COMPUTERIZED SIMULATION IN

CHEMICAL MARKETING

216-66

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Abstract

This paper reviews the developments, testing, and implementation of large scale computerized micro-analytic simulation of market behavior. Problems associated with model conception and specification, function verification and system and sub-system testing and validation are discussed with reference to operating systems. Sample simulation runs based on test markets are evaluated and representative management uses of the system are discussed.

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Introduction

During the brief time available this morning I would like to discuss with you what I consider to be one of the most exciting new management tools to emerge from the application of systems technology to marketing problems. This management tool is computerized micro-analytic simulation -- an approach to management based on the use of computers as integrating mechanisms for organizing and structuring marketing data in terms of models which represent management's perceptions of the market environment.

During the last decade significant progress has been made in measuring behavior within the market place and in relating management actions to market responses. Quantitative representations of important aspects of market behavior have been developed and validated. Management knowledge and assumptions of competitive interactions have been translated into models which can be tested. Computerized micro-analytic simulations based on these models have generated behavior closely approximating that observed under comparable conditions in real world markets.

Simulation based computer systems have provided realistic artificial environments in which managers have examined the implications of historical and hypothetical marketing programs under various assumed competitive conditions. Such simulations have been used by managers to evaluate the appropriateness of alternative solutions for a wide range of consumer and industrial marketing problems.

My objectives this morning are (1) to outline an approach to marketing management based on the use of micro-analytic simulation and (2) to note the advantages accruing to managers who are using this new technique as an aid in the formulation and evaluation of alternative marketing policies and strategies.

Marketing Management in the Chemical Industry

The manager concerned with the formulation of policy and strategy in chemical product markets is faced with decisions which differ in two important respects from those of his associates concerned with production and research.

1. The marketing manager must attempt to plan for developments in an environment in which controlling considerations involve human behavior -- the behavior of customers, competitors, salesmen, whole-salers-distributors, brokers, retailers, consumers, and government.

2. Management success in achieving objectives is dependent on their ability to understand and manipulate actions and responses within the external environment. In most instances they must persuade in order to achieve desired results -- management is not able to exercise direct control.

The planning and implementation of marketing programs involves the coordination of many types of management activity designed to persuade the prospective customer to take actions or develop attitudes and beliefs favorable to a particular company's brands. In the chemical industry the problem may be greatly magnified by the insertion of numerous middlemen and processors between raw material producer and the ultimate consumer.

Simulation systems designed for use by marketing management focus on the processes through which management attempts to influence behavior in relevant market sectors. The models on which such simulations are based encompass micro-analytic representations of consumer and/or industrial purchaser behavior and

competitive interactions in the environment external to the corporation.

System Development Procedures

In developing a simulation of competitive market behavior the firm and its competitors are viewed as input generators. The external market simulation is then designed to duplicate the response characteristics of comparable real world markets to the inputs generated by the competing firms.

Boundary Definitions

System development activity normally begins with a definition of the boundary conditions which limit the scope of the system to be developed. In most instances this preliminary specification is relatively crude. Management generally attempts to describe a limited number of sectors. The description may be of the form illustrated in Figure 1. This figure shows management's preliminary conception of the prescription drug market environment. Lines connecting various sectors of the illustration indicate management interest in interactions between these markets.

At the outset, management must also specify the objectives which they hope to achieve through use of the system once it has been developed, validated, and implemented. Objectives of the type defined above frequently determine whether a particular aspect of the environment will be included or excluded. Proposed applications also determine the level of detail and accuracy which management requires of the operating system.

Once the desired scope and objectives have been specified, macro descriptions of behavior within the environment to be simulated can be undertaken.

Macro Specification Development

Macro specification is designed to achieve two interrelated objectives. First, it initiates the process of quantitative model formulation. Second, it provides an opportunity for managers and researchers to establish the conceptual framework and preliminary definitions of key variables.

During the macro specification phase, major emphasis is placed on stating that which management knows, assumes, and hopes. Underlying assumptions about the nature of the environment are given close scrutiny. Boundary conditions established in preliminary discussions are refined to the point where the scope and detail of future analysis and evaluation may be established. Thus, macro specifications formalize the preliminary model structure and establish the frame of reference for all subsequent model development.

Figure 2 illustrates this step in the process of system specification. Concepts illustrated in Figure 1 have been expanded through recognition of additional sectors and more complete definition of interactions between sectors. Flows of information, orders, prescriptions, and product have been identified.

Beginning with the company in the upper left hand corner of the flow chart, product flow is followed through wholesalers, chain outlets, pharmacies, and hospitals. Parallel order flows are noted from the wholesaler, hospital, and pharmacy levels. Distribution facilitating information generated by the company is indicated as an important input to salesmen, wholesalers, pharmacies, and doctors. Information inputs to the company include observer reports, salesman reports, panel research, and direct mail research.

Salesmen are represented as receiving information from the company and transmitting it to wholesalers, pharmacies, hospitals, and doctors.

Wholesalers are perceived as receiving information directly from the company and through its salesmen, transmitting orders to the company, and receiving product from it. The small oval to the left of the wholesaler sector indicates product inventory at the wholesaler level. Inputs to the wholesaler are indicated as originating in the hospital, pharmacy, and salesman sectors. Wholesaler salesmen are represented as order takers.

Pharmacies receive information from the company via its salesmen and some wholesaler salesmen. The possibility of both direct and through-salesman order

procedures is noted. Inventory maintenance is indicated by the oval to the left of the pharmacy sector.

At the level of detail represented in the Figure 2 flow chart, the hospital is analogous to a pharmacy.

The doctor is described as receiving information from the company salesmen, media, and direct mail promotion. An additional source of information is represented by the information line leaving the lower right hand corner of the doctor rectangle and returning to that same sector. This line represents doctor interaction and the generation of "word-of-mouth" communication. The company receives information inputs about the doctor sector through observer reports, panel, and direct mail research.

The patient is shown as interacting with the doctor, receiving prescriptions under control of the doctor, and under certain circumstances, initiating refill procedures.

While competitors are not illustrated in this flow chart, the actions of relevant companies are considered in detail in the actual simulation.

The process of macro specification is frequently iterative. Initial specifications provide the basis for preliminary definitions which are then modified in the light of additional conceptual development, market studies, and data constraints. For example, once preliminary formulations for the drug market simulation had been developed, substantial time was spent in discussing these formulations with members of management as well as practicing physicians. These interactions, as well as additional analysis, and empirical research led to refinement of the initial structures.

Data Requirements

Macro specifications refine boundary conditions to the point where specific data requirements may be established. Data sources included monthly audits of drug store invoices, weekly audits of prescriptions written, audits of the

distribution and content of journal advertising, quarterly reports from panels of doctors who recorded individual patient treatment, direct mail promotions, and salesman details (sales messages for specific drugs). Specialized research studies were also employed to determine doctor knowledge, experience, attitudes, and treatment procedures.

Micro Specification Development

Once key decision and response elements have been identified the focus of model development shifts to micro specification. The first activity in this phase is the creation of detailed models based on management hypotheses regarding the problem environment and verified where possible by reference to behavioral theory and existing data. Working within the structure supplied by the macro specifications each decision point is described in terms of inputs to and outputs from that decision. Hypothesized relationships between inputs and observable behavior are formulated in terms of measurements which permit validation of the model against data from the real world. Each functional relationship is explicitly described in mathematical or logical expressions, and instructions for computer system design and programming are established.

Simulations of the type being considered here involve unusually complex computer programs. As a result, a major portion of micro specification normally focuses on the creation and testing of computer programs required for data packing, multi-level system control, and overlapped processing.

Function Formulation

Each decision and response function encompassed by macro specifications is investigated. In some instances initial theoretical constructs are validated. In others, empirical evidence suggesting alternative constructs is obtained and the process of formulation is repeated for revised structures.

The final structure established by micro specifications includes processes through which the doctor is exposed and responds to media, conventions, sales-

men, and word-of-mouth communication; evaluates indications exhibited by a patient; establishes desired actions, efficacy, and safety; and schedules the patient for a return visit.

Explicit Decision Representation

Decision and response functions are formulated and tested as probabilities since data from the real world environment are in the form of frequency distributions. Generation of explicit decision outputs for each cell within a simulated population requires conversion of the probabilistic statement into explicit yes/no decisions. A number drawn randomly from a rectangular distribution of range 0 to 1.0 is compared with the stated probability to determine each probabilistic event.[1]

Behavior of an Artificial Population

Once validated at the function level, decision and response formulations of the type described above are combined in a simulation structure encompassing artificial populations exhibiting actions and responses governed by these formulations

A Week in the Life of a Simulated Consumer

Figure 3 was obtained by monitoring the "thoughts and actions" of one member of a simulated consumer population during a simulated week in which the population experienced events comparable to those encountered by a comparable real world population during the week beginning February 19, 1962.

Identifying Characteristics

The information provided beginning with the third line of output in Figure 3 identifies characteristic attributes of consumer 109. He is a suburban (SU) resident of New England (NE) between 25 and 35 years of age with an income between $8,000 and $10,000 per year, and has a college education. He presently owns a product of brand 3 manufacture purchased six years earlier.

Consumer 109 presently favors retailers 5, 11, and 3 in that order. He

subscribes to or otherwise has available media of types 1, 4, 9, 10, 11, and 12. Media of types 2, 3, 5, 6, 7, 8, and 13 through 24 are not available to him.

Consumer 109's attitudes are summarized in a matrix beginning on line 6 of Figure 3. This matrix indicates his orientation toward 12 product character-istics, 12 appeals, 4 brands, and 18 retailers. From these figures it may be established that the most important (highest attitude) product characteristic insofar as consumer 109 is concerned is characteristic 8 which he regards very highly (+5). Appeals 11 and 4 are similarly indicated as of primary importance to this artificial consumer. From the retailer attitude portion of this matrix his preference for retailers 11 and 5 (both +5 attitudes) and 3 or 16 (both +3 attitudes) may be established. The final entry in the orientation matrix indicates that consumer 109 is aware of brand 1.[2]

Consumer Memory Content

The line stating "MEMORY DUMP FOLLOWS. BRANDS LISTED IN DESCENDING ORDER 1 THROUGH 4" introduces the print-out of consumer 109's present simulated memory content. This memory dump is a record of noted communications retained by the consumer relating specific product characteristics and appeals to each of four brands. From this report it can be established, for example, that consumer 109 has retained 14 communication exposures associating product characteristic 8 with brand 1, 13 exposures relating product characteristic 8 with brand 2, and 14 exposures associating appeal 7 with brand 3.

Media Exposure and Response

The entry in the report following the memory dump indicates that the segment of the simulation representing media exposure processes has become operational. Six media appear (are published or broadcast) during week 117. Consumer 109 is not exposed to medium 3 since that medium is not available to him (see media availability indicator in the characteristic output). Medium 4 also appears in week 117 and since it is available to consumer 109 he may be

exposed to relevant ads appearing in it. The output indicates that he is exposed to an advertisement for brand 3 but does not note that communication. On the other hand an advertisement for brand 4 also present in medium 4 during week 117 is noted as indicated by the line reading, ADVERTISEMENT 19, BRAND 4 NOTED. CONTENT FOLLOWS. The output message then indicates that advertisement 19 contains a high prominence $(4)^3$ reference to product characteristic 11 and a medium prominence (2) reference to characteristic 4. Advertisement 19 also contains medium prominence references to appeals 5, 7, and 12.

Consumer 109 does not see medium 7 although it appears in week 117, however, he is exposed to three advertisements in medium 12 which also appears during that week. The advertisement for brand 2 is noted while those for brand 3 and 1 are not. Media 16 and 23 also appear in week 117 but are not seen by consumer 109.

Word-of-Mouth Exposure

Report entries following the media exposure section indicates that consumer 109 is exposed to word-of-mouth comment generated by consumers 92, 104, and 117, but fails to note communication from any of these individuals. Had noting occurred, a message content report comparable to that generated for advertising would have specified the information noted.

Product Experience

Consumer 109 did not have product experience during week 117. Had he made use of the product a report of his response to product use indicating product characteristics or appeals, if any, emphasized by the use experience would have been printed.

Decision to Shop

The next entry in the Figure 3 output indicates that consumer 109 has made an explicit decision to shop; that his highest perceived need is for brand 3; and that his first choice retailer is 5. Simulation models representing in-store experience have been loaded.

In-Store Experience

The first entry within the SHOPPING INITIATED section notes that the consumer is exhibiting behavior associated with the explicit decision to shop option and is seeking brand 3 (there is therefore NO SEARCH activity -- no opportunity for accidental exposure). Simulated retailer 5 is carrying brand 3 therefore consumer 109 finds the brand he is seeking (3).

Retailer 5 has placed point-of-sale display material for brand 3. The consumer is exposed and notes its content emphasizing appeals 3 and 6, and product characteristics 5, 7, 10, and 11 as attributes of brand 3. Retailer 5's simulated salesmen are either not pushing brand 3 or busy with other customers. In any event, consumer 109 is not exposed to selling effort while shopping in retailer outlet 5.

Decision to Purchase

The output statement DECISION TO PURCHASE POSITIVE -- BRAND 03, $38.50, specifies that consumer 109 has made a decision to purchase brand 3 at a price of $38.50. The line following indicates that retailer 5 can make immediate delivery of brand 3.

Response to Purchase

Since consumer 109 has now purchased brand 3 his awareness which was favoring brand 2 is changed to favor brand 3.

Word-of-Mouth Generation

Since consumer 109 is now the proud owner of a brand 3 product, it is not surprising to find him initiating word-of-mouth comment regarding his new purchase. The content of his communication regarding brand 3 emphasizes product characteristics 2 and 8 and appeals 4 and 11 -- the appeals and product characteristics toward which he has the highest perceived brand image as indicated in the previous memory dump.

Forgetting

Consumer 109 did not lose any of his existing memory content during week 117.

The final output line of Figure 3 indicates that consumer 109 has concluded week 117.

Simulated Population Behavior

Following completion of the specified number of simulated consumer weeks for a given consumer record, the simulation reads another consumer record from the tape file and repeats the process as described. After all consumers have been considered for the specified period of simulated time, final summary reports are written and the simulation terminates.

Testing

Once a simulation has been developed to the point where it can be used to produce artificial behavior, the emphasis shifts to testing. Although the ultimate test of any model is its usefulness, the stability, reliability, and validity of a simulation should be ascertained before it is used as an operational tool.

Stability Testing

Stability tests are concerned with the reasonableness of the model's performance when it is subjected to different, but feasible, parameter values and input data, and run for substantial periods of time. The major problems encountered in stability testing are selection of specific parameter values, definition of "reasonable" performance, and determination of an appropriate time period for the test.

Reliability Testing

Tests of reliability focus primarily on the question of reproducability of results. The basic problem is one of determining stochastic variations of important outputs when different series of random numbers are used to determine

stochastic variations of important outputs when different series of random numbers are used to determine specific outcomes within the system. Confidence intervals for important outputs can be established using various statistical techniques.

Validity Testing

Tests of validity are concerned with "truth". While reliability may be assessed using standard statistical techniques there are no objective measures of truth. Consequently, the researcher must turn to a subjective evaluation of the accuracy of the assumptions used to create the model and the consistency of its performance with theory and empirical data. In the final analysis, a model is realistic if it duplicates the relevant characteristics of the real phenomenon. For example, Turing has suggested that a model may be called "realistic" if a person knowledgeable in the subject being modeled -- i.e., a person having experience with the relevant reality -- cannot distinguish model output from output generated by the real system.[4] Thus, once the validity of assumptions has been established tests must be made of model output.

The procedure normally followed in testing the validity of a micro-analytic simulation is to proceed sequentially through analyses of individual functions, individual cell behavior, and total population behavior.

Once simulated behavior of the type outlined in Figure 3 has been established through Turing tests,[5] the system may be used to produce behavior over time.

Figure 4 illustrates the cumulative prescription market shares generated by two general practitioners operating in the simulated environment during one year. These two doctors prescribed only one relevant drug during the first two weeks of simulated activity. However, as the year progressed, they tried six other drugs. Their cumulative brand shares for the ten brands are shown at week 52. Output of the type illustrated in Figure 4 is used primarily to test system stability.

Population Level Validation

Meaningful tests of population behavior require aggregation of simulated cell behavior. In the doctor case, population behavior is validated by analyzing the proportion of prescriptions allocated to each brand (brand shares), and changes in knowledge, attitudes, and perceived brand images of important segments of the population.

For example, Figure 5 illustrates the brand shares of ten frequently used drugs resulting from 100 simulated doctors' treatment of several thousand patients. In conducting such tests, the population is initialized to duplicate the distribution of relevant parameters as they existed at a specified point in time in the real world environment. In the case of the Figure 5 run, the artificial population was initialized to correspond to conditions existing at the beginning of 1961.

Inputs to the simulation during performance tests describe conditions existing in the real world during the relevant time period. In this case inputs specified the content and media allocation for all journal, direct mail, salesman detail, and convention promotion generated by competitors operating in the relevant market area during 1961. Tests performed following this simulation run established that the rank order of brand shares at the end of 1961 in the real and simulated worlds were equivalent and the maximum error for any one brand was less than six percentage points.

It should be pointed out that this test is a duplication of history -- not a prediction of the future. A great deal of real world data was used in providing inputs for this test and in estimating important parameters. When the model is used for prediction of the future, subjective judgment must be used to develop inputs, and assumptions must be made about the stability of important parameters.

Management Uses of Micro-Analytic Simulation

Given a system of the type described in this paper, management must assess system performance in terms of intended applications. If, in their opinion, performance is sufficient to warrant use of the simulation as a representation of the real world environment, applications of the type outlined below may be appropriate. However, if, in their opinion, the simulation fails to duplicate salient attributes of the real world environment further development leading to a more refined system must be undertaken or the use of the technique rejected.

Testing Implicit Models

One of the first benefits to accrue from the development of a simulation system is the systematic testing of management conceptions of the environment in which they operate. In reviewing alternative formulations and evaluating functions, cell model behavior, and total population performance, management must make explicit the implicit models which they use in decision making.

The "What If?" Question

Given that management accepts simulation performance as indicative of real world response under comparable conditions, the simulation becomes a test market without a memory in which management may examine with impunity the implications of alternative policies and strategies. Whether introducing new products or considering modification of a marketing program, management may apply alternative strategies in the simulated environment and evaluate their implications under various assumed competitive conditions.

The effectiveness of such pretesting is dependent on management's ability to predict probable competitive responses to proposed actions, as well as the accuracy of the simulation system. Management may find it profitable to examine the impact of best and worst case competitive response patterns. In most instances the best case assumes that competition will continue with programs developed prior to initiation of company actions, while the worst

case assumes full competitor knowledge of the proposed company program and actions designed to thwart company efforts.

Performance References

The simulated environment also provides the reference points against which the progress of operations in the real world may be measured. Given a simulation pre-test, management can determine, by monitoring appropriate variables, whether or not a program is progressing as planned. If conditions producing satisfactory performance in the simulated environment are encountered in the real world, it is assumed that final results will be comparable.

Summary

This paper has focused on characteristics of micro-analytic computer simulation as a tool of marketing management. The process of creating, testing, and using a complex simulation system has been discussed with reference to simulations of consumer and physician purchase and response behavior.

The future of simulation in marketing appears to be particularly promising. Although systems such as the drug market simulation tax the capacity of the largest commercially available computers, new computers with larger memories and even greater computational speed are being developed. The value of such systems rests on their potential to contribute significantly to the marketing executive as vehicles for testing pre-conceptions regarding complex environments, evaluating the implication of alternative policies and strategies, and providing performance references against which operational effectiveness may be assessed.

Footnotes

[1] If the number drawn is less than or equal to the stated probability, a positive outcome is assumed.

[2] The awareness measure used in this system is indicative of the respondents top-of-mind cognizance determined by eliciting the name of the first brand in a product class which "comes to mind".

[3] A five point (0-4) prominence scale is used to code content of all communication inputted to the model. Each communication is evaluated using the following coding structure.

Level of Prominence	Evaluation Scale
Extremely Prominent -- Impossible to Miss	4
Very Prominent -- Major Emphasis Given	3
Average Prominence -- Normal Identification	2
Present but not Prominence -- Easily Missed	1
Not Present -- Impossible to Determine	0

[4] Turing has suggested that if a person knowledgeable in the area of simulated decision making cannot distinguish the modeled behavior from reality the model is realistic. See: A. M. Turing, "Computing Machinery and Intelligence", MIND, October 1950, pp. 433-60

[5] Ibid.
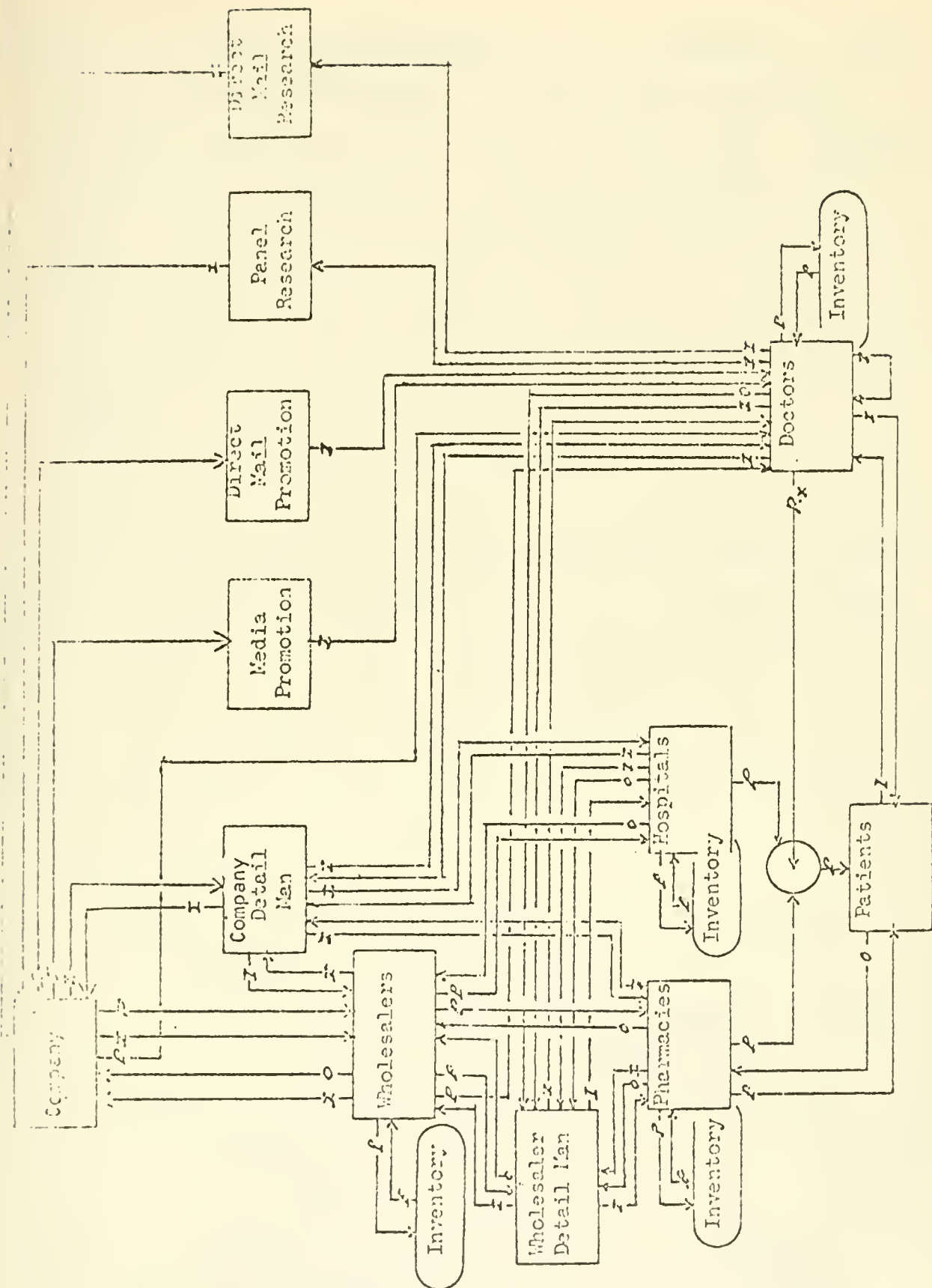
Figure 1

BOUNDARY DEFINITIONS -- AN EXAMPLE

Figure 2

Macro Specifications -- An Example
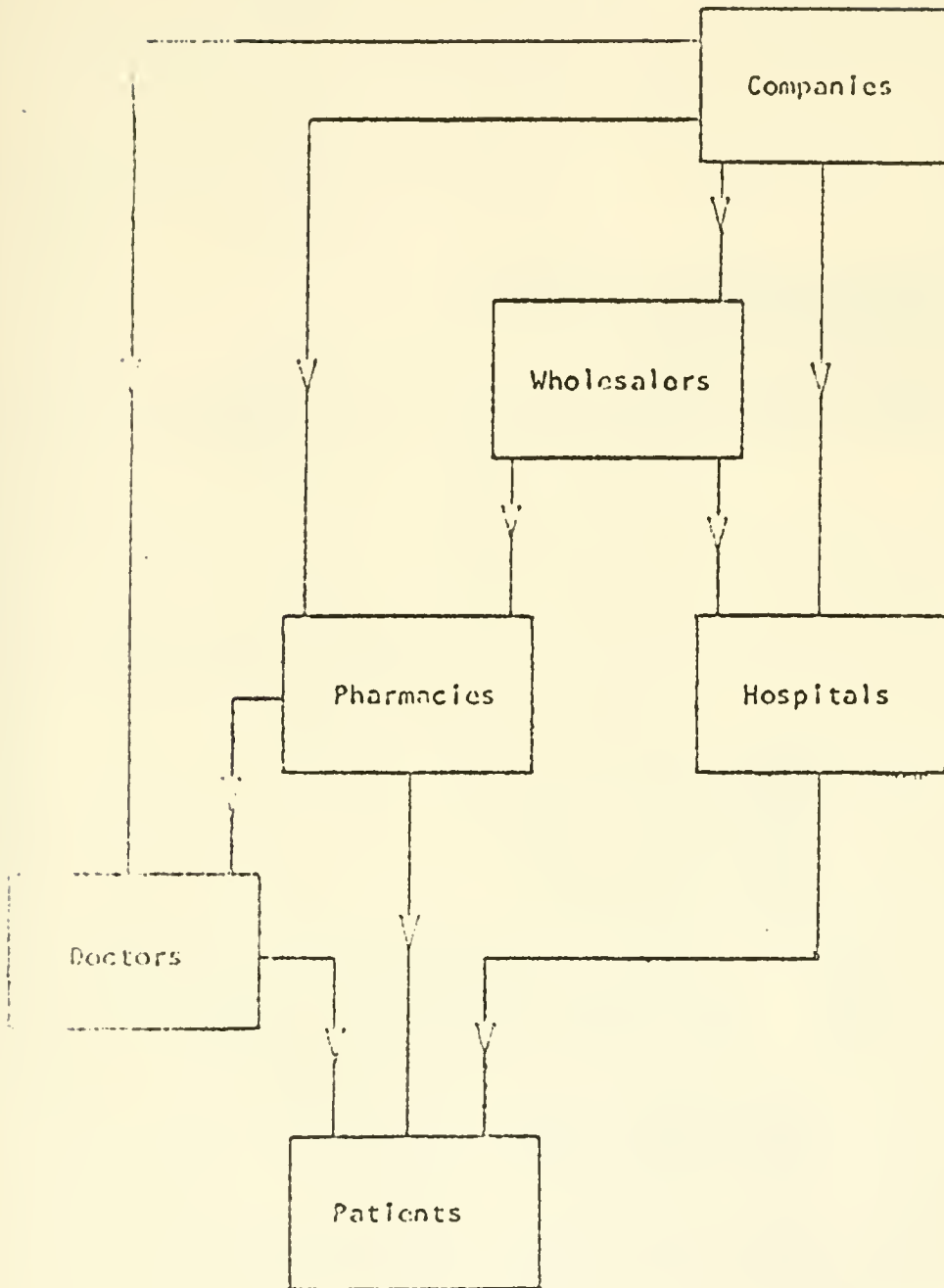
SIMULATION APP-03 TEST RUN APRIL 4, 1965 1400 HOURS

CONSUMER .109 NOW BEGINNING WEEK 117 -- FEBRUARY 19, 1962

- REPORT MONITOR SPECIFIED. TO CANCEL PUSH INTERRUPT.

- CHARAC - REGION NE SU, AGE 25-35, INCOME 8-10K, EDUCATION COLLEG

- BRANDS OWN 3, 6 YEARS OLD. RETAILER PREFERENCE 05, 11, 03

- MEDIA AVAILABLE 1 0 0 1 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0

- ATTITUDES . 1   2   3   4   5   6   7   8   9   10 .11..12
....

```
PROJ CHAR .  0  +1  +1   0  -3  -1   0  +5   0  +3   0   0
APPEALS   . -3   0  +1  +5   0  -3  +3   0   0   0  +5   0
BRANDS    . +2  +1  +3  +2
RETAILERS . +1  -5  +3  +1  +5  -5  -5  +1  -1  -3  +5  +1
          . -3  +1  -1  +3  +1  +1
AWARENESS .  1   0   0   0
```

- MEMORY DUMP FOLLOWS. BRANDS LISTED IN DESCENDING ORDER 1 TO 4

PRODUCT CHARACTERISTIC MEMORY   APPEALS MEMORY

1	2	3	4	5	6	7	8	9	10	11	12	.	1	2	3	4	5	6	7	8	9	10	11	1
2	3	15	0	5	5	4	14	8	7	1	3	. 8	9	7	3	1	11	7	4	4	3	9		
3	0	6	4	9	5	4	13	0	3	6	7	. 6	8	0	7	0	9	2	4	3	10	3		
0	6	15	7	0	3	11	3	5	2	5	7	. 0	4	8	10	9	2	14	3	9	7	9		
7	9	3	7	3	2	7	2	6	12	14	2	. 0	9	7	8	13	9	11	6	0	2	5		

- MEDIA EXPOSURE INITIATED

    - MEDIUM 003 APPEARS IN WEEK 117 -- NO EXPOSURES
    - MEDIUM 004 APPEARS IN WEEK 117
        - EXPOSURE TO AD 013, BRAND 3 -- NO NOTING .
        - EXPOSURE TO AD 019, BRAND 4
            - AD 019, BRAND 4 NOTED. CONTENT FOLLOWS
            - PROD. C 11 P=4, 4 P=2,
            - APPEALS 5 P=2, 7 P=2, 12 P=2,
    - MEDIUM 007 APPEARS IN WEEK 117 -- NO EXPOSURES
    - MEDIUM 012 APPEARS IN WEEK 117
        - EXPOSURE TO AD 007, BRAND 2
            - AD 007, BRAND 2 NOTED. CONTENT FOLLOWS
            - PROD. C 8 P=3, 12 P=1,
            - APPEALS 2 P=1, 4 P=1, 6 P=1, 10 P=1,
        - EXPOSURE TO AD 013, BRAND 3 -- NO NOTING
        - EXPOSURE TO AD 004, BRAND 1 -- NO NOTING
    - MEDIUM 015 APPEARS IN WEEK 117 -- NO EXPOSURES
    - MEDIUM 023 APPEARS IN WEEK 117 -- NO EXPOSURES

FIGURE 3

COMPUTER OUTPUT

- WORD OF MOUTH EXPOSURE INITIATED

        - EXPOSURE TO CONSUMER 0093 -- NO NOTING
        - EXPOSURE TO CONSUMER 0104 -- NO NOTING
        - EXPOSURE TO CONSUMER 0117 -- NO NOTING

- NO PRODUCT USE IN WEEK 117

- DECISION TO SHOP POSITIVE -- BRAND 3 HIGH PERCEIVED NEED
                            -- RETAILER 05 CHOSEN

- SHOPPING INITIATED

    - CONSUMER DECISION EXPLICIT FOR BRAND 3 -- NO SEARCH
    - PRODUCT EXPOSURE FOR BRAND 3
        - EXPOSURE TO POINT OF SALE 008 FOR BRAND 3
            - POS 008, BRAND 3 NOTED. CONTENT FOLLOWS
            - PROD. C   3 P=4,   6 P=4,
            - APPEALS   5 P=2,   7 P=2, 10 P=2, 11 P=2,
    - NO SELLING EFFORT EXPOSURE IN RETAILER 05

- DECISION TO PURCHASE POSITIVE -- BRAND 3, $ 38.50

    - DELIVERY IMEDAT
    - OWNERSHIP = 3, AWARENESS WAS 2, NOW 3

- WORD OF MOUTH GENERATION INITIATED

    - CONTENT GENERATED, BRAND 3
            - PROD. C   3 P= +15,   8 P=+15,
            - APPEALS   4 P= +50, 11 P=+45

- FORGETTING INITIATED -- NO FORGETTING D

-- CONSUMER 0109 NOW CONCLUDING WEEK 117   --   FEBRUARY 25, 1962

-- CONSUMER 0110 NOW BEGINNING WEEK 117   --   FEBRUARY 19, 1962

QUIT,
R 11.633+4.750

FIGURE 4

Sample Output -- Two Doctors

SIMULATION TEST RUN
1961 TIME PATH SIMULATION FOR .   1 THRU 10
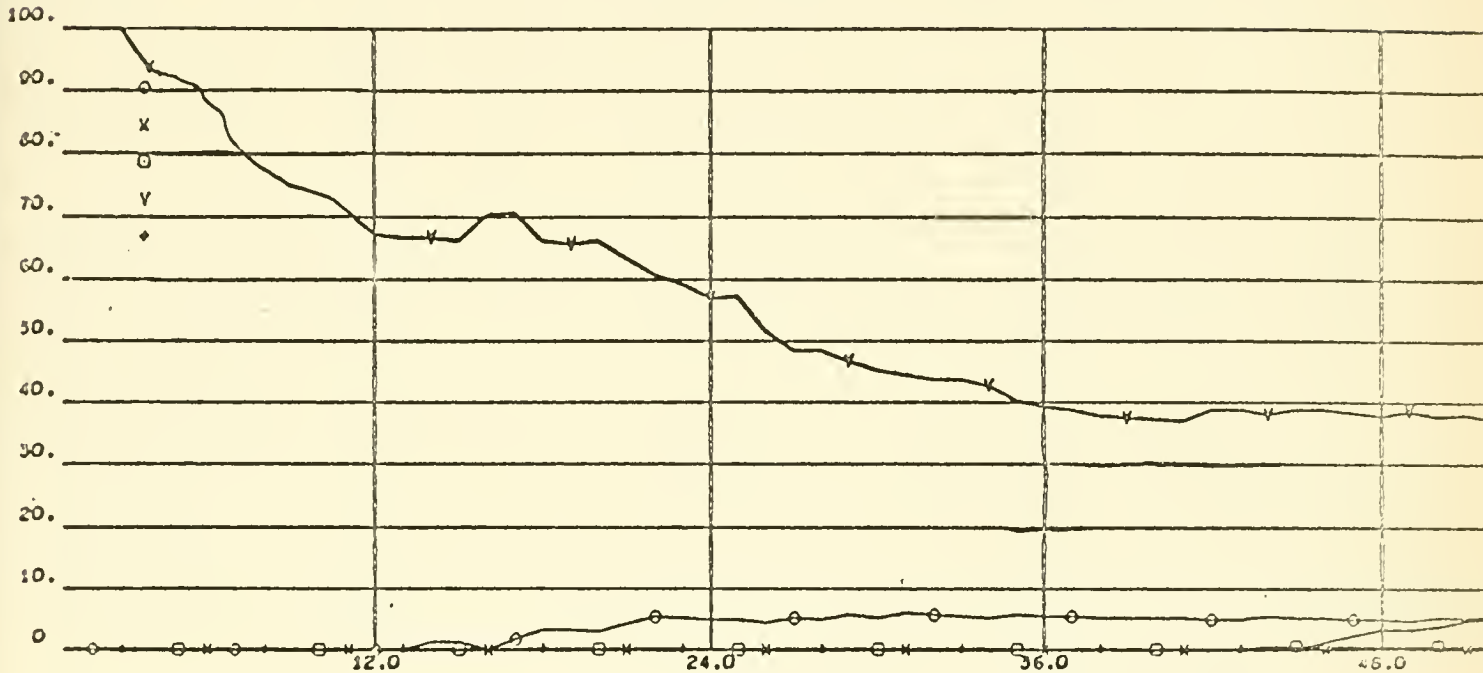
SIMULATION TEST RUN
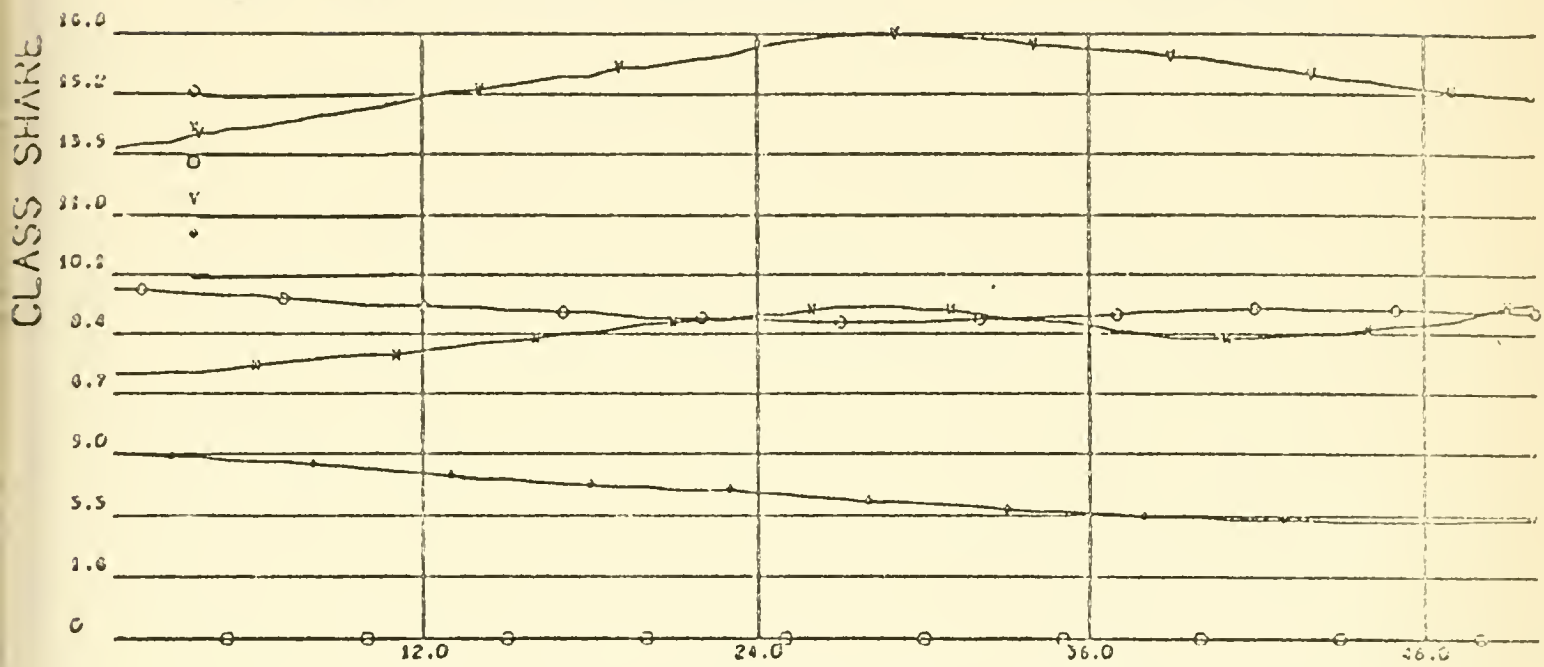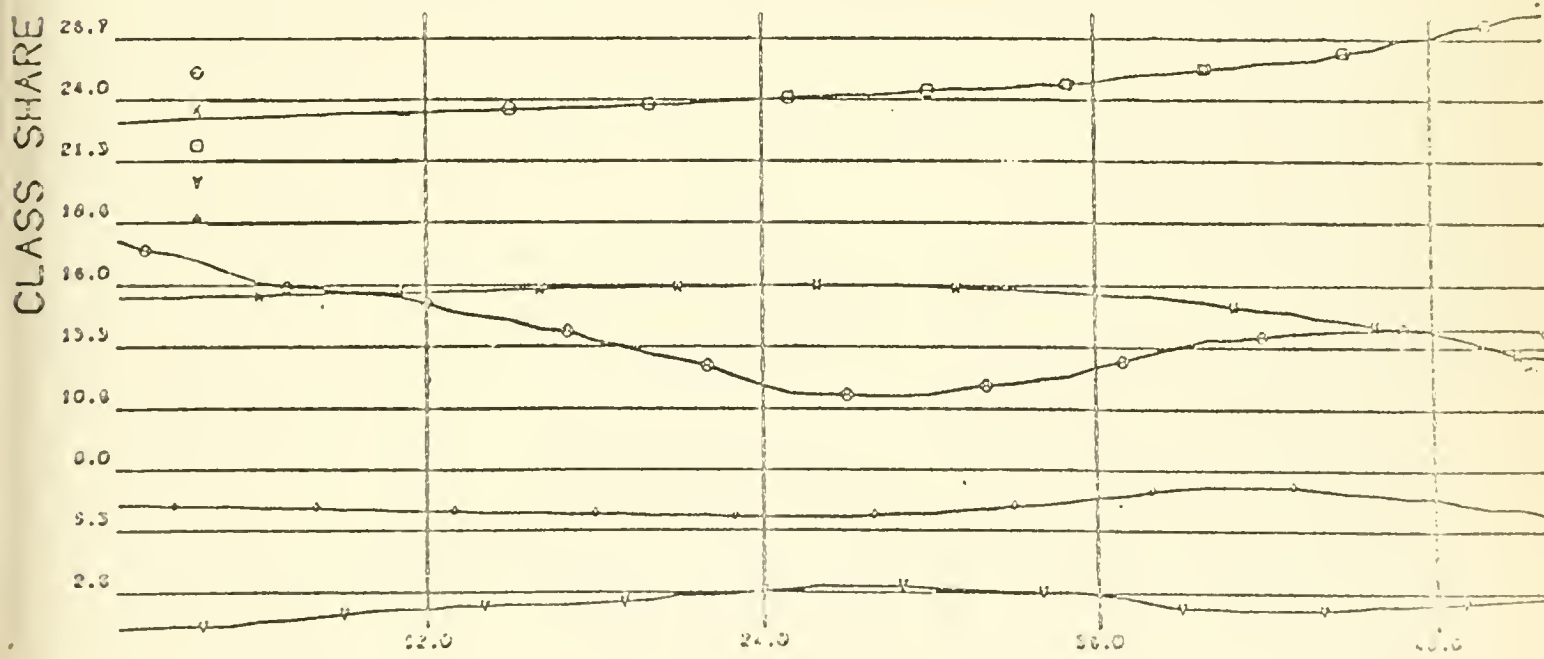1961 TIME PATH SIMULATION FOR   1 THRU 10
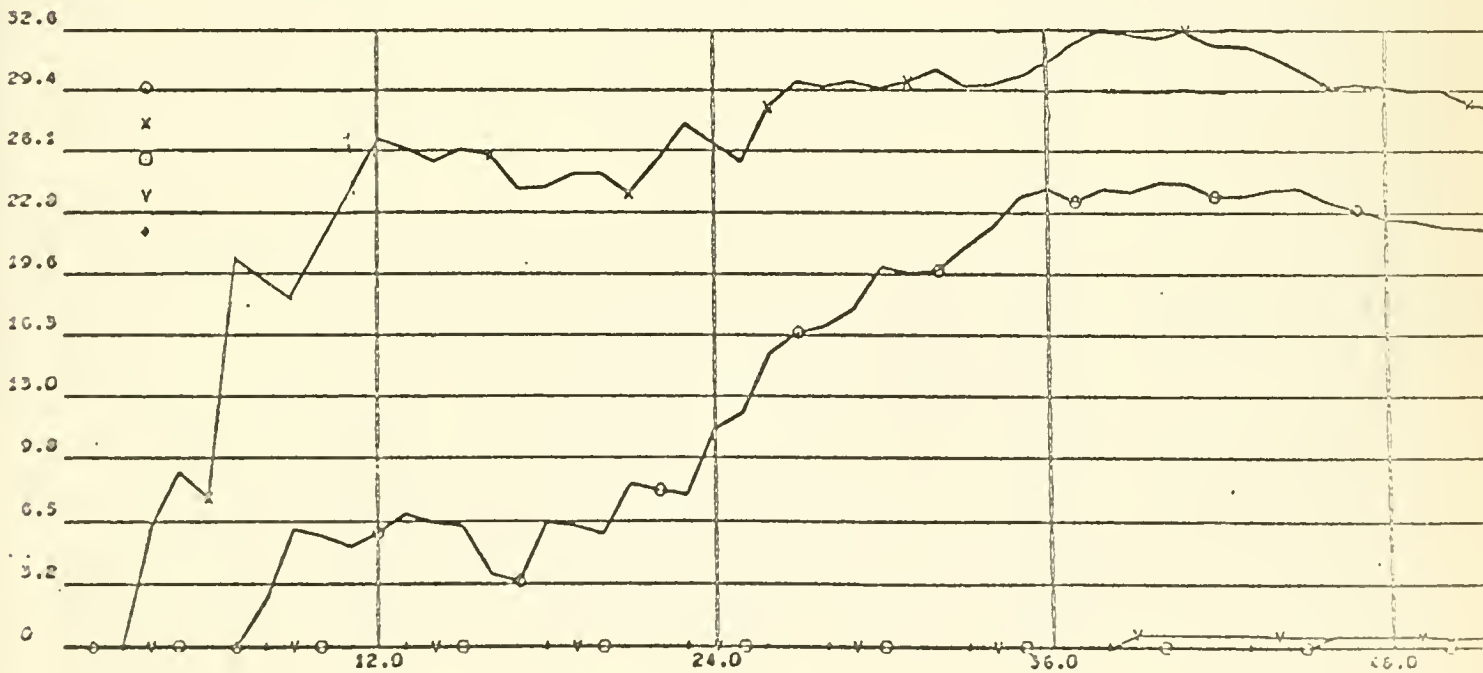
FIGURE 5

Sample Output -- 100 Doctors