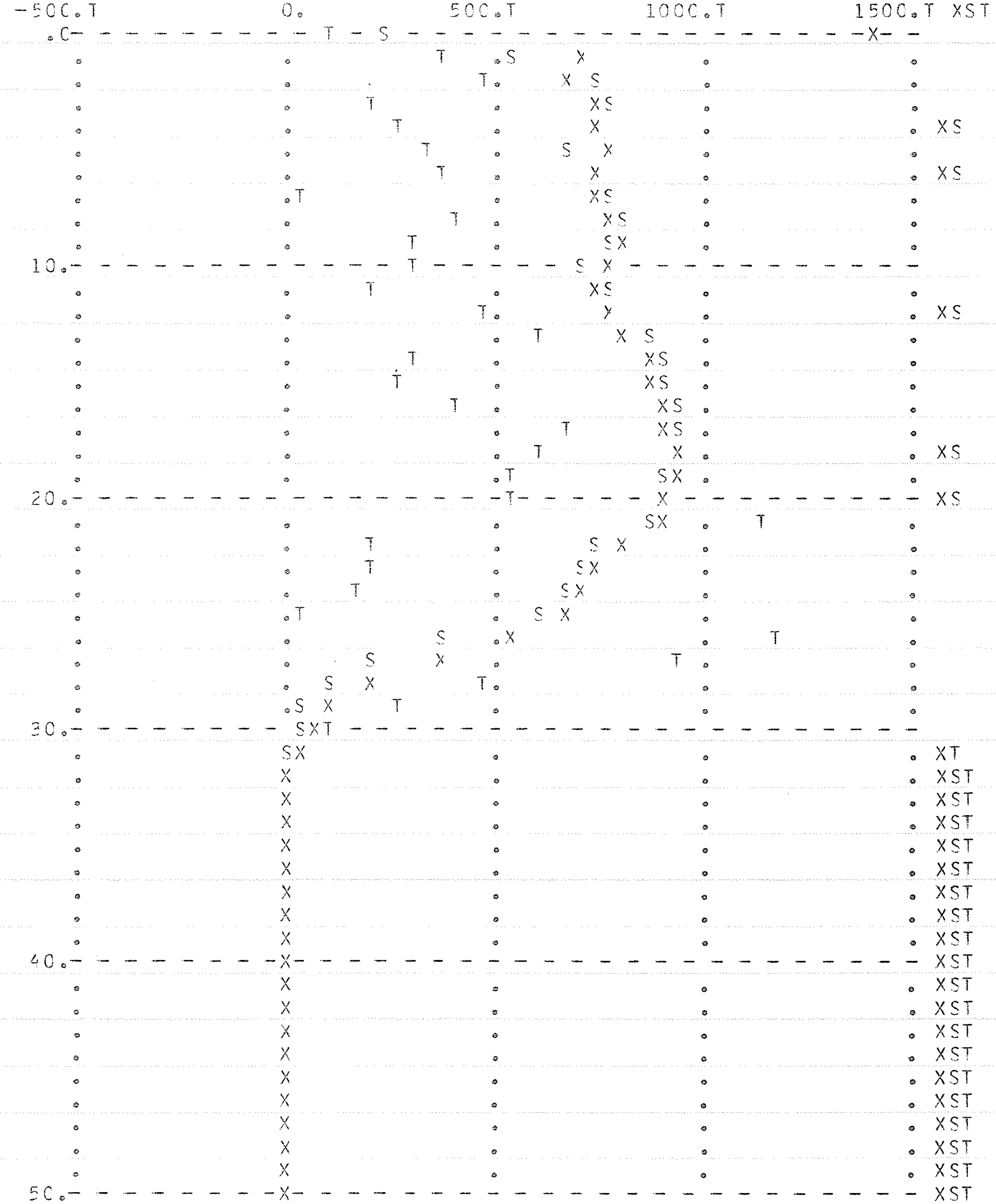

STA=Z,BIAS=B,P=P

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     .0            .5             1.             1.5            2. ZBP
  .CP - - - - - - - - - - - - Z - B - - - - - - - - - - - - - - -
    P              .           Z  B              .              .
    P              .           Z  B              .              .
    P              .             ZB              .              .
    P              .             ZB              .              .
    P              .            Z B              .              .
    P              .            Z B              .              .
    P              .              Z              .              . ZB
    P              .            Z B              .              .
    P              .            Z B              .              .
  10.P - - - - - - - - - - - - - Z B - - - - - - - - - - - - - - -
    P              .             ZB              .              .
    P              .            Z B              .              .
    P              .           Z  B              .              .
    P              .             ZB              .              .
    P              .             ZB              .              .
    P              .            Z B              .              .
    P              .           Z  B              .              .
    P              .           Z  B              .              .
    P              .            Z B              .              .
  20.P - - - - - - - - - - - - - Z B - - - - - - - - - - - - - - -
    P              .         Z    B              .              .
    P              .             ZB              .              .
    P              .             ZB              .              .
    P              .             ZB              .              .
    P              .              Z              .              . ZB
    P              . Z            B              .              .
    P         Z    .              B              .              .
    P        Z     .              B              .              .
    P   Z          .              B              .              .
  30.P Z - - - - - - - - - - - - - B - - - - - - - - - - - - - - -
    PZ             .              B              .              .
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
  40.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
    Z              .              B              .              . ZP
  50.Z - - - - - - - - - - - - - - B - - - - - - - - - - - - - - - ZP
```

TIME	SYMM MEME	SIGM INT	SSM SAT	SM CON	OVTS P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
E+00	E+03	E+03	E+03	E+03	E+00	E+03	E+00	E+03	E+00	E+03	E+03	E+03	E+00	E+03
	E+09	E+06	E+00	E+03	E+00									
.0	24.306	21.193	27.939	367.19	5.0000	240.0	.66152	230.6	1.0000	1400.0	.015	.02	14.8	.000
	.000	.0	.001	.002	.0000									
1.	17.630	21.118	27.110	247.12	3.7523	811.3	.79555	1164.7	.9835	784.8	.685	.69	683.9	.436
	.000	.0	.000	.001	.0000									
2.	13.996	20.564	27.522	233.27	3.7574	1115.0	.80842	1596.2	.9404	893.5	.836	.84	835.9	.922
	.000	.0	.000	.000	.0000									
3.	22.921	19.588	16.271	228.45	3.8866	1181.8	.81443	1681.2	.9319	1046.9	.936	.94	935.3	1.199
	.000	.0	.000	.000	.0000									
4.	19.204	18.407	17.817	219.04	3.9517	1225.8	.82621	1656.6	.9343	1104.6	1.006	1.01	1005.9	1.377
	.000	.0	.000	.000	.0000									
5.	19.913	17.867	19.435	233.57	4.0824	1184.1	.80803	1781.3	.9219	1159.1	1.043	1.04	1043.3	1.488
	.000	.0	.000	.000	.0000									
6.	24.582	17.620	18.991	247.26	4.0407	1239.7	.79546	1995.3	.9005	1143.5	1.063	1.06	1062.7	1.553
	.000	.0	.000	.000	.0000									
7.	12.708	17.898	12.301	171.43	3.9954	1283.0	.88572	1155.9	.9844	1155.0	1.069	1.07	1069.0	1.585
	.000	.0	.000	.000	.0000									
8.	20.008	17.838	19.817	230.44	3.9962	1285.4	.81195	1908.1	.9092	1157.2	1.077	1.08	1076.8	1.604
	.000	.0	.000	.000	.0000									
9.	18.455	18.077	17.915	218.35	4.0104	1281.8	.82706	1750.9	.9249	1175.1	1.079	1.08	1079.3	1.613
	.000	.0	.000	.000	.0000									
10.	20.012	18.747	19.738	241.32	4.1253	1209.6	.79918	2079.0	.9000	1185.2	1.298	3.23	1088.4	1.767
	.025	1.9	6.574	2.147	1.0000									
11.	20.303	18.803	13.676	223.68	4.2378	1367.3	.82040	2290.0	.9000	1162.1	2.930	9.78	1084.7	3.323
	.124	32.4	7.503	4.968	1.0000									
12.	22.400	18.806	23.726	290.29	4.4706	1548.5	.76857	3587.6	.8412	1263.1	4.925	30.54	1098.2	8.082
	.917	240.5	12.244	9.267	1.0000									
13.	22.400	19.773	22.468	298.26	4.6141	1817.3	.76359	4509.7	.8000	1333.9	7.002	57.27	1131.4	17.597
	2.468	963.8	12.095	11.594	1.0000									
14.	22.852	21.030	17.091	285.85	4.6882	1978.8	.77135	4921.0	.8000	1425.6	8.603	86.44	1159.8	30.617
	5.316	2608.1	12.682	13.691	1.0000									
15.	22.400	21.889	16.936	286.40	4.6779	2108.2	.77100	5326.4	.7347	1363.1	9.229	82.75	1191.6	41.267
	4.059	3328.5	8.639	11.385	1.0000									
16.	22.722	22.408	17.923	294.60	4.6723	2149.2	.76588	5571.8	.6856	1342.1	8.719	91.95	1187.1	43.428
	5.179	4167.6	9.715	12.276	1.0000									

1/25/73 APPLE

TIME	SYMM	SIGM	SSM	SM	CVTS	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
	MEME	INT	SAT	CCN	P									
17.	21.210	22.657	23.972	317.68	4.6829	2164.9	.75145	6006.9	.6000	1324.8	9.117	104.81	1176.8	47.485
	7.856	5639.5	11.887	13.919	1.0000									
18.	22.400	22.738	24.533	327.92	4.7067	2186.6	.73515	6493.8	.6000	1315.1	9.541	102.95	1164.4	51.599
	5.470	6122.3	8.186	12.951	1.0000									
19.	22.671	22.648	21.642	314.02	4.6897	2189.6	.75373	6030.6	.6000	1319.8	9.034	99.16	1160.5	50.630
	6.831	5790.2	10.985	12.282	1.0000									
20.	24.776	22.414	21.731	324.54	4.7088	2169.7	.74149	6265.8	.6000	1329.4	8.929	96.04	1164.1	50.094
	6.737	5640.3	11.148	12.064	1.0000									
21.	11.017	22.151	14.057	225.60	4.7770	2152.9	.81801	4386.9	.8000	1336.4	9.177	103.83	1164.4	50.456
	8.152	6242.5	12.220	13.222	1.0000									
22.	9.698	22.212	23.902	276.64	4.9567	1993.1	.77710	4987.4	.8000	1529.6	9.766	104.76	1199.1	52.393
	7.292	6380.1	10.781	12.909	1.0000									
23.	9.465	21.956	23.873	276.35	4.9978	1970.4	.77728	4923.4	.8000	1556.3	9.795	95.96	1236.1	53.002
	4.385	5776.0	7.029	11.770	1.0000									
24.	9.638	20.445	24.301	272.57	5.0120	1935.9	.77965	4740.3	.8000	1558.3	8.971	81.26	1250.7	47.697
	5.121	4406.6	10.400	10.323	1.0000									
25.	10.342	18.246	20.625	248.33	5.0460	1851.8	.79479	4216.5	.8000	1543.9	8.989	85.79	1254.0	45.237
	5.621	4461.3	10.644	11.675	1.0000									
26.	11.575	16.074	15.892	228.12	5.2392	1701.3	.81485	3521.2	.8479	1550.9	9.962	106.59	1252.7	47.293
	7.927	5746.6	11.582	14.290	1.0000									
27.	10.108	14.269	13.174	203.06	5.4076	1629.7	.84617	2837.5	.9000	1506.6	11.414	126.78	1247.2	55.540
	11.232	7620.2	13.119	15.415	1.0000									
28.	9.688	12.831	18.384	224.61	5.4913	1628.5	.81924	3359.7	.8640	1470.7	12.021	133.93	1232.9	63.750
	8.686	8760.1	9.266	14.704	1.0000									
29.	9.395	11.875	12.922	190.25	5.5641	1597.7	.86219	2503.4	.9000	1461.9	11.309	112.39	1222.5	63.549
	7.472	7230.0	9.915	11.858	1.0000									
30.	8.925	11.220	12.677	183.86	5.6016	1540.9	.87017	2252.0	.9000	1435.1	10.180	90.65	1215.9	57.395
	3.460	5379.6	6.121	9.849	1.0000									
31.	11.458	10.733	9.213	177.05	5.6376	1450.8	.87869	1939.3	.9061	1379.9	8.408	65.73	1202.5	44.835
	2.761	3173.0	7.907	7.789	1.0000									
32.	12.612	10.399	10.786	188.87	5.5884	1398.1	.86391	2076.1	.9000	1336.7	7.913	66.22	1182.5	37.794
	3.341	2714.4	9.700	9.113	1.0000									
33.	12.588	10.454	9.100	173.75	5.4056	1498.1	.88281	1919.9	.9080	1325.1	8.270	76.29	1164.6	36.975
	4.293	3086.1	10.624	10.928	1.0000									
34.	13.063	10.659	16.697	225.61	5.5817	1406.0	.81799	2829.0	.9000	1334.6	9.571	92.35	1165.6	41.366
	6.243	4019.0	12.245	12.326	1.0000									

1/25/73 APPLE

TIME	SYMM / MEME	SIGM / INT	SSM / SAT	SM / CCN	CVTS / P	SP	STA	CONTM	BIAS	SAC	MOTIVE	CC	BC	AT
35.	12.775	10.799	6.745	166.03	5.4761	1535.9	.89246	1846.8	.9153	1328.8	10.241	106.19	1162.4	48.720
	7.940	5186.1	12.660	12.873	1.0000									
36.	10.687	10.876	5.491	149.97	5.5432	1536.6	.91254	1522.1	.9478	1347.6	11.066	131.08	1168.8	57.181
	11.798	7449.1	14.065	14.669	1.0000									
37.	12.955	10.953	4.336	158.22	5.6021	1542.9	.90222	1727.3	.9273	1365.6	11.962	143.51	1174.6	67.031
	10.170	9565.5	10.178	14.907	1.0000									
38.	12.356	11.034	12.753	200.99	5.5610	1597.6	.84876	2760.9	.9000	1356.2	11.390	120.98	1178.4	68.239
	6.899	8210.6	8.379	12.066	1.0000									
39.	12.249	11.149	11.437	193.44	5.5531	1575.2	.85820	2526.2	.9000	1397.9	10.112	102.59	1182.4	60.753
	5.990	6420.0	9.176	10.746	1.0000									
40.	12.914	11.245	9.598	183.94	5.4489	1596.6	.87007	2326.5	.9000	1391.3	9.391	93.78	1189.3	54.094
	5.952	5443.9	10.228	10.757	1.0000									
41.	25.413	11.326	14.886	281.00	5.4431	1568.8	.77438	3957.5	.8043	1416.4	9.407	97.97	1192.8	50.313
	6.303	5442.5	10.426	12.017	1.0000									
42.	24.725	11.623	14.458	261.87	5.1543	1803.7	.78633	4320.8	.8000	1385.5	9.487	108.82	1188.0	50.935
	9.840	6236.3	14.232	13.574	1.0000									
43.	24.373	12.922	8.266	232.13	5.0950	1872.2	.80983	4032.9	.8000	1444.1	10.496	129.57	1196.3	57.014
	13.182	8437.7	14.865	15.553	1.0000									
44.	24.497	15.038	16.479	286.29	5.1111	1918.0	.77107	5011.4	.7977	1489.6	11.287	132.50	1212.4	64.365
	10.129	9494.6	10.604	14.841	1.0000									
45.	28.601	17.366	18.458	324.63	5.0389	2038.5	.74132	6013.0	.6000	1482.9	10.787	125.43	1227.2	65.036
	8.743	9033.0	9.753	13.784	1.0000									
46.	24.544	19.332	21.008	312.22	4.8120	2144.4	.75486	5964.3	.6071	1351.5	9.902	110.15	1209.2	62.216
	7.285	7850.7	9.351	12.521	1.0000									
47.	24.074	21.062	26.289	343.70	4.8120	2158.4	.70557	7153.0	.5541	1331.8	9.290	98.10	1177.2	56.284
	6.379	6626.4	9.656	11.737	1.0000									
48.	26.713	22.171	17.560	311.36	4.6860	2177.2	.75540	5945.7	.6109	1256.6	8.621	89.22	1152.1	50.743
	5.599	5592.8	9.814	11.244	1.0000									
49.	26.703	23.099	25.182	346.83	4.6254	2176.5	.69969	7258.9	.5223	1187.8	8.271	87.64	1127.9	46.764
	6.382	5094.9	11.879	11.488	1.0000									
50.	25.625	23.650	27.755	353.55	4.5898	2170.1	.68709	7547.9	.4356	1260.3	8.449	93.31	1118.4	46.429
	7.773	5394.1	13.601	12.309	1.0000									

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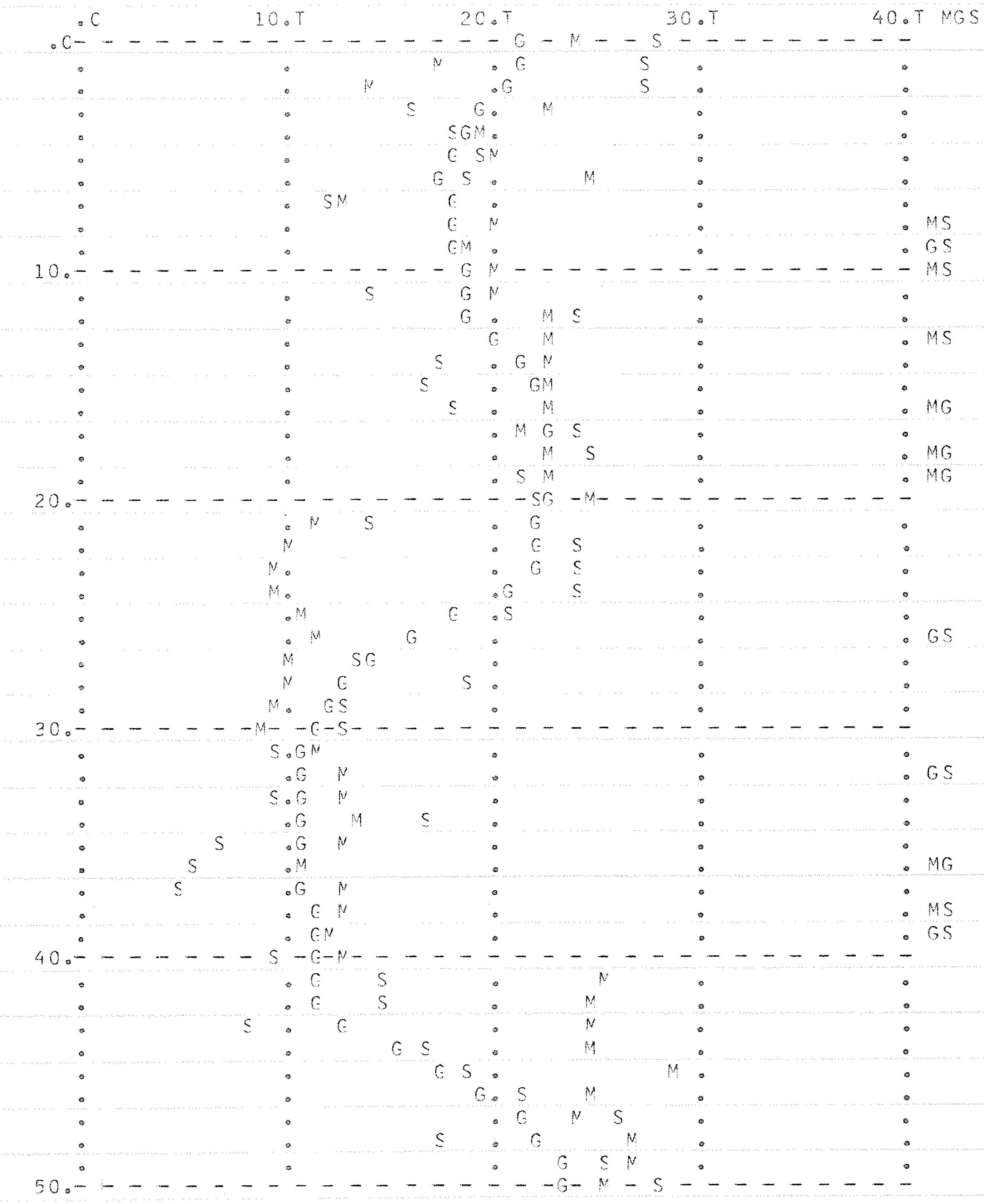

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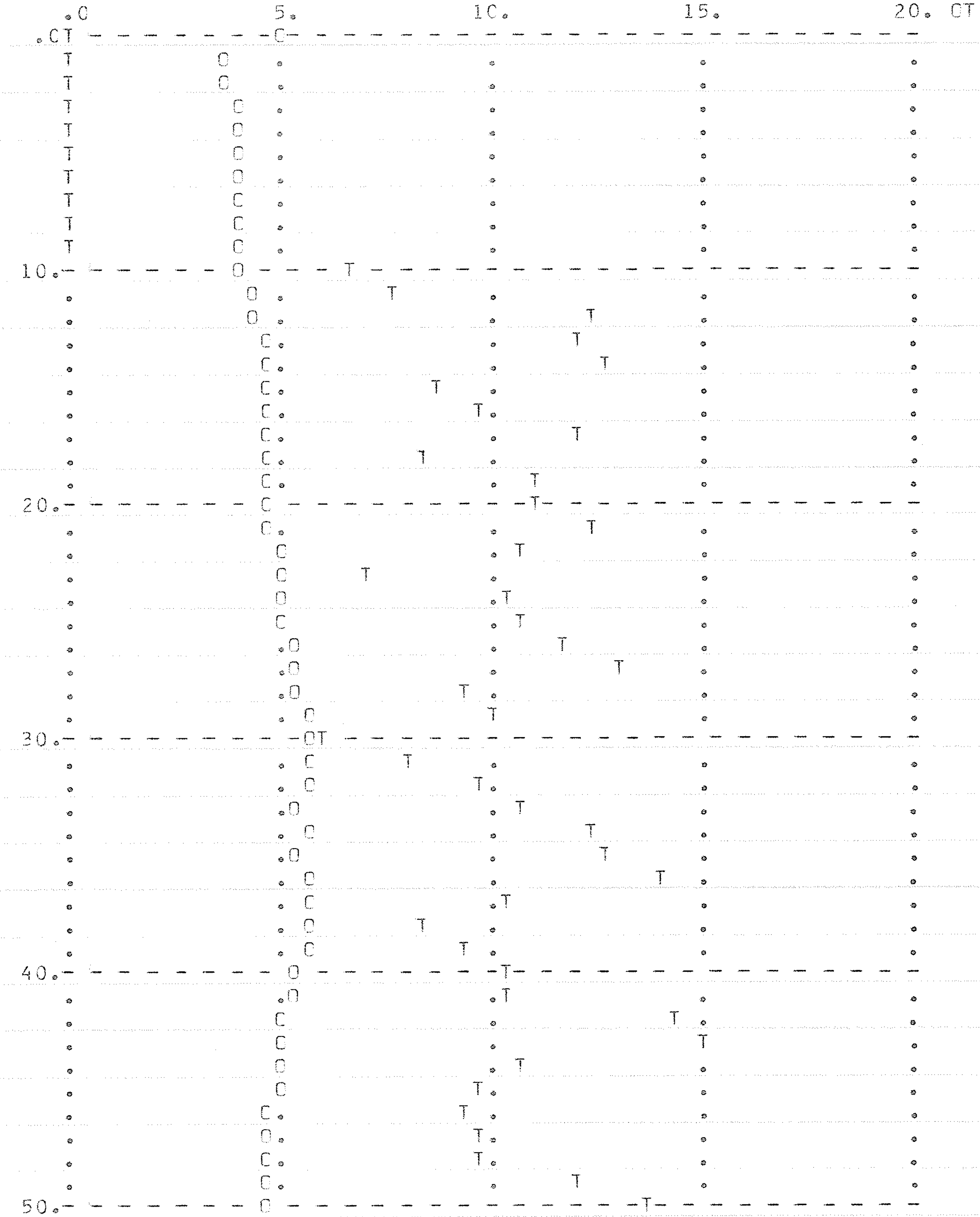

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 .CM - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
   M              .              .              .              . MCBAN
10.MC- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - MB,CAN
   BM C           .              .              .              . MAN
   BMAN     C     .              .              .              .
   B MN A         . C            .              .              .
   B  MN    A     .          C   .              .              .
   B  M        A  .         C    .              .              . MN
   B  MN        A .            C .              .              .
   B  MN         A.              .C             .              .
   B  MN         A.              .C             .              .
   B  MN          A              C              .              .
20.B -MN - - - - -A- - - - - - -C- - - - - - - - - - - - - - - -
   B  MN          A              .C             .              .
   B  MN          .A             .C             .              .
   B  MN          .A            C.              .              .
   B  M          A.        C     .              .              . MN
   B  MN         A.          C   .              .              .
   B  MN         A.              . C            .              .
   B  M N         . A            .       C      .              .
   B   M          .   A          .         C    .              . MN
   B  MN          .   A          .   C          .              .
30.B -M- - - - - - -A- - - - -C- - - - - - - - - - - - - - - - - MN
   B NM         A .    C         .              .              .
   B MN       A   .    C         .              .              .
   B MN       A   .       C      .              .              .
   B  MN       A  .            C .              .              .
   B  MN          A              . C            .              .
   B  MN          . A            .        C     .              .
   B   M          .    A         .            C .              . MN
   B  MN          .    A         .     C        .              .
   B  M           .  A           .C             .              . MN
40.B -M- - - - - - A - - - - - C - - - - - - - - - - - - - - - - MN
   B  MN          A             C.              .              .
   B  MN          A              .  C           .              .
   B  M N         . A            .        C     .              .
   B  MN          .   A          .         C    .              .
   B  MN          .    A         .       C      .              .
   B  MN          .   A          .  C           .              .
   B  MN          . A           C.              .              .
   B  M           A           C  .              .              . MN
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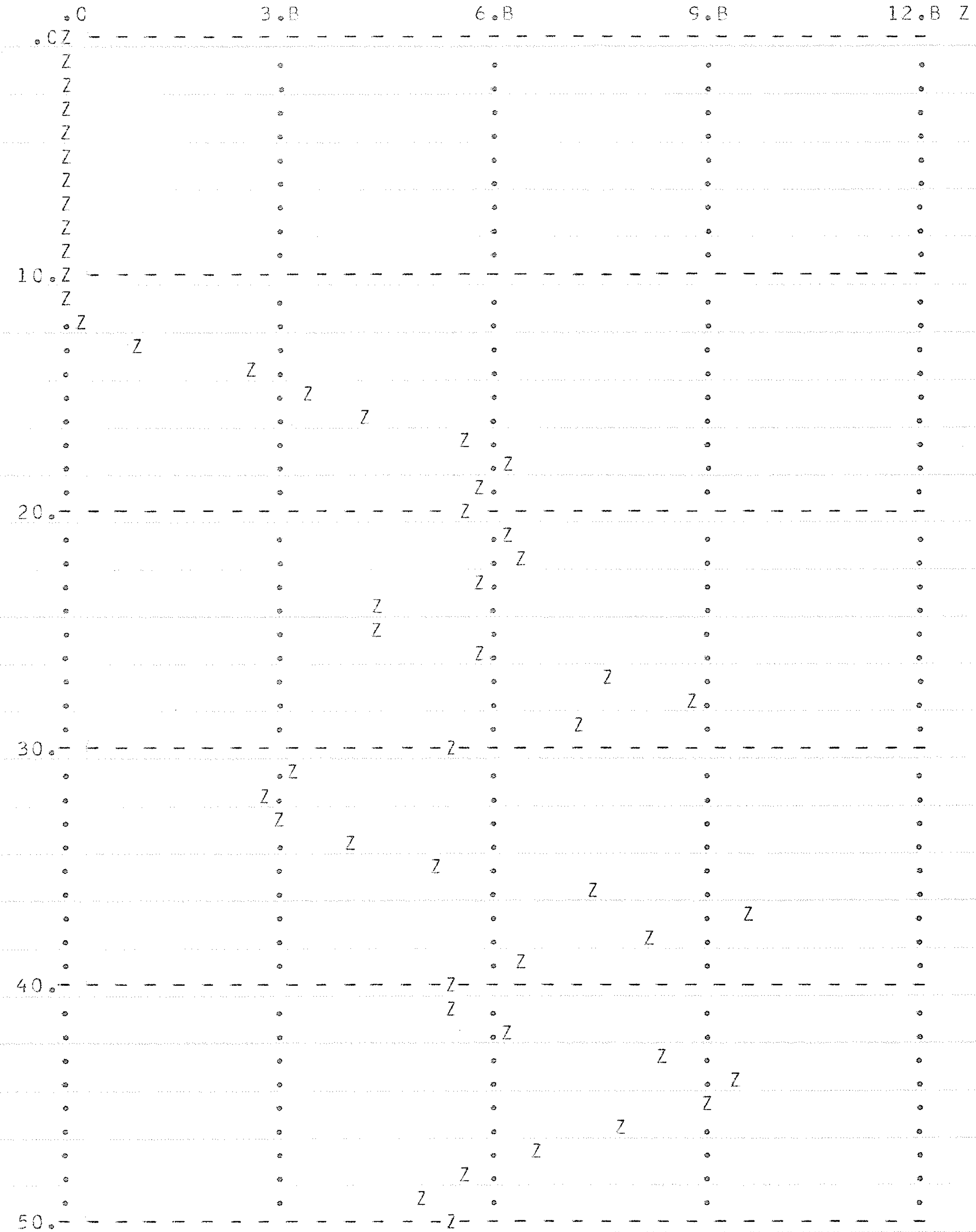

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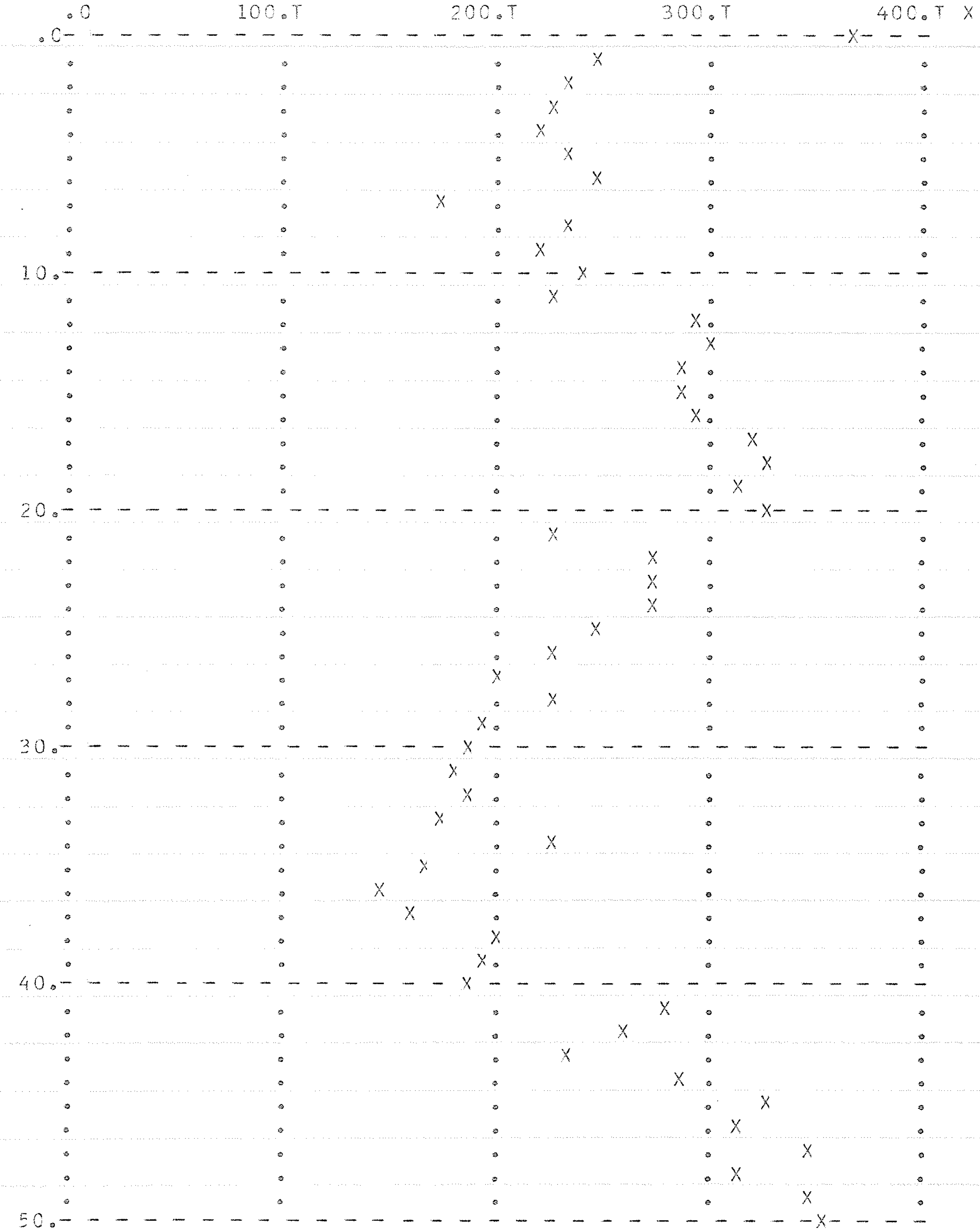

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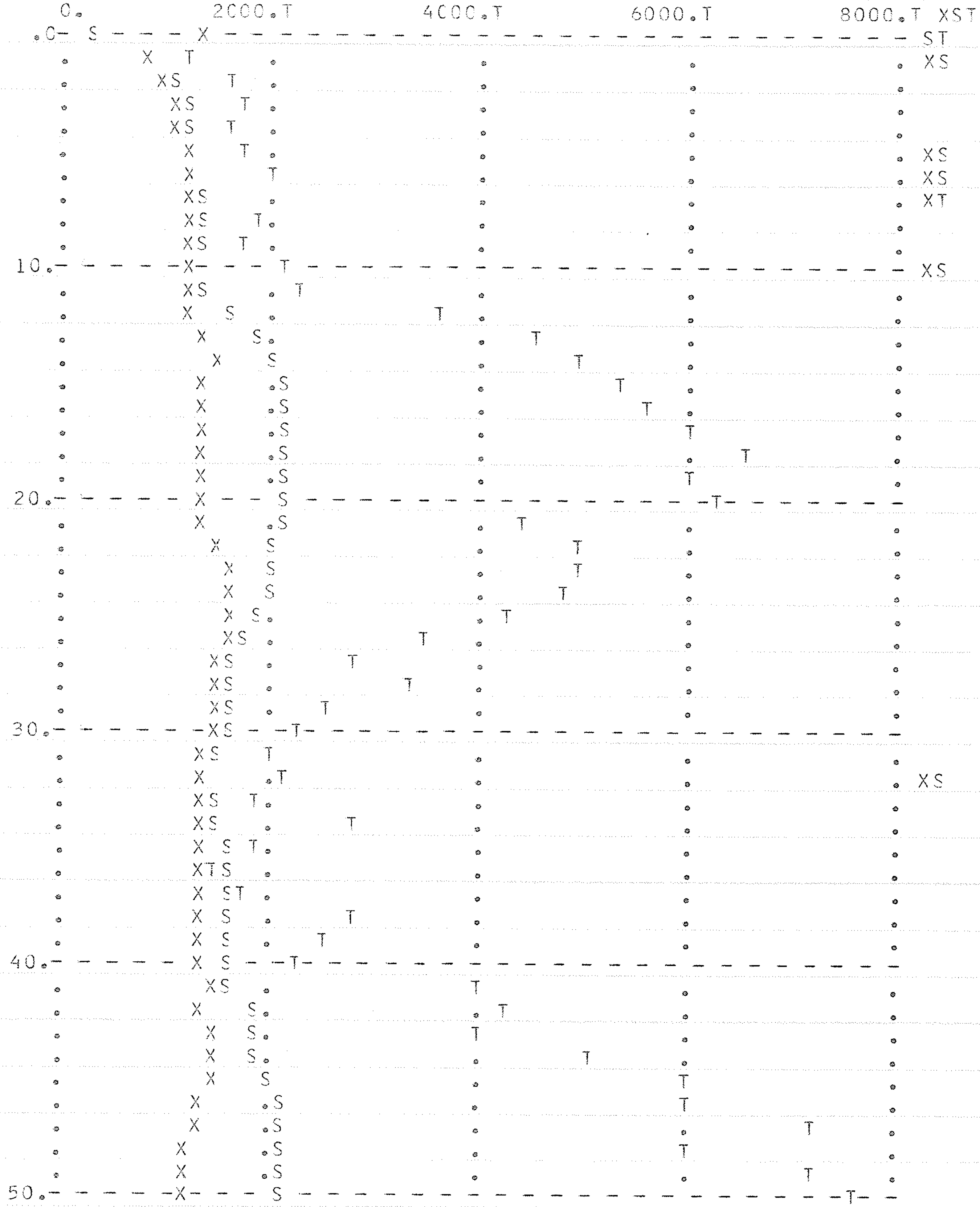

STA=Z,BIAS=B,P=P