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OUTDOOR RECREATION DEMAND MODELLING

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ABSTRACT:

The work described in this paper appears to be the first attempt to set up a fairly complete simulation model of outdoor recreational travel. At present this model is being used to formulate and evaluate management policies for the Geelong region. It seems likely that the methodology could have wide application; however a number of issues still await resolution - the formulation of a suitable list of socio-economic descriptors, the aggregation problem, the problem of reportage of vacational travel - are but a few. Never-the less recreational travel is a large and growing percentage of all travel and the provision of access and the presentation of environmental stability at sites requires informed decision-making - models such as this can assist.

A possible shortcoming of the Geelong model is that it does not offer any insights into how demand will be influenced by changes in site conditions, other than site access costs. The paper has presented a theoretical framework for including attitudinal data into the model structure which will improve the model's ability to cope with such changes. It is important to note that the inclusion of attitudinal data does not change the logic of the model structure; it merely adds more explanatory variables.

INTRODUCTION

One has only to drive down to a Melbourne bayside beach on a Sunday in mid summer to realise that recreation travel is a significant component of the total demand for road usage. Recreation travel is causing road congestion which in many instances is as high as that occurring during the weekday peak hours and the recreators themselves are often inflicting severe damage on environmentally sensitive recreation areas. Despite the importance of the problem very little research has been carried out to study the nature of recreation travel demand; most of the work undertaken to date in the field of travel demand modelling has concentrated on the factors which influence mode choice for weekday work trips or, more recently, shopping and social trips.

This paper summarises work undertaken for the Victorian Department of Youth Sport and Recreation and the Geelong Regional Commission to develop a model to help identify recreation sites with the *Geelong*[1] Region where excessive demand seemed likely to cause environmental damage. A related requirement was for the model to predict and evaluate the likely responses to demand management procedures - principally pricing and access costs - but also to long run changes in demographic structure. Moreover the effects of any policy had to be explored in full: the different responses of competing sites and of competing regions as well as the effect on participation in recreational activities were all to be dimensions of the model.

A possible shortcoming of the Geelong demand model described here is that it does not offer any insights into how demand will be influenced by changes in site conditions, other than changes in generalised cost of access to the site. That is, it fails to take account of those factors which relate to the "supply" of recreation facilities. For example, an area may be popular for bushwalking because of its natural state. "Improving" the area by developing toilets and picnic tables may mean that the demand for use of the area by bushwalkers will decrease but the overall use of the area will increase because more picnickers come into the area. Such changes in usage patterns cannot be predicted by the Geelong model which is concerned with future levels of demand given that the relative "attractiveness" of sites to undertake specific activities remains unchanged. This shortcoming is not as restrictive as one might imagine when the *strategic* nature of the policy formulation for which the model has been developed is made clear.

The paper concludes with a discussion of the way in which attitudinal data could be collected and used to improve the "behavioural" basis of the demand model.

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1 See Fig. 1

THE GEELONG RECREATION STUDY

Geelong (see Figs. 1 and 2) is a city of more than 110,000 people. Since the war, the city has seen the development of a significant heavy manufacturing industry. The city is situated at the neck of a wide peninsula separating Bass Strait and Port Phillip Bay. The southern shores of the peninsula alternate between rugged and picturesque cliffs and excellent surfing beaches; the northern and eastern shores offer protected swimming and boat launching. To the north of the city two small mountain ranges, the You Yans and the Brisbane Ranges, provide opportunities for walking and picnicking.

Apart from Geelong itself, demand for these facilities is greatly influenced by the large conurbation of Melbourne (population 2.6 million), situated only 74 kms to the north-east along a fast freeway. The only other significant influence is the small city of Ballarat (population 60,000), 50 kms to the north-west.

Broadly, the purpose of the study was to develop a model to help to identify sites where excessive demand seemed likely to cause environmental damage.

The model requirements suggested a disaggregate approach - that is, to synthesise for each site k a demand schedule

$$(1) \qquad T_k^s = T_k(COST^s, SES^s)$$

where T_k^s is the annual number of trips made to k by an individual s described by a vector $SES^{(s)}$, and paying a total cost $COST^s$. This method offered a number of advantages. Firstly it makes extremely parsimonious use of the data - each sampled recreationist provides one complete observation. Secondly, T_k can provide insights into individual motivations and behaviour. Against this the initial output of the models is not in suitable form for policy analysis. This problem is overcome by aggregating the models over all individuals in the market.

The data used in calibrating the Geelong models were collected from nearly 1800 individuals from 800 households in the urban areas of Melbourne, Geelong and Ballarat. Each respondent was required to recall all holidays and outdoor recreation activities undertaken over the previous 12 months.

An obvious question is how accurately can an individual recall all events undertaken over a 12 month period. To aid memory recall respondents were shown a map of the study area and instructed to mark each place they had visited. The maps tended to discipline the respondents' train of thought and helped keep both interviewer and interviewee interest alive over the period of the interview. There is some evidence to suggest that respondents tended to *overestimate* the number of times they went to particular sites *if these sites were visited infrequently*. There is an unconscious tendency for occasional visits to a site (e.g. a visit which may have been made 2 years earlier) to be brought forward to the past 12 months. It is difficult to see how such overestimation can be avoided short of asking respondents to keep annual recreation diaries, or interviewers spending more time probing each response to ensure more accurate recall. If this study were to be repeated, interviewers would be instructed to probe for accuracy *particularly when respondents claim to have been to a site only once in the past 12 months.*

It seems reasonable to assume that the extent of such response overestimation decreases as the number of times an individual reports to have visited a site increases. For example, if a respondent claims to visit the You Yangs every weekend, then one can safely assume that this is more or less the case.

Evidence from other surveys undertaken by the Victorian Ministry for Tourism indicates that people tend to *underestimate* the number of *holidays* undertaken when asked to recall over a 12 month period. (A more suitable period is reported to be about one month.) The extent of the underestimate has not been analysed.

Very little is known about how important these biases are in their effect on recreation demand analyses of the sort attempted in the Geelong Recreation Study. It may be that the overestimates associated with site visit recall are compensated by the underestimate of holiday participation. (In a later section it is reported that the study's estimate of number of visitors to the You Yangs indicates that the *data* produced overestimates of visitor rates (possibly by as much as 50%)).

A further problem associated with the sample related to lack of information on activities undertaken by only a small proportion of the population. Many such minority activities are important as they can seriously affect the environmental stability of an area. If, for example, only 20 of a sample of 2000 individuals reported to have undertaken *dune-buggy* activities, then very little rigorous work could be undertaken to "model" this behaviour. More information could be gathered by interviewing *only* dune buggy drivers *on site*. This additional information can be used for developing models provided the new observations are *weighted* by their market proportion.

The Model

Activities, Sites, Regions Before describing the model structure in detail, we shll first establish a vocabulary.

The following *activities* were identified as being of primary interest:

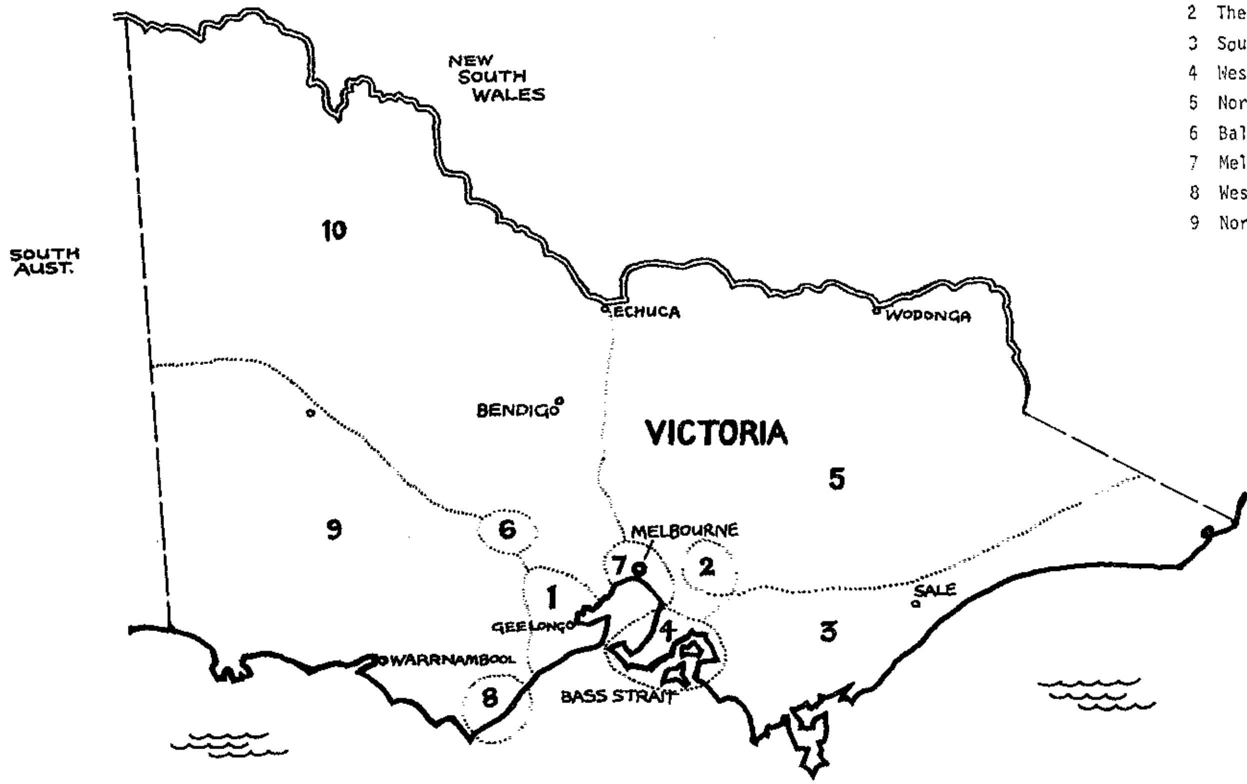
1. Visiting a beach
2. Surf swimming
3. Protected Beach Swimming
4. Surfboard riding
5. Fishing
6. Bushwalking
7. Picnicking
8. Auto touring.

The household survey collected information on 23 specific recreation *sites* within the Geelong region; 13 were chosen finally for modelling purposes (see Fig. 2):

1. Lorne
2. Anglesea
3. Bells Beach
4. Torquay
5. Breamlea
6. Barwon Heads
7. Point Lonsdale
8. Queenscliff
9. Indented Heads
10. Portarlington
11. Easter Beach
12. You Yangs
13. Brisbane Ranges.

Whereas these sites compete with each other for the patronage of recreationists, they also compete with sites not in the Geelong Region. Accordingly it was necessary to introduce formally the notion of a *region* into the structure, and to develop models of regional demand. The regions considered were (see Fig. 1):

1. The Geelong Region
2. The Dandenongs
3. South Gippsland
4. Western Port
5. North-East
6. Ballarat
7. Melbourne
8. Otways
9. Western Victoria
10. North-West



Description of Regions

1 The Geelong Region
2 The Dandenong Ranges
3 South Gippsland
4 Western Port
5 North East
6 Ballarat
7 Melbourne
8 Western Region
9 North West

FIG. 1: THE STUDY REGIONS

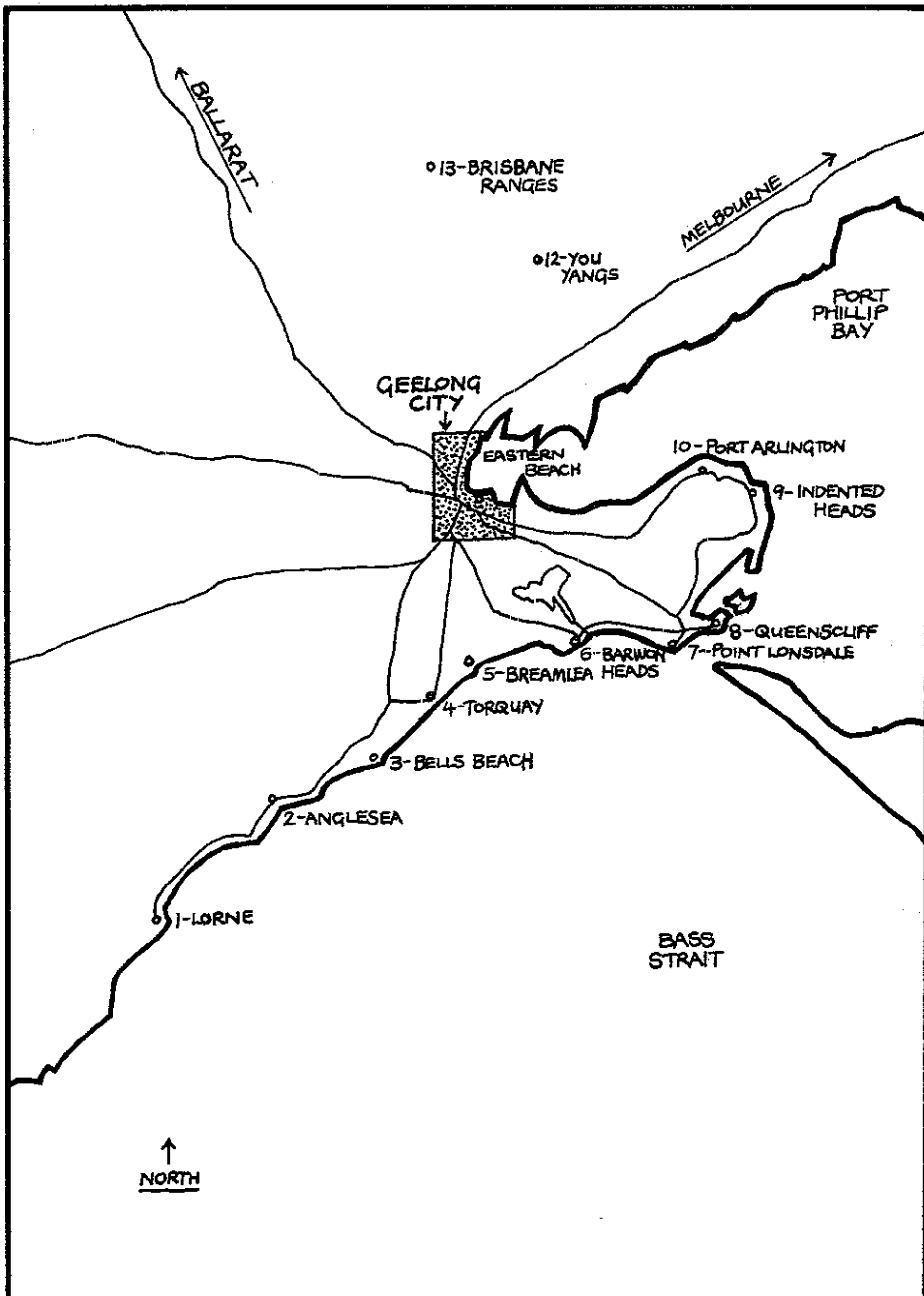


FIG. 2 - STUDY AREA: THE GEELONG REGION

The model aims at simulating outdoor recreational behaviour in a fairly complete way. Essentially the structure is a development from an outline by Gilbert (1974). We distinguish trips made from home (day trips) and trips made from a holiday location (holiday trips). Day trips are seen as arising from a sequence of four events:

(1) an individual chooses to participate in a given activity-i; write X(i) for the probability.

(2) the individual embarks on a certain number of activity i day trips annually; write N(i) for the expected number.

(3) the individual chooses a region g for his activity-i day trips; write $R_i(g)$ for the probability.

(4) the individual chooses a site k within g for his activity-i day trips; write $D_{ig}(k)$ for the probability.

If we assume that regional and site choice are independent of trip frequency then the expected number of activity-i trips made by a given individual to k in g is

(2) $$T_{ik} = X(i)N(i)R_i(g)D_{ig}(k)$$

This does not include trips made from holiday locations. However, examination of the data showed that an insignificant number of day trips was made from holiday locations to alternative sites. No doubt this says as much about the sample's ability to recall holiday behaviour as it does about the behaviour itself. In any case we were forced to assume that all holiday activities were undertaken at the holiday site; this assumption leads to

(3) $$T'_{ik} = X(i)N'(i)R'_i(g)D'_{ig}(k)$$

where for a given individual and each activity i

T'_{ik} is the expected number of holiday trips to site k,

X(i) is as before

$N'(i)$ is the expected number of trips while on holiday

$R'_i(g)$ is the probability of choice of region g in which to holiday

$D'_{ig}(k)$ is the probability of choice of holiday site k within g at which to stay.

Thus the given individual makes $T_{ik}+T'_{ik}$ annual trips to site k for activity i, and attention is focused on the seven separate sub-models that determine this quantity. Fig. 3 represents the inter-relationships between the sub-models.

Each of the seven sub-models has, as in dependent variables, the socio-economic characteristics of the individual recreationist. The specifications of the seven models are set out in Table 1. It will be observed that models are of two types, log-linear and logistic. The former takes the form

$$\text{(4)} \qquad \log N(i) = \sum_j \alpha_j s_i$$

where s_j is a vector of socio-economic descriptors of the individual and α_j is a vector of parameters: this relationship was estimated by regression.

The logistic function is of use in describing choice between a number of dissimilar alternatives by a number of dissimilar individuals. It is assumed that the probability that individual t chooses alternative s is given by

$$\text{(5)} \qquad p(s,t) = \exp U(t,s) / \sum_r \exp U(t,r)$$

where (t,s) is to be thought of as *utility* and is a linear function of the attributes of t and s:

$$\text{(6)} \qquad U(t,s) = \sum_j \beta_j t_j + \sum_m \alpha_m s_m$$

where t_j and s_m are vectors of attributes of t and s respectively, and β_j and α_m are vectors of parameters. These parameters are estimated by maximum likelihood techniques; hypothesis testing may be based on t-statistics associated with the estimates. Details may be pursued in Charles River Associates (1972), but for our purpose the principal insight into the structure is that the parameters may be thought of as marginal utilities.

The Participation Model, X(i) Table 2 summarises those factors found to have a signifigant effect on X(i), the probability that an individual will undertake activity i. The + or - indicates the direction of the effect, and the number in brackets is the t-statistic[1]. All signs are plausible and the relative magnitudes of the t-statistics appear about right.

The Day-Trip Frequency Model, N(i) Table 3 summarises those factors having a signifigant influence on

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1 In general our intention is to give only the flavour of the results; the t-value will be the limit of our statistical reportage.

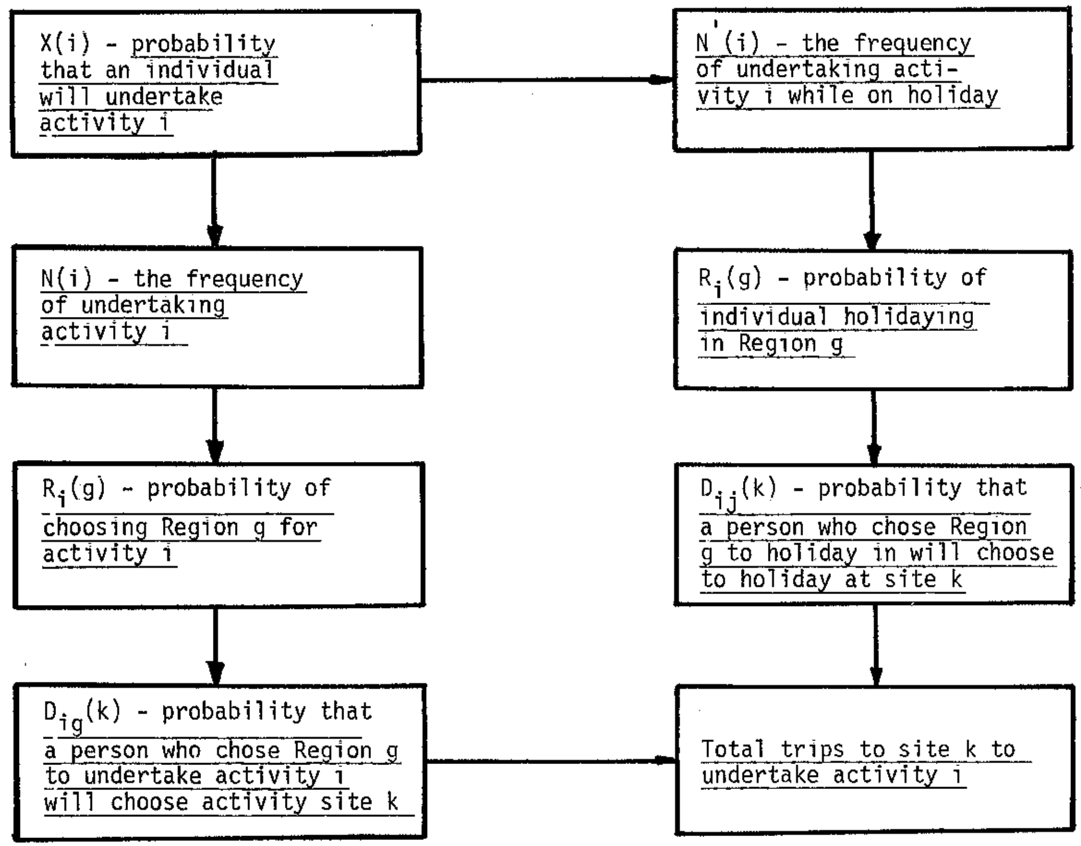

FIG. 3: MODES STRUCTURE

Table 1 - Sub-Models

MODEL	DESCRIPTION	INDEPENDENT VARIABLES	FUNCTIONAL FORM
1. $X(i)$	probability that a given individual participates in activity i	socio-economic descriptors of the individual	logistic function
2. $N(i)$	expected number of activity i trips made by a given participant	socio-economic descriptors of the individual	log-linear
3. $R_i(g)$	probability that an activity i trip is directed to region g	socio-economic descriptors of the individual, regional characteristics of g	logistic function
4. $D_{ig}(k)$	probability that in activity i trip to region g is directed to site k	socio-economic descriptors of the individual, site characteristics of k	logistic function
5. $N'(i)$	as for $N(i)$, for activities while on holidays	$N(i)$	log-linear
6. $R'_i(g)$	probability of individual holidaying in Region g	(See $R_i(g)$)	logistic function
7. $D'_{ig}(k)$	probability that holiday trip in Region g is directed to site k	(See $D_{ig}(k)$)	logistic function

	Region g	(See $R_i(g)$)	logistic function
7. $D'_{ig}(k)$	probability that holiday trip in Region g is directed to site k	(See $D_{ig}(k)$)	logistic function

Table 2 - The effect which each socio-economic factor has on the probability of undertaking each activity

VARIABLES	ACTIVITIES							
	Visiting Beach	Surf Swimming	Protected Beach Swimming	Surf Board Riding	Fishing	Bushwalking	Picnicking	Auto Touring
1. If MALE:	- (-1.92)	+ (1.10)		+ (4.20)	+ (5.81)		- (-1.02)	
2. If completed secondary Education	+ (2.31)	+ (2.73)	+ (1.30)			+ (2.00)	+ (1.25)	
3. If employed in Passive Employment	+ (2.30)	+ (2.72)	+ (2.00)				+ (2.07)	
4. Distance to nearest Facility:	(-1.09)	- (-1.24)		- (-5.03)		- (-2.10)	- (-1.04)	
5. If aged 13-20		+ (4.88)		+ (7.94)				
6. If aged 21-34		+ (4.12)	+ (1.30)	+ (6.14)		- (-1.95)	+ (1.55)	
7. If aged 35-60			- (-1.09)			- (-2.79)		
8. If aged > 60 years	(-1.81)						- (-1.61)	- (-3.59)
9. Adjusted Income					+ (2.76)	+ (2.07)		
10. Born in Australia	- (-2.08)	- (-1.02)	- (-1.94)	+ (2.17)				
11. No. of Children		+ (2.58)	+ (2.92)		+ (2.71)	+ (2.68)	+ (1.94)	+ (1.32)
12. No. of Babies				- (-1.91)				
13. No Access to Car	- (-1.25)	- (-2.37)		- (1.78)	- (-2.68)	- (-2.35)	- (-1.60)	- (-3.05)
14. If Unemployed		+ (1.60)		+ (1.33)				

Blank cells indicate that the particular characteristic did not have a statistically significant effect (t< 1.0) on the individual's probability of undertaking the activity in question, *or* that the variable was not tested for certain reasons.

+ = variable has a positive influence on probability of participating in activity

- = variable has a negative " " " " " " " the frequency with which an individual undertakes a particular activity, *given that he participates*. The last rider - that we are dealing with only the committed - accounts for the occasional result that seems to run counter to intuition. For example, it will be observed that the presence of young babies appears to have a *positive* effect on surfboard riding. The point is, of course, that if a parent is sufficiently motivated to participate *at all*, he will presumably participate quite strongly.

The frequency analysis was undertaken also for holiday trips - that is, trips undertaken from holiday locations. The results are similar and are not presented.

The Regional Choice Model, $R_i(g)$ The schema outlined in a later section requires nine regional choice models, one for each activity. For economy these activities were merged into three:

(a) Surf beach activities (Surf Swimming, Surfboard Riding)

(b) Other beach Activities (Visiting Beach, Protected Beach Swimming, Fishing, Power Boating)

(c) Non-Beach activities (Bushwalking, Picnicking, Touring).

(a) Surf beach activities. The models and the t-statistics associated with the estimation of the Surf Beach Activities model are summarised in Table 4. The utility (or choice stimulus) of each of the six alternatives is a linear sum of generalised cost of travel to each choice Region[1], income, and the two dummy variables (and also a constant term). The relative magnitudes of the t-statistics indicate that the principal explanator is the measure of separation, Generalised Cost. On the other hand, income and job type have small but measurable influences on choice.

1 "Generalised cost" is a concept borrowed from transport planning; it is a linear combination of the vehicle operating cost of travel and a cost derived from the time taken to make the trip.

Table 3 - The effect which each socio-economic factor has on the *frequency* with which each activity is undertaken (Day Trips)

	ACTIVITIES							
	Visiting Beach	Surf Swimming	Protected Beach Swimming	Surf Board Riding	Fishing	Bushwalking	Picnicking	Auto Touring
1. If MALE:				+ (1.05)				
2. If completed secondary education		- (-1.35)			+ (1.06)			- (-1.62)
3. If employed in passive employment		+ (1.41)						
4. Distance to nearest facility	- (-2.83)	- (-5.50)	- (-1.69)	- (-3.17)			- (3.4)	
5. If aged 13-20								
6. If aged 21-34		- (1.08)	+ (1.12)		- (-4.00)			
7. If aged 35-60								
8. If aged 60 > years							- (1.27)	+ (1.50)
9. Adjusted income		-	-					
10. If born in Australia		- (-3.12)	- (-3.14)		-		+	
11. No. of children			- (-1.36)		- (-1.43)	- (-2.92)	+ (1.96)	
12. No. of Babies			- (-1.09)	+ (2.36)				+ (1.55)
13. If no Access to car	+ (1.54)	+ (1.10)			- (-2.20)		+ (1.90)	- (-2.51)
14. If Unemployed	+ (1.29)				- (-1.14)		- (-1.39)	+ (2.19)

See Table 1 for notes on blank cells.

Note that these findings relate only to individuals who have undertaken the activity *at least once* in the past 12 months.

Table 4 - Surf Beach Activities Region Choice Model
(t-Statistic associated with each explanator)

Region	Geelong Region	South Gipps-land	Western Port Region	Mel-bourne	Otway Region	Western Victoria
General-ised Cost	-32.1	-32.1	-32.1	-32.1	-32.1	-32.1
If age > 35	0.52	-0.51	-1.09	-1.59	-0.24	
Income	2.36	2.14	3.36	1.13	1.28	
If blue collar worker	-2.94	0.65	-2.19	-3.42	-2.70	

The remaining two models (for activity groups b and c) were simpler in structure: the only significant variable appeared to be Generalised Cost.

Table 5 compares the mean General Cost elasticities[1] for the models and the major choice regions. Observe the complexity of the response. First, the elasticities vary *across activities:* typically surfers are not much influenced by cost changes, ordinary beach-goers rather more; non-beach recreational activities, however, tend to be quite price elastic. Second, the response varies across regions. This complexity is, we must confess, re-assuring - it part-vindicates our labyrinthine approach.

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1. Price elasticity of demand concerns the relationship between price and demand. It is the ratio between the proportional increase in demand caused by a small price decrease and the proportional decrease.

Table 5 - Regional Choice Elasticities

Region	Geelong Region	South Gippsland	Western Port	Melbourne	Otway	Western Region
(a) Surf Beach Activities	0.1	1.4	0.6	-	0.5	1.2
(b) Other Beach Activities	0.3	1.2	0.6	0.4	1.0	1.9
(c) Non-Beach Activities	0.8	2.7	1.3	0.8	0.2	2.8

The Site Choice Model, $D_{ig}(k)$

As suggested in §2.2, a *site* choice model was developed for each of the nine activities. All the models had essentially the same structure as the *regional* choice models. All included generalised cost of travel to the site as an explanator and this was invariably the most powerful variable. Other variables were

- an attractiveness variable (related to length of beach or area of park)
- age (a dummy on 20-35 age group)
- occupation (a dummy on blue collar workers)

In general these variables were highly significant.

The price elasticities across activities are of general interest. As before, they depend on the choice - in this case the site. Table 6 sets out the median elasticity.

Table 6 - Site Choice Elasticities

Visiting Beach	Surf Swimming	Beach Swimming	Surfboard Riding	Fishing	Bush Walking	Picnicking	Auto Tours
0.38	0.73	1.20	0.05	0.58	3.17	0.74	0.34

Again, there is a striking non-uniformity in response to price changes. The figures provide an interesting insight into site choice behaviour. It appears, for example, that any change in generalised cost of travel to a site (by imposing tolls, parking charges or allowing roads to depreciate, for example) will have least effect on the number of surfboard riders (e=0.05): differences in cost of travel are presumably regarded as less important than finding good surf. On the other hand picnickers (e=+0.74) and bush walkers (e=+3.17) seem to be more sensitive to generalised cost of travel, close sites are more readily accepted.

Holiday Site and Region Choice Models The two holiday models, $R_i'(g)$ and $D_{ig}'(k)$ in Table 1, are quite similar to their trip analogies and we shall not discuss them at any length.

The explanatory variables were:-

- generalised cost
- income
- age
- feasibility of undertaking activities at site.

The last variable needs comment. Whereas separate holiday models were *not* calibrated for each activity type; it is clear that participation in given activities conditions choice of holiday sites wherein those activities are possible. This influence was reflected by an indicator of joint *participation of individuals in a particular activity* and the *possibility of undertaking the activity at the site*. In fact, this variable was quite successful.

Aggregating the Sub Models

The models described in §2 are rich in insights into recreational behaviour, nevertheless they do not provide the information required by site managers: *numbers of visitors in parks and on beaches*. To obtain this information, the individual demands need to be summed across the entire market.

This can be a complex problem; our solution was to adopt the zonal classification used by the Australian Census, and to assume that the demand generated by each such zone may be represented by the disaggregate demand functions evaluated at the zonal means. In other words, referring to equation (1) in §1, the demand for site k generated by the inhabitants of zone j is

$$C_{jk} = T_k(COST_{jk}, SES_j)P_j$$

where $COST_{jk}$ is the cost of travel from zone j to site k

SES_j is a vector of zonal means of socio-economic descriptiors of j

P_j is the population of zone j

and T_k represents the composite demand function described in §2.

To obtain aggregate annual demand C_k at a site k it is now a matter of summing over all zones j:

$$C_k = \sum_j C_{ij}$$

This procedure entails admitted biases (see for example McFadden (1975); however the simplifications involved were simply too inviting to pass up.

The efficiency of this structure depends, of course, on its ability to predict change, and the elasticities which are built into or may be derived from the models are probably as effective a policy datum as predictions of *levels* of demand.

There are very few opportunities available to compare model estimates with site counts. The most reliable on-site surveys have been undertaken at the You Yangs Forest Park where the total *number* of annual visitors has been estimated with the aid of a road traffic counter, and the *origin* of visitors estimated by on-site surveys. A comparison of these results with the model estimates is presented in the following table:

Table 7

Comparison of *On-Site* and *modelled* usage Information for You Yangs

		On-Site Information	Model Estimate
(i)	Annual Visitors	220,000	332,000
(ii)	Origin of Trips:		
	Suburbs East of Melbourne	23.1%	17.1%
	Suburbs West of Melbourne	28.1%	32.8%
	Corio)		12.8%)
	Rest of Geelong)	51.2%	19.0%) 49%
	Elsewhere)	(N = 555)	17.1%)

It should be emphasised that the models have been developed as a tool for predicting future changes in patterns of participation so that planners and park managers will be able to predict where and when the major points of pressure are likely to occur. In this respect the absolute magnitude of visitors at any site may not be critical as it is a knowledge of future changes that is of most use to the planner. *If an area is presently under threat of environmental degradation because of over-use, then it is the relative change from the present position that one is interested in more than the present visitor rate.* If the present visitor rate to the You Yangs is considered to be close to the maximum that the park can accommodate without endangering wild life and vegetation in the area, and environmental scientists predict that an increase greater than, say, 5% in the annual visitor rate will cause irreparable harm to the area, *then Forest Commission manager will be keen to be advised on means of controlling visits to the area rather than with information on the absolute visits.* That is, for planning policy work, relative *changes* from the status quo are usually more relevant to management decisions than absolute levels of demand.

The relative accuracy with which the origin split has been estimated reflects the sensitivity of the Region and Site choice models and indicates that location choice will be responsive to changes in population settlement patterns and site access "costs".

That is, whilst the Geelong models may overestimate actual trip production rates (perhaps by up to 50%) the models appear to be sensitive for use in predicting future *relative* changes of site usage.

Policy Formulation

The model developed for the Geelong Recreation Study has offered site and regional planners/managers with insights into future levels of demand. An example of the type of output produced is illustrated in following Tables. Table 8 represents a breakdown by activity of visit to each site as estimated for the year 1986. These estimates are based on a particular population growth pattern for this year; the population in each zone of aggregation, the age/sex distribution of this population, the level of unemployment, level of adjusted income, etc. The figures in Table 8 represent demand based on what was regarded as the "most likely" population distribution for 1986.

Table 9 represents total visitor growth rates for each site between the years 1976 and 1986. These estimates are also available broken down by visitors' place of residence, and by whether the visitor was making a day trip or the trip whilst on holidays.

The second stage of the Geelong Recreation Study has involved the formulation of a recreation site development strategy for the Geelong Region. The remainder of this section gives a broad outline of how the model has been used to assist in developing such a strategy.

Table 8 - Annual Frequency of Visits to Sites by Activity ('00's) - Results of Model - Predicted for Jan-Dec 1986

Site	Visiting Beach	Surf Swimming	Protected Beach Swimming	Surfboard Riding	Fishing	Bush Walking	Picnicking	Sight Seeing Driving	Total
Lorne/Fiarhaven	2938	2239	1466	447	853	1035	1690	3285	13954
Aireys Inlet	1404	111	273	80	312	316	402	498	3996
Anglesea/Road Knight	2174	3378	1450	354	857	1123	1914	2580	13831
Bells Beach/Pt Addis	1694	250	-	734	228	-	-	33	2935
Torquay/Jan Juc	1905	6196	2137	705	655	1047	1552	2446	16543
Breamlea/13th Beach	508	501	-	921	-	-	-	19	1948
Barwon Heads/Ocean Grove	2816	3604	2109	43	1141	1624	2503	3723	17953
Pt Lonsdale	437	554	370	99	670	199	329	1212	3871
Queenscliff	972	-	1061	-	458	491	894	1580	5456
St Leonards/Indented Hds	1813	-	938	-	989	718	1265	1758	7480
Portarlington	2936	-	1598	-	1050	877	1587	2335	10377
Eastern Beach Area	3244	-	1589	-	1170	-	87	213	6306
You Yangs	-	-	-	-	-	1950	1736	503	4198
Brisbane Ranges	-	-	-	-	-	1607	811	641	2547
Total (00)	22842	17580	12922	3770	8387	10483	14765	20830	

Table 9 - Total Number of Visitors to Site (000)

Site	1976	1986	
		Total	% Increase over 1976
Lorne	1098	1395	27.1
Aireys Inlet	305	400	31.1
Anglesea	1077	1383	28.4
Bells Beach	235	293	24.6
Torquay	1414	1654	16.9
Breamlea	171	194	13.5
Barwon Heads/O.Gv.	1454	1795	23.5
Pt Lonsdale	308	387	25.6
Queenscliff	442	546	23.5
St Leonards	584	748	28.1
Portarlington	824	1038	25.9
Eastern Beach	533	630	18.2
You Yangs	331	420	26.8
Brisbane Ranges	207	255	23.2

The predicted increase in visits to a site is available by activity (Table 8), by place of origin and by day/holiday breakdown. The managers of a site are then faced with the following proposition for each activity undertaken at the site:

> "In the next 10 years it is expected that the number of visits to this site to undertake activity X will increase by x per cent".

Management options open to the managers include:

(a) If the site is capable of taking the extra x% without straining existing resources then the management authority might decide to "do nothing" by keeping expenditure on the site at its present level to maintain the site in its present condition.

(b) If the x% increase is going to cause a deterioration of the existing environment beyond the level which present maintenance expenditure can hold then the management authority must decide on a preferred development policy. Such a policy might include:

(i) maintain expenditure at present level and knowingly allow the environment to deteriorate

(ii) Implement increased expenditure programs so that the site can withstand the pressure of increased visitor levels (at beach sites, for example, such policy might vary from fencing off sand dunes which might be threatened by site visitors, to completely re-structuring the site by building retaining walls, resurfacing car parks, etc.) The scale of programs will depend on the availability of resources and expectations about the type of future environment for the area.

(iii) Restrict visitors to the area so that the level of usage of the site does not exceed a pre-determined "critical" level.

A number of management policies are available should the planning authority decide that the existing environment should be preserved by restricting the number of visitors to a site, or *region* as a whole. In each case the demand model will be able to provide some guidance on the effectiveness of each policy.

For example, suppose an authority decides to restrict the number of people at a particular site by relocating the car park further away from the site-thereby increasing the "generalised cost" of travel to the site. By rerunning the whole model it would be possible to assess the redistribution of trips to sites within the Region. Prior to any model running however, an examination of the elasticities in Table 6 would give the analyst a reasonably reliable feel for the likely effect of each policy. If, for example, a site is under threat of environmental deterioration due to an increase in the number of picnickers (e=0.74), a policy which increases the generalised cost of travel to the site will have a far more significant effect on the visitor level than if the policy was aimed at deterring fishermen (e=0.58) or, more particularly, surfboard riders (e=0.05).

On a regional scale the model is ideally suited for assessing the effects of major freeway links on recreation travel patterns within Victoria; the opening of the Westgate Bridge which will link the Eastern suburbs of Melbourne and the main Geelong Road with a high speed road link will increase the number of people travelling to the Geelong Region. Table 5 indicates that this will be true particularly for "surfbeach activities" (e=0.1) and "other beach activities" (e=0.3), with *relatively* fewer people using the bridge to travel to the Geelong Region to undertake non-beach outdoor recreation activities (e=0.8).

DEVELOPING A MORE BEHAVIOURAL BASIS FOR THE MODEL(1)

Because disaggregate models of the sort developed in the Geelong Recreation study are calibrated on the observed patterns of recreation choice of *individuals*, they are commonly referred to as being *"behavioural"*. To the extent that individual recreation choice has been modelled against socio-economic and site characteristics it is possible to say that the study has produced models of recreation *"behaviour"* which are suitable for use in policy analysis. However, the models are *not "behavioural"* if by that term we mean that individual attitudes and perceptions of choice attributes underlie the modelling process.

It is important to note that the Geelong Recreation Study approach relates reported individual behaviour to individual characteristics *directly*, without reference to any underlying psychological motivations. Individuals have attitudes to each component of the "recreation experience", *and it is these attitudes that ultimately determine individual behaviour*.

The past 2 years have seen a growing body of theory *and practice* in the field of transport planning which demonstrates that attitudinal data can be successfully used to improve the reliability of transport planning models. For example, Recker and Golob (1976) have used attitudinal ratings of descriptive attributes of travel modes in an attempt to improve the "traditional" modal choice modelling techniques. Such attributes included features such as "comfort", reliability of service", "safety", "opportunity to read" etc.

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1 Part of the theory presented in this section was developed in a study of recreation demand modelling undertaken for the Australian Bureau of Transport Economics. The attitudinal questions are after those used in a survey undertaken for the Victorian Ministry for Conservation and the Country Roads Board in a study of outdoor recreation on the Mornington Peninsula. The opinions expressed in this section are those of the authors and not necessarily those of these authorities.

We wish now to address the problem of how attitudinal data could be included in any future recreation demand study. It is suggested that future surveys should collect two types of information:

(a) Data suitable for reproducing the "conventional" analysis of the Geelong Recreation Study; viz, individual socio-economic and recreation travel information.

(b) Attitudinal data which will be of use in providing a description of the motivations which link individual socio-economic characteristics and reported recreation behaviour. Conventional analyses such as the Geelong Recreation Study bridge these intermediate cognitive steps with the one structure (the single regression or logit analysis), and in so doing provide no insight into the underlying decision making *process* of the individual.

A Theoretical Framework

The theoretical basis proposed here[1] is Anderson's Information Integration theory as proselytised, in particular, by Louviere (1977). This approach will place any future analysis within a rigorous theory of perception and cognition and one wherein great emphasis is placed on developing true specifications of the underlying psychological laws. By this means it is hoped that the behavioural content of any data analysis will be enlarged both with the inclusion of new socio-economic variable and a more sensitive analysis of the old.

Attitudes to Activities The way in which attitudinal data could be included in the analysis of recreation travel demand is illustrated in Fig. 4.

In Boxes 1 and 2 we are searching for a *statistical* relationship between individual socio-economic characteristics and attitudes to particular

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1 The keen student is referred to a series of Technical Reports by Anderson (1976), *Center for Human Information Processing*, University of California, La Jalla.

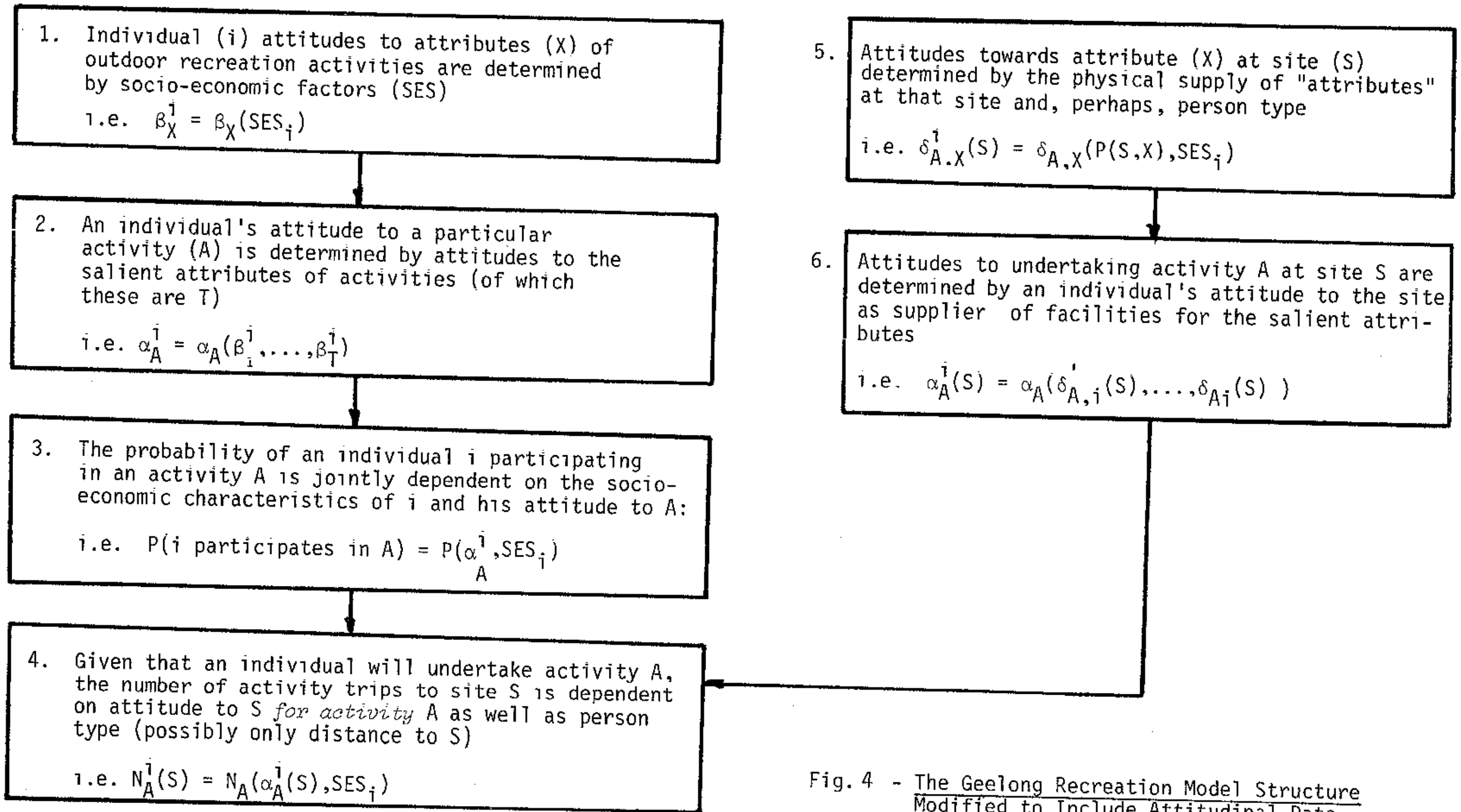

Fig. 4 - The Geelong Recreation Model Structure Modified to Include Attitudinal Data

activities. To clarify the discussion we need to define two terms:

(i) An ACTIVITY is an outdoor recreation pastime, such as surf-board riding, picnicking, trailbike riding, etc.

(ii) An ATTRIBUTE of an activity represents an inherent quality of an outdoor recreation experience. For example, an outdoor recreation pursuit can be classified according to the attributes of (a) *activeness* or *passivity*, (b) being an activity undertaken *with friends* or whilst *alone*, (c) being *dangerous* or otherwise, etc.

It is hypothesised that an individual's attitude to an activity is nothing more than his combined attitudes to the attributes which he perceives as being salient to the activity. That is, if an individual perceives surfboard riding as being (i) very active (ii) involving a lot of time with friends (iii) involving a certain amount of danger and, (iv) a healthy pastime, then those 4 attributes represent his *salient* set. *It is the individual's attitude to these 4 salient attributes that determine his attitude to surfboard riding.*

The information required as a basis to analysing these attitudes could be gained by asking a set of questions similar to the following:

(a) <u>Attitudes to Attributes</u>

A. We are interested to know what you <u>personally</u> like or dislike about recreation activities. The following list of characteristics describes certain aspects of recreation participation. What is your attitude to these characteristics? Try <u>not</u> to relate your answers to any particular activity which you presently undertake.

	DISLIKE					DON'T CARE	LIKE				
Activities which are STRENUOUS	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities undertaken OUTDOORS	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities requiring some SKILL/CHALLENGE	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities undertaken in LARGE GROUPS	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities which are COMPETITIVE	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities which are NOT STRENUOUS	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities which are PHYSICALLY DANGEROUS	-5	-4	-3	-2	-1	0	1	2	3	4	5
Activities which do not require a great amount of SKILL	-5	-4	-3	-2	-1	0	1	2	3	4	5

and so on

Note that is is possible to "like" equally both STRENUOUS and NON STRENUOUS activities. (For example, one could "like" both playing tennis and going to the theatre.) It is for this reason that "opposite" attributes may appear in the salient attribute set.

A complete list of possible attributes could be determined in a pilot survey. Brown (1977) has discussed the ways in which such preliminary survey work can be undertaken.

The information gained for this question will provide the basis for developing insight into the analysis described in Box 1 of Fig. 4. In fact this question measures β_{X}^{i}.

(b) Attitude to Particular Activities The following type of question would be asked about activities which are to be modelled:

B What is your attitude to taking part in the following activities yourself? Answer this question for each activity whether or not you have ever done this activity.

	DISLIKE					DON'T CARE	LIKE				
SURF SWIMMING	-5	-4	-3	-2	-1	0	1	2	3	4	5
SWIMMING AT A BAY BEACH	-5	-4	-3	-2	-1	0	1	2	3	4	5
JUST VISITING A BEACH	-5	-4	-3	-2	-1	0	1	2	3	4	5
SURF BOARD RIDING	-5	-4	-3	-2	-1	0	1	2	3	4	5

and so on, for all activities.

This information will enable the choice processes illustrated in Box 2 of Fig. 4 to be explored. That is, combined with the information from Question A, the data can be analysed to provide an insight into individual attitudes to a particular activity as related to his attitudes to the activity's salient attributes. In fact, this question directly measures α^i_A.

Attitudes to Activity Sites We turn now to Boxes 5 and 6 in Fig. 4 and discuss the type of data required to interpret individual attitudes to sites. In Box 5 we are interested in individual attitudes to a site for undertaking *particular activities*. That is, *for each activity* the following type of question is asked *of respondents who have undertaken the activity at least once in the past 12 months*.

C. How would you rate the following as places for surfboard riding?

	BAD					AVERAGE					GOOD
PORISEA BACK BEACH	-5	-4	-3	-2	-1	0	1	2	3	4	5
SORRENTO BACK BEACH	-5	-4	-3	-2	-1	0	1	2	3	4	5
RYE BACK BEACH	-5	-4	-3	-2	-1	0	1	2	3	4	5
GUNNAMAIIA	-5	-4	-3	-2	-1	0	1	2	3	4	5
PI LEO	-5	-4	-3	-2	-1	0	1	2	3	4	5

and so on

This question measures $a_n^i(s)$

Examination of Box 6 indicates that information regarding individual attitudes to particular activity attributes at each site would be required to provide complete information on site attitudes. This data could be collected in the following way:

D "How do you rank the following characteristics of PORTSEA as a place to undertake SURF SWIMMING?"

(This question is updated for each *site* and each *activity* undertaken).

	most unreliable surf						always good surf
1. RELIABILITY	1	2	3	4	5	6	7
	always filthy						always clean
2. CLEAN BEACH	1	2	3	4	5	6	7
etc				etc			

This question measures $\delta^i_{A,X}(S)$

It is interesting to note that attitudinal questions of the type A, B, and C have been asked successfully in a recent survey undertaken for the Victorian Ministry for Conservation and the Country Roads Board; details of this survey will be reported in due course. Interviewers have reported that at least half an hour is required to administer the three questions. Based on this experience it is estimated that to administer Question D for 13 sites and 8 activities would take well over 10 hours per respondent! It is for this reason that question type D cannot be asked in practice, although the relationship expressed in Box 4 can be estimated (by simple linear regression) directly from the data collected from Question C, without having to derive $\delta^{i}_{A,X}(S)$. Such a short cut will inevitably reduce the amount of "behavioural" insight which the models will possess.

The Attitudinal Data in the Context of the Total Analysis

In the foregoing discussion we have examined a theoretical basis for attitudinal analysis and described the type of questions which would have to be asked to obtain a suitable data base for such an analysis. From an analysis of the attitudinal data we will have an understanding of two phenomena.

(i) Expected levels of individual attitudes to activities with respect to the socio-economic characteristics of the individual- α^{i}_{A}. An attitude to a single activity (A) will be expressed as a combination of attitudes to the salient attributes of that activity.

(ii) An individual's attitude to a particular site (S) for undertaking activity A $-\alpha^{i}_{A}(S)$. These attitudes could be related to the physical attributes of the site.

It is important to appreciate that the *main body* of any future survey would still be concerned with collecting socio-economic and recreation participation data of the sort collected and analysed in the Geelong Recreation study. Indeed, Boxes 3 and 4 in Fig. 4 are nothing more than the *Geelong Recreation Model with* α^{i}_{A} and $\alpha^{i}_{A}(S)$ as new sets of variables.

CONCLUSION

The work described in this paper appears to be the first attempt to set up a fairly complete simulation model of outdoor recreational behaviour. At present this model is being used to formulate and evaluate management policies for the Geelong region. It seems likely that the methodology could have wide application; however a number of issues still await resolution - the formulation of a suitable list of socio-economic descriptors, the aggregation problem, the problem of reportage of vacational travel - are but a few. Nevertheless recreational travel is a large and growing percentage of all travel and the provision of access and the presentation of environmental stability at sites requires informed decision-making - models such as this can assist.

A possible shortcoming of the Geelong model is that it does not offer any insights into how demand will be influenced by changes in site conditions, other than site access costs. The paper has presented a theoretical framework for including attitudinal data into the model structure which will improve the model's ability to cope with such changes. It has been demonstrated that the inclusion of attitudinal data does not *change* the modelling logic (See Fig. 3); it merely adds more explanatory variables.

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