MARKET MEASUREMENT AND ANALYSIS

Proceedings of ORSA/TIMS
Special Interest Conference
March 26-28, 1979

Edited by
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and
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OPTIMIZATION OF THE ADVERTISING POLICY FOR A RECREATION PARK

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Abstract

This paper deals with the problem of the desirable level of advertising expenditure, the optimal distribution of this expenditure in time, and the allocation over the media -- TV, radio, and newspaper -- for a recreation park in the Netherlands. First, a model is specified and estimated, relating number of visitors to advertising effort. It also takes into account nonadvertising variables that affect the number of visitors.

Then this model is used in a heuristic advertising planning procedure which, by means of incremental analysis for a given budget level, searches for the optimal allocation of the advertising budget over media and time.

With this procedure ways to readjust the advertising policy are found by allocating the budget differently over media and time and by changing the overall budget level. According to the model, these changes lead to considerably more visitors and increase profit.

Introduction

A recreation park in the Netherlands uses three types of advertising to attract visitors: television spots, radio spots, and print ads in daily newspapers. The management of the park has the following questions about its advertising policy.

1. Is the current level of total advertising expenditures right?
2. How should the advertising budget be allocated over the three media?
3. When, i.e., on which days during the eight months of the year when the park is open, should the advertisements be placed?

This paper tries to answer these three questions by developing a model for the relationship between advertising effort and daily numbers of visitors. This model is the basic element of a heuristic procedure for the allocation of advertising expenditures over the three media and over the year. It can also be used to evaluate the consequences of alternative levels of the advertising budget.

The paper is organized as follows: First, the situation is described briefly. In the next section the model for the daily number of visitors is developed and the parameterization of this model, using historical data, is described. Then the heuristic advertising planning procedure is dealt with, and the results obtained with this procedure are presented. Finally, a number of conclusions and recommendations to the management of the park are made.

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The author wishes to thank Jaap Bijkerk, Gerard Verwey, and Bart Braam for their help in carrying out the computations. Frans de Hey did very useful exploratory work for this study.

Brief Description of the Situation

The park was opened in 1969, and currently receives 600,000 to 700,000 visitors a year. It spends about 10 percent of total turnover on advertising, newspapers receiving the largest share (53%), followed by TV (39%), and radio (8%). The management feels that advertising is essential for the attraction of visitors. This feeling is based partly on the lesson learned in 1972, when TV and radio advertising were dropped and newspaper advertising was drastically reduced. As a result, the number of visitors fell by more than 200,000. The number of visitors recovered in the following years, when advertising was resumed. The park is open from March 1 to October 31, every day of the week.

According to the number of visitors, three periods can be distinguished:

1. spring/autumn season: the months March, April, May, September, and October;
2. summer season: the months June, July, and August, excluding the vacation peak;
3. vacation peak: the three-week period in which the workers in the major Netherlands industries -- construction, metal, and related industries -- have their holidays. The time of this vacation varies from year to year; it falls for the greater part, or completely, within July.

The average number of daily visitors in the summer season is four times as high as in the spring/autumn season; in the vacation peak it is nine times as high. The management of the park distinguishes between two types of visitors: individuals and visiting groups. The latter are school classes, groups of aged persons, etc. Our analysis in the following sections only refers to the first group: the individual visitors, who represent about 80 percent of the total number of visitors.

The analysis data were available on the daily number of visitors for the years 1970 to 1977, and, also from 1970 onwards, on the emission dates of TV and radio spots and the publishing dates of the printed advertisements. For the newspaper ads each publishing date represents the placement of an advertisement in 15 Netherlands daily newspapers (national as well as regional) on the same day. The content and layout of the advertisement in all three media did not vary much over the years.

Marketing variables other than advertising do not seem very important for explaining the variation in numbers of visitors. The mix element product, the park itself, did not undergo major changes over the years; the mix element admission price roughly followed the inflation.

The Model

Factors to be Included and Structure of the Model

The purpose of the study was to develop a model representing the effects of the various advertising activities on the daily number of visitors. However, when doing so, one has to take into account factors other than advertising that also influence the number of visitors on a given day. For example:

- day of the week (D). There is a certain pattern in the distribution of visitors over the week. Especially, weekend days are different from week days.

- month (M). Because of the large differences in the numbers of visitors, three different seasons have already been distinguished. However, even within each season there are clear differences from month to month:
- weather (W),
- school vacations (SV),
- special holidays (SH): Easter, Ascension Day, Whitsun, the Queens Birthday, Liberation Day,
- year (Y).

It was assumed that together with advertising (ADV) these factors are the major variables that influence the daily number of visitors (V). Obviously, there are interactions between these factors. For example, the difference between the number of visitors on a weekend day and a week day (i.e., the weekend effect) is higher in a month with a high general level of daily visitors than in a month with a low level of daily visitors. To give another example: an advertisement will have a greater effect on the number of visitors when placed just before a major holiday than when placed before an ordinary week day. Because of these interactions, a multiplicative model was specified with a basic structure similar to that of Little's BRANDAID model (Little, 1975). Our model for the daily number of visitors has the following form:

$$V_t = c \cdot f_{D,t} \cdot f_{M,t} \cdot f_{W,t} \cdot f_{SV,t} \cdot f_{SH,t} \cdot f_{Y,t} \cdot f_{ADV,t} \, , \qquad (1)$$

where V_t is the number of visitors on day t, c is a constant and the $f_{\cdot,t}$ represents multiplicative factors corresponding with the variables just mentioned. To explain the nature of these multiplicative factors, we take $f_{D,t}$, the day-of-the-week factor, as an example. There is a reference situation in which $f_{D,t}$ takes the value 1. Here, we arbitrarily chose Monday for the reference situation. For the other days of the week $f_{D,t}$ represents the ratio of the number of visitors on that day to the number of visitors on Monday (all other circumstances being equal). The other nonadvertising factors (the advertising effect is dealt with in the next subsection) should be interpreted in a similar way.

With respect to the year effects, there is a steady decline in the annual number of visitors, probably because of the decreasing "newness" of the park (at the start there are many people who want to see the park at least once) and because of the decreasing birth rate (the park is especially attractive to small children). In the ultimate advertising planning model the year effect is modeled by a negative growth curve. In the estimation phase the values of f_Y for the various years are estimated directly, taking 1974 as the reference situation.

The Advertising Submodel

The advertising effect, represented by the factor $f_{ADV,t}$ in the visitors' function (1) consists of advertising by three different media: television (TV), radio (RA), and daily newspaper (DN). Within the advertising submodel we assume the same multiplicative structure as in the main model (1), i.e., we postulate:

$$f_{ADV,t} = \prod_{j=1}^{3} fa_{jt} \, , \qquad (2)$$

where fa_{jt} is the advertising factor for medium j on day t, and j = 1, 2, 3 corresponds with television, radio, and newspaper, respectively.

Next, the relationship between the advertising factors fa_{jt} and the past advertising effort for medium j has to be specified. We assume that this relationship has the same form for all three media. Generally, the number of visitors on a given day is not only affected by the most recent advertisement, but there is also a carry-over effect from previous advertising activities, especially as we are working with a model for the daily number of visitors. For example, somebody may see an advertisement of the park on Tuesday, but his first opportunity to visit the park may be in the next weekend or in his children's school vacation. To describe these lagged effects of past advertising, a model was developed in which it is assumed that the effect of an advertisement decreases with the number of days elapsed since the appearance of that advertisement, according to the hyperbolic function:

$$y = \frac{1}{x} \quad . \tag{3}$$

Here y = index of effect, and x = number of days elapsed since the advertisement appeared. The effect of an advertisement at day t_o on the number of visitors at day t $(t_o < t)$ is, according to Equation (3):

$$1/(t - t_o) \quad .$$

Figure 1 depicts the decreasing effect of an advertisement in time according to this hyperbolic function.

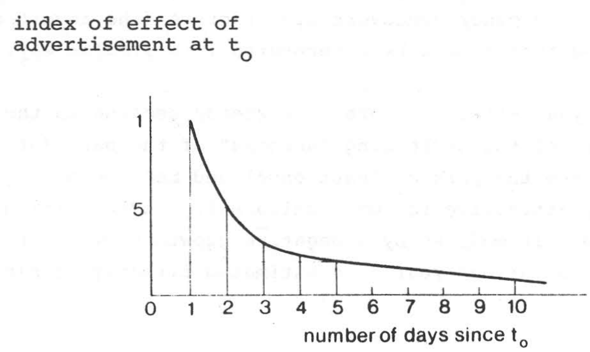

Figure 1

Hyperbolic Decrease in the Effect of Advertising

At least in principle, all advertisements that appeared before t have an impact on the number of visitors at t. The total cumulative effect, as expressed for day t, of all advertisements in medium j that appeared before t is represented by:

$$cum_{jt} = \sum_{\substack{i \\ t_o^j(i) < t}} 1/(t - t_o^j(i)) \tag{4}$$

where the index i runs over the consecutive advertisements in medium j and $t_o^j(1)$, $t_o^j(2)$, ..., etc. are the days on which these consecutive advertisements in medium j have appeared.

This way of computing past advertising effects is illustrated in Figure 2. From this figure it is also clear that the effect of an advertisement is assumed to start the day after it appeared. Usually, people plan a visit to the park at least the evening before. Thus, the denominator in the hyperbolic function (3) is always greater than or equal to one.

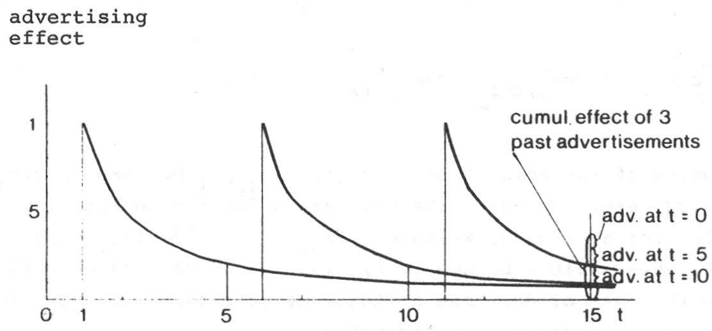

Figure 2

Illustration of the Computation of Cumulative Advertising Effect at t = 15, caused by Advertisements at t = 0, t = 5, and t = 10, respectively (hyperbolic model)

The cumulative advertising effect for a medium, as given by Equation (4), may be considered as the total "stock of goodwill" caused by advertising in the past. The factors cum_{jt} could be entered directly into the advertising submodel, i.e., by putting

$$fa_{jt} = cum_{jt} \qquad \text{for } j = 1, 2, 3 \quad t = 1, 2, \ldots .$$

However, such a model would imply that after a long period of no advertising, visits to the park would stop completely. This is not realistic, so to make the model more "robust," we add the constant one to the factor cum_{jt}. Furthermore, an exponent α_j is introduced to express any differences in effectiveness between the media. In this way we obtain:

$$fa_{jt} = (1 + cum_{jt})^{\alpha_j} \qquad (j = 1, 2, 3) , \tag{5}$$

and the complete advertising submodel is:

$$f_{ADV,t} = \prod_{j=1}^{3} (1 + cum_{jt})^{\alpha_j} \ . \tag{6}$$

Note that in this model the advertising factor for a medium becomes one after a long period of no advertisements in this medium. So the latter situation serves as the reference situation here.

Now the choice of the hyperbolic function in the advertising submodel will be discussed. At first glance it might be thought that the hyperbolic function, as depicted in Figure 1, implies a very rigid assumption about the way the advertising effect decreases over time. However, this is not so in the ultimate model (6), since in this model the advertising effect and its distribution over time are determined by the parameter α_j, which can be adapted to the particular situation under study. We can illustrate this with a numerical example. Consider the placement of an advertisement in medium j on day two. For simplicity, we assume that there has not been any advertising in medium j for a long time, i.e., before the placement:

$$cum_{j,t} = cum_{j,t+1} = cum_{j,t+2} = \ldots = 0 .$$

Then, as a consequence of the advertisement on t, $cum_{j,t+1}$ becomes 1, $cum_{j,t+2}$ becomes 0.5, $cum_{j,t+3}$ becomes 0.33, etc. However, the new values for the advertising factors fa_{jt} depend on α_j. For example, for $\alpha_j = 0.25$, we have: $fa_{j,t+1} = 1.19$, $fa_{j,t+2} = 1.11$, $fa_{j,t+3} = 1.07$, but when $\alpha_j = 0.75$, these values become 1.68, 1.36, and 1.24, respectively. So the advertising effects and the rate of decrease of these effects over time are clearly determined by the specific value of the response coefficient α_j.

The hyperbolic model implies decreasing incremental effects of additional advertisements in the same medium. For a specific day t the effect of past advertisements in medium j is given by cum_{jt}. Suppose an additional advertisement in medium j is scheduled on some day before t, which has the effect of increasing cum_{jt} by the amount q. (If the advertisement were to appear the day before t, q would be equal to one; if the placement were two days before t, q would be 0.5, etc.) We examine the effect of the increase in cumulative advertising on fa_{jt}, the advertising factor for medium j at day t. Before the additional advertising we had:

$$fa^o_{jt} = (1 + cum_{jt})^{\alpha_j} \qquad (o = \text{old}) .$$

After the additional advertising we had:

$$fa^n_{jt} = 1 + cum_{jt} + q)^{\alpha_j} \qquad (n = \text{new}) .$$

Omitting the subscripts j and t we can express the new factor in the old one in the following way:

$$f^n = [(f^o)^{\frac{1}{\alpha_j}} + q]^{\alpha_j} .$$

Alternatively, increasing the level of cumulative advertising has the effect of multiplying the corresponding advertising factor by F, defined as:

$$F = f^n/f^o = [(f^o)^{\frac{1}{\alpha_j}} + q]^{\alpha_j}/f^o .$$

Since

$$\frac{dF}{df^o} = - q[(f^o)^{\frac{1}{\alpha_j}} + q]^{(\alpha_j - 1)} / f^{o^2}$$

is negative ($f^o, q > 0$), the higher the current level of the advertising factor, the smaller its relative increase.

With a numerical example (taking $\alpha_j = 0.50$), the effect on the number of visitors at t of an advertisement on the day before t is an increase by 41 percent if the current value of fa_{jt} is 1 (the situation after a long time without advertising), but the increase is only 20 percent if, as a consequence of previous advertising, the current value of fa_{jt} is already 1.5.

The phenomenon of decreasing incremental effects of additional advertisements is a realistic feature of the hyperbolic model.

The Model in a Form That Can Be Estimated

The model is parameterized by least squares regression, using historical data for number of visitors, day of the week, weather, advertising activities, etc. To be able to put the multiplicative model into an additive form by means of a logarithmic transformation, all multiplicative factors of Equation (1), except the advertising factor, are expressed as powers of e. As an example, we take $f_{D,t}$, the factor for the day of the week effect. We write:

$$f_{D,t} = (e^{\alpha_{TU}})^{TU_t} (e^{\alpha_{WE}})^{WE_t} \ldots (e^{\alpha_{SU}})^{SU_t} ,$$

where

$$TU_t = \begin{cases} 1 \text{ if day t is a Tuesday,} \\ 0 \text{ otherwise.} \end{cases}$$

$$WE_t = \begin{cases} 1 \text{ if day t is a Wednesday,} \\ 0 \text{ if otherwise, etc.} \end{cases}$$

The parameter α_{TU}, α_{WE}, etc. represents the effects of Tuesday, Wednesday, etc. The other factors-- month, weather, etc.--are written in an exponential form in a similar way. Now Equation (1) is transformed into:

$$\underbrace{V_t = c(e^{\alpha_{TU}})^{TU_t} \quad (e^{\alpha_{SU}})^{SU_t}}_{\text{day of the week factors}} \quad \underbrace{* \ldots\ldots\ldots\ldots\ldots\ldots *}_{\substack{\text{other exponential factors} \\ \text{corresponding with month,} \\ \text{year, weather, school} \\ \text{vacation, etc.}}} \quad \underbrace{\prod_{j=1}^{3} (1 + cum_{jt})^{\alpha_j}}_{\text{advertising factor}} . \qquad (7)$$

After logarithmic transformation, Equation (7) becomes:

$$\ln V_t = \ln c + \underbrace{\alpha_{TU}TU_t + \ldots \alpha_{SU}SU_t}_{\text{day of week effect}} + \underbrace{\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots}_{\substack{\text{similar terms for the effects} \\ \text{of month, year, weather,} \\ \text{school vacation, etc.}}} + \underbrace{\sum_{j=1}^{3} \alpha_j \ln(1 + cum_{jt})}_{\text{advertising effects}} \quad (8)$$

The parameters of Equation (8) can directly be estimated by least squares, using information on the number of visitors, the weather, characteristics of the days, and advertising activity in the past. The quantities cum_{jt} are straightforwardly computed from knowledge of the appearance dates of past advertisements, using Equation (4).

As an alternative for the hyperbolic advertising model, a model was considered in which, for a given day t, the effect of advertising in the past is represented by a series of multiplicative factors, one for each day before t. The multiplicative factor equals one if, on the day in question, no advertising appeared; otherwise, the factor is greater than one. In this model the advertising effects can be represented in a similar way as the non-advertising effects in Equation (7). For medium j and day t we can write:

$$fa_{jt} = (e^{\beta_1})^{A_{j,t-1}} (e^{\beta_2})^{A_{j,t-2}} (e^{\beta_3})^{A_{j,t-3}}, \ldots, \quad (9)$$

where fa_{jt} is defined as in the section on the advertising submodel,

$$A_{j,t-k} = \begin{cases} 1 \text{ if on the } k^{th} \text{ day before t an advertisement appeared in medium j,} \\ 0 \text{ otherwise,} \end{cases}$$

and β_1, β_2, β_3, ... represent the effects of advertisements one, two, three, ..., days ago. To restrict the number of parameters, additional assumptions about the βs can be made, e.g., the Koyck structure:

$$\beta_2 = \lambda\beta_1 ,$$

$$\beta_3 = \lambda^2\beta_1 ,$$

etc.,

where

$$0 < \lambda < 1 .$$

After logarithmic transformation these parameters can be directly estimated. For our data the estimation results (in terms of R^2, significance of variables, etc.) were practically as good as for the hyperbolic model. However, in the optimization phase this model gave very strange results. The reason is that the model structure, as represented by Equation (9), implies that the multiplicative factor, corresponding with an advertisement on a certain day, is a constant and does not decrease as the current advertising activity becomes higher. Therefore, because of the multiplicative structure, this model implies that the higher the current level of advertising in a medium, the higher the effect of an additional advertisement. Such a situation of increasing returns to scale is unrealistic. When using such a model for optimization purposes, the advertisements stick together in time and the model predicts unrealistically large numbers of visitors for such periods of heavy advertising. Therefore, this model will not be dealt with further in this paper.

Estimation and Validation Results

General

As mentioned before, data on number of visitors and advertising activities were available for the years 1970 to 1977. Weather data referring to the same period were obtained from the Netherlands Weather Bureau.[1] The parameters were estimated using the data for the period 1970-1976. The 1977 data were set aside for validation purposes.

Table 1

Estimation Results

(coefficient of nonadvertising variables converted to multiplicative factors)

		Spring/ Autumn Season	Summer Season	Vacation Peak
	Constant (Monday is reference situation)	33.65	1220.58	8848.47
Day of Week	Tuesday	1.26	1.23	1.60
	Wednesday	1.71	1.20	1.42
	Thursday	1.17	1.00	1.21
	Friday	1.00	.70	.79
	Saturday	4.41	1.00	.42
	Sunday	8.38	1.73	.64
Weather -	Low Temperature	.93	1.00	1.00
	Sunny	1.10	.85	.90
Month -	April	2.00	-	-
	May	4.10	-	-
	July	-	3.46	-
	August 1-15	-	2.82	-
	August 16-31	-	1.20	-
	September	4.40	-	-
	October	1.85	-	-
	Special holiday: Sunday	2.12	-	-
	Special holiday: weekday	17.25	-	-
	School vacation	5.13	-	-
	First week vacation peak	-	-	.80
Year factors (1974 is reference situation)				
	1970	1.15	1.48	1.89
	1971	1.16	1.32	1.47
	1972	1.18	1.03	.97
	1973	1.05	1.06	.57
	1975	.92	.73	.50
	1976	1.11	.76	.48
Advertising response coefficients				
	α_{TV}	.913	.345	.350
		(9.51)*	(2.55)	(1.72)
	α_{RA}	-	.149	.442
			(2.27)	(2.04)
	α_{DN}	.719	-	.029**
		(6.76)		(.13)
	R^2	.849	.726	.858
	DW	1.05	1.01	1.32
	N	1056	522	122

*Numbers in brackets are t-values.

**Not significant at the five percent level.

[1] The "Koninklijk Nederlands Meteorologisch Instituut."

Table 1 presents the estimation results. Separate models were estimated for three seasons, as is indicated in Table 1. The models were estimated in logarithmic form, but in Table 1 the coefficients for the nonadvertising variables have already been converted into multiplicative factors.[2] Of course, R^2 and the results on the significance of the coefficients refer to the logarithmic model. Of the nonadvertising factors (except for the year factors), all coefficients in Table 1 that differ from 1.00 refer to coefficients in the logarithmic model that were significant at the five percent level. Variables not significant at this level were omitted from the model, after which the other parameters were re-estimated. Multiplicative factors in Table 1 that have the value 1.00 correspond with such nonsignificant variables. A dash in Table 1 means that the explanatory variable in question is not applicable for that model.

For the advertising variables, in addition to the estimated response coefficients, the t-values are reported. The general conclusion from Table 1 is that the explanation of daily numbers of visitors by the model is quite good. R^2 ranges from .73 for the summer season to 0.86 for the vacation peak. Also, the results for the advertising variables seem to be very satisfactory. Below the results of Table 1 are elaborated on.

Effects of Nonadvertising Factors

The estimated values for the day of the week factors show evident differences in the pattern of visitors over the week between the three seasons. In the spring/autumn season the visitors are heavily concentrated in the weekend, with the number of visitors on Sunday being eight times as high as on Monday. In the summer season the relative difference between days is much smaller. In the vacation peak the distribution is the reverse of that in the spring/autumn season: relatively large numbers of visitors on the weekdays Tuesday, Wednesday and Thursday, and smaller numbers on the weekend days.

Of the three weather variables originally included in the regression -- temperature, rain, and sun -- only temperature and sun showed significant effects. The numbers corresponding with the weather variables in Table 1 should be interpreted as follows. The 0.93 for "low temperature" in the spring/autumn season means that a temperature below normal[3] decreases the number of visitors to 93 percent of the number of visitors that can be expected when the temperature is normal or above normal. On the other hand, a day more sunny than normal in the spring/autumn season has the effect of increasing the numbers of visitors by 10 percent. The weather factors for the other seasons should be interpreted in a similar way. Note that during the summer months, sunny weather has an opposite effect; in this period it decreases the number of visitors.

To obtain the results, as presented in Table 1, for each day t, the number of visitors at day t was related to the weather variables at (t-1). Using the weather variables of the previous day gave a better explanation than the weather variables of the same day. The moment the decision is made to go to the park plays a role here.

The reference month for the spring/autumn season is March. Table 1 shows that the number of visitors increases toward the summer and decreases toward October. Also, within the summer season (with June as the reference month), there are clear differences between

[2] For example, in the logarithmic model for the spring/autumn season the coefficient of the Tuesday variable was .203. The corresponding value in the multiplicative model is $e^{0.203} = 1.26$, which is the number given in Table 1.

[3] "Normal" refers to a specific temperature range, defined for each day by the Weather Bureau.

the months. Because of the large differences between the first and second half of August, separate dummies were applied for both halves. Since the vacation peak falls for the greater part or completely in July, no month variables were included in the model for this period.

In the model for the spring/autumn season two variables for special holidays were included: one for special holidays on Sunday (Easter Sunday, Whit Sunday), the other for special holidays on week days (Easter Monday, Ascension Day, the Queen's Birthday, and Liberation Day). Especially for the latter variable we found a large multiplicative factor. The school vacation factor in the spring/autumn season refers to the school vacation around Easter and in October. The factor for the first week of the vacation peak indicates that the number of visitors in the first week of this season is lower than in the rest.

As expected, the year factors show a general decline in the number of visitors over the years, most notably for the summer season and the vacation peak. The year factors in Table 1 are not strictly decreasing. Incidental factors, such as the opening of new competing parks and changes in promotional activities of competitors, may temporarily disturb the overall trend. Another such factor is the oil crisis, which, in 1974, increased the percentage of the Netherlands population that spent their holidays in their own country and had a favorable effect on the numbers of visitors to the park in that year (especially in the vacation peak).

Advertising Effects

All advertising response coefficients reported in Table 1 are significant at the five percent level, except the coefficient for newspapers in the vacation peak. For the summer season the estimated response coefficient for daily newspapers was even slightly negative, so that the newspaper variable was removed from the equation for that season, and the other coefficients were re-estimated. Since the park never used radio advertising in the spring/autumn season, no coefficient for radio could be estimated for that season.

There were no high intercorrelations between advertising and nonadvertising factors, except a correlation coefficient of -0.78 between the TV-variable and the year factor 1972 in the summer season (1972 was the year without TV-advertising). However, re-estimation of the parameters for the model, after removing the data from 1972, practically produced the same regression coefficients. Intercorrelations among advertising variables were small or of modest size (smaller than 0.5) with one exception: for the vacation peak the correlation coefficient between TV and radio advertising was 0.73. So, it should be kept in mind that for the vacation the effects of television and radio could not be separated completely.

The Durbin-Watson (D.W.) statistics given in Table 1 indicate autocorrelation in all cases. For this reason the Cochrane-Orcutt procedure, as described by Johnston (1972, pp. 262-263) was applied. For all three seasons one iteration was sufficient to bring the D.W. statistics to a value greater than 1.70. This transformation did not cause great changes in the regression coefficients. In the validation process, to be discussed shortly, the estimates before and after removing the autocorrelation are compared.

The results in Table 1 demonstrate evident effects of TV advertising for all seasons. Also, the radio advertising in the summer and vacation peak is effective. However, newspaper advertising is only effective in spring and autumn, perhaps because of different reading habits during the summer months. The magnitudes of the response coefficients for TV and radio imply a larger relative effect of advertising in the spring/autumn season than in the two other seasons. This is not true for the absolute effects, since the daily number of visitors is much higher during the summer months.

In addition, a notable result is the relatively high effectiveness of radio in the vacation peak, perhaps because the radio (car radio, transistors) is used more intensively in this period when a large percentage of the Netherlands population is on the road, camping, or at other vacation facilities.

It would be interesting to study the relationship between the observed differences in effectiveness of the various media over the seasons and possible differences in the decision process on the part of the visitors. About this process, which refers to the decision to make a trip and the choice of destination, relatively little is known at this moment.

Validation

For the period 1970-76, the estimation period, as well as for the year 1977, which represents "fresh data," daily number of visitors were predicted with the model and compared with the actual numbers. To be able to make such predictions for 1977, the year factor for 1977 was needed. This factor was computed as follows. It was assumed that the year factor declines according to the negative growth curve:

$$g_t = \min + (1 - \min)e^{-at} , \qquad (10)$$

where g_t = year factor in year t (t = 0 corresponds with 1970, t = 1 with 1971, etc.) and min and a are parameters. g_o was set equal to one, and, using the estimated year factors for the years 1970 to 1976 as data, min and a could be estimated.[4] Afterwards Equation (10) was used to compute the year factor for 1977. (This procedure was carried out for each season separately.)

Table 2 gives the prediction results, compared with the actual data. The correlation coefficients between predicted daily number of visitors and actual numbers are quite high. Also, the other statistics demonstrate a satisfactory performance of the model.

Table 2

Prediction Results for the Estimation and the Validation Period

	Estimation Period 1970-1976		Validation Period 1977	
	Original Coefficients	Coefficients after Removing Autocorrelation	Original Coefficients	Coefficients after Removing Autocorrelation
R (predicted, actual)	.91	.91	.90	.87
Average deviation between predicted and actual number of visitors per day	754	730	641	742
The same, expressed as percentage of the average number of visitors per day	31%	30%	29%	34%
Average deviation between predicted and actual number of visitors per week	3,405	3,523	3,017	4,149
The same, expressed as percentage of the average number of visitors per week	20%	21%	20%	28%
Predicted total number of visitors for the whole period	4,113,872	3,830,151	494,038	460,529
Actual total number of visitors for the whole period	4,118,754	4,118,754	536,573	536,573

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[4]This was done by finding the least squares value (after a logarithmic transformation) for each of a series of values for min and then taking the (min, a) combination with the smallest sum or squares.

For the estimation period the coefficients estimated before and after removal of autocorrelation produce results of about the same quality, but for the validation period the original coefficients give better results. Therefore, these coefficients are used in the optimization reported in the next section. A notable result is that for the original coefficients the prediction for the validation period is practically as good as for the estimation period. Only the total number of visitors for 1977 is "underpredicted" by eight percent.

Optimizing the Advertising Policy

The model for the number of visitors, specified and parameterized in the previous sections, was used to answer the questions: how much should be spent on advertising; which media should be used for advertising; and when should the advertisements be placed? Although we speak of "optimizing" the advertising policy here, no attempt was made to find the absolutely best policy. Because of the large number of influencing variables, this seems too ambitious. However, a heuristic procedure was developed to use the information obtained in the previous sections to find better advertising schemes. The next subsection describes this procedure; subsequently, various results obtained in this way are reported.

The Heuristic Advertising Planning Procedure (HAP)

The procedure basically is an incremental search procedure. The advertising budget is allocated on a step by step basis in such a way that for each additional budget slice, advertisements are bought that maximally increase the number of visitors per additional guilder spent. Similar stepwise allocation procedures have been applied earlier in planning of promotional activity, e.g., in media planning procedures such as the High Assay Model (see Moran, 1963) and in the CALLPLAN procedure developed by Lodish (1971).

For a given year we take the period during which the park is open; March 1 to October 31, a period of 245 days. Given the total budget, the question is on which of these 245 days to place advertisements and which media to use. Of these 245 days, the Sundays have to be excluded immediately, since on Sunday there is no TV or radio advertising and no newspaper in the Netherlands.

For a specific year under study the dates of public holidays, school vacations, construction workers' vacation, etc., are known. For the weather variables the averages from the past are the best predictions. (In fact, for each day we took the type of weather that during the last 18 years occurred most often on the days with that serial number.) In this way, for each of the 245 days a quantity can be computed that represents the number of visitors as determined by the nonadvertising factor (the first part of Equation (7)).

Here the year factor is dependent on the year for which the advertising planning is to be carried out and is determined by the negative growth curve (Equation (10)). After the nonadvertising factors, the effect on advertising in the previous years are taken into account by means of the last term of Equation (7). Then, the procedure starts assigning advertisements to days in the current year. In Figure 3 the procedure is schematically depicted in the form of a flow chart. One constraint, not mentioned therein, is that since the park has a maximum capacity (set at 14,000 visitors a day), an advertisement is not placed if it would cause the number of visitors on one (or more) of the first seven days after the placement to increase beyond that maximum capacity.

advertisement. Such a situation of increasing returns to scale is unrealistic. When using such a model for optimization purposes, the advertisements stick together in time and the model predicts unrealistically large numbers of visitors for such periods of heavy advertising. Therefore, this model will not be dealt with further in this paper.

Estimation and Validation Results

General

As mentioned before, data on number of visitors and advertising activities were available for the years 1970 to 1977. Weather data referring to the same period were obtained from the Netherlands Weather Bureau.[1] The parameters were estimated using the data for the period 1970-1976. The 1977 data were set aside for validation purposes.

Table 1

Estimation Results

(coefficient of nonadvertising variables converted to multiplicative factors)

		Spring/ Autumn Season	Summer Season	Vacation Peak
	Constant (Monday is reference situation)	33.65	1220.58	8848.47
Day of Week	Tuesday	1.26	1.23	1.60
	Wednesday	1.71	1.20	1.42
	Thursday	1.17	1.00	1.21
	Friday	1.00	.70	.79
	Saturday	4.41	1.00	.42
	Sunday	8.38	1.73	.64
Weather	- Low Temperature	.93	1.00	1.00
	Sunny	1.10	.85	.90
Month	- April	2.00	-	-
	May	4.10	-	-
	July	-	3.46	-
	August 1-15	-	2.82	-
	August 16-31	-	1.20	-
	September	4.40	-	-
	October	1.85	-	-
	Special holiday: Sunday	2.12	-	-
	Special holiday: weekday	17.25	-	-
	School vacation	5.13	-	-
	First week vacation peak	-	-	.80
Year factors (1974 is reference situation)				
	1970	1.15	1.48	1.89
	1971	1.16	1.32	1.47
	1972	1.18	1.03	.97
	1973	1.05	1.06	.57
	1975	.92	.73	.50
	1976	1.11	.76	.48
Advertising response coefficients				
	α_{TV}	.913	.345	.350
		(9.51)*	(2.55)	(1.72)
	α_{RA}	-	.149	.442
			(2.27)	(2.04)
	α_{DN}	.719	-	.029**
		(6.76)		(.13)
	R^2	.849	.726	.858
	DW	1.05	1.01	1.32
	N	1056	522	122

*Numbers in brackets are t-values.

**Not significant at the five percent level.

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[1] The "Koninklijk Nederlands Meteorologisch Instituut."

the months. Because of the large differences between the first and second half of August, separate dummies were applied for both halves. Since the vacation peak falls for the greater part or completely in July, no month variables were included in the model for this period.

In the model for the spring/autumn season two variables for special holidays were included: one for special holidays on Sunday (Easter Sunday, Whit Sunday), the other for special holidays on week days (Easter Monday, Ascension Day, the Queen's Birthday, and Liberation Day). Especially for the latter variable we found a large multiplicative factor. The school vacation factor in the spring/autumn season refers to the school vacation around Easter and in October. The factor for the first week of the vacation peak indicates that the number of visitors in the first week of this season is lower than in the rest.

As expected, the year factors show a general decline in the number of visitors over the years, most notably for the summer season and the vacation peak. The year factors in Table 1 are not strictly decreasing. Incidental factors, such as the opening of new competing parks and changes in promotional activities of competitors, may temporarily disturb the overall trend. Another such factor is the oil crisis, which, in 1974, increased the percentage of the Netherlands population that spent their holidays in their own country and had a favorable effect on the numbers of visitors to the park in that year (especially in the vacation peak).

Advertising Effects

All advertising response coefficients reported in Table 1 are significant at the five percent level, except the coefficient for newspapers in the vacation peak. For the summer season the estimated response coefficient for daily newspapers was even slightly negative, so that the newspaper variable was removed from the equation for that season, and the other coefficients were re-estimated. Since the park never used radio advertising in the spring/autumn season, no coefficient for radio could be estimated for that season.

There were no high intercorrelations between advertising and nonadvertising factors, except a correlation coefficient of -0.78 between the TV-variable and the year factor 1972 in the summer season (1972 was the year without TV-advertising). However, re-estimation of the parameters for the model, after removing the data from 1972, practically produced the same regression coefficients. Intercorrelations among advertising variables were small or of modest size (smaller than 0.5) with one exception: for the vacation peak the correlation coefficient between TV and radio advertising was 0.73. So, it should be kept in mind that for the vacation the effects of television and radio could not be separated completely.

The Durbin-Watson (D.W.) statistics given in Table 1 indicate autocorrelation in all cases. For this reason the Cochrane-Orcutt procedure, as described by Johnston (1972, pp. 262-263) was applied. For all three seasons one iteration was sufficient to bring the D.W. statistics to a value greater than 1.70. This transformation did not cause great changes in the regression coefficients. In the validation process, to be discussed shortly, the estimates before and after removing the autocorrelation are compared.

The results in Table 1 demonstrate evident effects of TV advertising for all seasons. Also, the radio advertising in the summer and vacation peak is effective. However, newspaper advertising is only effective in spring and autumn, perhaps because of different reading habits during the summer months. The magnitudes of the response coefficients for TV and radio imply a larger relative effect of advertising in the spring/autumn season than in the two other seasons. This is not true for the absolute effects, since the daily number of visitors is much higher during the summer months.

For the estimation period the coefficients estimated before and after removal of autocorrelation produce results of about the same quality, but for the validation period the original coefficients give better results. Therefore, these coefficients are used in the optimization reported in the next section. A notable result is that for the original coefficients the prediction for the validation period is practically as good as for the estimation period. Only the total number of visitors for 1977 is "underpredicted" by eight percent.

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Here the year factor is dependent on the year for which the advertising planning is to be carried out and is determined by the negative growth curve (Equation (10)). After the nonadvertising factors, the effect on advertising in the previous years are taken into account by means of the last term of Equation (7). Then, the procedure starts assigning advertisements to days in the current year. In Figure 3 the procedure is schematically depicted in the form of a flow chart. One constraint, not mentioned therein, is that since the park has a maximum capacity (set at 14,000 visitors a day), an advertisement is not placed if it would cause the number of visitors on one (or more) of the first seven days after the placement to increase beyond that maximum capacity.

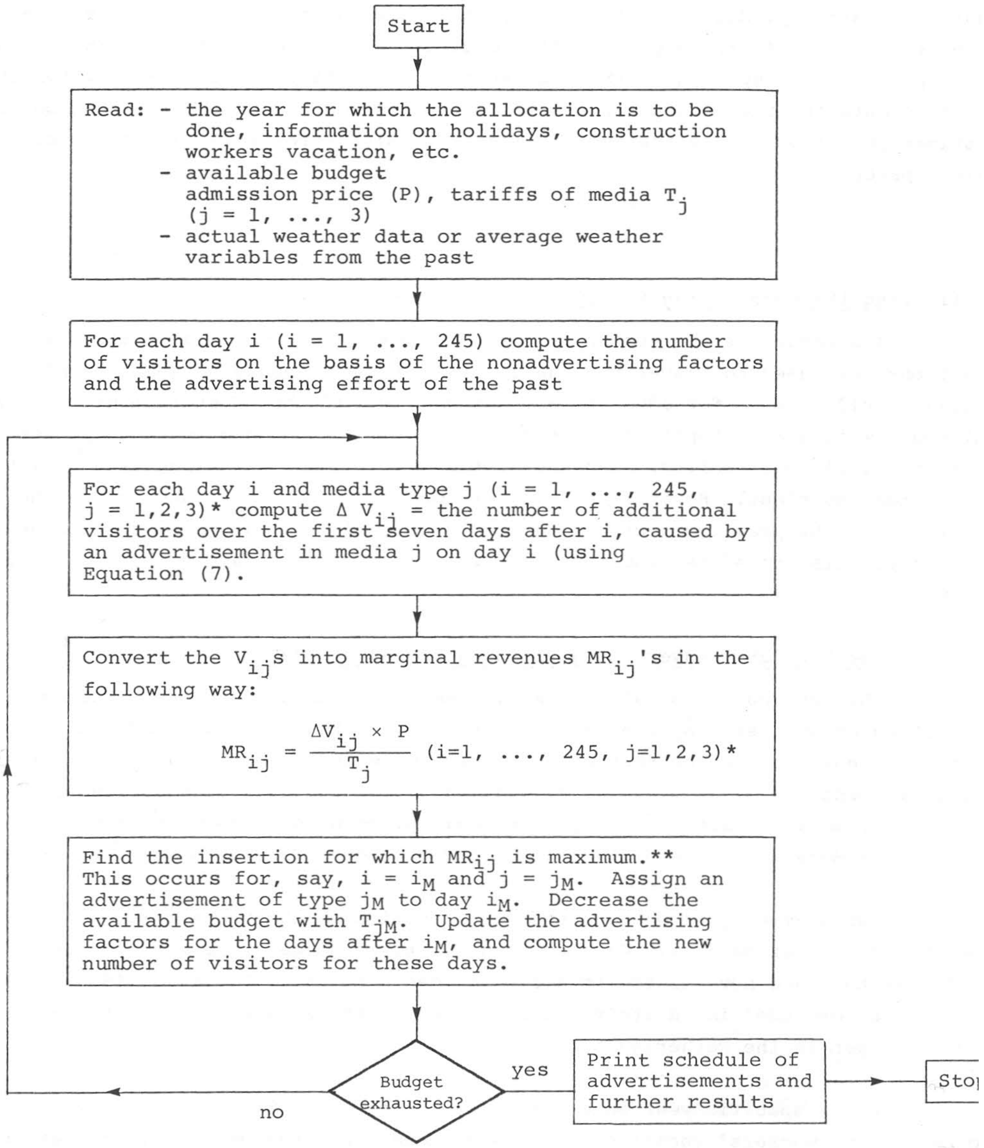

Figure 3

Flow Chart of Heuristic Advertising Planning Procedure (HAP)

*As far as applicable. For example, according to the model, no newspaper advertising is considered for the summer season (see Table 1).

**With the convention of no more than one advertisement of the same type on the same day.

There are several reasons why this heuristic procedure does not guarantee an advertisement schedule that is globally optimal. First, to determine the optimal placement at each step, for practical reasons only the additional visitors in the first week after the insertion are considered. But, of course, according to the model, an advertisement generally also has an effect after this first week. (After the placement of an advertisement this effect is taken into account, though.) Secondly, the incremental search procedures only looks forward and does not have the possibility of omitting an advertisement placed at an earlier stage, although at some point this might be profitable. Thirdly, no cost considerations are taken into account. Each additional visitor is assumed to increase profit by an amount equal to the admission price. However, on days with large numbers of visitors additional personnel has to be hired, so that the profit for such days is depressed. Such variable costs have not been taken into account. Nevertheless, as will be seen in the next section, the heuristic procedure does help us to find better advertising schedules and to answer the question of how much to spend on advertising.

Advertising Schedules Developed with HAP

In using the heuristic advertising planning procedure, we concentrate on the year 1977. For this year various optimal advertising schedules (for different conditions) were developed with HAP, and these schedules were compared with the actual schedule for 1977.

We took the year 1977, to be able to make such comparisons. However, the results for the allocation of the budget over media and over the various periods of the year can directly be generalized to other years. For a specific year only has to account for the exact dates of the spring holidays (Easter, etc.) and the period of the construction workers' vacation, which determines when the vacation peak falls. (In HAP this information can be given as input by the user, and, in this way, HAP can be used for every year desired.)

In 1977 total advertising expenditures were Dfl 320,000 -- distributed over the media as follows: 39 percent TV, 8 percent radio, and 53 percent daily newspaper advertising. The number of advertisements in the three media were: 25, 17, and 16, respectively. The tariffs per advertisement were: Dfl 5,000 for TV, Dfl 1,000 for radio, and Dfl 10,500 for newspapers (a combination of 15).

In all optimization cases to be reported in this subsection the budget was set at the current level: Dfl 320,000. In the next subsection the budget level will be varied.

First, we considered the situation where the budget was to be allocated over the media in the same way as was actually done in 1977, but where the days on which these advertisements appear could be chosen freely. Table 3 gives the resulting schedule of advertisements, as compared with the actual schedule (indicated by stars). The optimal schedule is considerably different from the actual one:

- no newspaper advertising during the summer months;
- no advertising in March, but -- different from the actual scheme -- advertising in September;
- in the spring a concentration of advertising around Easter, Ascension Day, and Whitsun, instead of a regular pattern of one advertisement a week;
- low level of advertising in June;

- a much less regular pattern of advertisements than the actual schedule with most advertisements on Saturdays.[5]

Both schedules have intensive advertising (especially by radio) in July and the first half of August. Here again, the advertising in the optimal schedule is much less regular than in the actual schedule. The fact that heavy concentration of advertisements on Saturdays is not advisable, is obvious for the vacation peak, because -- as Table 1 indicates -- in this peak people tend to come on weekdays rather than during the weekend.

Table 3

Optimal Schedule of Advertisements for 1977

	March (3)			April (4)			May (5)			June (6)			July (7)			August (8)			Sept (9)			Oct (10)		
Date	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN
1													1	*1			*1							
2				*									*1	*1	*						1			
3																	*				1			
4				1		1				*		*	1	*1										
5				1		1											*1							
6				1		1										*1	*1	*						
7				1		1	*							*										
8				1		1								*			1							
9				*1		*1							*	*	*		1							
10																	*							
11										*		*	1	1			*							
12	*													*1			*	*						
13													1	1		*	*1							
14							*																	
15														*										
16				*									*	*	*									
17							1														1			
18							1		*1	*		*		*										
19	*						1							1										
20							1		1				1	*1		*								
21							*1		1				1	1										
22														1										*
23				*									*	*1	*									
24																					1			
25										*	*1	*	1	*1										
26	*						1							1										
27							1		1		1			1		*								
28							*1		*1		*			*1										
29				*		*					*			1	*									
30						1				1	1		*1	*1										
31																								

Easter: April 10/11
Ascension Day: May 19
Whitsun: May 29/30
Vacation Peak: July 1-22
Autumn Vacation: October 17-23

Budget = Dfl 320,000
Allocation over media is fixed: 25 TV, 27 RA, 16 DN.
Number of visitors = 562,369
Stars represent the actual schedule of advertisements in 1977.

Table 6 gives a summary of the actual advertising schedule (case 1) and the schedule of Table 3 (case 2 in Table 6) on a month-by-month basis. Table 6 also shows that a better distribution of advertisements in time increases the number of visitors from 485,600[6] to

[5]Fortunately, in the years before 1977, this concentration of advertising on Saturday was much less heavy; otherwise, estimation problems would have arisen. In the regression, for which the results are reported in Table 1, the correlation coefficient between advertising variables and the Sunday variable is on average 0.18 with a maximum of 0.44. (An advertisement on Saturday produces a peak in the corresponding advertising variable on the next Sunday.)

[6]485,600 is the number of visitors predicted for 1977, for average weather conditions. The number 494,038 in Table 2 is the total number of visitors predicted for 1977, given the actual weather conditions in that year.

562,369, i.e., by about 80,000 visitors. With an average admission price of Dfl 4.75, this means Dfl 380,000 in additional revenues.

In the second situation considered, in addition to the placements of the advertisements in time, the allocation of the total budget over the media TV, radio, and newspapers is free. Table 4 gives the resulting schedule of advertising, and in Table 6 (case 3) this schedule is presented in summary form.

Table 4

Optimal Schedule of Advertisements for 1977

	March (3)			April (4)			May (5)			June (6)			July (7)			August (8)			Sept (9)			Oct (10)		
Date	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN
1														*1		1	*1		+					
2				*									*1	*1	*	+	1		1		+			
3																	*1		1		1			
4				+						*	+	*	1	*1			1							
5				1										1		1	*1							
6				1			+							1		*1	*1	*						
7				1			*1		+					*1										
8				1		+								*		1	1		+					
9				*1		*1							*	*1	*	1	1		1		+			
10																	*1		1		+			
11				+						*		*		1			*1							
12	*			+										*1			*1	*						
13														1		*1	*1							
14							*												+					
15														*					+					
16				*									*	*1	*				1	+				
17							1												1		1			
18							1		*1	*	1	*		*1										
19	*						1							1										
20							1		+					*1		*			+					
21							*1		+				1	1					+					
22													1	1					+					*
23				*									*1	*1	*				1		+			
24											1								1		1			
25										*	*1	*	1	*1										
26	*						1						1	1										
27							1		1	+	1		1	1		*								
28							*1		*1		*1		1	*1										
29				*		*					*1		1	1	*									
30				1							1		*1	*1										
31																								

Easter: April 10/11
Ascension Day: May 19
Whitsun: May 29/30
Vacation Peak: July 1-22
Autumn Vacation: October 17-23

Budget = Dfl 320,000; allocation over media is free
Number of visitors = 595,734
+ signs indicate additional insertions if the budget would be increased by 50 percent)
* represent the actual schedule of advertisements in 1977.

As can be seen, HAP only adopts seven newspaper advertisements, instead of 16, and the budget freed in this way is spent on more TV and radio advertising. The allocation over the media in the optimal schedule is: TV 63 percent, radio 13 percent, and newspapers 24 percent, as compared with 39 percent, 8 percent, and 53 percent, respectively in the actual scheme.

Most additional TV spots should be in September and August, the additional radio spots in August, July, and June, in that order of importance. In Table 4 September is allotted more advertisements than in Table 3, while in the actual schedule September did not get any advertisements at all. The further differences between the optimal scheme in Table 4 and the actual scheme are rather similar to the differences discussed in the context of Table 3 before. The predicted number of visitors for the advertising schedule of

Table 4 is 595,734. Apparently, the first step -- optimizing the timing of the current advertisement types over the year which generates 80,000 additional visitors -- has a greater impact than the second step -- optimizing the allocation over the media, which increases the number of visitors by a further 30,000.

Until now the recreation park never used radio advertising in the spring/autumn season. Because of the relatively high response coefficients for radio advertising found for the other seasons and because of its low price, radio advertising in spring and autumn might be worth considering. We do not have a radio response coefficient for that season. To get an impression of the effect of radio advertising in the spring/autumn season, we introduced a response coefficient based on the assumption that the ratio of the response coefficients for radio and TV is the same for the spring/autumn season as for the summer season. According to this, the value for the response coefficient for radio in the spring/autumn season was set at: 0.149/.345 * 0.913 = 0.394. The resulting schedule of advertisements is given in Table 5 and summarized in Table 6 (case 4). The major difference with the schedule in Table 4 is that some of the TV spots are substituted by radio spots, concentrated in May, September, and April (in this order of importance). According to the model, the radio option in spring/autumn increases the total number of visitors from 595,734 to 679,128.

Table 5

Optimal Schedule of Advertisements for 1977

	March (3)			April (4)			May (5)			June (6)			July (7)			August (8)			Sept (9)			Oct (10)		
Date	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN	TV	RA	DN
1					1									*1			*			1				
2				*	1								*	*1	*				1	1				
3																	*		1	1	1			
4				1	1			1		*		*	1	*1										
5				1	1			1						1			*							
6				1	1		1	1						1		*	*1	*		1				
7				1	1		*1	1						*1						1				
8				1	1	1								*			1			1				
9				*1	1	*1							*	*1	*				1	1				
10																	*		1	1	1			
11					1					*		*		1			*							
12	*				1									*1			*	*						
13					1			1						1		*	*1			1				
14							*	1												1				
15														*						1			1	
16				*				1					*	*1	*				1	1				
17							1	1											1	1	1			
18							1	1	*	*		*		*1										
19	*						1	1						1						1				
20							1	1	1					*1		*				1				
21							*1	1	1				1	1						1				
22														1					1	1				*
23				*				1					*1	*1	*				1	1				
24								1											1	1	1			
25								1		*	*	*	1	*1										
26	*						1	1						1										
27							1	1			1			1		*								
28							*1	1	*		*1			*										
29				*	1	*					*1			1	*									
30				1	1						1		*1	*1										
31																								

Easter: April 10/11
Ascension Day: May 19
Whitsun: May 29/30
Vacation Peak: July 1-22
Autumn Vacation: October 17-23

Budget = Dfl 320,000; allocation over media is free; radio advertising considered in spring/autumn season (value of response coefficient tentatively assessed).
Number of visitors: 679,128.
Stars represent the actual schedule of advertisements in 1977.

This increase is rather spectacular, but the tentative character of the radio coefficient should be taken into account. Nevertheless, it seems worthwhile to put a certain amount of the budget into radio advertising in spring and autumn.

Table 6

Distribution of Advertisements over the Media and over the Months in the Actual Schedule for 1977, as Compared with a Number of Schedules Obtained for Different Conditions with HAP

	March	April	May	June	July	Aug	Sept	Oct	Total
1. Actual Schedule									
TV	3	5	4	4	5	4	0	0	25
RA	0	0	0	3	16	8	0	0	27
DN	0	2	2	4	5	2	0	1	16
						(485,600)			
2. Optimal allocation -- actual budget, fixed allocation over media									
TV	0	6	8	1	9	1	0	0	25
RA	0	0	0	3	18	6	0	0	27
DN	0	7	5	0	0	0	4	0	16
						(562,369)			
3. Optimal allocation -- actual budget, allocation over media is free									
TV	0	6	9	0	11	6	8	0	40
RA	0	0	0	7	23	12	0	0	42
DN	0	1	3	0	0	0	3	0	7
						(595,734)			
4. Same situation as 3, but radio advertising allowed in spring/autumn season									
TV	0	7	10	0	5	0	9	0	31
RA	0	13	18	4	22	4	19	1	81
DN	0	2	2	0	0	0	4	0	8
						(679,128)			
5. Same situation as 3, additional advertisements if budget is increased by 50 percent									
TV	0	3	1	1	0	1	7	0	13
RA	0	0	0	1	0	0	0	0	1
DN	0	1	3	0	0	0	5	0	9
						(657,943)			

NOTE: Numbers in brackets are number of visitors.

Varying the Advertising Budget

The advertising schedules found in the last subsection are based on different allocations of the current advertising budget. Of course, HAP can also be used to study the effects of changes in the total advertising budget. Figure 4 depicts the total number of visitors and the marginal number of visitors for budget levels ranging from 0 to Dfl 800,000, as computed by HAP. Thus, for each budget level (in Figure 4 the budget increases with steps of Dfl 100,000) the allocation of the budget over media and in time is optimal in the sense of the HAP-procedure.

The first thing to be noted from Figure 4 is that without any advertising in 1977, the total number of visitors, as predicted by the model, is 329,611. Therefore, roughly one-third of the current number of visitors (485,600) would not have come if there had been no advertising.

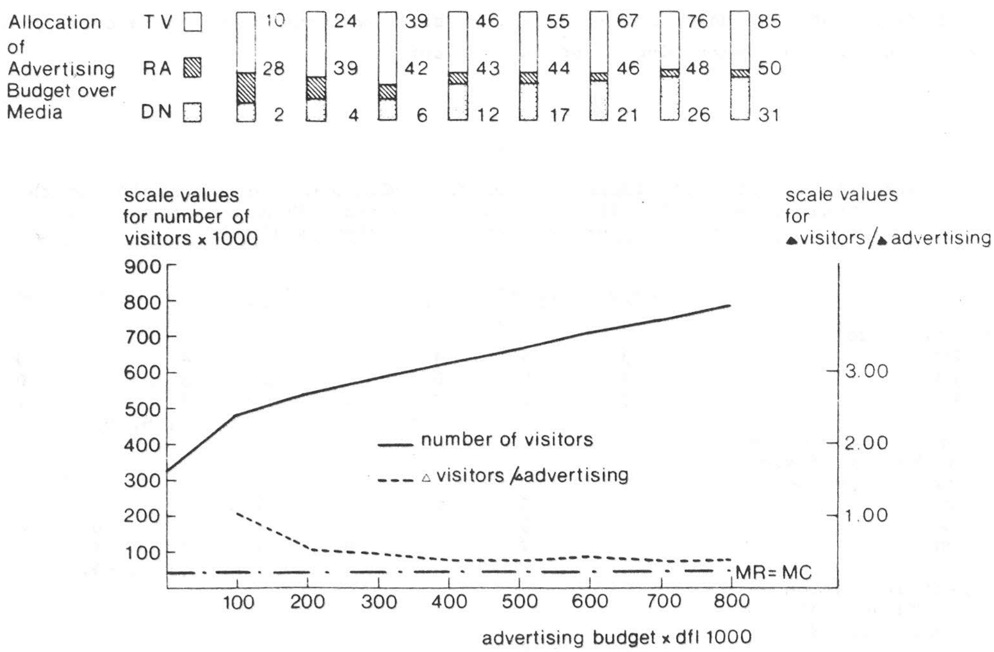

Figure 4

Number of Visitors, Marginal Number of Visitors, and Allocation over the Media for Different Levels of the Advertising Budget

Increasing the advertising budget first has a rather dramatic effect, but after Dfl 100,000, the response curve becomes less steep and then continues to the right in a slightly concave way. At one point this concave character is interrupted slightly. The marginal number of visitors (defined here as the additional number of visitors per additional Dfl 100,000 budget) first decreases quickly and then -- after a value of 0.41 has been reached for a budget of Dfl 300,000 -- continues to the right with a very small rate of decrease. In Figure 4 the level of the marginal number of visitors has been indicated that corresponds with the situation: MR = MC, i.e., where marginal revenues of advertising equal marginal costs. This level is simply computed as one divided by admission price per visitor: 1/4.75 = 0.21. Figure 4 shows that for the whole budget interval considered, the marginal number of visitors is well above this critical level. In fact, at the current level of advertising expenditure (around Dfl 300,000) the marginal number of visitors is about twice as high as this critical level, so that a budget increase would remain profitable even if the number of additional visitors were half the number predicted by the model. Therefore, some increase in the advertising budget seems advisable (of course, provided that the budget is optimally allocated over media and in time). With respect to the size of such an increase, it should be remarked that although, according to Figure 4, profit increases almost linearly with the advertising budget, the predictions in Figure 4 become less reliable as the budget level gets farther away from the average level in the estimation period (about Dfl 300,000).

However, an increase of Dfl 100,000 to Dfl 200,000 might be considered, In Table 4 it has been indicated which additional advertisements are to be placed if the budget were increased by 50 percent (i.e., by Dfl 160,000). In Table 4 these additional advertisements are indicated by plus signs. Most additional advertisements (see also Table 6, case 5) are allotted to the spring/autumn season, and for a relatively important part are newspaper advertisements. According to the model, such a budget increase would generate 62,000 additional visitors and increase the profit by about Dfl 135,000.

In the upper part of Figure 4 the allocation of the advertising budget over TV, radio, and newspaper is given for each of the budget levels: Dfl 100,000, Dfl 200,000, ..., Dfl 800,000. The numbers represent absolute numbers of advertisements; the rectangles show the proportional shares going to each of the three media. First, much radio advertising is adopted in the schedule; then TV advertising comes in, and when the budget is increased further, the less profitable newspaper advertising gets more attention.

When developing Figure 4, no radio advertising in spring/autumn was considered. Of course, introducing radio advertising in this season might considerably change the media mix in Figure 4.

Conclusions and Recommendations

The results obtained with the heuristic advertising planning procedure HAP, as reported in the previous subsections, lead to the following conclusions and recommendations.

1. The effect of advertising on the number of visitors has clearly been demonstrated. It can be estimated that without advertising the park would lose about one-third of its visitors.

2. According to the model there are considerable advantages in readjusting the allocation of the current advertising budget with respect to media and time. The best schedule of advertisements found with the model generates about 110,000 visitors more than the actual schedule. This best schedule is given in Table 4. The major adjustments, as indicated there, are the following.

    a. The share of the advertising budget for TV and radio should be increased; the share of daily newspapers should be decreased considerably.

    b. The remaining newspaper advertisements should be confined to spring and autumn.

    c. Advertising in March is not advisable; advertising in September should be increased, however.

    d. In the spring advertising should be more concentrated around Easter, Ascension Day, and Whitsun, instead of a regular pattern with one advertisement each Saturday.

    e. During the vacation peak, advertising should be directed toward the midweek days: Tuesday, Wednesday, and Thursday. For September a policy of increased advertising activity toward the weekends is recommended.

    Furthermore, the introduction of radio advertising in the spring/autumn season seems profitable.

3. At the current level of advertising expenditure, additional revenues of increasing the budget are, according to the model, about twice as high as the costs. So there is no question of overspending on advertising. On the contrary, an increase in the advertising budget should seriously be considered. Additional advertising effort should be directed toward the months of September, May, and April, in this order of priority.

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