

UNIVERSITY OF
ILLINOIS LIBRARY
AT URBANA-CHAMPAIGN
BOOKSTACKS

CENTRAL CIRCULATION BOOKSTACKS

The person charging this material is responsible for its renewal or its return to the library from which it was borrowed on or before the **Latest Date** stamped below. **You may be charged a minimum fee of \$75.00 for each lost book.**

Theft, mutilation, and underlining of books are reasons for disciplinary action and may result in dismissal from the University.


TO RENEW CALL TELEPHONE CENTER, 333-8400

UNIVERSITY OF ILLINOIS LIBRARY AT URBANA-CHAMPAIGN

JUL 28 1998

When renewing by phone, write new due date below
previous due date.

L162



Digitized by the Internet Archive
in 2011 with funding from
University of Illinois Urbana-Champaign



BEBR

FACULTY WORKING
PAPER NO. 1251

DIFFSTRAT: An Analytical Procedure for Generating Optimal
New Product Concepts for a Differentiated-type Strategy

*D. Sudharshan
Jerrold H. May
Thomas Gruca*

College of Commerce and Business Administration
Bureau of Economic and Business Research
University of Illinois, Urbana-Champaign

BEBR

FACULTY WORKING PAPER NO. 1251

College of Commerce and Business Administration

University of Illinois at Urbana-Champaign

May 1986

DIFFSTRAT: An Analytical Procedure for Generating Optimal
New Product Concepts for a Differentiated-type Strategy

D. Sudharshan, Assistant Professor
Department of Business Administration

Jerrold H. May
University of Pittsburgh

Thomas Gruca, Assistant
Department of Business Administration

ABSTRACT

Firms are likely to consider employing multiple products in markets where competition and heterogeneity of consumer preferences suggests the use of market segmentation. The problem of identifying the optimal multiple new product concepts for such a market may be considered in either a sequential (one product at a time) or a simultaneous fashion. We show that the "optimal" new product concepts generated sequentially are different from, and generally inferior to, those generated simultaneously. In this paper we present a new procedure, DIFFSTRAT, which solves this problem for a wide range of consumer preference models. This procedure utilizes a fundamental insight called the augmented space approach to solve this problem.

INTRODUCTION

Having decided upon the market it is going to enter, a firm has three broad market coverage strategies to choose from: (i) undifferentiated marketing, (ii) differentiated marketing, and (iii) concentrated marketing (Kotler, 1984, p. 267). Under the first strategy, the firm would ignore market segment differences and offer just one product to the entire market. In contrast, under concentrated marketing, the firm would choose one and only one segment of the market and would provide one market offering specifically aimed at this segment. Although "some brands have skillfully built up reputations of being suitable for a wide variety of people," Gardner and Levy (1955) state that: "In most areas audience groupings will differ, if only because there are deviants who refuse to consume the same way other people do....It is not easy for a brand to appeal to stable lower-middle-class people and at the same time to be interesting to sophisticated, intellectual upper-middle-class buyers....It is rarely possible for a product or brand to be all things to all people." In this type of market, the recommendation is to consider multiple product offerings, with each offering being aimed exclusively at one or a few segments. Such a strategy would be of the differentiated marketing type.

The market place is replete with examples of firms following the differentiated marketing strategy. An example from Kotler (1984) is Edison Brothers in the retail shoe business. It operates nine hundred shoe stores that fall into four chain categories each targeted toward a different market segment. They are as follows:

<u>Segment</u>	<u>Chain name</u>
Higher-priced shoes	Chandler's,
Moderate-priced shoes	Baker's,
Budget shoes	Burt's,
and Stylized shoes	Wild Pair.

General Motors, Ford, Chrysler, Toyota, Nissan, etc., in the car industry all seem to follow a similar strategy. Procter and Gamble is a well known user of such strategies in various markets.

We believe that the availability of sophisticated consumer need-based methods for generating optimal new product concepts would be useful to a manager pursuing a differentiated marketing strategy. Such methods would consider the problem of offering multiple products to a market. Each product would be targeted at either a segment or a small number of segments. In this paper we report on a procedure (DIFFSTRAT--for differentiated strategy) that has been developed exclusively for this purpose. The problem is formulated as being one of determining that combination of new product concepts in an attribute space that would make for an optimal differentiated strategy.

Realizing that a firm using DIFFSTRAT might already have some existing products in the same market, we also provide for the following:

- i) consideration of cannibalization--by considering the net incremental demand of the new and existing set of products over the existing set,
- ii) repositioning of existing products along with new product introductions to achieve the highest incremental demand,

and iii) the possibility of deleting some or all existing products of the firm in considering new products for this market.

Interest in analytical models/procedures for generating optimal new product concepts based on an analysis of consumer needs has been growing. This is evidenced by the recent literature reporting procedures/algorithms for new product concept generation (viz. Shocker and Srinivasan (1974, 1979); Albers and Brockhoff (1977, 1980), Albers (1976, 1979, 1982); Green, Carroll and Goldberg (1981); Zufryden (1979); Gavish, Horsky and Srikanth (1983); May, Shocker and Sudharshan (1982, 1983); Sudharshan, May and Shocker (1986); and Sudharshan (1982)). Albers' (1976) procedure SILOP was specifically developed for the single choice ideal point model (i.e., each segment is associated with an ideal point model of preference in an attribute space, and that segment's entire sales potential is assigned to the product closest (in terms of Euclidean distance) to its estimated ideal point). Pessemier, Burger, Teach, and Tigert (1971); Shocker and Srinivasan (1974, 1979); and May, Shocker and Sudharshan (1982) argued that the probabilistic choice models (each segment's share is allocated probabilistically to several products, not just one) are more realistic (i) in the case of frequently purchased consumer non-durables, and (ii) when preference models are specified at the consumer segment level.

In the context of single optimal new product concept generation problems, there is evidence (May, Shocker, Sudharshan (1982),

Sudharshan (1982, 1984), Sudharshan, May and Shocker (1986)) that the use of procedures which assume single choice consumer models may be inefficient in market environments in which probabilistic choice models are better predictors of aggregate choice. Therefore, there is a need to develop a procedure permitting probabilistic consumer choice models for the problem of generating simultaneously optimal multiple new product concepts.

Winter (1979) reports a procedure for determining the optimal combination of marketing mixes and segments, based on cost-benefit considerations. However, his procedure assumes that there is a predetermined set of marketing mixes to choose from. If we can a priori specify a set of products and then want to decide on the product-segment combinations that are optimal, this procedure would be appropriate. If, on the other hand, our task is to find an optimal set of product concepts for a given market, then we need a procedure for searching through the product-attribute space, rather than one for evaluating a finite set of alternatives.

Management may not be able to launch multiple new product concepts simultaneously. Financial and managerial resources may not be adequate. But such constraints do not rule out multiple new product entry phased in over time. We would argue, that in certain cases, management would be better off choosing that combination of new products that, if introduced, would provide the highest incremental revenue over existing products. In particular, if the rest of the

market structure is expected to be stable and/or market signals may be used to reserve product positions, then such a consideration is perhaps warranted. The alternative is, of course, to choose the best single product now; then, at a later date, consider the best new product in the market which now has one more existing brand (the previously introduced new one), and so on. By choosing the optimal multiple new products simultaneously, management chooses the set that is expected to be the best performer and will be better able to plan new product entries.

If they decide to introduce new products sequentially, knowledge of impending entries will enable (i) planned development of a new products program for an entire market, rather than on a new product by new product basis, (ii) sharper positioning of the product being introduced currently, (iii) reservation of positions for impending entries by signalling both competitors and distribution channels, if management so desires, (iv) gradual repositioning of existing product(s) as suggested by the analysis.

The following example provides a comparison of the positions and expected performances between simultaneously and sequentially generated multiple new products.

In Exhibit 1, we consider five segments, S1, S2, S3, S4, and S5, with sales potentials of 80, 20, 40, 60, and 30 units respectively. Assume an ideal-point model (Srinivasan and Shocker (1973), Shocker and Srinivasan (1974, 1979); May, Shocker and Sudharshan (1982)),

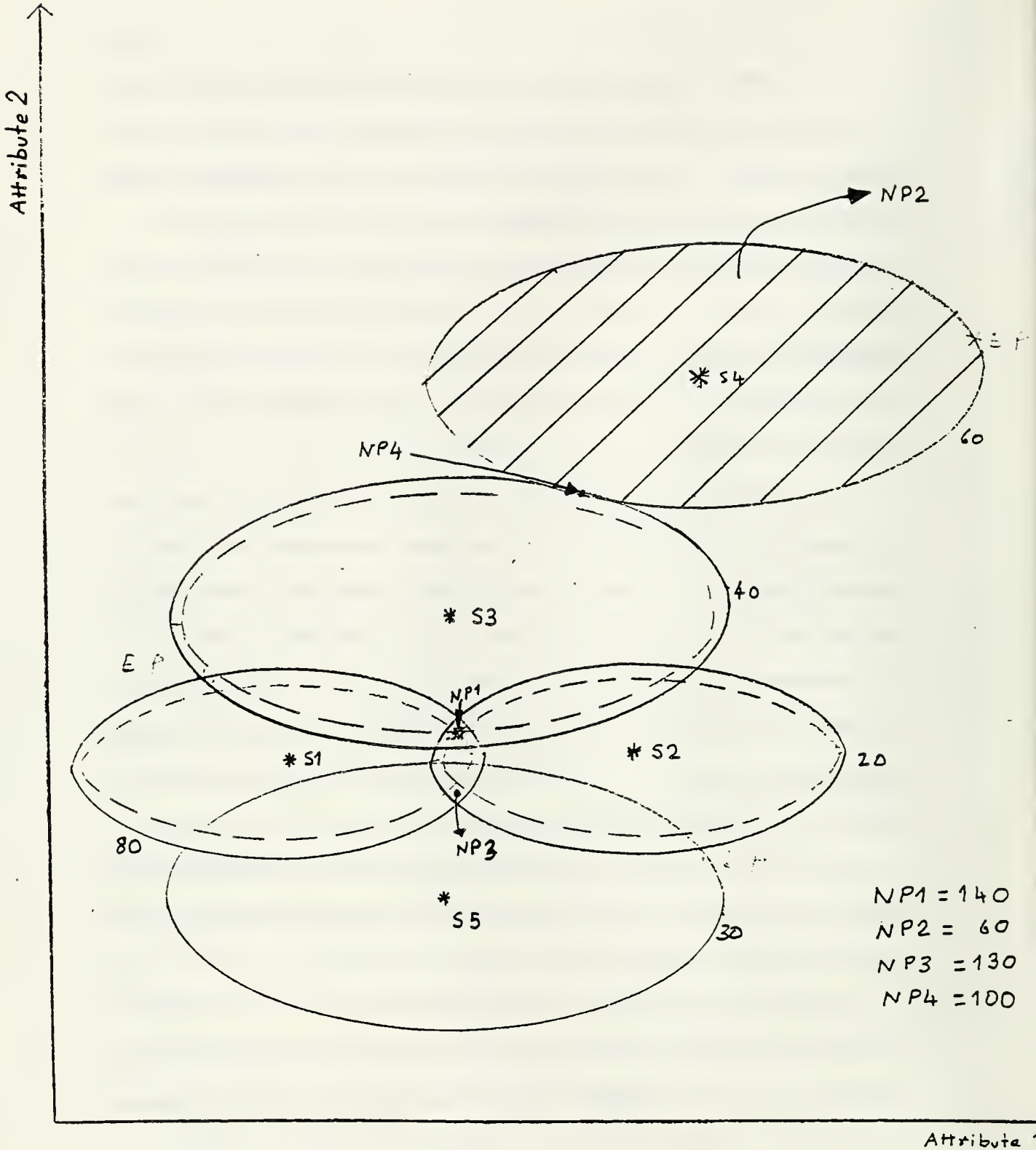


Exhibit 1: Simple Example Showing Differences Between Simultaneous Consideration and Sequential Consideration

i.e., a consumer segment's preference for a product is inversely proportional to that product's weighted Euclidean distance (in perceptual space) from the segment's ideal point. Both the weights for each segment and the ideal points are estimated using a procedure such as LINMAP (Srinivasan and Shocker (1973)). We further assume that a segment will choose the product that is closest to its ideal point, i.e., the single choice model. It should also be noted that in the probabilistic choice case the differences between simultaneous and sequential solutions are expected to be greater. We assume a decision space of two product attributes for this example.

The contours drawn around the five segment's ideal points (in Exhibit 1) represent, respectively, their individual closest isopreference region boundaries. The differential importances attached to the two attributes by a segment leads to the elliptically shaped isopreference contours. If the weights are equal, the contours would be circles in a space of two attributes. The closest contour for any segment is generated by describing a locus for it with its ideal point as the center such that the closest existing product to it lies on this locus. Thus, for any new product to "capture" a segment it has to be positioned inside that segment's closest isopreference contour. The unbroken (solid) contours represent the closest isopreference boundary for the respective segments in Exhibit 1. Consider the sequential selection and introduction of two optimal new products in the market of Exhibit 1. The first new product (NP1) would be positioned at NP1, capturing a total sales potential of 140 units

($S1+S2+S3$). No other position in this market would provide a larger potential. Once NP1 has been introduced, the closest isopreference boundaries shift inwards for S1, S2, and S3, as represented by the broken contours. The best new product position, given the position of NP1, will be anywhere within the closest isopreference contour of S4 (choose NP2 without loss of generality) shown by the hatched area in Exhibit 1. The sales potential for NP2 is 60 units. The total sales potential from the two new products is 200 units.

Now, consider simultaneous entry. The best simultaneous two new products solution will have a sales potential of 230 units--an optimal solution would be NP3 and NP4 in Exhibit 1. Simultaneous introduction is never inferior to sequential, and, as we have just shown, may be superior.

Further advantages of considering simultaneous entry would emerge if one takes into account the synergy that might be generated by two new products. (For some analytical formulations for incorporating synergy effects into the "profit" function see Sudharshan and Kumar (1984).)

Note that a bump and shift type solution approach will not necessarily generate the simultaneous optimal solution. First generate the first new product position as the single best new product position. Next, generate the second position as the best single position in the market which now includes the first generated new product. Next, assume that the market consists of all existing new products and the second new product, but not the first. Generate a new product for

this market. A comparison of the two incumbent positions and the first two positions is made to determine if the new set of two products is better than the earlier set. This procedure is repeated until no further improvement in solutions is better.

In the example considered, NP1 and NP2 would be the first two products generated. Given NP2 in the market, but not NP1, the best position still is NP1, and the procedure would stop, giving the same non-optimal solution in the sequential consideration method. An exception, in our example, would arise if the second position chosen happened to be NP4--which is possible, but not highly probable. (The best (as per Sudharshan, May and Shocker (1986)) available procedures for this class of problems--the methods of Gavish, Horsky and Srikanth (1983), and Albers and Brockhoff (1980), would lead to a more interior solution for the NP2 position.) As the number of products and the number of dimensions to be considered for entry increases the iterative procedure is less likely to produce the same solution as the simultaneous procedure.

PROBLEM FORMULATION

Following Shocker and Srinivasan (1974, 1979), products are conceptualized as bundles of benefits and costs. A product-market consists of those products judged by potential customers to be appropriate for some generic purpose. The competing alternatives and ideal products are represented as point locations in a perceptual space

spanned by attribute dimensions determinant of brand preference/choice in that market. Preference behavior is modelled as a linear combination of the different product attribute discrepancies (see Shocker and Srinivasan (1979) for a review of the logical and empirical justification for multi-attribute models generally). Following Pessemier, et al. (1971), choice is modelled probabilistically from among the k -closer competitors, where k can vary between 1 and the number of available brands.

Following the notation in Shocker and Srinivasan (1974) and Sudharshan, May, and Shocker (1986), let n_B be the number of existing brands in the product market, n_M be the number of market segments, n_A be the number of determinant product attributes, n_N be the number of new products to be introduced,

$Y_j = \{y_{jp}\}$ = the modal perception of the j^{th} product on the p^{th} dimension.

$W_i = \{w_{ip}\}$ = the attribute weights for the i^{th} segment.

$I_i = \{I_{ip}\}$ = the ideal point for the i^{th} market segment. It is assumed finite, but need not lie in the region where feasible products might be located.

d_{ij} = the weighted Euclidean distance from the j^{th} product to the k^{th} segment's ideal point.

S_i = the i^{th} segment's demand.

π_{ij} = the share of the i^{th} segment's demand allocated to the j^{th} product alternative. $\pi_{ij} = f(d_{ij}^{-1})$ and

$$\sum_{j=1}^{n_B} \pi_{ij} = 1 \text{ for each } i = 1, 2, \dots, n_M \text{ before entry}$$

and

$$\sum_{j=1}^{n_B+n_N} \pi_{ij} = 1 \text{ for each } i = 1, 2, \dots, n_M \text{ after entry.}$$

Following Bachem and Simon (1981) and Shocker and Srinivasan (1974), several forms for π_{ij} (i.e., decision rules) can be considered:

Case 1. Every available alternative could have some non-zero likelihood of purchase, e.g., $\pi_{ij} = a_i/d_{ij}^b$ where $a_i = 1/\sum_{j=1}^{n_B} (1/d_{ij}^b)$ and b is a parameter which varies with the product class (Pessemier, et al. 1971). Whether or not a segment actually purchases a brand, there is the potential to do so. As a model of segment behavior, it is more credible than as a model of individual behavior, where individuals often are observed to restrict their purchases to many fewer than all available brands (Urban (1975); Silk and Urban (1978)).

Case 2. Individuals are assumed more likely to become familiar with products which come reasonably close to meeting their objectives, due to self-interest (Aaker and Myers (1974)). A parameter k (possibly k_i which varies with each individual), restricts choice to the k "closer" alternatives. $\pi_{ij} = a_i/d_{ij}^b$ for $d_{ij} < d_i^{(k)}$, where $d_i^{(k)}$ is the distance from the i^{th} segment's ideal point to its k^{th} closer product, and $\pi_{ij} = 0$ otherwise.

Case 3. Individuals purchase only their most preferred brand, i.e., $k = 1$. This was referred to earlier as the single choice model.

SILOP, due to Albers (1976) provides a solution procedure only for this case.

Assume that the firm's single objective is to maximize total incremental demand, or preference share, from the introduction of new products. This means that we must account for any demand for the new products which is cannibalized from the firm's existing brands. Let

Ψ_i = the set of k closer products before introduction.

χ_i = the i^{th} firm's self (existing and new) products before introduction.

π_{ij} = product likelihoods of purchase before (after) introduction of new products,

$x_n = \{x_p\}$ = the n^{th} product's position,

L = an arbitrarily large number,

and Ψ_i^* , χ_i^* , and π_{ij}^* are the after entry equivalents to Ψ_i , χ_i , and π_{ij} respectively. Then, as in Albers (1979) and Gavish, Horsky and Srikanth (1983) for the single new product case, we can identify the optimal new positions by solving the mixed integer nonlinear programming problem

$$\text{Maximize } \sum_{i=1}^n \left(\sum_{j \in \chi_i^*} u_i \pi_{ij}^* - \sum_{j \in \chi_i} \pi_{ij} \right) S_i$$

subject to

$$d_i^{(k)} (1 - u_i) \leq \left[\sum_{p=1}^n (I_{ij} - x_p)^2 w_{ij} \right]^{1/2} < d_i^{(k)} + L(1 - u_i)$$

for all $x \in R$, and $i \in n_M$, where u_i is zero or one depending on whether (1) or not (0) a self product (existing or new, located at $\{x_p\}$), is among the k closet for the i -th segment. The difference between the total revenue obtained by the firm's self and new products together,

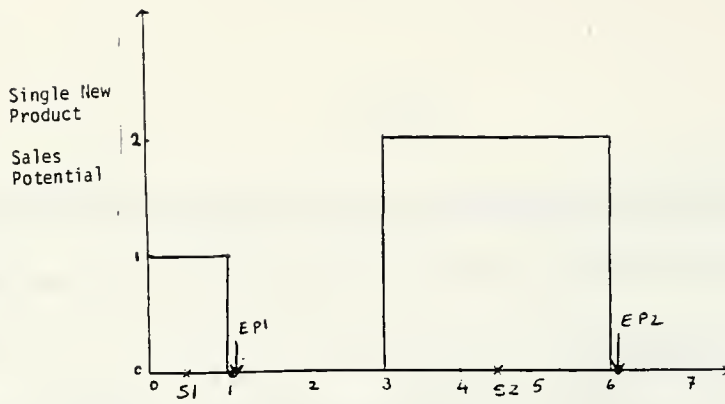
after entry of its new products, and that obtained by all the firm's (existing) products before entry is the objective being maximized.

The DIFFSTRAT Procedure

We use a fundamental insight (augmented space method) to determine the positions of multiple new products that are simultaneously optimal. We illustrate this idea with an example. Without loss of generality, consider a perceptual space of one dimension, and two segments S1 and S2 as shown in Exhibit 2a. Let there be two existing products EP1 and EP2 located as shown in the Exhibit. Let the sales potential of segment S1 be 1 unit and that of S2 be 2 units. The ordinate in Exhibit 2a represents the sales potential attainable by any one new product position. In a typical application of PRODSRCH (May, Shocker, Sudharshan (1982), Sudharshan (1982), Sudharshan, May, Shocker (1986)) or PROPOPP (Albers (1982)), or the method of Gavish, Horsky and Srikanth (1983), we would attempt to find the best single new product position for such a market. Let our problem now be to find the two new products that are jointly optimal.

Consider an augmented space of two dimensions (number of new products desired times number of dimensions of perceptual space). In Exhibit 2b, we have labelled the two dimensions AS Dim 1 and AS Dim 2 (for augmented space dimensions 1 and 2 respectively). Let AS Dim 1 be the possible locations of new product 1 (NP1),¹ and AS Dim 2 be the

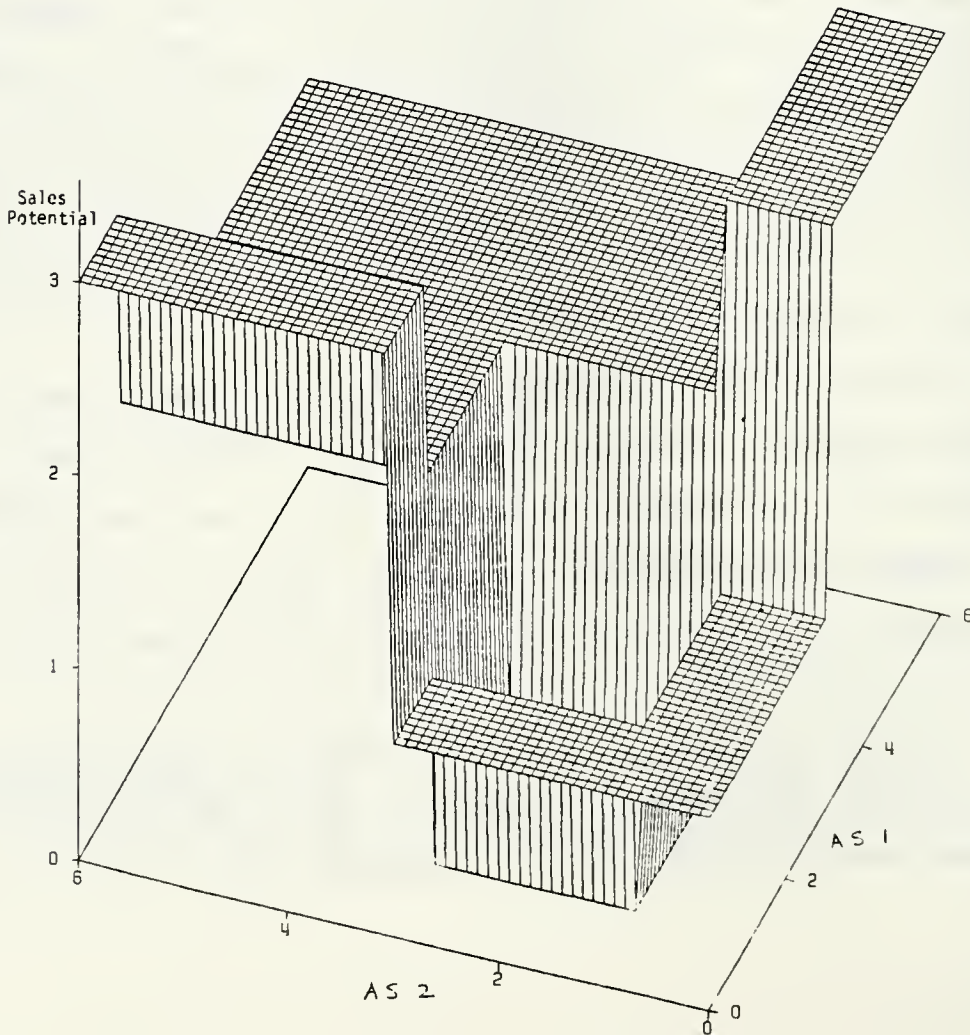
¹The numbering of the new products as 1 and 2 is purely arbitrary, since they are simultaneously introduced. However, this numbering is useful both for the example here, as well as an index to be used in our computer software implementation of DIFFSTRAT.



S1 - Segment 1 ideal point ; EPI - Existing Product 1
S2 - Segment 2 ideal point ; EP2 - Existing Product 2

Exhibit 2a: Simple Joint Space Representation of a Product-Market

Exhibit 2b: Augmented Space Map of Joint Sales Potential For Two New Products



space of location of all possible new product 2 (NP2) positions. We location of all possible new product 2 (NP2) positions. We then construct an objective function in this space which represents the sales potential of all the joint combinations of the respective positions of the two new products (not allowed to occupy the same location a degenerate case).² We now try to find an optimal position in this space (given by the coordinates on AS Dim 1 and on AS Dim 2) which would represent a solution to this joint optimization problem. The coordinate AS Dim 1 gives us the position of new product 1 (NP1) in the original space and AS Dim 2 gives the position of the second new product (NP2). The objective function for the problem of Exhibit 3, for the single new product problem with a probabilistic choice consumer model, shows that the objective function is not generally smooth. For the single choice case it would be of a step-like nature.

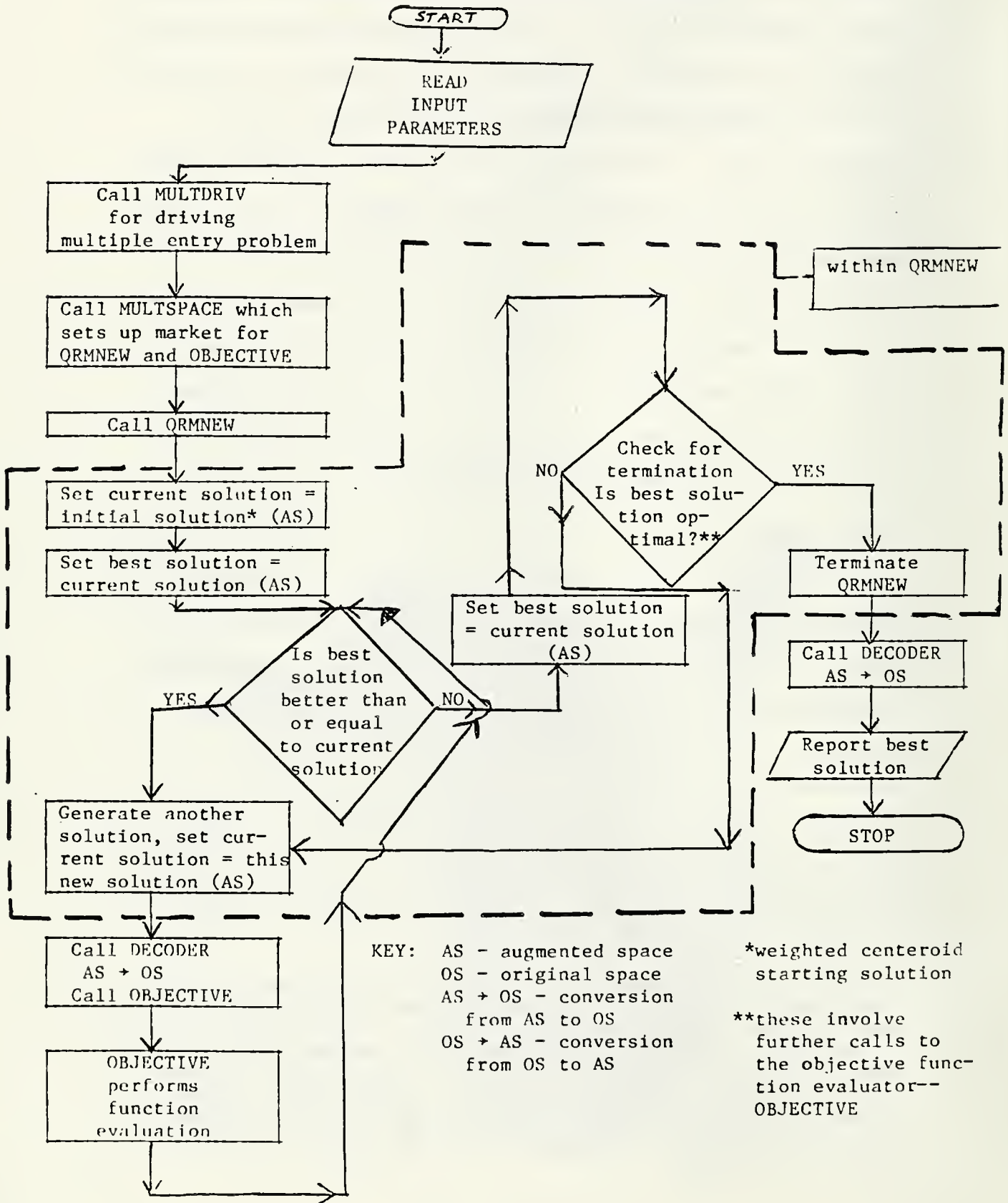
Not discussed earlier, QRMNEW (May, 1979) is the optimizer within DIFFSTRAT. It is used to find that combination of the analyst specified n_N (the number of new products that we wish to consider) that would provide the highest incremental demand of all feasible combinations of n_N positions.³ The augmented space that is set up by

²If the two new products are located at positions (in Exhibit 2a) 0.5 and 5, respectively, sales potential for new product 1 is 1 and that for new product 2 is 2. The total sales potential for this combination of new products is 3. Looking at Exhibit 2b, the sales potential corresponding to coordinates (0.5,5)--AS1 gives the location of the first new product, and AS2 the second one--is 3.

³It is possible to use DIFFSTRAT to try different number of new product entries and provide the positions and the expected incremental demand for each number of new products tried. If the market structure is specified correctly, it is expected that an optimal number of products for a given market can be found in this fashion. In other words, the optimal number of new product concepts can be generated endogenously if desired. The decision whether to specify the number of products exogenously or endogenously would depend on the budget available for analysis.

Exhibit 3

A Simplified Flow Chart of DIFFSTRAT



MULTSPACE is the space in which every point represents a unique combination of n_N product positions. For each such point, OBJECTIVE evaluates the expected incremental demand. Consumer preference models are available (as specified) in original space (OS) only. OBJECTIVE, given the positions of a set of new products (that constitute one position in augmented space (AS)) can evaluate the expected incremental demand associated with this set. The conversion of a point in AS to the corresponding positions in OS thus needs to be done; and is carried out by DECODER. The rules for this conversion were explained earlier in our discussion of the example, and shown graphically in Exhibits 2a and 2b.

DIFFSTRAT reports (i) the best set of new product positions, (ii) the segments that each of these products is best suited to, (iii) the expected incremental demand from this set, (iv) the expected demand for each new product, and self-products from each segment, and (v) the closest two competitors for each new and existing self product for each segment. If repositioning/deletion of existing self products has been allowed, reports (i)-(v) are provided, indicating which self-products have been deleted or repositioned and providing their expected demand from each segment.

Computational Examples with DIFFSTRAT

To illustrate the differences in the market shares obtained between simultaneously located new products and sequentially located ones, we performed a few simulation comparisons. Table 1 shows the positions and market shares for the simultaneous and sequential new

products. Markets are characterized by the number of ideal points (50 or 100), the number of existing products (10 or 15), and the size of the consideration set of the consumers ($k = 2, 3, \text{ or } 5$). New products are introduced into such markets. The joint spaces of perceptions and preferences are two dimensional, which is realistic (Aaker and Myers (1972)), and which permits plotting of the market structure, enabling a visual comparison of the positions to be made.

The numbers of new products introduced was also varied (2,3, or 4). Column 4 of Table 1 shows the positions of the new products positioned sequentially. Column 5 shows the same for the DIFFSTRAT new products. From this table, it is clear that there is considerable difference between the positions of the sequential and simultaneous new products. The difference in market shares is apparently not as great as one might expect. But, considering frequently purchased goods, where each share point has considerable value (e.g., from Williams (1985), for soft drinks, each share point is worth \$300 million, from Giges and Freeman (1985), for cookies, it is worth \$31 million, and for coffee, \$45 million), such differences are definitely meaningful, and necessary to consider in decision making.

Exhibit 4 provides a graphical illustration of the differences in the positions of new products obtained using PRODSRCH sequentially, and using DIFFSTRAT (simultaneous positioning). For the same market (the locations of the ideal points are shown in Exhibit 5), first, three new products were positioned sequentially using PRODSRCH. Their positions are designated . Second, DIFFSTRAT was used to position

TABLE 1

Comparison of Sequentially Positioned vs. Simultaneously
Positioned Optimal New Products

No. of existing products	Size of considera- tion set K	Number of new products	Sequentially located new product positions		Simultaneously located new product positions		Sequential new products market share	Simultaneous new products market share
			Dimensions 1 2	Dimensions 1 2				
10	2	3	6.6, 4.1 3.6, 4.8 8.0, 5.4	6.4, 3.8 3.6, 4.9 8.0, 5.5	} 34.98	37.30		
10	2	4	6.6, 4.1 3.6, 4.8 8.0, 5.4 2.7, 3.3	6.6, 3.7 3.9, 7.6 9.2, 6.4 5.9, 8.9				
10	3	2	6.9, 7.1 6.9, 7.0	7.1, 6.9 4.4, 3.6	} 20.7	22.24		
	3	4	6.9, 7.1 6.9, 7.0 3.6, 3.9 4.9, 7.0	5.4, 6.9 6.6, 5.1 3.6, 3.9 4.8, 6.3				
15	5	3	7.6, 6.8 7.6, 5.7 7.8, 5.4	4.3, 7.4 4.0, 6.2 7.8, 4.5	} 18.62	20.14		
15	5	4	7.6, 6.8 7.6, 5.7 7.8, 5.4 4.3, 7.4	7.6, 6.8 4.6, 4.0 8.1, 6.6 4.1, 6.5				
15	3	4	6.4, 3.2 3.8, 3.8 4.2, 7.0 2.3, 5.5	6.2, 2.7 3.4, 6.0 7.4, 7.4 8.2, 4.5	} 28.42	32.12		
10	3	3	7.6, 5.6 3.9, 3.4 3.6, 5.2	7.5, 4.3 3.3, 6.1 5.8, 8.1				
10	5	3	7.4, 5.2 3.8, 5.8 4.0, 5.4	8.1, 5.9 3.2, 6.2 5.9, 3.3	} 28.20	29.56		

Table 1, continued

No. of ideal points	No. of existing products	Size of consideration set K	Number of new products	Sequentially located new product positions	Simultaneously located new product positions	Sequential * new products market share	Simultaneous new product market share
				Dimensions 1 2	Dimensions 1 2		
	15	3	3	4.6, 7.1 6.5, 7.0 5.2, 6.8	3.1, 4.6 6.4, 6.8 4.9, 6.7	} 21.04	22.69
	15	5	2	7.2, 5.6 6.9, 5.5	7.6, 5.0 7.0, 1.9	} 16.17	16.45

* Correlated $t = 5.718$, $p > 0.001$, for the difference simultaneous market share - sequential market share.

three new products, their positions are shown using the symbol \diamond in Exhibit 4. Third, the fourth sequential new product was positioned using PRODSRCH, it is represented by \blacksquare . Lastly, DIFFSTRAT was used to position four new products. These are shown as \square . The differences in the positions of the PRODSRCH new products and the DIFFSTRAT new products appear relatively minor for three new products. But, for four new products these positions are remarkably different!

A carefully constructed simulation comparison is called for to better understand market structures. We now have relatively good procedures (PRODSRCH and DIFFSTRAT) to generate optimal new products in markets with unequal sales potentials associated with each segment, and where the segments can have a probabilistic preference share model ($k > 1$). We can address the issues of the equilibrium market structures that would prevail under different market assumptions. This becomes especially easier if we consider that if the effects of advertising and distribution are introduced using response function models (Stern and El-Ansary (1982), Urban and Hauser (1980), Little (1979), etc.), then, marketing strategies, in equilibrium, can be separately analyzed for product positioning strategies and for advertising and distribution strategies, respectively (Hauser and Shugan (1983), Kumar and Sudharshan (1986)).

Discussion and Conclusions

Unlike existing procedures which allow for evaluation of prespecified new product concepts (see Shocker and Srinivasan (1979) for a review of such methods), or, those which given a set of new product

EXHIBIT 4: POSITIONS OF SIMULTANEOUS AND SEQUENTIAL NEW PRODUCTS

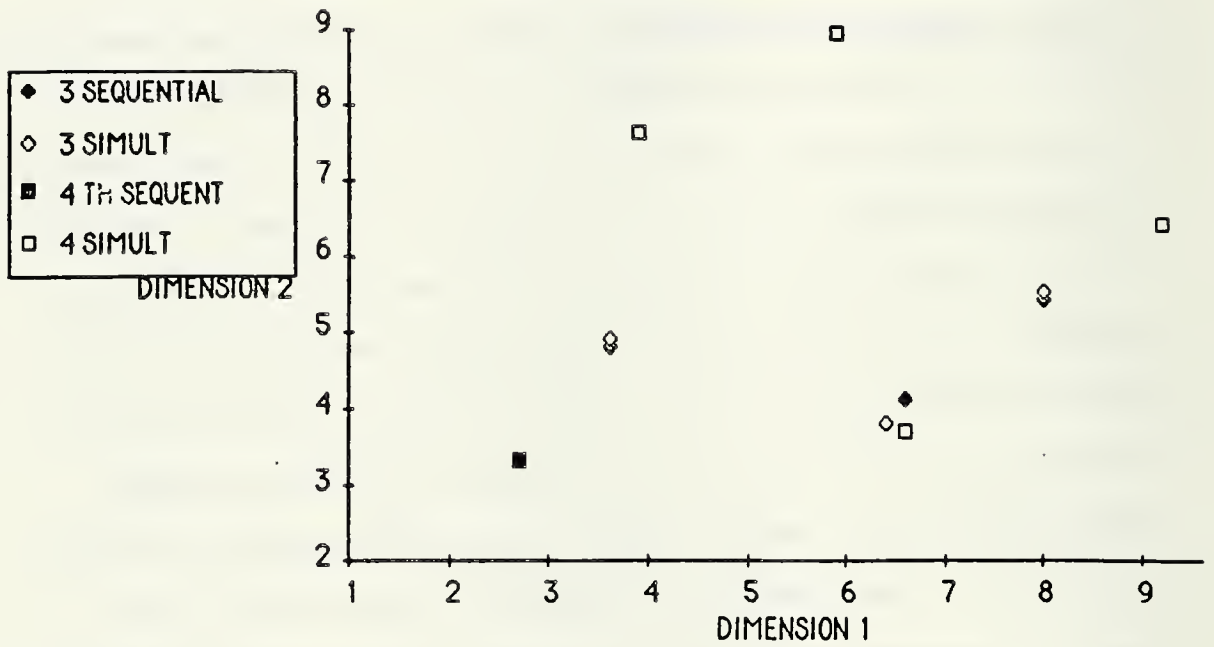
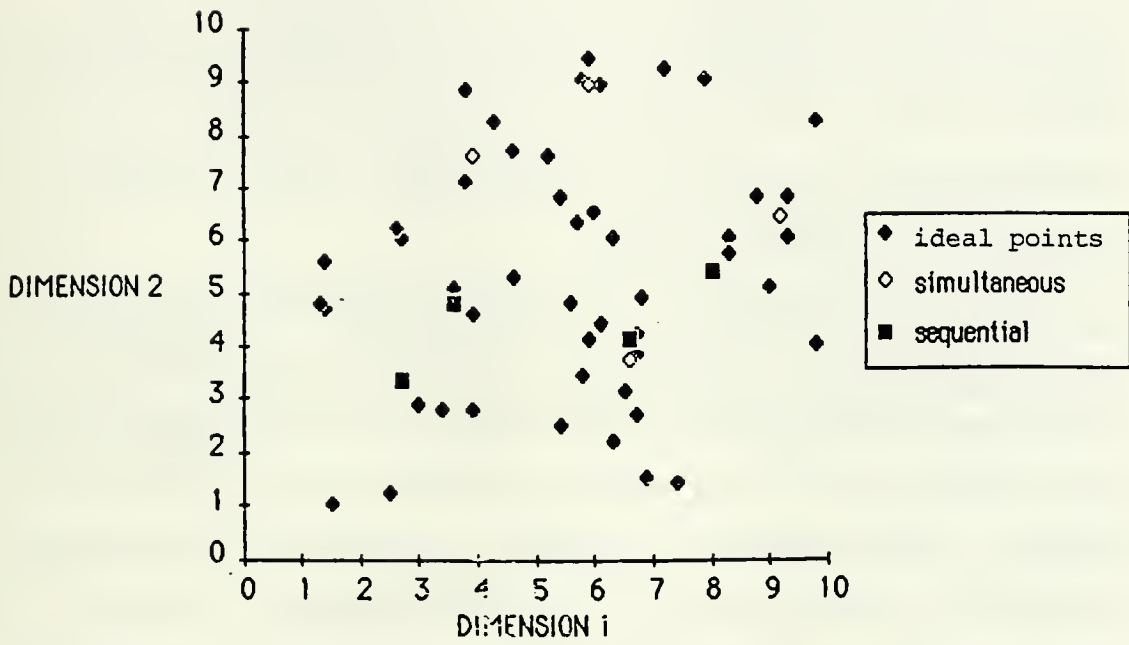


EXHIBIT 5: JOINT SPACE OF IDEAL POINTS
AND NEW PRODUCTS



alternatives, match these products to appropriate segments (Winter, 1979), DIFFSTRAT is the only general procedure that generates optimal multiple new product concepts for a product-market. It is the only procedure that provides management with an optimal set of new product concepts to be used if a differentiated marketing strategy is chosen. Of course, as in any such analysis, the value of the output is limited by the quality of the input information regarding market structure. DIFFSTRAT provides considerable diagnostic information regarding the segments at which each new product concept should be targeted, the expected share of each segment's sales potential, and the suggested repositioning of existing brands.

While in our discussion in this paper the augmented space approach has been implemented in the context of the market model formulated by Shocker and Srinivasan (1974), this approach is generalizable to other market models as well. For example, the POSSE (Green, Carroll, and Goldberg, 1981) framework for generating a single optimal new product concept could also be extended to a multiple new product concept generation framework using the augmented space approach of DIFFSTRAT. In POSSE, as we understand it, for each of several potential new product positions (generated randomly) the corresponding expected demand is estimated using a choice simulator. Based upon such estimations for several potential positions, a smoothed demand function (or response surface) is developed for the entire feasible positions space. Optimization of this smoothed surface leads to the "optimal" new product position. The conversion of POSSE to a augmented space

type procedure would involve a generation of combinations of possible new product positions using the augmented space to generate such combinations. The choice simulator would be required to provide the expected demand for each combination generated. The response surface obtained by evaluating the demand for every randomly generated position in augmented space could be smoothed. Optimization of this smoothed demand function in augmented space would lead to that combination of new product positions that would have the maximum demand. The accuracy of this solution is dependent upon how close the smoothed function is to the true objectives.

The availability of DIFFSTRAT along with work by Lane (1980), Hauser and Shugan (1983), Kumar and Sudharshan (1986), should permit the incorporation of simultaneous multiple product entry effects into competitive models (theories) of product market structure evolution and equilibrium.

References

- Aaker, David and John G. Myers (1974), Advertising Management, Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Albers, Sonke (1976), "A Mixed Integer Non-Linear Programming Procedure for Simultaneously Locating Multiple Products in an Attribute Space," in R. Henn et al. (eds.), Methods of Operational Research, Vol. XXVI, Proceedings of First Symposium on Operational Research, University of Heidelberg, September 1-3, 1976, 899-909.
- Albers, Sonke (1979), "An Extended Algorithm for Optimal Product Positioning," European Journal of Operational Research, 3 (May), 222-231.
- Albers, Sonke (1982), "PROPOPP: A Program Package for Optimal Positioning of a New Product in an Attribute Space," Journal of Marketing Research, 19 (November), 606-608.
- Albers, Sonke and Klaus Brockhoff (1977), "A Procedure for New Product Positioning in an Attribute Space," European Journal of Operational Research, 1 (January), 230-238.
- Albers, Sonke and Klaus Brockhoff (1980), "Optimal Product Attributes in Single Choice Models," Journal of the Operational Research Society, 31, 647-655.
- Bachem, Achim and Hermann Simon (1981), "A Product Positioning Model with Costs and Prices," European Journal of Operational Research, 7 (August), 362-370.
- Day, George S., Allan D. Shocker, and Rajendra K. Srivastava (1979), "Customer-Oriented Approaches to Identifying Product-Markets," Journal of Marketing, Vol. 43, No. 4 (Fall), 8-19.
- Gardner, Burleigh and Sidney Levy (1955), "The Product and the Brand," Harvard Business Review (March-April), 37.
- Gavish, Bezalel, Dan Horsky, and K. Srikanth (1983), "An Approach to the Optimal Positioning of a New Product," Management Science, 29 (November), 1277-1297.
- Giges, Nancy and Laurie Freeman (1985), "Wounded Lion? Trail of Mistakes Mars P&G Record," Advertising Age, July 29, 1, 50-51.
- Green, Paul E., J. Douglas Carroll, and Stephen Goldberg (1981), "A General Approach to Product Design Optimization via Conjoint Analysis," Journal of Marketing, 45 (Summer), 17-37.

- Hauser, John R. and Steven M. Shugan (1983), "Defensive Marketing Strategies," Working Paper, Sloan School of Management, M.I.T., Cambridge, MA.
- Kotler, Philip (1984), Marketing Management: Analysis, Planning, and Control, Englewood Cliffs, NJ: Prentice-Hall.
- Kumar, K. Ravir, and D. Sudharshan (1986), "Attack-Defense Marketing Strategies: An Equilibrium Analysis," Working Paper, University of Illinois. Under review for Marketing Science.
- Lane, W. J. (1980), "Product Differentiation in a Market with Endogenous Sequential Entry," Bell Journal of Economics, 11 (1) (Spring), 237-260.
- Little, John D. C. (1979), "Aggregate Advertising Models: The State of the Art," Operations Research, Vol. 27, No. 4 (July-August), 629-667.
- May, Jerrold H. (1979), "Solving Non-Linear Programs Without Using Analytic Derivatives," Operations Research, 27 (May-June), 457-484.
- May, Jerrold, Allan D. Shocker, and D. Sudharshan (1982), "Optimal Product Location: A Simulation Comparison of Methods," in Raj Srivastava and Allan D. Shocker (eds.), Analytic Approaches to Product and Marketing Planning: The Second Conference, Report 82-109, Cambridge, MA: Marketing Science Institute, 178-198.
- May, Jerrold, Allan D. Shocker, and D. Sudharshan (1983), "A Simulation Comparison of Methods for New Product Location," Working Paper Number 82-126, Owen Graduate School of Management, Vanderbilt University, Nashville, TN.
- Pessemier, Edgar A., Philip Burger, Richard Teach, and Douglas Tigert (1971), "Using Laboratory Preference Scales to Predict Consumer Brand Preferences," Management Science, 17 (February), 371-385.
- Shocker, Allan D. and V. Srinivasan (1974), "A Consumer-Based Methodology for the Identification of New Product Ideas," Management Science, 20 (February), 921-937.
- Shocker, Allan D. and V. Srinivasan (1979), "Multi-Attribute Approaches to Product-Concept Evaluation and Generation: A Critical Review," Journal of Market Research, 16 (May), 159-180.
- Silk, Alvin H. and Glen L. Urban (1978), "Pre-test Market Evaluation of New Packaged Goods: A Model and Measurement Methodology," Journal of Marketing Research, 15 (May), 171-191.

- Srinivasan, V. and Allan D. Shocker (1973), "Linear Programming Techniques for Multidimensional Analysis of Preferences," Psychometrika, Vol. 38, No. 3 (September), 337-369.
- Stern, Lou W. and A. I. El-Ansary (1982), Marketing Channels, 2nd ed., Englewood Cliffs, N.J.: Prentice-Hall.
- Sudharshan, D. (1982), On Optimal New Product Concept Generation: A Comparison of Methods. Unpublished Doctoral Dissertation, Graduate School of Business, University of Pittsburgh.
- Sudharshan, D. (1984), "A Laboratory Comparison of Two Methods of Optimal New Product Concept Generation: Toward Validation," Working Paper, Department of Business Administration, College of Commerce and Business Administration, University of Illinois, Urbana-Champaign, (February).
- Sudharshan, D., Jerrold H. May and Allan D. Shocker (1986), "A Simulation Comparison of Methods for New Product Location," Working Paper, University of Illinois. Under review for Marketing Science.
- Sudharshan, D. and K. Ravi Kumar (1984), "Multiple Product Positioning: A Note on Incorporating Effects of Synergy," Working Paper, Department of Business Administration, College of Commerce and Business Administration, University of Illinois, Urbana-Champaign. Also presented at the Joint National Meeting of the ORSA/TIMS, November 7-9, 1983, Orlando, Florida.
- Urban, Glen L. (1975), "PERCEPTOR: A Model for Product Positioning," Management Science, 8 (April), 858-71.
- Urban, Glen L. and John R. Hauser (1980), Design and Marketing of New Products, Englewood Cliffs, NJ: Prentice-Hall, 286-290.
- Urban, Glen L., D. Johnson, and R. Brudnick (1979), "Market Entry Strategy Formulation: A Hierarchical Model and Consumer Measurement Approach," Working Paper, Sloan School of Management, M.I.T., Cambridge, MA.
- Williams, Monci Jo (1985), "Soft Drink Wars: The Next Battle," Fortune, June 24, 70-72.
- Winter, Frederick R. (1979), "A Cost-Benefit Approach to Market Segmentation," Journal of Marketing (Fall), 103-111.
- Zufryden, Fred (1979), "A Conjoint Measurement-Based Approach for Optimal New Product Design and Market Segmentation," in Allan D. Shocker, ed., Analytic Approaches to Product and Marketing Planning, Cambridge, MA: Marketing Science Institute, 100-114.

HECKMAN
BINDERY INC.



JUN 95

ed - To - Place N. MANCHESTER,
INDIANA 46962

UNIVERSITY OF ILLINOIS-URBANA



3 0112 042410578