

The Stochastic Generation of a Multidimensional Scaling Technique Utilized in the Teaching of Marketing Management

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Abstract

In the teaching of marketing courses, it becomes necessary to present to students the utilized methodology and procedure of an associated marketing fundamental or principle. The marketing fundamental in this presentation is product positioning. Products are positioned by marketing managers with the aid of Multidimensional Scaling Techniques (MDS). This paper describes a computer simulation model using a Monte-Carlo technique that generates input data to PREFMAP, a MDS program. The purpose of PREFMAP, supplied by Bell Laboratories, is to output pedagogical product positioning information to students.

INTRODUCTION

Multidimensional scaling is a term that is applied to a variety of computer-based techniques that have as their goal the representation of an object in multidimensional space based on one or more respondent's perception of, or attitudes toward the subject. (24 p.353) The origin of multidimensional scaling is attributed to the classic work of Young and Householder, 1938 (27 pp.19-22), in which they laid the foundation for the later work by Richardson, 1938 (20, 6 pp.659-660), Guttman, 1944 (10 pp.139-150), Coombs, 1950 (5 pp.148-158), and Torgerson, 1952 (22 pp.401-419).

Most of the recent MDS research and writing has been conducted by two separate and distinct groups. The first group consists of Carroll (2) and Chang (4). The second group is composed of Green and Rao (9).

The use of Multidimensional scaling techniques in marketing is documented by the work of Turner (25 pp.165-172), Lillus (17), and Doehlert (6 pp.250-258). Further writing on MDS in marketing is presented by Green and Carmone when they noted, multidimensional scaling is concerned with the spatial representation of consumer perceptions and preferences. The dimensions of the "space" are "multi" in number, one for each of the significant characteristics used to measure the perception of preference. (7)

Multidimensional scaling is a technique (procedure) use to determine consumer attitudes and preferences. These attitudes and preferences are used by the marketing manager to position the product. Positioning is a strategy based on the fact that the human mind screens and rejects much of the information offered it because of the sheer volume of today's advertising. (14, p.517) Therefore, product positioning as a strategy avoids the direct competitive attack. Examples follow. Seven-Up is the uncola. Goodrich doesn't have a blimp. Vick Chemical positioned NYQUIL as a nighttime cold remedy only, and did not compete directly with all the cold remedies (12, p.297). Perhaps the classic product positioning example has been, "AVIS is only number 2" but "We try harder." Avis lost money for more than a decade before this simple admission. Every year since, they have brought in more money than all the previous direct attacks had against Hertz. (26, p.19)

Examples of the use of MDS techniques in determining consumer perceptions of products are illustrated below in Figures 1-3. The marketing manager analyzes this information and then positions the product through advertising.

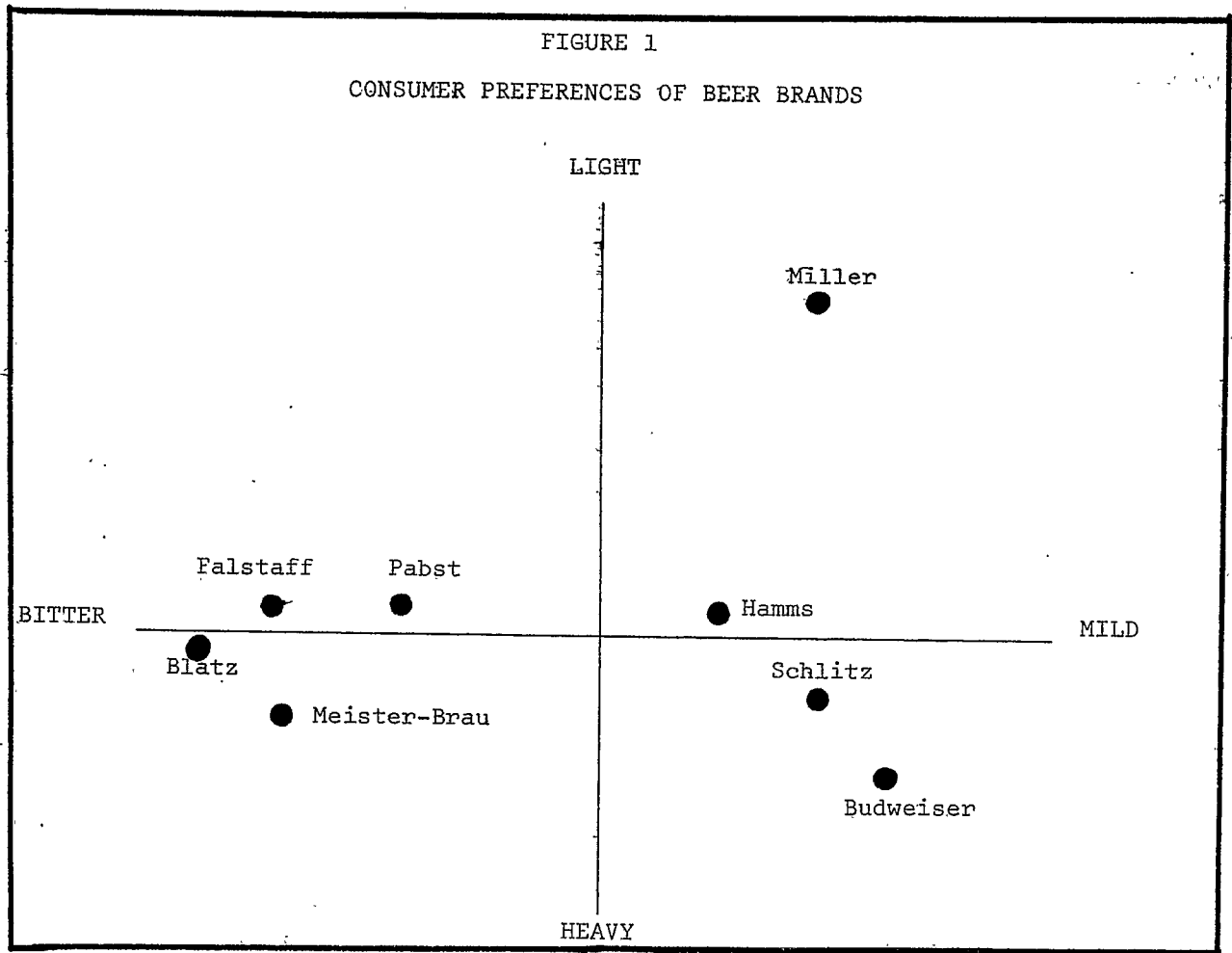


Figure 1 is a distribution of consumer preference of beer brands according to mildness and lightness (13). The measure of brand dissimilarity would be the geometric distance between any pair of brands: Formula (1)

$$D_{ij} = \sqrt{(X_{i1} - X_{j1})^2 + (X_{i2} - X_{j2})^2}$$

where D_{ij} = distance, or perceived dissimilarity, between brands i and j .
 X_{i1} = brand i 's rating on Attribute 1.
 Other x 's are similarly interpreted.

The second example of Multidimensional scaling, applied to marketing illustrating consumer perceptions of car brands, (8 pp.159-180), is presented in Figure 2.

FIGURE 2

CONSUMER PREFERENCES OF CAR MODELS

SPORTY

NON
LUXURIOUS

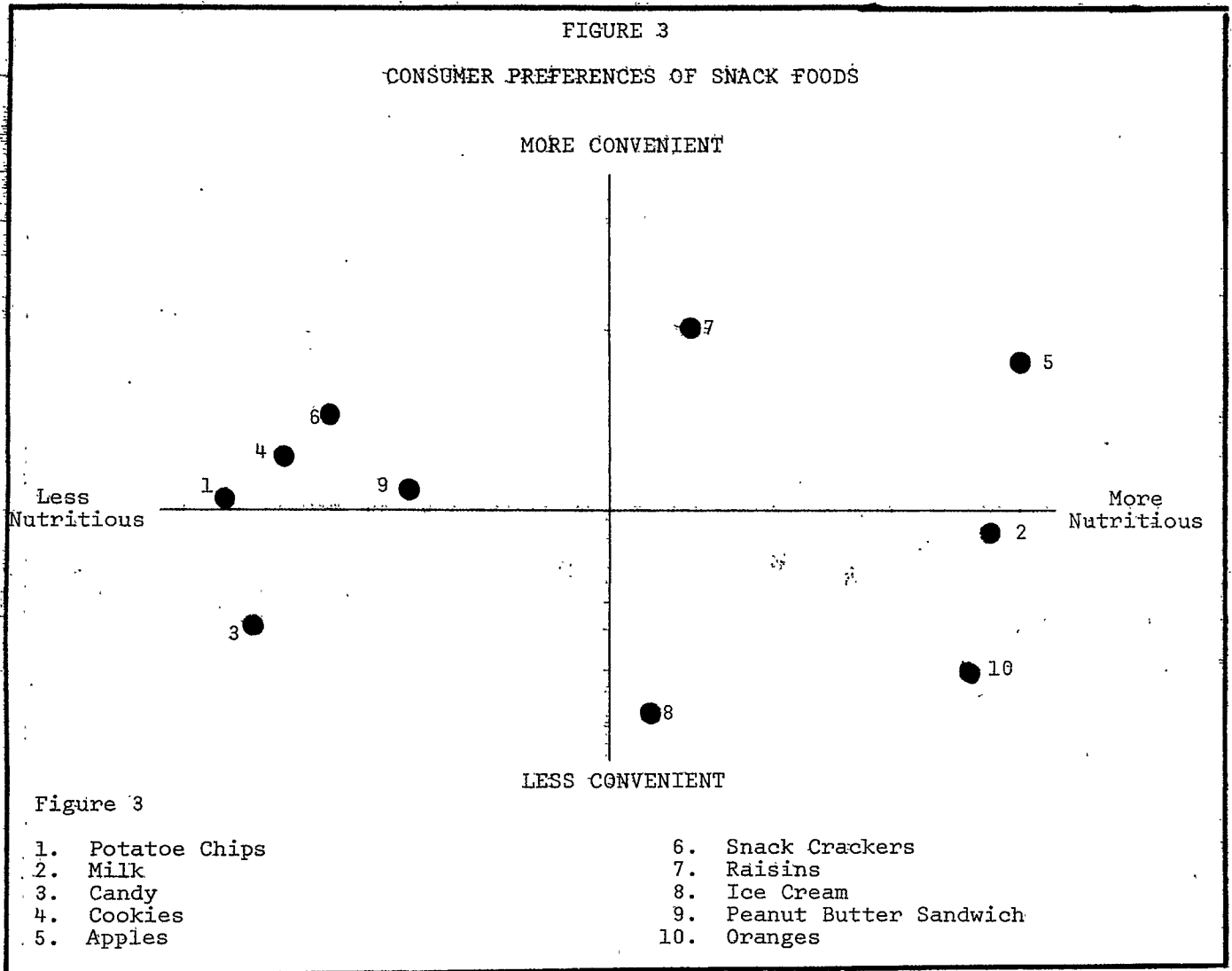
LUXURIOUS

NONSPORTY

STIMULI - 1968 CAR MODELS

- | | |
|---------------------------|--------------------------|
| 1. Ford Mustang 6 | 7. Jaguar Sedan |
| 2. Mercury Cougar V8 | 8. AML Javelin V8 |
| 3. Lincoln Continental V8 | 9. Plymouth Barracuda V8 |
| 4. Ford Thunderbird V8 | 10. Buick LeSabre V8 |
| 5. Ford Falcon 6 | 11. Chevrolet Corvair |
| 6. Chrysler Imperial V8 | |

The final example is concerned with the consumer perceptions of snack foods (18 pp. 66-72).



The three examples of Multidimensional scaling techniques are all based on five assumptions. (1) The consumer thinks consciously or unconsciously of basic dimensions when he thinks about a product class. (2) These dimensions are independent of each other and each is scalable. (3) These dimensions have equal weight in the buyer's mind. If the dimensions are weighted differently by the buyer, then the simple Euclidian distance should be modified into a weighted Euclidian distance. (4) The buyer can indicate where each brand is located in the space. (5) The

preference surface over the perceptual space symmetrically decreases in all directions from the ideal point. (15 p.493)

The Simulation

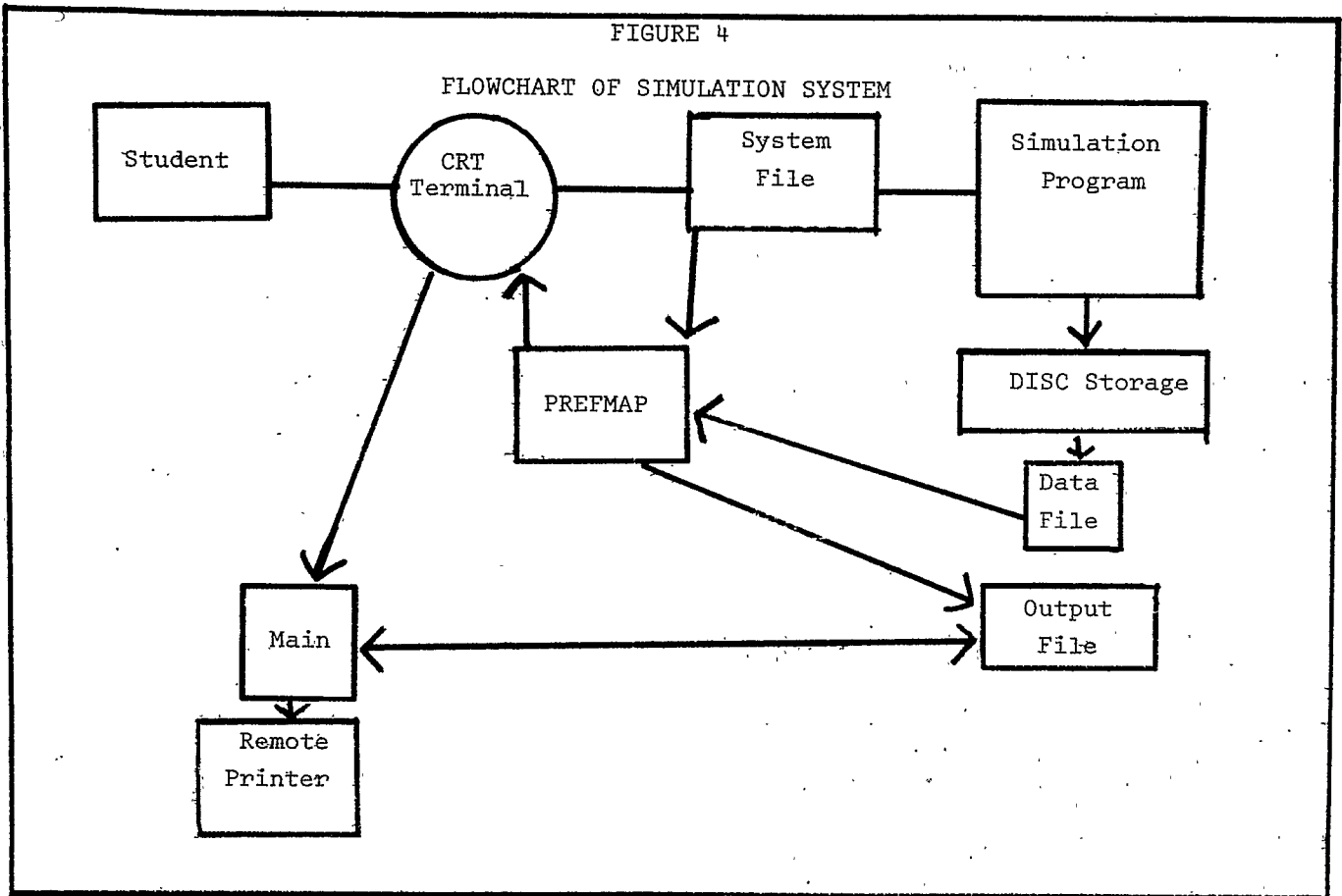
The introduction of the paper reported the significance of Multidimensional Scaling and product positioning. This section reports on the simulation of MDS and product positioning.

The entire purpose of the simulation

is to provide marketing students with varying situations to analyze. The varying situations are in reality the output of a Multidimensional scaling technique from which the input data was simulated. The input data is simulated for the usual reasons: (1) The system does not have to be constantly interrupted by consumer perception surveys. (2) It is easy to change environmental conditions that would take years in real time. (time compression) (3) and (4) Cost and time are the final and most critical reasons to simulate input data for the Multidimensional scaling technique. It is just too costly and time consuming to be conducting surveys measuring consumer perceptions toward brands. Although there have been past MDS studies, as previously cited above, the actual numbers is not overwhelming. Also, by using simulation, the professor is better able to control and have more flexibility over the input data.

The entire simulation process of the MDS technique is illustrated in Figure 4. The student, after logging in on the terminal, types - SIMMDS and hits return. This simple command is the only input required by the student. The system file first calls the simulation program to be executed. The program stochastically generates its output by means of a Monte-Carol method. The Monte-Carlo method, consist of experimental sampling with random numbers, (11). The simulated data is then stored in on-line disc storage in a data file. After this is finished, the system file executes an MDS program. The MDS program, used in this simulation system and obtained from Bell Laboratories, is PREFMAP. Other MDS programs are DISTAN, developed by Rao (19), MDPREF (3), M-D-SCAL V (16) and PARAMAP (21, pp. 561-592). This MDS program, PREFMAP, uses as its input the output stored in the newly created data file and generated by the simulation program. PREFMAP, written in FORTRAN, is then executed. The output of PREFMAP, such as Figures 1-3, are routed to a disc storage file and returned to the student via CRT terminal. After the simulation and if a hard copy is desired, the student requests the main computer to dispose the data to a remote printer.

FIGURE 4



After the simulation information has been returned to the students, certain product positioning decisions must be answered. (1) What position, if any, does the product own in the prospect's mind? (2) What product position is desirable? (3) What companies must be outgunned if we are to establish that position? (4) Is there enough marketing money to occupy and hold the position? (5) Does the creative approach match our positioning strategy? (23, p.114)

CONCLUSION

The computer simulation of a Multidimensional Scaling Technique is a valuable tool in the teaching of the marketing strategy, product positioning.

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