TN 37: Comments on the Paper "The Substitutability Concept: Implications for Recreation Research and Management," by Hendee and Burdge

By Jay Beaman

(Virtually this same commentary and Hendee and Burdge were published in JLR see references)

"**COMMENT**"

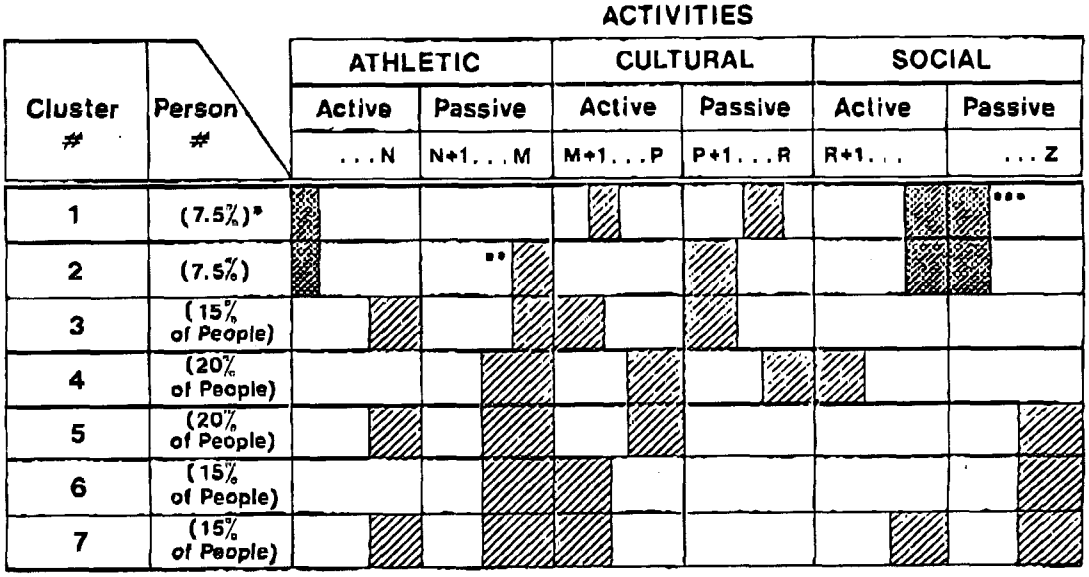
The Hendee and Burdge (1974) paper is an extremely important one in that it presents a discussion of certain concepts that are beginning to play an important role in recreation research. However, this author believes that certain important ideas on the substitutability concept that have been reported are not discussed by Hendee and Burdge (Beaman & Lindsay 1974, Beaman and Leicester 1970, Bishop and Witt 1972, Burton 1971, Currie 1973, Ellis and Wolfe 1970, Gillespie 1973, Rousseau 1973). It should be noted that Bishop and Witt (1972) have discussed the problem of tradeoffs as it relates to a major planning model to be developed in the Province of Ontario (Ellis and Wolfe 1970). Beaman and Leicester (1970) consider tradeoffs in the context of urban recreation. Almost certainly, Hendee and Burdge had no access to the documents just cited because results were not published in journals or books with wide circulation.

One important concern regarding substitutability (noted in published material with limited circulation, e.g. TN 10) is the necessity to distinguish between clustering of activities as carried out using factor analysis, and clustering of individuals on the basis of the activities in which they participate. Burton's work (1971) is a classic example of the use of factor analysis to derive "activity clusters," However, whether one considers Bishop's (1970) work in which factor analysis is used to compare communities, or examines one of the other studies cited by Hendee and Burdge, when examining clusters derived by factor analyses which are supposed to have planning implications, one is looking at methodologically unsound analyses.

To understand why factor analysis should not be used to derive "activity clusters," one need only understand a few basic considerations that should be made before adopting the factor analysis technique to process survey information on activities in which people say they participated. Factor analysis should only be used when the data for analysis are considered to have underlying dimensions that all people have in common (recall the early research on single or multiple dimensions of intelligence), so any subgroup of the population selected for analysis would have the same dimensions as the population as a whole. Data should not be considered to have an internal structure such as the structure suggested by the clustering illustrated in figure 1 (from Beaman & Lindsay 1975). Figure 1 suggests that the people in a community or nation, as suggested by Romsa's (1973) results may be broken up into collectivities of people on the basis of the activities in which individuals participate. In this context activity package has a behavioural meaning. Obviously, each collectivity into which a population may be divided is characterized by the intercorrelations between the activities that define that "cluster of people.

Consider that a number of activity packages are associated with collectivities so that every person in a community has an "activity package". For a given collectivity, one may ask what the intercorrelations of people's participation in activities and examine the correlations by factor analysis. Meaningful correlations should all relate to the first principal component. The intercorrelations for the population are averages over segments based on the relative sizes of various collectivities in a population, rather than give any information about the individual collectivities per se. If certain subgroups of the population of a city are selected for analysis, one does not get the same factor structure as for the population as a whole, unless one deals with a very particular kind of sample that is designed to be representative of the city as a whole. But,

when a population is subdivided on the basis of age, sex, education, income, and/or other variables, the relative balance between collectivities that exists for the population in general cannot be expected to hold for special subgroups. The fact that a balance will not be preserved for many subdivisions is confirmed by cluster profiles derived by Romsa (1973) and also confirmed by Currie (1973). The point here is that factor analysis is only an appropriate tool to use to look for "trade-off" structure in data when the invariance of factor structure for subgroups in the population condition holds (see Horst 1965 or Harmon 1959). Specifically, if the invariance of correlations based on people's participation in activities assumption is to hold, one must be able to say that the population being subjected to a factor analysis not be structured in the way that Romsa's cluster analysis shows the population of Canada is structured, with respect to its participation in outdoor recreation activities. When such a structuring exists, factor analysis is not an appropriate technique for learning something about the structuring of relations between activities for the population concerned.



* Person #'s are not given. but one could consider that, say, persons 1, 8, 18, etc.. are in Cluster 1.
** ///// and/or ▒ indicate the primary activities of importance in defining the cluster indicated.
*** In the text reference is made to tent camping. trailer camping, fishing, hunting and driving for pleasure. Participation in these activities is indicated by the dark grey areas. Tent camping. fishing and hunting are assumed to be ATHLETIC-ACTIVE, so to 'distinguish participation in these activities the dark grey area appears under ATHLETIC-ACTIVE for Clusters 1 and 2.

A more detailed critique of the factor analysis "clustering" technique for defining activity packages could be based on reference to a number of points. In particular, the instability (loose definition) of structures defined by Varimax rotations or other factor rotation algorithms is one point that should be considered. Along this line, it may be noted that algorithms have been developed to relate factor structures derived on one set of data with factor structures derived on another set of data. However, it has also been shown that because of the nature of the transformations involved, factor structures from two sets of data can often be related even if there is little relationship. One should keep this fact in mind in evaluating Bishop's (1970) work and more recent comparative works slated for publication in 1974.

In CORDS "A Search for Structure in the Patterns of Participation of Canadians in Outdoor Recreation Using Cluster Analysis Methods: The Windsor Work" (Rousseau 1973), the following statement is made which elucidates the difference between factor analysis and cluster

analysis.

The approach of analyzing participation data to find clusters of people who have similar activity patterns, may be contrasted with an approach described by Burton and Noad (1968). This method is applied to 1969 8M data in a thesis prepared by Gillespie (1973). In Burton's clustering approach correlations between activities are examined without consideration of whether the correlations between activities reflect a clustering of individuals or not.

Burton (1968) has suggested that correlations between activities reflect tradeoffs that can be made in planning. However, the "true" clustering approach used by Romsa et al. only supports Burton's claim when the correlations observed have the right , value for individuals within a cluster. Even when participation in activities is correlated for individuals with the same activity package, two activities may be complimentary not substitutable (Beaman and Leicester 1970).

Cluster analysis is the technique that this paper maintains must be used in dealing with the substitutability. Substitutability is the central concern of the Hendee and Burdge article. The material presented in the Hendee and Burdge article under the title "An Empirical Illustration of Substitutability" is an example of the Burton type of analysis to which this article takes a great exception. It is not the argument of the article that factor analysis might not give some interesting insights. The argument supported here is that factor analysis will almost certainly give a number of incorrect impressions. And, it is open to drastic misinterpretation and thus should, in general. be avoided.

A discussion of substitutability immediately raises questions about correlations between activities that are not adequately discussed in the Burdge and Hendee article, First, in the Beaman and Leicester monograph a major focus is on breaking a population into groups for which it is meaningful to talk about clusters of activities and activity packages related to behavior. Supply factors (e.g. see TN 29) present a problem in using cluster analysis. This commentary is salient on the matter because a research report will appear shortly (Kim et al. 1974) and the results will allow discussion of one way of considering supply in carrying out a cluster analysis. However, it is not reasonable to use the comments to present the supply factor analysis strategy as making comments on substitutability.

An important point made by Beaman and Leicester is that a population does not have behavior patterns (an activity package or tradeoffs) in the sense that one can use population figures for planning purposes. They stress that there are groups within the population who have what may be called their own activity packages, and they contend that until we recognize the collectivities within the population that have common activity packages (common behavioral characteristics), it is meaningless to talk about tradeoffs or substitutability of activities. Their point is that a critical issue in recreational planning is for whom, for what purpose. Regarding the concern of for whom, for what purpose in research on other topics on literature not already cited, see Beaman (1974a) and Beaman (1974b) which point out the issue of the gravity function of whom, for what kind of trip, and the attractivity of what kind of a park for whom, for what kind of visit. Type of user group even plays a role in the theoretical considerations introduced in Beaman, Knetsch and Cheung (1974).

In substitutability studies, one's concern must be with whether a certain activity is substitutable with another activity for people having a given activity package and a given time slot (these factors are stressed in Beaman and Leicester 1970). People who have different activity packages have different interests, and thus may not perceive the substitutability of different

activities in the same way. Therefore, "group" membership is important in how substitutability is defined (as is the specific time context of a given substitution).

Beaman and Leicester (1970), in discussing the issue of how a person chooses a facility in which to participate, after considering the ramifications of group membership (some kind of a set to participate in given activities in given circumstances), proceeded to distinguish between substitutability of activities and complementarity of activities, In particular, it was noted that activities for a group of people with fairly common interests may be highly correlated for two reasons. Two activities being correlated may reflect the fact that people recognize the two activities as substitutes or in fact the two activities may be complementary, and satisfaction with participation in one activity may be contingent on participating in the other activity. To pursue this example along rather a trivial line, vigorous exercise may only be satisfying if there is the possibility of the activity of cleaning up afterwards. Thus, one may ask if Hendee and Burdge are only dealing with substitutability; or, are they also implicitly concerned with complementarity.

In all fairness, it should be noted that a version of the issue of group membership as important in explaining participation choices, is mentioned in some articles cited by Hendee and Burdge. They cite literature that refers to activities as possibly only being interchangeable, depending on who participates with whom. But this focus on groups in the sociological sense of social contact does not touch on the general dimensions involved in the issue of substitutability which have already been noted. Certainly one may expect that people with whom one participates will have a tendency to be in a similar collectivity (have a similar activity package with persons in some respects) with persons with whom they participate (see figure 1). In this regard, as Beaman and Leicester have noted in their monograph, people may be in a similar group with respect to their participation in outdoor or physical recreation activities, but may be in drastically different groups with respect to their participation in social or cultural activities.

In conclusion, it is important to note that when one recognizes the importance of distinguishing collectivities within the population, and distinguishing activity packages defined in some way other than using factor analysis, it then becomes clear that raising such questions about the satisfaction of users of facilities should be done with respect to meaningful collectivities. Activity groupings defined by factor analysis are inappropriate to note when referring to satisfaction or when planning what should be provided. It is, with respect to collectivities, defined on the basis of similar participation "sets" that meaningful planning must take place, and it is with respect to these collectivities that planning options and ramifications of political decisions must be evaluated (TN 32; Beaman & Lindsay 1975).

Along the same line, discovering activities for which there are no substitutes is only meaningful in the context of specific collectivities of the population. Examining Romsa's work shows that there are large numbers of people for whom there are probably no substitutes for the very few activities in which they actually participate. This conclusion may be contrasted to the factor analysis results of Gillespie derived using the same data studied by Romsa which suggests that there are large numbers of tradeoffs that apply to all Canadians. Gillespie (following the Burton framework) has confused correlations in the aggregate with what is meaningful to collectivities within the population that have their own distinct behavioral patterns.

Finally, the authors is concerned that people do not make the kind of mistakes in interpretation just noted, or carry out inappropriate analyses in trying to pursue the important research area reviewed by Hendee and Burdge that has been a motivating factor for the preparation of these comments.

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