A NEW PRODUCT DESIGN MODEL: THE CASE OF A CARRIBEAN RESORT DESTINATION

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ABSTRACT

The model developed in this study designs a new product based on a target market's responses to preference stimuli. The model is applied to a Caribbean resort destination. Previous research has indicated the perceptual dimensions subjects use to evaluate resort destinations might be classified as hotel related and environment attractiveness related.

Since there is more than one hotel at a resort destination, the model designs a product line of many different hotels. Hotels are defined by their attributes. A list of vacationers' most popular hotels is compiled and salient hotel attributes are photographed. A preference analysis of the photographs (attributes) is undertaken using an additive linear model. Utility weights of the attributes are then generated for individual respondents in a consumer sample. An iterative heuristic search is developed that allows each person in the sample to design a more satisfying hotel. The hotel is temporarily "built" if it attracts more consumers than an existing hotel. Hotels having fewer rooms than the potential demand are assumed to increase prices until supply and demand are in line. The number of rooms, potential demand and mean utility at each hotel is developed. Hotels that are unprofitable are eliminated and consumers not satisfied with a hotel are assumed to vacation elsewhere. Elimination of unsatisfied vacationers has the effect of decreasing hotel and resort destination demand.

A land use plan is used to operationalize environmental attractiveness. Consumers' locate required infrastructure facilities relative to their most preferred hotel. Engineer appraisals are used to rate the relative suitability of each location at the resort destination site for every infrastructure facility. An aggregation of preferred facility location coordinates across subjects is used to define the most preferred facility location configuration. A model is developed to search unoccupied and occupied locations with the objective of moving facilities to maximal rated locations while maintaining a satisfactory correlation with the preferred facility location configuration. The configuration correlation measures consumer satisfaction with the new facility location configuration.

INTRODUCTION

The risks and costs of developing new products has been well documented (11). However, the risks and costs of developing a new product in the form of a resort destination are particularly great.

Some third world countries have found tourism a major source of income. As a result, other third world countries having tourism potential but limited resources have been encouraged to invest in resort destination development. To reduce the financial and social risks of a new resort destination the marketing concept (i.e., satisfying the consumer at a profit (11)) could be employed as a basis for developing a new resort destination design model.

Although the conceptual similarity of a new resort destination to a new product is obvious, the similarity of the terminology used by resort designers is less obvious. Therefore, some terms will be reviewed. A resort destination, as used in this study, refers to a tropical beach-oriented geographic area or site where consumers purchase vacation services. Within the defined geographic area are located various public facilities and hotels. Each hotel and public facility has a unique location; the sum of all potential locations constitutes the resort destination site.

Resort destinations can be developed by the private sector, public sector or any combination thereof. Examples of resort destinations might include: Acapulco, Mexico; Miami Beach, Florida; Cancun, Mexico; etc. A resort destination, as defined, contains two or more hotels and although the hotels might be considered attributes of the resort destination they might also be considered as individual products. Since a hotel seems to be more appropriately referred to as a product, the term product will be used instead of attribute when referring to a hotel. Furthermore, the set of hotels at a resort destination are referred to as a product line of hotels.

Resort destination design consists of an aspatial hotel profile component and a spatial facility location component. In this study, a hotel profile consists of the primary dimensions consumers use to evaluate hotels. Facility location refers to the individual locations of the

public facilities at the resort destination. The pattern formed by the location of all facilities is referred to as the facility location configuration.

PAST RESEARCH

Selected past research on new product design and the location of facilities on virgin land was reviewed.

PRODUCT DESIGN

Interest in applying the marketing concept to design products has been growing. Researchers and model builders have made important contributions to the area of product design. For example the first writings in the area appeared under the title of idea generation with the objective of helping to stimulate product design.

Recent product design models are based on an assumption well articulated by Lancaster (12).

"We assume that the interest of consumers is in characteristics, not in goods per se. Thus the individual consumer has preferences, in the first instance, over the set of characteristics collections. Any preference concerning collections of goods are derived preferences, a particular goods collection being preferred over another only because the collection of characteristics associated with the former is preferred to the collection of characteristics associated with the latter."

Operationalizing this concept has resulted in computer assisted models utilizing information processing and multidimensional scaling algorithms. The first recent attempt at a new product design model was made by Stefflre (16) using a psycholinguistic approach. However Steffre's approach was somewhat subjective. Urban (19) developed PERCEPTOR to design new products; however, the results were not easily interpretable by management. Silk (15) discussed the uninterpretability of results and advocated the need for "actionable" results in new product design. McClain and Rao (14) dealt with the problem of actionable results as they impact health care systems. Although McClain and Rao were not interested in design they assumed a design could be generated by averaging within cluster preferences.

Past models have not: (1) produced actionable design results, (2) captured completely the complexities of the consumers choice process, (3) considered the artistic nature of design, (4) included index of satisfaction or (5) included an index of product profitability.

LOCATION

Currently there appears to exist two broad approaches to locating facilities on virgin land:

(1) Industry practice

(2) Modeling approach

Satisfying consumers while considering land preparation cost, has been accomplished in industry by organizing an interdisciplinary team of resort planners and engineers (13). Presumably engineers and planners jointly arrive at the location objectives for each facility and then engineers determine the cost implications of locating a public facility at one location as opposed to another. However, the consumers' opinions regarding location are ignored. Apparently it is assumed planners and engineers can adequately represent consumers' interests.

Models dealing with the location of facilities for large land projects have also been developed. Wiel et al. (18) developed a search technique that attempted to find a location whose characteristics most closely matched the facility's location objectives. The concept of finding the best fit between facility location objectives and location characteristics has been discussed by Chapin (3, p. 370). "Location requirements take the form of guiding principals and standards for the placement of uses of land." Thus, facilities have location requirements or objectives and locations (i.e. pieces of land within a site) have characteristics. To locate a facility, the facility's location objectives must be highly consistent with the location's characteristics.

Baird, et al. (2), using a laboratory environment, had subjects locate facilities under different scenarios. A spatial analysis of the data was conducted. Based on past research, the use of consumers' preferences in the Baird et al. study has merit. Lynch (20) has determined the urban area possesses distinct and recordable qualities and that persons are able to observe and record these qualities. Furthermore, these distinct and recordable qualities affect an individual's satisfaction with the urban environment. In addition to size and density, Lynch suggests that the outline or shape and internal pattern of cities are all dimensions that are observed.

The approaches used to locate facilities on virgin land have either considered cost and not consumers' preferences or consumers' preferences and not cost. Clearly the consumer should not become involved in the engineer's technical contribution to location analysis. However, the consumers' input to the planner's subjective decision process seems useful. Including only consumers' preferences for infrastructure location decisions would not consider the cost of land development; so, both consumers' preferences and engineers technical appraisals are needed.

In addition to the idiosyncracies of the previous models, it appears that nothing has been said or implied in the literature or in practice about resolving the situation of where to locate a facility when two equally suitable locations are available. Another dimension of this problem is which facility gets the location when only one top rated location is available?

This study reports efforts to develop and operationalize a more comprehensive, management oriented, new product design model by incorporating factors previously excluded from past new product design models. The model is based on the marketing concept (i.e., satisfying the consumer at a profit) and is developed for a new resort destination. However, the model is applicable to many new products.

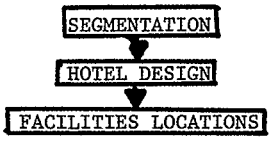
THE MODEL

Past research (7,8,4) has indicated consumers' preferences for a resort destination might be thought of as:

P=F(UH,SL) where:
P=subject's preference for the resort destination
UH=subject's utility for a hotel profile (HOTEL DESIGN)
SL=subject's satisfaction with the facility location configuration (FACILITIES LOCATIONS)

The previous functional relationship is operationalized in Figure 1. In addition a management decision variable in the form of predetermined target markets is introduced. Each section of the model will be subsequently discussed.

Figure 1
OVERVIEW OF RESORT DESTINATION DESIGN MODEL



SEGMENTATION

Segmentation provides management with the ability to observe differences in preferred resort destination designs based on demographic and psychographic segmentation criteria.

HOTEL DESIGN

A four step methodology was used in the hotel design model: (1) Identification of Hotel Design Attributes; (2) Identification of Popular Hotels; (3) Measurement of Consumer Preferences (4) Hotel Design Using a Heuristic Simulation.

IDENTIFICATION OF HOTEL DESIGN ATTRIBUTES

Previous research (7,4,8) indicates consumers use the following perceptual dimensions to evaluate hotels: (1) Hotel External Design; (2) Room Price Per Night; (3) Hotel Location; (4) Bedroom Design; (5) Restaurant Design; (6) Internal Facilities and (7) External Facilities.

Internal facilities were defined as containing the subfactors of light recreation (i.e., ping pong, shuffle board, etc.), night life and shops available at the hotel. External facilities were defined to contain the subfactors of golf, boating, tennis and scuba diving.

IDENTIFICATION OF POPULAR HOTELS

Management was asked to identify its target market. Based on the previously defined perceptual dimensions target market subjects were asked to list the most attractive hotels in which they had stayed. The most popular set of these hotels was photographed based on the perceptual dimensions. The end results were several colored photographs which were called factor levels.

MEASUREMENT OF CONSUMER PREFERENCES

Using the Lancasterian concept of product choice and assuming persons use the additive information processing model an eight by seven experimental design with an independent error estimate was developed. This design was chosen because of its parsimony regarding consumer responses. As an alternative one could have chosen a sixteen by seven or larger design requiring at least twice as many consumer responses. While the latter design will, assuming errorless data, produce more precise main effects estimates a recent study (17) found that cognitively difficult tasks requiring subject responses resulted in data containing error.

To utilize the eight by seven design to measure consumer preferences, subjects were first asked to rank order the levels of each factor. The most and least preferred levels of each factor (photographs) were systematically placed in the eight by seven experimental design forming hotel profiles (i.e., hotel designs) along the rows. Subjects were then asked to rank order the hotel profiles in terms of their preference. The rank orders were submitted to MONANOVA, which generated weights of utilities for the most and least preferred levels of each factor. The utility values for the intermediate rankings were determined using a direct magnitude estimating technique (9). Although this technique has been criticized (1) it has been successfully demonstrated in the literature (9).

HOTEL DESIGN USING A HEURISTIC SIMULATION

Designing hotels based on utility values should optimize consumers' satisfaction. To achieve this objective the classical optimization techniques of linear programming and non-linear integer programming were reviewed in terms of the design problem and proven infeasible.

Finding a solution that comes close to an optimum solution is the approach which is next best to finding an exact optimum solution. Heuristic search techniques can approximate an optimal solution, although there is no precise way of determining how close one has come to the optimal solution. Frank and Green (6, p. 89) have indicated a heuristic model is a branch of simulation.

The heuristic simulation developed accepts the same information from management as the architect would get: (1) number of hotels to be built and (2) the potential annual room demand. Four other pieces of data are also used. The first, derived from industry data, is the number of rooms associated with each photograph of the external design factor. The second, derived from a monotonic analysis of variance (MONANOVA), is each individual's utility value for each level of the seven hotel design factors. The third and fourth are management estimates representing the level of satisfaction needed to attract target market consumers and the occupancy rate required for a profitable hotel.

The model begins by seeking an intelligent starting set of hotel designs. The starting set of hotel designs is conceptualized as building a management specified number of hotels attribute by attribute. This process is begun by first locating subjects at their most preferred locations. The subjects at each location then "VOTE" on the level of the next attribute to be added to the hotel design being constructed at the location. After the attribute has been added to the hotel, any subject sufficiently dissatisfied with the developing design and more satisfied with another design may vacate his present hotel and move to a more satisfying hotel. Once all hotels are constructed, all subjects reside in a hotel generating a level of satisfaction (utility) and the initial set of hotel designs is established. From that set of hotel designs a random start (generated externally) seeks to improve each subject's utility; thus, eventually improving overall utility. The model attempts to improve the configuration using two heuristic sub-models. One is based on subject generated hotel designs. The other is based on subject generated hotel designs given a fixed location for the hotel design. In either instance the model is considered to have achieved improvement when a subject finds himself in a more satisfying hotel (i.e., hotels that yield a higher overall utility across attributes).

The first improvement heuristic asks the subjects to design (using the J attributes of price, location, external design, etc.) a hotel based on his highest (SU(ℓ,m)), second highest overall utility, etc., down to his lowest utility. That is, the subject is first asked to design a hotel combining the level of each attribute generating his highest overall utility. His design (the M+1 hotel) competes in the model against the existing M hotels in terms of attracting subjects. If the subject-generated hotel has a higher occupancy rate than the existing hotel presently on the same location, the existing hotel is eliminated and subject-generated hotel is built on the location. It then becomes part of the existing M hotels. The subject continually builds hotels and has them compete against the existing hotels until either the utility of the hotel he proposes to build is less than that of the hotel in which he resides or one of his proposed hotel designs has been more successful than an existing hotel design. This process is undertaken for each subject.

The second improvement heuristic attempts to make the design of a hotel at a given location more attractive to subjects. The given location is identified as the location containing the least attractive hotel (i.e., the lowest occupancy rate). Each subject tries to design a more attractive hotel using J-1 attributes. Only J-1 attributes are used in the second heuristic because location, one of the J attributes, is fixed. However, as the second heuristic progresses the location that initially had the least attractive hotel may become the location having the most attractive hotel; therefore, another location is specified as least attractive. Thus, as more attractive hotels are built, the model keeps trying to improve the design of the hotel having the lowest occupancy by fixing the location attribute and having each subject design hotels on the fixed location. This submodel treats each subject in the same manner and operates under the same decision rules as the first improvement technique.

At any point in the model a hotel can be so attractive that the demand for its rooms is greater than its supply of rooms. In such cases the model increases the price per night of a room in the overoccupied hotel. This decreases subjects' utility causing them to find other more attractive hotels. The price is sequentially increased until the occupancy rate falls below 100%.

The hotel design model was also constructed to have the capability of accepting hotel designs created from outside the model. This feature assisted in establishing the internal validity of the model. The hotel design model has two other features: the model eliminates unprofitable hotels due to low occupancy rates. The model also assumes subjects not achieving a given level of satisfaction will not vacation at the resort destination; causing potential demand to decline.

A flow diagram of the hotel design model appears in Figure 2, on the next page.

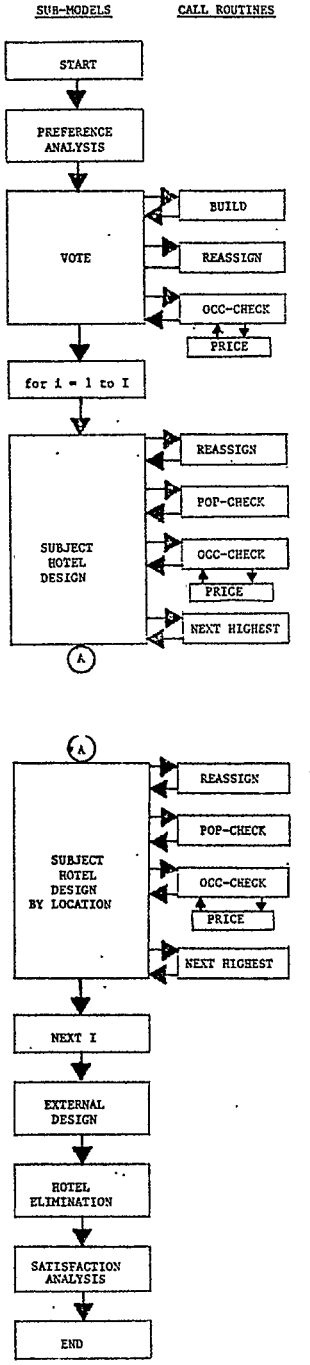
FACILITIES LOCATIONS

The following three step methodology was used in the facilities location model: (1) Consumers' Location Preferences: (2) Engineer's Site Evaluation and (3) Heuristic Search Technique.

CONSUMERS LOCATION PREFERENCES.

Given a set of public facilities, it is assumed consumers can evaluate their preferences for each facility location and for the facility location configuration. To obtain location preferences, consumers were presented with a site map, a set of distance reference points and asked to indicate their preferred locations for public facilities relative to their preferred hotel location. The locations' coordinates were averaged across consumers to arrive at aggregate location preferences.

Figure 2
HOTEL DESIGN FLOW DIAGRAM
SUB-MODEL/CALL ROUTINE DESCRIPTIONS



DESCRIPTION

PREFERENCE ANALYSIS

Raw preference data are analyzed and utility weights for factor levels generated.

VOTE

Subjects go to their most preferred location and build a hotel based on a voting process. Subjects dissatisfied with the design of a hotel can leave the hotel at any time. The output represents an intelligent starting configuration of hotels.

BUILD

The hotel attribute receiving the most votes from subjects at the hotel is added to the hotel design.

REASSIGN

Subjects' utilities for all existing hotel designs are calculated and subjects go to the hotel yielding the highest utility.

OCC-CHECK

The number of subjects wanting to stay at a hotel is counted; if the room demand exceeds the number of rooms at the hotel PRICE is called.

PRICE

Price is increased causing subjects to be less satisfied with their present choice of hotels and possibly more satisfied with alternative hotels.

SUBJECT HOTEL DESIGN

Each subject designs hotels based on the set of J attributes yielding him the highest utility, etc.

SUBJECT HOTEL DESIGN (cont.)

Each subject designed hotel, one at a time, competes against the existing M hotels for subjects and the most profitable M hotels are retained.

SUBJECT HOTEL DESIGN BY LOCATION

The location s, containing the least profitable hotel, is identified. Using his J-1 highest, next highest, etc., set of attributes, each subject attempts to design a hotel having greater profitability than the hotel on location s. Each subject designed hotel, r, competes against the hotel, m, located at s. If r is more successful than m, r replaces m at s.

POP-CHECK

The occupancy rate of the subject designed hotel is compared with the occupancy rate of the hotel on the same location and the more successful hotel retained.

NEXT HIGHEST

The subject's set of J attributes producing his next highest utility is determined.

EXTERNAL DESIGN

Designs created by persons from outside the model using the same factor levels as the model, are allowed to compete with model created designs.

HOTEL ELIMINATION

Hotels not meeting a management specified level of profitability are eliminated from the M hotel designs and subjects affected choose an alternative hotel.

ENGINEER'S SITE EVALUATION

The search procedure required an estimate of each location's suitability for each facility. To obtain this information an engineer was asked to review technical reports and become acquainted with the site in terms of locating infrastructure facilities. The engineer was given the following material: (1) Engineering Site Feasibility Studies; (2) Core Drilling Data and (3) Topographic and other Engineering Maps. The engineer was then asked to (1) rate the suitability of each location for each facility and (2) rank order the facilities in terms of their priority for obtaining best locations.

HEURISTIC SEARCH TECHNIQUE

Satisfaction might be thought of as a continuum where there are degrees of satisfaction and dissatisfaction, and where a determinable point exists separating the continuum into areas representing consumer satisfaction and dissatisfaction.

In this model the relationship between the aggregate preferred configuration of facility locations and the final configuration of facility locations is assumed to constitute subjects' degree of satisfaction. It is further assumed that management is capable of defining or obtaining the point (i.e., relationship between average preferred configuration and final configuration) below which consumers perceptions of satisfaction change from satisfied to dissatisfied. The degree of satisfaction is calculated by correlating the aggregate preferred facility location configuration with alternative land preparation cost reducing configuration. Furthermore, it is assumed managements' objective is to satisfy consumers and that they are willing to pay the extra land preparation cost to insure consumer satisfaction with the environmental attractiveness of the resort destination.

A search technique or simulation is constructed that uses consumers aggregate preferred facility location configuration as a starting point and seeks to find more suitable locations for each facility presently not on a top rated location. The F facilities are arranged in an engineer determined priority order which establishes the order in which the search heuristic seeks to improve facility locations and the priority order in which facilities will be assigned to top-rated locations. Facility location is improved by finding unoccupied locations having higher engineer determined ratings where each location was rated for each facility. The rating of each location indicates how closely the engineer thought a location's characteristics fit the facility location objectives.

An epsilon area for all facilities is defined. Starting with the highest possible rating, QMAX, the rating of locations within the area are reviewed. Locations with a QMAX rating are considered as potential temporary locations, subject to QMAX being greater than the rating of the facility's present location, QLOW. The facility is temporarily moved to each QMAX location. A correlation coefficient of each new facility location

configuration, P*(f,r), with the preferred facility location configuration, P(f,r), is calculated. All new facility location configurations producing a correlation value above a management determined minimum value are retained. Those falling below the critical value are dropped. From the locations producing facility location configurations that are acceptably related to the preferred facility location configuration, the location generating the most acceptable configuration becomes the location of the facility under consideration. If acceptable unoccupied locations with a QMAX rating are not found, a second search routine is activated.

The second search routine considers the same epsilon area around the facility as the first routine. However, instead of considering unoccupied locations with QMAX ratings, the second routine considers only occupied locations with QMAX ratings occupied by lower priority facilities (f'). All locations satisfying the previous conditions are defined and the facility under consideration, f, temporarily assumes the location of each f' facility one at a time. The f' facility assumes the location previously occupied by f. A correlation coefficient determines the relationship of each new location configuration with the preferred facility location configuration. The maximum correlation coefficient is selected and then a permanent exchange is made of the location for facility f, with the location of the facility on the QMAX location generating the highest correlation with consumers' preferred facility location configuration. This process is undertaken for all facilities to be located.

When trying to locate facilities it is possible to have two facilities competing for the same location. In such cases, it is assumed that engineers or planners involved with locating facilities would perform a cost benefit analysis to decide what facility should get the location. For the model to resolve situations like this the priority ranking developed by the engineer represented the order in which facilities would be assigned to a location.

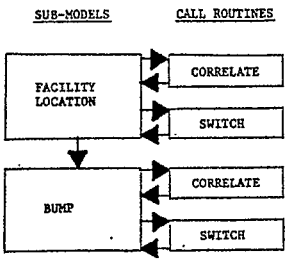
The movement of higher priority facilities from location to location vacates locations previously not available to lower priority facilities. An iterative process allows the model to try to improve the rating of locations for each facility subject to maintaining a given relation to consumers' preferred location configuration.

A flow diagram of FACILITY LOCATION appears in Figure 3, in next column.

MODEL APPLICATION

This section presents the resort destination design generated by the model including data preparation. The resort destination design is based on a sample of approximately 200 North American respondents the government of Venezuela identified as the target market. Subjects were interviewed at Cancun, Mexico, a resort having

Figure 3
FACILITY LOCATION FLOW DIAGRAM AND
SUB-MODEL/CALL ROUTINE DESCRIPTION



FACILITY LOCATION

The land preparation costs for all unoccupied locations within a defined epsilon (ε) area are reviewed for each facility. Facilities are moved to the lowest cost locations, subject to maintaining a prespecified relation with an initial location configuration.

CORRELATE

The Pearson correlation coefficient is used to determine the relationship between the interfacility distances of the initial location configuration and the interfacility distances resulting from a facility being moved.

BUMP

If FACILITY LOCATION is unsuccessful in finding an unoccupied lowest cost location, BUMP will search for lowest cost locations that are occupied by lower priority facilities. If BUMP is successful in finding a lower priority facility occupying a lower cost location that maintains a prespecified relation with the existing location configuration SWITCH is engaged.

SWITCH

If BUMP has been successful, SWITCH will move the higher priority facility to the better location and the lower priority location to the location previously occupied by the higher priority facility.

similar characteristics to the one the Venezuelan Government had proposed.

DATA PREPARATION

Prior to employing the model, subjects' MONANOVA generated stress values and the signs of their utility values were examined with the objective of eliminating subjects whose responses appeared to contain error. Stress values were calculated based on the three heaviest weighted factors. These three factors generally differed among subjects. The three heaviest weighted factors plus the hotel profile rank ordering based on seven factors were again submitted to the MONANOVA program and stress values produced. Table 1 presents a summary of stress and the total utility explained by the three heaviest weighted factors. Because there is no objective method of identifying subjects with unacceptably high stress values and because stress values did not differ much from those of past research no subjects were eliminated based on stress. Figure 4 presents the same data in scattergram form. The signs of utility values for the price factor were analyzed to further check for an indication of subjects whose response data contained error. Fifteen subjects had sign reversals and were eliminated from the sample.

Table 1

FREQUENCY TABULATION OF STRESS VALUES FROM MONANOVA

PERCENT OF HIGHEST UTILITY EXPLAINED BY THE THREE FACTOR RECEIVING THE HIGHEST UTILITY WEIGHTS, ON AN INDIVIDUAL BASIS*

STRESS INTERVAL	100-95%	94-90	89-85	84-80	79-75	74-70	69-65	64-60	59-55	54-50	Totals
0 ≤ S ≤ .05	48	12	32	37	36	42	18			3	220
.05 ≤ S ≤ .10											
.10 ≤ S ≤ .15											
.15 ≤ S ≤ .20						11	2	2			15
.20 ≤ S ≤ .25						3	5	18			26
.25 ≤ S ≤ .30						2	1		1		4
.30 < S									7		7
TOTALS	48	12	32	37	36	58	26	20	8	3	280

*Note: For example, subject 1's utility volumes for the J factors might have been $.000J_1 + 1.633J_2 + .289J_3 + .000J_4 + .000J_5 + 2.021J_6 + .866J_7$. Subject 1's highest three factors are J_2, J_6 and J_7, summing to 4.320 or 93.7% of the total utility of 4.609.

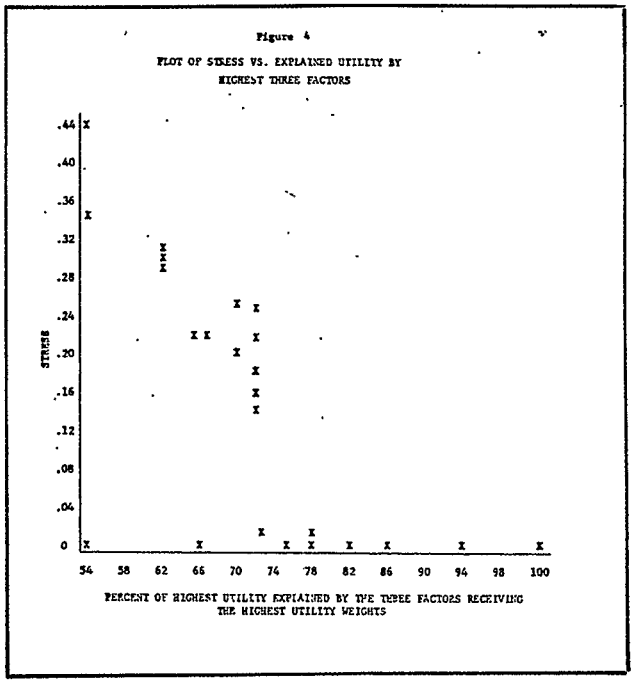
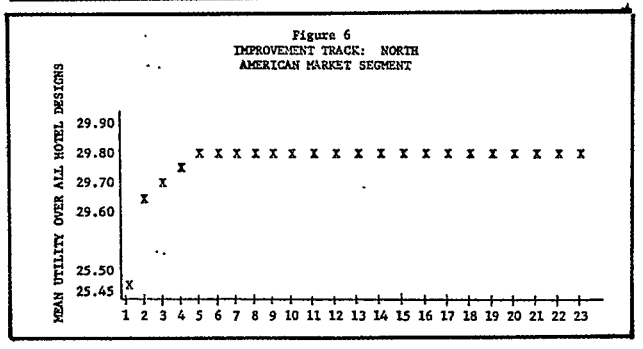


Figure 5
STARTING SET OF HOTEL DESIGNS: NORTH AMERICAN MARKET SEGMENT

FACTOR I	FACTOR II	FACTOR III	FACTOR IV	FACTOR V	FACTOR VI			FACTOR VII			Annual Available Rooms	Annual Potential Demand	Occupancy Rate	Mean Utility
					SUB-FACTOR 1	SUB-FACTOR 2	SUB-FACTOR 3	SUB-FACTOR 1	SUB-FACTOR 2	SUB-FACTOR 3				
External Hotel Design	Price	Location	Bedroom	Dining Room	Shops at Hotel	Night Recreation	Night Life	Sailfish Boating	Night Tennis	No Scuba at Hotel				
1 Grass Hut	5 $95 per night	1 Location AAA	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	36,500	41,071	112%	25.73
1 Grass Hut	5 $95 per night	2 Location BBB	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	36,500	12,500	34%	27.07
8 Individ. Concrete Pool	5 $95 per night	3 Location CCC	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	1 Yoga Lessons	1 Gambling	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	45,625	43,750	96%	25.42
1 Grass Hut	5 $95 per night	4 Location DDD	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	36,500	10,714	29%	27.04
1 Grass Hut	5 $95 per night	5 Location EEE	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	36,500	25,893	71%	23.43
1 Grass Hut	5 $95 per night	6 Location FFF	1 Thatched Ceiling Design	1 Small, Formal	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 No Scuba at Hotel	1 9 Hole Golf Course	36,500	16,071	44%	24.08
												228,125	150,000	66%	25.48
												TOTALS			



RESORT DESTINATION DESIGN

Two market segments, North Americans and Venezuelans, were submitted to the model and two resort destination designs produced. Only the North American market segment is presented here. However, as some interesting differences in the two market segments were generated, North American and Venezuelan results will be compared.

Figure 5 (North American Market Segment) presents the starting set of hotels generated by VOTE and the corresponding average utility per hotel, average utility over all hotels and hotel occupancy rates. Following the establishment of the starting set of hotels (product line of hotels) the model iterates through a search heuristic attempting to improve each subject's satisfaction for the hotel design in which he is staying. From the starting configuration, to a point where improvement could no longer be made, the model progressed according to the track in Figure 6.

STARTING CONFIGURATION AND SUBSEQUENT DESIGNS

The mean utility overall hotel designs (within a set of designs) is plotted against the sequential order in which the set of hotel designs occurred, including the starting set of hotel designs. Thus, one on the abscissa represents the starting set of hotel designs; two and three represents the SUBJECT HOTEL DESIGN and SUBJECT HOTEL DESIGN BY LOCATION respectively within the first iteration.

Each subsequent pair of designs (e.g., 4 and 5, 6 and 7, etc.) represents another iteration. The final set of hotel designs appears in Figure 7. All hotels maintained occupancy at above 40%. Therefore no hotels were eliminated.

Figure 7
FINAL SET OF HOTEL DESIGNS: NORTH AMERICAN MARKET SEGMENT

	FACTOR I	FACTOR II	FACTOR III	FACTOR IV	FACTOR V	FACTOR VI SUB-FACTOR 1	FACTOR VI SUB-FACTOR 2	FACTOR VI SUB-FACTOR 3	FACTOR VII SUB-FACTOR 1	FACTOR VII SUB-FACTOR 2	FACTOR VII SUB-FACTOR 4	Annual Available Rooms	Annual Potential Demand	Occupancy Rate	Mean Utility
	External Hotel Design	Price	Location	Bedroom	Dining Room	Shops at Hotel	Light Recreation	Night Life	Boating	Tennis	Golf				
	8 Individ. Cottage Pool	1 $35 per night	1 Location AAA	5 Oct Room Star Win Fan	5 Covered, Open Thatched	5 Tennis Clothing Shop	6 Water Skiing	3 Disco	2 Deep Sea Fishing	4 Day Tennis Only	3 18 Hole Golf Course	45,625	29,464	64%	29.09
	4 Sm Modrn Low Rise	1 $35 per night	2 Location BBB	6 Balcony Modern Design	1 Small, Formal	3 Car Rental	3 Snorkel	3 Disco	5 Sailing Lessons	1 Night Tennis	3 18 Hole Golf Course	27,375	22,321	81%	28.92
	1 Crane Hut	1 $35 per night	3 Location CCC	1 Thatched Ceiling Design	5 Covered, Open Thatched	4 Drug Store	9 Horse Back Riding	3 Disco	6 Catmaran	1 Night Tennis	1 9-Hole Golf Course	36,500	25,000	68%	31.05
	8 Individ. Cottage Pool	1 $35 per night	4 Location DDD	6 Balcony Modern Design	5 Covered, Open Thatched	4 Drug Store	3 Snorkel	5 Native Music	5 Sailing Lessons	1 Night Tennis	3 18 Hole Golf Course	45,625	21,429	47%	29.75
	9 Modern 2-Story Cottage	1 $35 per night	5 Location EEE	1 Thatched Ceiling Design	5 Covered, Open Thatched	4 Drug Store	3 Snorkel	3 Disco	3 Sailing Lessons	4 Day Tennis Only	2 No Golf at Hotel	36,500	28,571	78%	29.95
	9 Modern 2-Story Cottage	1 $35 per night	6 Location FFF	6 Balcony Modern Design	7 Open Air Thatched Thatched	1 Native Crafts	3 Snorkel	3 Disco	1 Sailfish	1 Night Tennis	1 9 Hole Golf Course	36,500	23,215	64%	30.20
	TOTAL									2 Scuba Equip Rental	2 Scuba Lessons		150,000	66%	29.82

For this market segment, the subject's mean maximum utility is 32.01. The mean maximum utility represents the sum of the utilities for each subjects' most preferred hotel profile over all subjects. The mean utility for the hotel design in which each subject is staying is 29.82 representing an average satisfaction rate of about 93%. However, one subject did not obtain an 80% rate of satisfaction and was subsequently eliminated from the sample. This reduction had the following effect on demand. (Table 2).

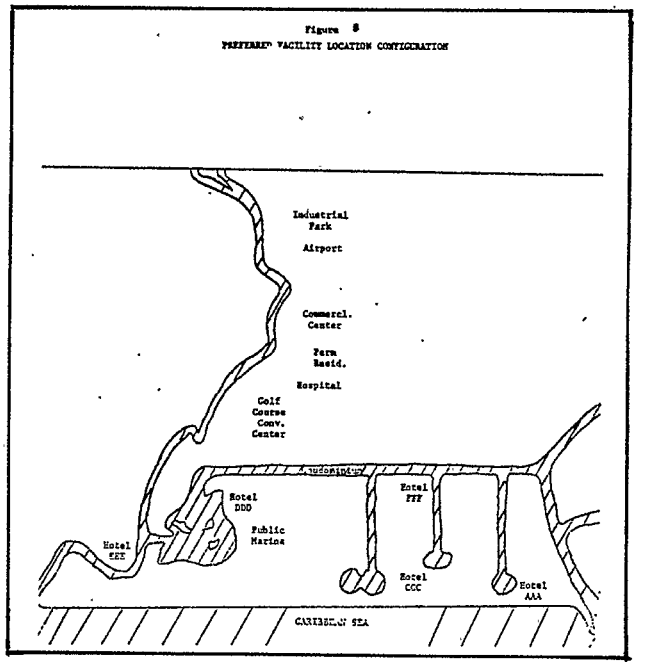
After completing the hotel design the model moves on to facility location. The preferred facility location configuration shown in Figure 8 is used as the starting point. Table 3 presents the engineer's ratings of the preferred locations.

Table 2
EFFECT ON POTENTIAL DEMAND AND OCCUPANCY RATES OF ELIMINATING UNSATISFIED SUBJECTS

Hotel Locations	Demand Prior to Satisfaction Analysis	Demand After Satisfaction Analysis	Final Occupancy
AAA	29,464	29,464	64%
BBB	22,321	22,321	81%
CCC	25,000	25,000	68%
DDD	21,429	21,429	47%
EEE	28,571	28,571	78%
FFF	23,215	22,321	61%
TOTAL	150,000	149,107	65%

Table 3
RATINGS OF PREFERRED FACILITY CONFIGURATION LOCATION

Facility	Grid Location (X,Y)	Rating
Airport	12,14	5
Convention Center	10,8	5
Commercial Center	11,11	5
Industrial Park	12,15	5
Condominium	11,6	0
Hospital	11,9	5
Permanent Residence	11,10	5
Golf Course	10,8	3
Public Marina	10,4	0



The model proceded to search potential locations containing higher ratings, where higher ratings indicated a more appropriate location for the facility under consideration. The facility location configuration generated from the search routine had an average aggregate consumer satisfaction rate of 95%. The satisfaction rate was

obtained by correlating the interpoint distance from the preferred facility location configuration with the final facility location configuration appearing in Figure 9. All facility locations in the final location configuration had a rating of 5.

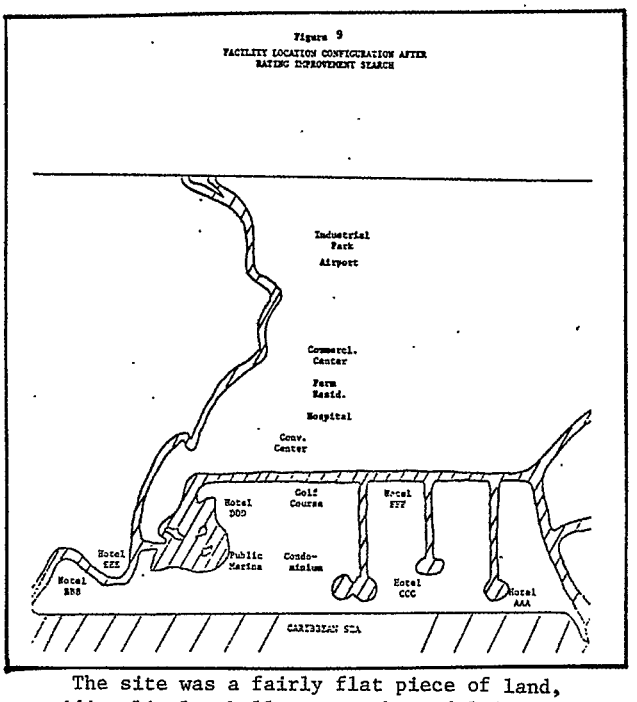


Figure 9
FACILITY LOCATION CONFIGURATION AFTER RATING IMPROVEMENT SEARCH

The site was a fairly flat piece of land, providing little challenge to the model in terms of finding top rated (i.e., rating of five) locations. This can be seen by the high correlation of the final facility location configuration with the preferred facility location configuration.

SUMMARY

Comparing the Venezuelan and North American market segments produced some noticeable differences for both hotel design and facility location. Differences in the two market segments' hotel designs were (1) external designs preferred by the North American market segment are, in general, not the same as those preferred by the Venezuelan market segment. (2) In general, the Venezuelans preferred more formal bedrooms and restaurants than the North American. (3) The Venezuelan market segment had more preference for having clothing stores at their hotels than did the North Americans. The North Americans were more interested in having drug stores, car rentals and native craft shops available. (4) Most of the subjects in the two market segments preferred having a discotheque to other forms of hight life. This was an interesting finding in light of an article appearing in the Wall Street Journal* months after the model had designed discotheques into the hotels. The following is the relevant portion of the article.

> "For some hotels, the current popularity of discotheques is leading to a source of additional income. Marriott Corp. opened its first disco at a St. Louis hotel in August 1975. It now has a total of 11 with two more scheduled to open in the next few months. Marriott says it regards its discotheques as a 'new marketing tool' that has 'brought a lot of new business' to its hotels."

*Source: Wall Street Journal Thursday, Nov. 4, 1976.

(5) The boating subfactor produced different results for the two market segments. The Venezuelans preferred deep sea fishing while the North Americans preferred a variety of sailing vessels. (6) The hotel at location BBB in the Venezuelan market segment preferred to have no external facilities (i.e., factor seven). The external facilities deal with recreation requiring a great deal of energy. Perhaps the subjects in this hotel prefer less energy demanding exercise.

Findings from the facility location configurations were: (1) One of the most interesting results of the facility location experiment was the subjects' ability to perceive reasonable infrastructure facility interrelationships (Figure 8) for location purposes. As might be expected, the airport and industrial park were located together some distance from the hotels. Also, the commercial center, hospital, permanent residence and convention center were clustered together as one might assume. (2) Individual facility's locations differed between market segments. For instance, the commercial center was much closer to the hotel locations in the Venezuelan market segment than in the North American segment. This was consistent with the segments' desire to shop for clothing and other items as was indicated from the results of a question on the demographic psychographic questionnaire. None of the North Americans indicated their primary motivation for their vacation was to make a purchase. However, many of the Venezuelan's indicated that making a purchase was their primary motivation. (3) The North American market segment appears to want more privacy as their preferred facility location configuration was a greater distance from their preferred hotel locations than the same relation for the Venezuelan market segment.

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