UC Berkeley
IURD Reprint Series

Title
Trade-off surveys in planning: theory and application

Permalink
https://escholarship.org/uc/item/1009r0rh

Authors
Dowall, D.E.
Juhasz, J.B.

Publication Date
1978-02-01

Peer reviewed

eScholarship.org Powered by the California Digital Library
University of California

D. E. DOWALL

J. B. JUHASZ



Trade-off surveys in planning: theory and application

Institute of Urban & Regional Development
University of California, Berkeley

Reprint No. 152

Reprinted from: Environment and Planning A 10,
(February 1978): 125-136.

The Institute of Urban and Regional Development serves the faculty and students of the Berkeley Campus conducting research into a wide array of policy-relevant questions. Its foci of inquiry are the processes of urban and regional growth and decline, the consequences that alternative styles of governance have for patterns of development, and the scientific bases for development policy and for policy planning.

Toward these ends, current research is directed to the economics of urbanization in the West and in the Third World; techniques of environmental management; effects of using new energy sources; emergent patterns of suburbanization and central area reconstruction; evaluation of alternative modes of transportation; design of effective means for supplying social services; contemporary issues in housing policy; regulation of urban growth and uses of land; determinants of urban livability and the factors shaping urban life; and potential improvements in methods of analysis, evaluation, and planning.

The Institute's members are drawn from departments throughout the Berkeley Campus, and their research findings are published in their respective professional journals and in commercially distributed books. The Institute prints and distributes many of their research papers; a catalog of publications is available on request.

Environment and Planning A, 1978, volume 10, pages 125-136

Trade-off surveys in planning: theory and application†

D E Dowall
Department of City and Regional Planning, University of California, Berkeley, California 94720, USA
J B Juhasz
College of Environmental Design, University of Colorado, Boulder, Colorado 80309, USA
Received 11 May 1977, in revised form 13 December 1977

Abstract. We report on two innovations in survey methodology for land-use planning: the use of trade-off choices and the application of cluster analysis to the data.

Cluster analysis is used to reduce the attitudinal items to significant dimensions. Cluster-score patterns can then provide empirical typologies of residents according to meaningful data-based distinctions. These subgroups of citizens can be found in homogeneous or heterogeneous subregions with differing consequences for the regional plan.

We report on an initial application of this methodology to the mountain area of Jefferson County, Colorado. A questionnaire utilizing the trade-off approach was administered to 316 citizens. The analysis of the citizens' responses yielded eight clusters, four general and four local in orientation. On the basis of the patterns of cluster scores, thirteen subgroups were identified, which were then arranged on a continuum of convenience-versus-environment orientation. The subgroups were found to occupy heterogeneous and homogeneous subregions of the mountain area. We discuss possible implications of these findings for a comprehensive plan, and argue that the findings, although of tentative substance, provide a confirmation of the methodology.

1 Introduction

A recent review article by Robinson et al (1975) summarizes existing work on the use of trade-off questionnaires in planning. They justify the use of trade-off methods on three grounds: (1) the increased validity of having respondents react to constrained, realistic choices; (2) the ability of trade-offs to generate results that are based upon informed judgment; and (3) the ability to sample preferences from a myriad of alternative futures, rather than to identify preferences about existing states. An added argument is that trade-offs educate subjects about the exhaustability of resources and goods. Although there is widespread agreement on these desirable attributes of trade-offs, there is no clearly defined methodology for their use, nor are there examples of applications useful to planning. In this paper we shall briefly describe how the method of trade-offs can be used by planners to assess citizen preferences, and we shall illustrate this description by reporting on the present status of an ongoing study utilizing trade-offs for the development of a comprehensive land-use plan for Jefferson County, Colorado, USA.

2 The concept of trade-offs

The basis of sampling trade-off preferences is that one can isolate quantifiable, independent, desirable dimensions of wants or needs, and that it is possible to identify some 'rate of exchange' between them. It is further expected that a sampling of such dimensions is enlightening about individual and group preferences.

The choice or trade-off between any two dimensions is dependent upon the cost and utility (satisfaction) associated with various quantities of each dimension. The ratio of the costs of the dimensions, together with a given level of income,

† This is a revised version of a paper presented at the American Institute of Planners meetings in San Antonio, Texas, 1975. Much of the work on this paper was done while one of the authors (DED) was an assistant professor at York University, Toronto, Ontario, Canada.

determines a budget function. The process of trade-off to attain an optimal 'mix' of the dimensions is known as utility maximization[1]—for a given budget, what combination of dimensions will yield the greatest level of satisfaction? Figure 1 illustrates three budgets ($25000, $50000, and $75000) and five levels of utility (note that they are ordinal values). Each level of utility is a locus of points representing equal levels of satisfaction (called indifference curves). Points of tangency between budget functions and indifference curves yield maximum levels of satisfaction for a given budget. They therefore represent the rational choice of an individual.

In theory, determining budget functions is straightforward. In practice, matters of public policy such as lack of pollution or aesthetics, although 'priced' in some sense, are extremely difficult to cost. Also such dimensions as privacy and lot size are neither truly independent nor dependent, but interactive. Combined pricing between the two dimensions is either impossible or extremely difficult, even in theory.

Each trade-off choice a subject makes between any two dimensions implies a point of tangency between the budget function and 'their' indifference curve. A family of indifference curves can be mapped by varying the exchange rates and the budgets. This is in fact what Samuelson did in developing "revealed preference" (Samuelson, 1948).

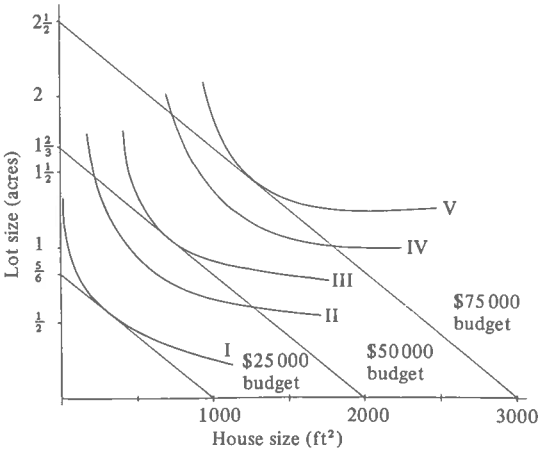


Figure 1. A diagrammatic example of an individual's utility map for lot size and house size.

3 The construction and analysis of trade-off surveys

Traditional uses of trade-offs (Wilson, 1962; Hoinville and Berthoud, 1970; Robinson, 1972; Robinson et al, 1975) have made subjects operate in multidimensional spaces by the use of various gaming devices. Psychological research from the classic work of Miller (1956) and of Osgood et al (1957) to the present (Pollio, 1974) indicates that such tasks are beyond the information-processing capabilities of most persons, and that multidimensional scaling techniques are needed (Torgeson, 1963; Green and Rao, 1972). The fact that recent applications of trade-off gaming have not taken the information-processing capacities of people into account is no doubt responsible for the high degree of unreliability of existing trade-off methods. Beyond a certain point subjects probably begin to respond randomly, or do not truly reach an indifference point, or both. This same fact leads us to believe that respondents use some underlying structure of constructs from which to generate a set of trade-off choices. Such an underlying set of dimensions is liable to be at most seven-dimensional, and is more likely about three- to five-dimensional. The aim of trade-offs is to create a format and

[1] The reader who is unacquainted with the microeconomics of consumer behavior should consult Henderson and Quandt (1958), pages 6–41.

a means of data analysis that will give us a reading of the underlying decision structure and of the rules of transformation from basic structure to visible behavior choices.

In practice multidimensional rating and costing is extremely difficult. In trade-offs, as in economics (Henderson and Quandt, 1958), the most useful approach is to cost and require responses two-dimensionally. The matrix of usual responses on trade-off surveys then becomes the individual choice behavior of each subject on each of the $X!/2!(X-2)!$ pairs of dimensions, with the entire budget or set of budgets of a population serving as the budget function. Because ordering is not relevant and because all trade-offs imply a minimum of two dimensions, the dimensions of choice behavior are not the 'X' or 'X^2' number of dimensions included in the survey but the $X!/2!(X-2)!$ binary choices that the subjects must make in weighing their responses. Thus the dimensions on the surface structure of behavior and choice are the possible paired combinations of those dimensions.

In the Jefferson County project we are concerned with ten initially priced dimensions which affect the physical environment of the study area. As a consequence the surface structure of our responses becomes $10!/2!(10-2)!$ or 45 variables on which the subjects can be sorted. Clearly if this data is to be fruitfully applied to planning contexts, some form of data reduction is prerequisite. Although we cannot go into a discussion of data-reduction methodologies here, our criteria was to utilize a method that will create a sensible understructure of fundamental variables, be the least ad hoc, and come closest to the underlying cognitive structures presumably being used by the subjects. The primary methods for data reduction that suggest themselves are factor analysis, cluster analysis, and discriminant analysis. Of the techniques evaluated, the Tryon method of cluster analysis (Tryon and Bailey, 1973) appears to be the most robust and the most useful because it allows various clusterings of objects as well as variables.

Once a set of underlying variables has been established and the loadings of the various initial variables on those factor scores have been indicated, subjects can be typed according to the patterns of responses across cluster scores. Unlike the derivation of cluster scores, subject typing does not assume that there will be a very small number of underlying subjects nor does it assume that different patterns of responses at different magnitudes are equated with each other. This procedure will identify types of clients for the planner according to the relative importance they place on patterns of underlying choice among the dimensions selected by the planner.

The most obvious use of subject types in planning is to plot the distribution of subject types on a map, and to identify geographic communities of interest and geographic barriers of conflict between subject types in the planning area. For example if an underlying dimension were of an environment-versus-convenience orientation, decisions regarding population densities, road improvements, water and sewage treatment requirements, etc could be made on the basis of the geographic distribution and mix of subject types derived from trade-offs constructed and analyzed in the manner outlined above.

4 An application of trade-off methods to Jefferson County, Colorado

This case study reports on the application of a trade-off approach to attitude assessment for the development of a comprehensive land-use plan for the mountain area of Jefferson County, Colorado. This area is experiencing extreme development pressures due to its location on the most desirable fringe of the rapidly growing Denver metropolitan area. County planners, in responding to the citizens' concern over rapid land conversion and development, sought to discover the reasons citizens prefer mountain living, and to systematically build this information into the planning process. After several attempts at questionnaire design, the decision to utilize trade-

off methods emerged. It was felt that by stressing the use of trade-off choices rather than by having people express agreements about desirable or undesirable courses of action, citizens would be educated to the realities of resource allocation, and would yield unbiased and meaningful information.

In order to elicit frank and thoughtful responses, the questionnaire began with a statement saying that it was similar to a secret ballot, thus guaranteeing total anonymity, and the results of an analysis of the completed questionnaires would have a significant influence on land-use policy decision. To insure that the results were representative a random sample of residences was generated from property tax records (for both owner-occupied and rented property). The questionnaire was designed to force respondents to make realistic choices *between* desirable dimensions of living associated with land use. These dimensions were selected in order to maximize their policy-relatedness to land-use planning, and so that the entire set of trade-offs exhausted the total possibilities of personal expenditure—public (tax-related) and private. After extensive discussions with land planners, citizens, and public officials, ten dimensions were developed. Table 1 presents the predetermined dimensions: column one names the dimension, column two gives a full definition and indicates the units of measurement, column three explains the rationale, and column four briefly outlines the method of costing.

Each of the ten dimensions was paired with each of the other nine in turn, yielding 45 unique trade-off questions. Because the initial funding for the project was limited to \$10000, the analysts were not in the position to empirically determine the trade-off frontiers as discussed in the theoretical section above. The frontiers were estimated for each of the questions on the basis of median family income for the area and on the basis of informed judgment. Despite this limitation, we feel that the frontiers are reasonable from both an economic as well as a psychological perspective. Figure 2 is an example of one of the trade-off questions. These 45 questions made up the first section of the survey questionnaire.

Each respondent was asked to indicate the position on a constrained choice line which he/she would choose as the most acceptable or desirable. By having the interviewees choose between all 45 possible pairings of the ten dimensions, a ten-dimensional space can be constructed which corresponds to the subjects' relative choices on each of the ten dimensions vis-à-vis the other nine. The BCTRY system of cluster analysis (Tryon and Bailey, 1973) can (if the assumptions are satisfied) reduce these ten dimensions to those which 'actually' describe the attitudes of the respondents.

The second section of the questionnaire related to the relative ranking of the ten dimensions in a future time perspective, and evaluated the motivations for and the drawbacks to mountain living. Since one cannot price the dimensions in the future because of unknown technological or other developments, the questions relating to the future asked the subjects to rank the dimensions. The motivational questions had a check-off-list format.

The third section was demographic. In this part, questions relating to age, sex, life-cycle stage, income, tenure, housing, and socioeconomic status were asked. Finally each filled-out questionnaire was coded according to the fire district in which it was administered; this provided a geographic location without comprising anonymity.

The questionnaire took approximately one hour to administer. It was readily understandable by all respondents when administered by a specially trained interviewer. Given the length of the questionnaire, the need for specially trained interviewers, and the expected cost of generating a random sample of citizens, we determined that our budget could support a maximum of 350 persons.

In order to generate an unbiased and representative sample of inhabitants we proceeded from land records in a step-by-step fashion to obtain a list of 350

residential structures. Next we instructed one interviewer to contact the occupants of these structures for interviews. By sampling from residential structures we feel that we avoided the biases associated with the use of telephone directories and utility-billing lists. Thus we believe we obtained as close to a random sample of inhabitants as is practically possible. In fact a comparison of the demographic variables with census data indicated that the socioeconomic structure for our

Table 1. Description of trade-off dimensions.

Dimension	Definition and units of measurement	Rationale	Costing approach
Travel to work	travel time to work in minutes, one way	assesses the importance which individuals place upon time taken in commuting to work	cost on the basis of auto operating costs, and opportunity costs based upon income
Other travel	travel time in minutes one way, for activities other than work	reflects attitudes towards the location, scale, and diversity of nonwork facilities	same as for travel to work
Size of house	floor area in square feet	reflects preference towards private residential space	cost in terms of current building costs per square foot
Distance to nearest neighbor	number of yards between the respondent's house and that of the nearest neighbor	reflects attitudes towards density and zoning policies	cost on the basis of the average lot size necessary to maintain distance
Number of visible man-made structures	number of man-made structures visible from the respondent's living-room window	assesses attitudes towards privacy, naturalness, and land use	cost based upon the cost of the lot, and of the landscaping necessary to achieve privacy
Recreation	dollars spent on recreation per month, per family unit	assesses private expenditure on and preferences for recreation	cost in terms of dollar expenditure
Personal expenditure	dollars spent per month, per family unit	assesses private expenditure and indirectly taps attitudes towards public goods	cost in terms of dollar expenditure
General public services	number of dollars in tax per year, per family unit, spent on general public services	assesses attitudes and preferences towards public services	cost based upon the number of dollars per year people would be willing to pay to obtain public services
Open space	number of dollars in tax per year, per family unit, spent on open-space programs	assesses attitudes towards public open space	cost based upon the number of dollars per year that people would be willing to pay for open-space programs
Pollution	number of dollars per year, per family unit, spent on avoiding pollution	taps attitudes towards natural environment; places subjective value on the lack of pollution	cost based upon the number of dollars per year that people would be willing to pay to live in a pollution-free environment

respondents closely approximated the census. From the 350 residential structures, we obtained 316 interviews before running out of time and money.

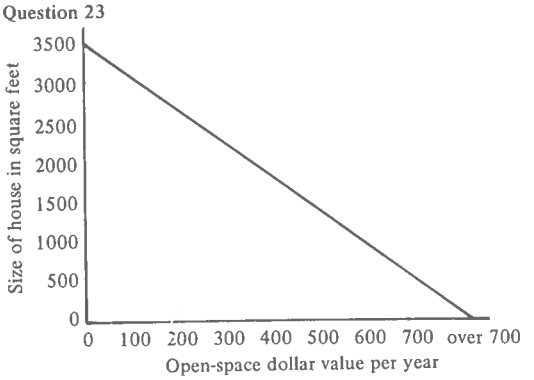


Figure 2. An example of one of the trade-off questions.

5 Results of the survey

Each of the 45 trade-off questions was scored on a 0–9 basis, with 0 meaning maximum choice for the first dimension and 9 meaning a maximum choice for the second dimension. Table 2 presents the means and standard deviations for the 45 trade-off questions. The forced rankings of the ten dimensions in the future were scored 0–9, with 0 referring to the highest priority and 9 the lowest. These results are presented in table 3.

We analyzed responses to the questions with regard to motivations for moving to the mountain area. Noteworthy was the relatively low importance placed on job opportunity and close access to work, and the relatively high values attached to privacy, environmental quality, and wildlife and/or natural scenery. Possible drawbacks to mountain living were few, focusing on fuel costs, rising population, and increasing urban development.

5.1 *Cluster analysis*

The next phase of the analysis was an attempt to reduce the number of attitudinal items to the 'true variables' of which they may be considered overlapping exemplars. In accordance with the recommended procedure of Tryon and Bailey (1973), an empirical cluster analysis was followed by two preset cluster analyses until we were satisfied that a best possible solution was achieved.

Cluster 1: environment or travel convenience. Cluster 1 is composed of the trade-off responses to questions 8, 9, 16, 17, 23, and 24 (see table 2 for variable names). A high score means that the respondent is willing to travel a great distance to work and to shop in order to have little pollution and lots of open space. To a lesser extent it was found that these same respondents are willing to have smaller houses in order to obtain little pollution and lots of open space. On the other hand a low score implies that the respondent is not willing to travel greater distances in order to have little pollution and lots of open space. The same respondents were found to score low for size of house versus pollution and open space. This cluster accounts for 26% of the variation in the scores for the 90 variables analyzed.

Cluster 2: public services or environment. Cluster 2 is composed of the following trade-off variables: 15, 28, 33, 39, and 43. A high score means that the respondent is willing to trade open space, little or no pollution, recreation, and privacy in order to obtain a high level of general public services; and to a lesser degree the same respondents were also willing to travel longer for nonwork purposes in order to

obtain general public services. On the other hand a low score indicates that the respondent is not willing to trade privacy, recreation, open space, little or no pollution, and, to a lesser degree, nonwork travel for more or better general public services. Together clusters 1 and 2 account for 39% of the variation in the scores.

Cluster 3: importance of personal expenditure. Cluster 3 is composed of the following trade-off variables: 5, 14, 21, 27, 32, 36, 38, and 42. A high score indicates

Table 2. Means and standard deviations for the 45 trade-off questions. The questions and their numbers correspond exactly to the variables and their numbers in the table.

Number of variable	Name of variable		Mean	Standard deviation
1	Travel to work versus	size of house	4·15	2·12
2		distance to nearest neighbor	5·15	2·85
3		number of visible man-made structures	5·82	2·79
4		recreation	2·84	2·32
5		personal expenditure	3·70	2·57
6		other travel[a]	4·87	2·50
7		general public services	3·34	2·61
8		open space	2·11	2·30
9		pollution	2·55	2·49
10	Other travel versus	size of house	4·08	2·24
11		distance to nearest neighbor	4·51	2·83
12		number of visible man-made structures	5·71	2·71
13		recreation	2·88	2·18
14		personal expenditure	3·08	2·49
15		general public services	3·34	2·45
16		open space	2·09	2·24
17		pollution	2·55	2·47
18	Size of house versus	distance to nearest neighbor	4·48	2·54
19		number of visible man-made structures	5·12	2·49
20		recreation	2·71	1·97
21		personal expenditure	3·43	1·97
22		general public services	3·06	1·92
23		open space	1·99	1·86
24		pollution	2·56	2·19
25	Distance to nearest neighbor versus	number of visible man-made structures	5·04	2·62
26		recreation	2·85	2·05
27		personal expenditure	3·69	2·34
28		general public services	3·25	2·39
29		open space	2·01	2·05
30		pollution	2·52	2·24
31	Recreation versus	number of visible man-made structures	6·06	2·47
32		personal expenditure	4·75	2·11
33		general public services	4·19	2·40
34	Personal expenditure versus number of visible man-made structures		5·53	2·49
35	General public services versus	number of visible man-made structures	5·90	2·41
36		personal expenditure	4·77	2·15
37	Open space versus	number of visible man-made structures	6·83	2·21
38		personal expenditure	5·50	2·26
39		general public services	4·78	2·45
40		recreation	4·86	2·46
41	Pollution versus	number of visible man-made structures	6·33	2·39
42		personal expenditure	5·29	2·27
43		general public services	4·44	2·40
44		recreation	4·54	2·39
45		open space	3·62	2·22

[a] Note that "other travel" is out of order here compared with tables 1 and 3.

that the respondent is willing to trade all of the items mentioned for clusters 1 and 2, with the exception of house size, for higher personal expenditure. To a lesser degree, however, these same respondents were found to score high for the size of house versus personal expenditure. A low score indicates that the subjects are not willing to trade the same items for more personal expenditure. The first three clusters account for 49% of the variance.

Cluster 4: privacy or convenience. Cluster 4 is made up of the following variables: 2, 3, 11, 12, 18, and 19. A high score indicates that the respondent is willing to trade travel to work, other travel, and size of house in order to obtain privacy (which in this case is a combination of distance to nearest neighbor and the number of visible man-made structures). On the other hand a low score indicates that the respondent is not willing to trade travel to work, other travel, and size of house in order to obtain privacy. The first four clusters account for 61% of the variance.

Cluster 5: drawbacks to mountain living. Cluster 5 consists of variables from those questions that evaluated motivations for and drawbacks to mountain living; some drawbacks are the level of taxes, road maintenance (snow removal), the need for a vehicle with four-wheel drive, the lack of public services, the rising cost of fuel, heating, and gasoline, and building costs. A high score indicates that these factors are very detrimental to living in the mountains. Conversely a low score indicates that the factors are not a drawback to living in the mountains. Clusters 1 to 5 together account for 73% of the variance.

Cluster 6: reasons for moving to the mountains. Cluster 6 is comprised of motivational variables that attempt to tap residential-location decisions. Some reasons for moving to the mountains are privacy, an environment unspoiled by pollution, solitude, wildlife and/or natural scenery, and sparse population. A high score indicates that the above were crucial factors in deciding to move to the mountains. Conversely a low score means that the above factors were not important in deciding to move to the mountains. The first six clusters account for 77% of the variance.

Cluster 7: job opportunity and access. Cluster 7 is made up of variables that assess the relative importance of job-opportunities and work-access dimensions in an individual's decision to live in the mountain area. A high score means that job opportunity and close access to work were important in the decision to move to the mountains. A low score would imply the converse. Clusters 1 to 7 together account for 79% of the variance.

Table 3. Means and standard deviations of forced rankings. Here the numbers of the variables are different from the numbers of the questions, which are given in parentheses after the name of the variable.

Number of variable	Name of variable	Mean	Standard deviation
46	Travel to work (46)	4·64	2·97
47	Other travel (47)	6·31	2·47
48	Size of house (48)	4·87	2·65
49	Distance to nearest neighbor (49)	4·01	2·73
50	Number of visible man-made structures (55)	4·81	2·76
51	Recreation (52)	5·72	2·47
52	Personal expenditure (54)	4·17	2·69
53	General public services (53)	4·38	2·57
54	Open space (51)	3·42	2·88
55	Pollution (50)	2·77	2·81

Cluster 8: future concern for pollution and open space. Cluster 8 is composed of the rankings of two trade-off dimensions: pollution and open space. A high score indicates that relative to the other eight dimensions, pollution and open space are not considered to be important in the future (the 1980s). Conversely a low score would indicate that pollution and open space are considered to be relatively important factors in the future. All eight clusters account for 80% of the variance.

5.2 *Communities of interest*

After identifying the eight clusters of attitudinal variables, we 'clustered' those subjects who had relatively similar patterns of response on these composite variables. The rationale and approach here is the same as in the variable clustering. The clustering of subjects is referred to as OTYPING and is described by Tryon and Bailey (1973). We identified thirteen OTYPES or 'communities of interest' which exist within the mountain area. We hypothesize that, to the extent that these communities of interest are dominated by the first four clusters, they will have wide generality in America. The standardized (mean = 50, standard deviation = 10) mean cluster scores of the thirteen OTYPES over the eight clusters are presented in table 4. Descriptions of the thirteen communities of interest follow.

Community of interest 1: hedonists. This community has high scores on cluster 3 (personal expenditure), cluster 2 (public expenditure over environment), cluster 6 (enjoys the mountains), and cluster 8 (future concern for pollution and open space). It constitutes 11·65% of the sample.

Community of interest 2: environmentalist commuters. This community scores very high on cluster 1. These people are willing to trade travel convenience for lack of pollution and open space. It comprises 9·82% of the sample.

Community of interest 3: pragmatists. This community is characterized by low scores on clusters 4 and 5 and high scores on cluster 3. These people are concerned with drawbacks to mountain living, with having high personal expenditure, and with convenience rather than privacy. Like community 2 there is a sense of convenience, and like community 1 'selfishness'—in this context giving an impression of pragmatism. It comprises 9·5% of the sample.

Community of interest 4: future-environment worriers. This community scores high on cluster 8, indicating future importance attributed to lack of pollution and open space. It comprises 8·73% of the sample.

Table 4. Cluster patterns of the thirteen communities of interest.

Community of interest	Cluster							
	1	2	3	4	5	6	7	8
1	48·64	57·72	58·89	54·06	48·82	57·10	53·93	44·60
2	70·69	54·75	53·82	53·94	45·81	51·08	45·18	44·29
3	45·99	52·43	59·10	43·72	59·27	45·81	47·25	52·51
4	44·96	54·18	50·92	42·37	46·62	44·83	54·14	66·49
5	48·38	39·38	37·51	47·20	49·93	49·20	51·21	42·88
6	52·95	44·12	43·75	63·32	48·96	56·75	48·68	42·25
7	50·19	51·94	50·36	50·31	57·77	57·86	47·28	62·88
8	47·42	54·31	45·25	46·97	46·24	47·16	68·46	45·74
9	51·21	51·86	47·13	44·03	50·90	54·94	40·58	41·55
10	46·91	48·17	47·41	44·08	39·85	54·76	42·45	54·14
11	45·03	40·74	43·27	57·79	43·62	38·15	50·45	53·16
12	44·33	54·43	53·18	39·85	29·29	32·66	41·71	49·09
13	44·43	31·80	66·27	63·74	45·54	55·14	43·84	45·77

Community of interest 5: individualist environmentalists. This community is characterized by low scores on personal expenditures (cluster 3) and on public services or environment (cluster 2). These people are generally uninterested in private spending and are not willing to barter environment for public services. It comprises 8·36% of the sample.

Community of interest 6: seekers of privacy and a better environment. This community scores high on cluster 4 (privacy in favor of convenience) and cluster 6 (environment as reason for moving), and low on cluster 3 (personal expenditure) and cluster 2 (will not trade environment for public services). Like community 5 it comprises 8·36% of the sample.

Community of interest 7: future-environment nonworriers. This is the opposite of community 4, having low scores on cluster 8. It also constitutes 8·36% of the sample.

Community of interest 8: job hunters. This community has high scores on cluster 7. These people want job opportunities and access to work. It comprises 7·27% of the sample.

Community of interest 9: convenience seekers and latent environmentalists. This community placed more emphasis on present convenience than on other factors, but they also expressed concern over future environmental quality. This group also constitutes 7·27% of the sample.

Community of interest 10: mountain people. This community scores low on cluster 5. These people are not concerned about the drawbacks of the mountain environment. It comprises 6·18% of the sample.

Community of interest 11: nonenvironmentalists. This community is characterized by low scores on cluster 6. These people are not in the mountain area for privacy, the lack of pollution, solitude, the wildlife and natural scenery, or the low population. It constitutes 5·80% of the sample.

Community of interest 12: convenience seekers. People in this community have low scores on cluster 6 (environmental quality was not their motivation for moving to the mountains) and on cluster 4 (they choose convenience over privacy). It constitutes 4·73% of the sample.

Community of interest 13: individualists. This community is characterized by low scores on cluster 2 and by high scores on clusters 3 and 4. This indicates 'universal' rather than 'particular' concerns, with a center on individualism; concern rests specifically on the environment, on personal expenditure, and on privacy, but *not* on public services or on convenience. 4% of the sample were individualists.

The thirteen communities of interest make up 98·74% of the sample. The remaining respondents had unique score patterns. Since the 'uniques' are such a small proportion of the sample, for our purpose they could be excluded from further OTYPING.

Although these communities of interest are clearly different from one another, we were struck by the explanatory power of a commitment to convenience or to the environment as an overreaching concept in differentiating between the groups. The communities of interest could be classified as convenience- or environment-oriented as follows:

Convenience-oriented: communities 1, 3, 5, 7, 8, 9, 11, and 12—a total of 63% of the population;

Environment-oriented: communities 2, 4, 6, 10, and 13—a total of 33·1% of the population.

Such a 2 : 1 split does not seem unlikely but it clearly contradicts the touted

constituency expressed by certain special interest groups who claim that either everyone is an environmentalist or no one is.

The demographic profiles of the communities of interest reveal several interesting points. First, the demographic variation between communities suggests that those communities concerned mainly with convenience and self-interest tend to have large families, are older, have above average incomes, and have homes of above average value. The environmentally concerned groups tend to be younger, have smaller families, have average incomes, and have relatively short mountain tenure. One interesting hypothesis relates to whether life-cycle stage will lead the present environmentalists to become assimilated into the convenience-oriented groups, or whether the balance between the two orientations will continue to shift as younger and less well-established people move into the area. Only future research can answer this question.

The most potentially valuable empirical result deals with the relationship between the communities of interest and their geographic location. The location of all 316 respondents was keyed to the eleven fire districts located in the study area. In the design of the study it was our opinion that the fire-district method of geographical coding would provide for ease in implementation and for anonymity of the respondent, and would offer a sufficiently fine division to identify geographic homogeneity or heterogeneity. In fact although anonymity was preserved the division was not fine enough. Nevertheless the results, which are mapped in figure 3, indicate that four of the eight convenience-oriented communities of interest (3, 5, 8, and 9) tend to be concentrated in the Evergreen area, whereas two of the five environment-oriented communities of interest (2 and 13) tend to be located in the Lookout Mountain area. Although these results were not as robust as we had hoped for, they do suggest that land-use preferences are not distributed randomly. Hence the geographic clustering of the communities is a potentially valuable planning tool. In a replication of this study (currently under way), we are using a finer geographic division in order to increase our capacity to differentiate spatially between and within the communities of interest.

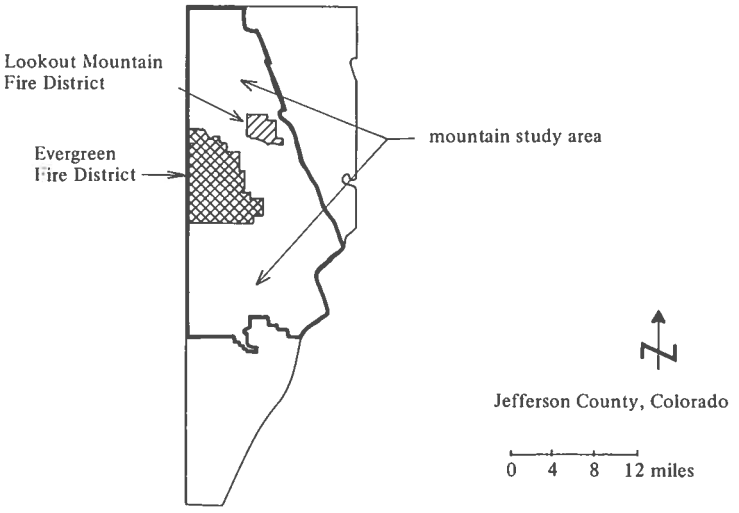


Figure 3. Study area and fire districts.

6 Application of survey results to land-use planning

At the completion of the study all data (cards, tape, printouts, and coding forms) were given to the planning office, along with a final report. The staff then analyzed the material and developed a set of scenarios which relate to planning land-use patterns.

These scenarios were then used to formulate a series of land-use policies for the various geographic areas of the mountain area. The county is now developing a draft land-use plan for the mountain area (Blackburn, 1975). Currently this procedure is being repeated for the plains area of the county.

7 Summary and conclusions

The results of our survey suggest that various population subgroups can be distributed along a continuum which poses environmental concern against a convenience orientation. Although without future research and validation this conclusion is tentative in nature, it is our belief that this environment-*versus*-convenience distinction is a powerful tool in developing regional land-use plans. These findings lead us to conclude that the alternative plans developed for the mountain area of Jefferson County should to varying degrees reflect both a high level of convenience and a high level of environmental quality. Although potential conflict exists it is our opinion that convenience and environmental quality are *not* mutually exclusive. The identification of homogeneous subregions through the use of the methodology presented here enables the planner to design a regional plan which reflects the subregional differences in the orientation of his or her constituents.

Acknowledgements. We would like to express our appreciation to the Jefferson County Board of Commissioners for their funding of this project, and to the Jefferson County Planning Office for their assistance in developing a random sample and for their general cooperation and support. We would like to acknowledge the assistance of Daniel E Bailey in the data analysis, and of Daniel Schler and William Howard in the administration, support, and preparation of the initial report. Also thanks are due to Tristam Dunn for the management of the project, and to Jim DiBerdinis for the training of interviewers and for generating the random sample, and to an anonymous referee for some helpful suggestions.

References

Blackburn W, 1975 "Mountain area survey, Golden, Colorado" mimeographed report, Jefferson County Planning Department, Golden, Colorado

Green P, Rao V, 1972 *Applied Multidimensional Scaling* (Holt, Rinehart and Winston, New York)

Henderson J M, Quandt R E, 1958 *Microeconomic Theory: A Mathematical Approach* (McGraw-Hill, New York)

Hoinville G, Berthoud R, 1970 "Identifying and evaluating trade-off preferences—an analysis of environmental/accessibility priorities" mimeographed paper, Social and Community Planning Research, London

Miller G A, 1956 "The magical number seven plus or minus two: some limits on our capacity for processing information" *Psychological Review* **63** 81-97

Osgood C E, Suci G, Tannenbaum P, 1957 *The Measurement of Meaning* (University of Illinois Press, Urbana, Ill.)

Pollio H R, 1974 *The Psychology of Symbolic Activity* (Addison-Wesley, Reading, Mass)

Robinson I M, 1972 "A note on the determination of community 'trade-off' preferences" *International Technical Cooperation Centre Review* **1** (4) 36-42

Robinson I M, Baer W C, Banerjee T K, Flachsbart P G, 1975 "Trade-off games" in *Behavioral Research Methods in Environmental Design* Ed. W Michelson (Dowden, Hutchinson and Ross, Stroudsburg, Pa) pp 79-118

Samuelson P A, 1948 "Consumption theory in terms of revealed preference" *Economica* **15** 243-253

Torgeson W R, 1963 *Theory and Methods of Scaling* (John Wiley, New York)

Tryon R C, Bailey D E, 1973 *Cluster Analysis* (McGraw-Hill, New York)

Wilson R L, 1962 "Livability of the city: attitudes and urban development" in *Urban Growth Dynamics* Eds F S Chapin, S F Weiss (John Wiley, New York) pp 359-399

© 1978 a Pion publication printed in Great Britain