1984

Perceptions of sports activities a multidimensional scaling analysis.

Michael H. Hall
University of Windsor

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PERCEPTIONS OF SPORTS ACTIVITIES: A
MULTIDIMENSIONAL SCALING ANALYSIS

by

Michael H. Hall
B.Sc., Trent University, 1979

A Thesis
Submitted to the Faculty of Graduate Studies
through the Department of Psychology
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of Master of Arts at the
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1984
ABSTRACT

To determine what characteristics of participant sports are used to distinguish one from another, similarity judgements of sports activities were analyzed with multidimensional scaling and cluster methods. One hundred and seventeen university students judged the similarity of ten popular sports using the method of multidimensional rank-orders. Two of the ten judgement tasks were repeated to assess item reliability and stability of judgements. Possible individual differences in judgements were assessed by MANOVA, principle components analysis and cluster analysis of the judgements. The multidimensional scaling and cluster analysis yielded an aggregate solution of three clusters: 1) net sports (tennis, badminton, volleyball); 2) target sports (golf, curling, bowling; and 3) major team sports (baseball, football, basketball, hockey) embedded in two dimensions. The dimensions were labelled: 1) team versus individual sports and 2) plane of action or surface versus air sports. The items were found to be reliable and the judgements stable. Although the MANOVA revealed differences in judgements according to the number of years lived in Canada and the interaction of sex and age, these were minor. The principle components analysis and cluster analysis indicates that these differences did not detract from the representativeness of the group solution. The study was determined to be an improvement over past attempts in this area. Implications were drawn for the issue of sports substitutability and planning.
ACKNOWLEDGEMENTS

I would like to thank Dr. R. Orr and Dr. G. Romsa for their critical review of this thesis and their thoughtful and meaningful input.

I am particularly indebted to Dr. M. Starr whose concern, intellectual modelling, enthusiasm and heart provided foundation for my academic pursuits. I can give no greater personal commendation than to call him my friend and mentor.
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CHAPTER I

INTRODUCTION

In the burgeoning field of leisure research, sport is readily identified as a major element of people's activities. Despite increasing levels of participation in sports (Fitness Canada, 1983), however, there is a striking lack of research directed towards understanding how participants choose one sport from among the many, prior to their involving themselves in it. The first step in establishing how such choices are made is to determine what features of sports activities people attend to when distinguishing one from another. This study attempts to uncover the dimensions along which sports activities are perceived to vary.

Although there has been little research aimed at determining the perceived dimensions of sports activities, there has been considerable effort directed towards discovering the dimensions along which people characterize the broader domain of leisure activities. One impetus behind such endeavours is the notion of the substitutability of recreation activities (Bishop, 1970; Hendee & Budge, 1974). If, it is reasoned, one can discover the way in which activities are similar, then one may determine which activities people will regard as interchangeable. Accordingly, knowledge of the dimensions along which leisure activities
vary and the position of various activities along this dimension should allow for more effective promotion and provision of recreation activities. Analogously, sports planning can be more readily undertaken if one has knowledge of the dimensions underlying people's perceptions of sports. The present study, aimed as it is towards discovering these dimensions, is thus of practical import.

Sports activities are best regarded as a subset of the broader domain of leisure activities. Techniques which can be used to uncover the perceived dimensions of leisure activities, can also be applied to uncover dimensions of sports activities and vice versa. An examination of approaches employed in attempts to delineate the dimensions of leisure activities will thus be useful.

The majority of empirical efforts directed towards uncovering these dimensions have employed factor analysis; cluster analysis and multidimensional scaling (MDS) have also been used, although less frequently.

Factor Analytic Approaches

Most factor analytic studies have utilized adult's reports of the frequency with which they participate in different leisure activities (e.g., Bishop, 1970; McKechnie, 1974; Witt, 1971). These participation rates are then inter-correlated and subjected to factor analysis. The factors or dimensions are revealed by interpretation of the patterns in which the activities group. These studies typically uncover three to seven factors; for example, Witt (1971), discovered four factors: sports, outdoor-water, adolescent-social, and aesthetic-sophisticate. Unfortunately, there are a number of problems with this type of factor
analytic approach.

Factor analysis is appropriately used only when the basic dimensions of the data are invariant for all the people under study (Beaman, 1975). However, Romsa (1975) has shown that various groups ("collectivities") of the population engage in distinct sets of activities ("activity packages"). The point is raised that the intercorrelation of people's participation rates actually represents the relative size of the various collectivities in the population, and not the structure of the relations between the activities themselves as others have maintained (Beaman, 1975).

Factor analytic studies also do not adequately address the substitutability issue. The issue here is the meaning of correlations between rates of participation in activities; these being the fodder for factor analysis. It has been assumed that a high correlation between participation rates implies that people recognize them as interchangeable. However, such high correlations may merely imply that two activities are complimentary with satisfaction with one activity being contingent on participation in the other (Beaman, 1975). For instance, satisfactory football playing may be dependent on an unenjoyable weight-training program.

A final and compelling observation about factor-analysis is that it uncovers a relatively large number of dimensions; due, for the most part, to its assumption of linear relationships between the variables under study (Shepard, 1972). Linearity, however, is a severe assumption when working with perceptual data (Schiffman, Reynolds, & Young, 1981), and more parsimonious results are possible with techniques which do not
operate under such a constraint.

**Multidimensional Scaling Approaches**

Multidimensional scaling techniques do not suffer the liabilities attendant with factor analytic approaches to this problem. Ritchie (1974, 1975), and Becker (1976) have demonstrated the usefulness of these techniques in uncovering the dimensions of leisure activities, and in a similar fashion, Bergier (1977), and Levine (1978) have used MDS to study dimensions of sports activities.

A brief outline of what MDS does will illustrate the usefulness of this technique; more formal descriptions may be found in Davison (1985), Kruskal and Wish (1978), Shepard (1972), or Schiffman, Reynolds, and Young (1981). Typically, people are asked to judge how similar objects (e.g., leisure activities) are, one to another, by use of numerical rating scales. These numerical ratings (termed proximities) are then converted by MDS procedures into a graphical spatial depiction, such that the objects are portrayed as points in space and the distance between these points represents the proximities among the objects. A concrete analogy may be helpful here. Note that, for the purposes of travel, the relationships among objects such as cities are adequately portrayed by means of a two-dimensional (i.e., having two axes) spatial depiction—a road map. Through MDS, a researcher can determine how many axes are required to best portray the proximities among the objects.

In MDS the number of axes represent the number of psychological dimensions which people use to characterize the object under study. By determining what qualities differentiate objects (represented by
points) at the extremes of the spatial axes, one can come to understand the psychological dimensions those axes represent, and thus the meaning of each object's position in space.

There are two types of MDS: metric and non-metric. Metric MDS treats proximities as ratio-scale data and attempts to reproduce the proximities when constructing their spatial representation. Non-metric MDS treats proximities as ordinal data and merely tries to reproduce the rank-order of the proximities when constructing their spatial representation. Further discussion of MDS will be limited to non-metric MDS which generally provides solutions which better represent the data using fewer dimensions than metric MDS (Schiffman, Reynolds, & Young, 1981).

It is important to note that MDS techniques will not necessarily capture all the relevant information in the data under study. Davison (1983) outlines this issue well. Most complex objects will vary in terms of continuous and dichotomous attributes. For example, sports activities may vary in terms of continuous attributes, such as amount of energy expended, or cost. They may also vary in discrete features, such as outdoors vs indoors. MDS techniques will represent data along continuous dimensions; but, to capture dichotomous features of the data, researchers often employ hierarchical clustering techniques.

Hierarchical clustering is an analytic method of classifying objects on the basis of their proximities. The purpose is to group objects so that those within one group are similar in some attribute(s) and yet differ in terms of some attribute(s) from those in another group. The clustering is hierarchical in the sense that at the lowest
level of analysis each object is considered to be its own group; with successive levels of clustering, the groups themselves are grouped together. This process culminates with one broad group or classification in which every object is a member. An example of a hierarchical approach to classifying objects is the biological taxonomy of phylum, class, order, family, genus, and species (although this particular taxonomy was developed in the absence of hierarchical clustering techniques). More complete descriptions of hierarchical clustering will be found in Johnson (1967) or Everitt (1980).

Research on Sports Activities

The method of choice in attempting to uncover the dimensions along which people view sports activities seems to be MDS in conjunction with hierarchical cluster analysis. As noted previously, Bergier (1978) and Levine (1977) both use this approach in their studies, which seem to be the only contributions to research in this particular area.

Bergier (1978) delineated the perceived dimensions of a number of spectator sports by employing a sample of Sport's Illustrated readers and using a stimulus domain which consisted of the following: auto racing, horse racing, boxing, football, tennis, soccer, golf, hockey, basketball, and baseball. Bergier (1978) discovered that four dimensions were used by his sample in differentiating among these sports: humanness vs machineness; pace of the sport; indoors vs outdoors; and participants vs spectators activity bond.

There are two points worth noting about this study. First, Bergier's sample consisted of Sport's Illustrated readers, comprised mostly of upper-income, well-educated males, most of whom were over 25
years of age. It is thus difficult to generalize Bergier's findings to the population as a whole.

A second comment calls attention to the importance of the stimulus domain selected for study. The dimensions one uncovers in MDS depends directly on the stimulus set employed. Two researchers may both study perceptions of sports activities, yet uncover different dimensions because they have included different sports in their stimulus sets. Bergier includes sports such as auto racing and harness racing in his stimulus sets; therefore the dimensions he uncovers relate specifically to that set of spectator sports and do not directly contribute to our understanding of participatory sports. Participatory sports refers here to those sports in which a sizeable segment of the population are likely to become involved.

Levine (1977) has also investigated perceptions of sports. Using a stimulus domain consisting of baseball, football, hockey, tennis, handball, track and field, skiing, boxing, golf and bowling, he discovered these sports were differentiated along two dimensions—team vs individual and degree of action. Levine's research design limits the generalizability of these results, which appear to be "method-bound".

One of the attractions of MDS is its ability to utilize data collected in a "constraint-free" fashion, free from experimental bias. This is accomplished using direct judgements of the perceived similarity between objects (e.g., by indicating on a seven point scale how similar one object is to another) as the data for analysis. Levine (1977), however, chose to employ a derived measure of distance in which subjects
were asked to respond to six bipolar adjective scales, with adjectives such as fast moving vs slow moving; complicated rules vs simple rules; and team vs individuals. Each scale had seven points reflecting degree of intensity (e.g., extremely fast moving to extremely slow moving). A two-dimensional solution was obtained which, not surprisingly, comprised of two of the six dimensions he had built into his scales. The guiding line of reasoning behind this endeavour is somewhat circular.

The basic disadvantages of Levine's method are twofold: a) it is doubtful that all the relevant dimensions which account for differences among stimuli activities can be obtained through use of adjective descriptions (Schiffman, Reynolds, & Young, 1981), and b) the use of adjective scales force the respondent to confine his responses to criteria pre-specified by the researcher (Green & Rao, 1972).

As a final comment on the research to date, one should note that the focus has been entirely upon groups' perceptions of sports. Although the possibility has been recognized that individual differences in perceptions are a general and pervasive phenomenon (Carroll, 1972), there is yet to be any attempt to assess the possible extent of individual differences in perceptions of sports, per se. This is unfortunate, since such individual differences, particularly if related to identifiable demographic characteristics of the population, have important implications for the planning, provision, and marketing of sports activities. One may discover, for instance, that older members of the population will regard different sports activities as interchangeable than will younger members.

The present research is designed to further our knowledge of the
dimensions underlying perceptions of sports activities by remedying the deficiencies noted in these studies.

**Research Approach**

This study examines people's perceptions of selected participatory sports activities through the use of MDS and hierarchical clustering. The study contains the following combination of features which distinguish it from previous endeavours in this area:

1. It utilizes a stimulus domain consisting of participatory sports.
2. It utilizes direct judgements of the similarities among sports activities.
3. It assesses the possibility that individual differences exist in perceptions of sports.
4. It employs a broad sample of university students of both sexes.

Some of these features of this research warrant further discussion.

**Selection of a Stimulus Set**

The issue of selecting stimulus items is non-trivial. The optimum strategy would be to include all sports activities; however, comparing all sports one to another is a time-consuming and undoubtedly an irritating task for a subject. It is therefore necessary to select a sample from the population of sports activities to serve as the stimulus set.

The selection of a stimulus sample must be guided by rational strategy rather than be accomplished by random selection, since to a
large degree, the solution retrieved is dependent on the stimulus set (as has been noted before). Schiffman, Reynolds, and Young (1983, p. 25) illustrate this issue well: "Suppose the stimulus set is white wine. If the stimuli all represent extreme examples of suspected attributes the solution will be (a) ... collection of clusters. Inclusion of a champagne may collapse the structure to the single dimension of bubbly - not bubbly." One must intuit the probable dimensions along which the sports vary so as to ensure that stimuli are chosen which have attributes ranging along each dimension.

The over-all organizational principle which guided the selection of stimuli was that all sports would involve a ball-like object. Additionally, the sports which were to serve as stimuli had to be familiar to those who are making judgement. With this in mind, sports were selected which would primarily represent a team vs individual dimension, secondary consideration was given to representing dimensions of: indoor vs outdoor, seasonality (i.e., Fall, Winter, Spring, Summer); and contact vs non-contact. Consequently, the following sports were selected to form the stimulus domain: baseball; hockey; football; volleyball; tennis; badminton; golf; curling; bowling; and basketball.

Obtaining Direct Judgements of Similarities Among Sports

Individuals were asked to judge how similar one sport was to another using the method of multi-dimensional rank order (Torgerson, 1958). Each individual was asked to rank all the sports in terms of their similarity to a "reference" sport with each sport in turn serving as a "reference". These rankings constitute the proximities which are subjected to analysis.
**Expectations**

Although this research was exploratory in nature, some expectations as to the probable nature of the results can be stated. First, there should be a clear, simple interpretable configuration. From the configuration, the concepts which were used to make the similarity judgements should be identifiable. According to the organizational principles underlying the stimulus domain, a team vs individual dimension is certainly expected to emerge along with other possible dimensions such as: indoor vs outdoor; seasonality; and contact vs non-contact. The findings of Bergier (1978) and Levine (1977) leads to the expectation that a pace or degree of action (slow vs fast sports) dimension should be found. Although some correspondence between the MDS and cluster solutions should be expected, the solutions could be quite different with MDS identifying continuous, quantitative factors, and clustering discrete, qualitative properties of the judgements.

Although the possibility of the existence of individual differences is to be assessed, there is no empirical or theoretical basis from which to predict either the degree or characteristics of such differences. However, people have been found to differ in terms of sports participation according to sex (Anderson, 1979) and one can assume that differences also occur according to age, since seniors tend to choose less intense forms of physical activity (Fitness Canada, 1983). Although differences in participation by no means imply that there will be differences in perceptions, this does suggest the possibility that sex and age differences in perceptions of sports should
be explored. People may also differ in their perception of sports according to experience with them. Those with more experience should make finer discriminations among sports or employ different dimensions to categorize them than will the less experienced. Finally, cultural differences among people are expected to be reflected in the dimensions they use to categorize sports. People who are not native to Canada may use different dimensions than those who live in Canada.
CHAPTER II

METHOD

Respondents

The respondents were 63 female and 52 male university students enrolled in an introductory psychology course at the University of Windsor, who ranged in age from 17 to 45 years with a median of 20 years. Twenty-six of the respondents had lived in Canada for ten years or less.

Research Instruments

All data were collected by means of a questionnaire entitled the Sports Attitude Survey (see Appendix). On the questionnaire respondents were asked to indicate their age, sex, and the number of years that they had lived in Canada. To assess the respondents' experience with sports they were asked to respond to three different scales which assessed whether they had played, were familiar with, or had seen, each of the various sports in the stimulus set.

Data Gathering Procedure

Stimulus Set. The following sports activities were used as the stimuli about which similarity judgements were made: badminton, baseball, basketball, bowling, curling, football, hockey, golf, tennis, and volleyball.

Judgement Task. The similarity judgements were obtained using Torgerson's (1958) method of multidimensional rank order. Each sport served as a reference item against which the similarities of the
remainder of the sports were judged and ranked to the reference sport. There were 10 such lists (one for each sport).

**Reliability.** The first two lists present were repeated at the end of the questionnaire to enable the reliability of the judgement process to be assessed. There were 12 lists in all.

**Order of Presentation of Stimuli.** Order effects in the presentation of stimuli were controlled for in the following manner:

a) the stimuli in the judgement lists were ordered such that a reference item and a stimulus item never occupied the same relative position in two lists. That is, if football was the reference item and basketball was the fourth item in the judgement list, it was ensured that when basketball was the reference item then football was in any position other than the fourth position; b) the judgement lists were structured such that each item appeared in each of the nine possible list positions at least once, and that no item appeared in the same list position more than twice; c) as much as was possible, stimuli were ordered such that their boundary items (i.e., the item preceding and following each stimulus) were different in each list, although this was impossible to completely achieve; and d) the judgement lists themselves were ordered so that the first item in the stimuli list did not appear as the reference item in the next two lists in the questionnaire.

**Instructions.** The instructions to the respondents informed them that this research was concerned with how similar various sports were to one another. They were told that they would be given 12 lists of sports, each with a different sport at the top of the list (the Reference Sport); and were asked to number the sports in each list
according to how similar they were considered to be to the Reference Sport. The most similar sport was to be given a 1, the second most similar a 2, and so on. An illustrative example of the task was provided, as well as a trial item for the respondents to attempt themselves. One of the judgement tasks and the instructions provided with each task are provided below.

Rank how similar each of the sports in the list is to the Reference Sport at the top of that list. Remember to use all the numbers between 1 and 9 in your ranking.

1. Football
   Baseball ( )
   Curling ( )
   Basketball ( )
   Tennis ( )
   Volleyball ( )
   Badminton ( )
   Golf ( )
   Hockey ( )
   Bowling ( )

Testing Procedure. Four different experimenters administered the questionnaire to students during their class time. Questionnaires were distributed to the class and the instructions within were read aloud. The respondents were asked if there were any questions as to the nature of the task at hand. After any questions were answered, the respondents completed the questionnaire.
Data Analysis Procedure

The data analysis was undertaken in four steps:

1. The raw data was processed to a form amenable to statistical analysis.

2. The reliability of the judgement task and the respondent's judgements were assessed.

3. The dimensions of sports utilized in the judgements were determined.

4. The role of individual differences in judgements was assessed.

Preliminary Processing of Raw Data. The raw data was examined to ensure that there were no missing judgements and that each sport in a list was assigned a different rank-order (i.e., that there were no ties). If more than one missing rank was found in a list, the data for that respondent was excluded from further analysis.

If a list contained a missing rank, that rank was merely deduced from the remaining eight. Ties were handled in a manner which ensured that the ipsative nature of the data was maintained. Ties were thus resolved such that the sums of the ranks equalled 45 (as did sums of ranks of all other lists), and the relative ranks of all non-tied items were maintained. This is best illustrated by example.
<table>
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<th>Corrected Rank Orders</th>
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<tr>
<td>Football</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseball</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Hockey</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Basketball</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Curling</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Golf</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>Bowling</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Tennis</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>Badminton</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Volleyball</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Once the raw data was corrected, a proximities matrix \((n \times n)\) was constructed for each subject, with the rows and columns of the matrix representing corresponding sports, and each element in the matrix being a measure of the degree of similarity (proximity) between these sports. The method of multi-dimensional rank order compels the respondent to make two judgements for each possible pair of activities; one for each time one of the sports serves as a reference. The average of these two judgements was used as the measure of the proximity between that pair of sports.

Since two of the judgement lists were repeated, the proximities for these stimuli were obtained by summing the repeated judgement for each sport, taking that average and using it as outlined above (i.e., as if it were one judgement). The end result of this was a 10 x 10
Assessing Reliability. As has been noted previously, two judgement lists appeared twice on the questionnaire, at the beginning and at the end. These repeated scales were used to assess two things: (1) the stability of subjects' judgements over time, and (2) the reliability of the judgement items.

To assess the stability of subjects' judgements, their responses to the first two lists were correlated with their responses to the last two lists. The mean of the 115 reliability coefficients thus obtained was used as an index of respondent reliability.

The reliability of the judgement items were obtained by intercorrelating the respondents' judgements for each item on the initial presentation of a list with their responses on the second presentation of that list. The mean of the resulting 18 correlations was determined and served as an index of item reliability on the judgement task.

Configuration Analysis. Multidimensional scaling and cluster analysis were employed to determine the dimensions used by the respondents in judging the similarities of the sports.

MDS was performed using the ALSCAL procedure of the Statistical Analysis System (SAS) (SAS Institute Inc., 1980). This analysis was conducted at the aggregate level and thus employed the average proximities between sports (i.e., averaged across subjects). The procedure used was non-metric (ordinal) and employed the usual Euclidean distance model.

The cluster analysis was performed using the Cluster procedure
(Ward's method) of SAS (SAS Institute Inc., 1982). The input for this procedure was the stimulus coordinates on the axes derived from the ALSCAL analysis.

**Individual Differences.** Possible individual differences in the perceptions of sports was assessed by three methods:

1) An age by sex, by years lived in Canada, by experience with sports MANOVA was performed with the vector of proximities as dependent variables.

2) The proximity vectors were used to cluster the individual judges.

3) The cross products of the proximity vectors were analyzed by principal components.
CHAPTER III

RESULTS

First, the reliability of the judgement items and the stability of the respondents' judgements are presented. These are followed by the results of analyses (MANOVA, cluster, and principal components) designed to determine possible individual differences in proximities. Finally, the results from the MDS and cluster analyses used to uncover the dimensions underlying the proximities are presented.

Reliability

In order to assess the reliability of the judgement items and the stability of the respondent's judgements, the first two judgement lists were repeated at the end of the Sport's Attitude Survey. The responses to the items on the two lists were intercorrelated; the item correlations had a range from .34 to .74 with most falling close to the mean of .56. This is good item reliability given the severe restriction of range of responses due to the nature of the task.

To assess the stability of the respondent's judgements their responses to the first two lists were correlated with their responses to the last two (repeated) lists. The intra-judge reliabilities ranged from .75 to 1.00 with an average of .95, indicating that respondents' judgements are quite stable.

Individual Differences

Four independent variables were expected to be sources of individual differences in the proximities: age, sex, years lived in
Canada (YLC) and prior experience with the sports activities (EXP). Two age groups were formed, using a median split (median = 20); the first, 20 and younger, and the other over 20. YLC was dichotomized into those respondents who had lived in Canada ten years or less, and those who had lived more than ten years in Canada. Since respondents differed little in terms of the extent to which they had seen; or were familiar with sports (see Table 1), only the number of sports played was used as an index of EXP. Using a median split (median = 8), they were divided into two groups; one consisting of individuals who had played eight or more sports, and the other consisting of those who had played less than eight sports.

The results of a four-way MANOVA (Age x Sex x YLC x EXP), performed on the proximities to test for profile similarity among respondents, are given in Table 2. A significant main effect was found for YLC, $F(45,55) = 2.64; p < .001$. There was a significant Age x Sex interaction, $F(45,55) = 1.72; p < .05$. The EXP x YLC interaction bordered on significance $F(45,55) = 1.59; p > .05$. All other effects were not significant.

An examination of the vector of discriminant weights associated with the YLC analysis reveals that those who have lived in Canada for ten years or less judge volleyball to be more similar to tennis (discriminant weight for volleyball/tennis = -.1075) than do individuals who have lived more than ten years in Canada. In the Age x Sex analysis, the discriminant weights indicate that subjects differ in their judgements of the similarity between volleyball and bowling.
### Table 1

**Responses to Sports Experience Scales**

<table>
<thead>
<tr>
<th>Sport</th>
<th>Familiar With</th>
<th>Seen</th>
<th>Played</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hockey</td>
<td>87.5%</td>
<td>96.5%</td>
<td>64.2%</td>
</tr>
<tr>
<td>Basketball</td>
<td>92.9%</td>
<td>99.1%</td>
<td>91.3%</td>
</tr>
<tr>
<td>Volleyball</td>
<td>92.1%</td>
<td>99.3%</td>
<td>93.0%</td>
</tr>
<tr>
<td>Golf</td>
<td>72.1%</td>
<td>90.3%</td>
<td>53.2%</td>
</tr>
<tr>
<td>Curling</td>
<td>55.9%</td>
<td>79.8%</td>
<td>20.4%</td>
</tr>
<tr>
<td>Baseball</td>
<td>90.2%</td>
<td>99.1%</td>
<td>87.6%</td>
</tr>
<tr>
<td>Tennis</td>
<td>91.2%</td>
<td>99.1%</td>
<td>88.5%</td>
</tr>
<tr>
<td>Badminton</td>
<td>94.7%</td>
<td>97.3%</td>
<td>92.1%</td>
</tr>
<tr>
<td>Football</td>
<td>84.8%</td>
<td>99.1%</td>
<td>72.3%</td>
</tr>
<tr>
<td>Bowling</td>
<td>86.9%</td>
<td>96.5%</td>
<td>82.4%</td>
</tr>
</tbody>
</table>
### Table 2

**Age x Sex x YRC x EXP MANOVA on Proximity Vectors**

<table>
<thead>
<tr>
<th>Source</th>
<th>Eigenvalue</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>.7470</td>
<td>.91</td>
</tr>
<tr>
<td>SEX</td>
<td>.8811</td>
<td>1.08</td>
</tr>
<tr>
<td>EXP</td>
<td>1.2756</td>
<td>1.56</td>
</tr>
<tr>
<td>YRC</td>
<td>2.1625</td>
<td>2.64**</td>
</tr>
<tr>
<td>AGE x SEX</td>
<td>1.4065</td>
<td>1.72*</td>
</tr>
<tr>
<td>AGE x EXP</td>
<td>.9180</td>
<td>1.12</td>
</tr>
<tr>
<td>SEX x EXP</td>
<td>1.1351</td>
<td>1.39</td>
</tr>
<tr>
<td>AGE x YRC</td>
<td>1.0867</td>
<td>1.33</td>
</tr>
<tr>
<td>SEX x YRC</td>
<td>.5797</td>
<td>.71</td>
</tr>
<tr>
<td>EXP x YRC</td>
<td>1.5006</td>
<td>1.59</td>
</tr>
<tr>
<td>AGE x SEX x EXP</td>
<td>1.2284</td>
<td>1.50</td>
</tr>
<tr>
<td>AGE x SEX x YRC</td>
<td>.8167</td>
<td>1.00</td>
</tr>
<tr>
<td>AGE x SEX x EXP x YRC</td>
<td>.6324</td>
<td>1.15</td>
</tr>
</tbody>
</table>

**Note:** The F value given in the table is an F approximation using the Hotelling-Lawley Trace.

- * p < .05
- ** p < .001
(discriminant weight = .728) and the similarity between volleyball and hockey (discriminant weight = .0622).

Ranking the groups in terms of how similar they judged volleyball to be to bowling; males over 20 years of age judge the two sports to be most similar (mean proximity = 6.1750); males 20 years old and younger judged them to be slightly less similar (mean proximity = 6.2422); females 20 years and younger judged them to be even less similar (mean proximity = 6.4000) and females over 20 judged them to be the least similar of all (mean proximity = 6.6944). The groups judged the similarity between volleyball and hockey in a similar fashion: males more than 20 years old found them to be the most similar (mean proximity = 3.3750), males under 20, somewhat less similar (mean proximity = 3.6562), females under 20 less similar again (mean proximity = 4.1889) and females 20 and older judged them to be least similar of all (mean proximity = 4.2361). Thus, males judge volleyball to be more similar to both hockey and bowling than do females; this difference being especially pronounced for males and females of 20 or more years of age.

The MANOVA thus indicates that individual differences do occur in the judgements; and that these are a function of YLC and Age x Sex. Furthermore, volleyball seems to be the sport about which judgements vary the most.

The 45 x 45 matrix of proximity vector crossproducts was analyzed by principle components to determine whether there were any systematic individual differences. The first eigenvalue of this matrix accounted for .91 of the total variance, the second for just over
and the remaining eigenvalues each accounted for less than .008. The first ten eigenvalues are given in Table 3. Since each corresponding eigenvector yields a multidimensional configuration, this analysis indicates that a group or aggregate MDS solution is an accurate representation of the respondent's judgements.

An hierarchical cluster analysis was used to determine if respondents could be classified into discrete groups on the basis of their proximities. A plot of the cubic clustering criterion (CCC) against the number of clusters (Figure 1) reveals a consistently negative CCC which, with minor early variations, tends to increase in size as the number of clusters increases. This indicates a unimodal distribution of proximities (Sarle, 1985) and shows that, to the largest extent, subjects were homogenous with respect to their proximities. One would therefore expect them to display similar MDS configurations.

The Configuration Derived from the Proximities

A MDS analysis (ALSCAL) was performed on the averaged proximities in order to determine how many dimensions were necessary to fit the stimulus (sport) proximities, and to locate the position of each sport on these dimensions.

Stress, a measure of goodness of fit, was used as a guide in determining the number of dimensions which fit the data. Going successively from the one to the four dimensional solutions, stress values of .265, .101, .021, and .009 were obtained. The three-dimensional solution with a stress value of .021 accounted for 99% of the variance in the proximities and provided the best compromise.
Table 3

First Ten Eigenvalues from the Principle Components Analysis of Proximities

<table>
<thead>
<tr>
<th>Eigenvalues</th>
<th>Proportion of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1207.35</td>
<td>.9135</td>
</tr>
<tr>
<td>15.9936</td>
<td>.0121</td>
</tr>
<tr>
<td>9.8951</td>
<td>.0075</td>
</tr>
<tr>
<td>9.2118</td>
<td>.0070</td>
</tr>
<tr>
<td>7.7266</td>
<td>.0057</td>
</tr>
<tr>
<td>7.0057</td>
<td>.0048</td>
</tr>
<tr>
<td>6.4150</td>
<td>.0038</td>
</tr>
<tr>
<td>5.0395</td>
<td>.0032</td>
</tr>
<tr>
<td>4.2139</td>
<td>.0028</td>
</tr>
<tr>
<td>3.7555</td>
<td>.0028</td>
</tr>
</tbody>
</table>
Figure Caption

Figure 1. Plot of cubic clustering criterion versus number of clusters for cluster analysis of respondents.
between accurate representation of the proximities and a parsimonious representation of their spatial configuration. Although the four dimensional solution provided a marginally better fit, it did not add to the interpretability of the solution.

All the team sports: football, baseball, basketball, hockey, and volleyball load positively on dimension one; while all the individual sports: badminton, tennis, golf, curling and bowling have negative loadings. On dimension two: baseball, tennis, badminton and volleyball had positive loadings; bowling, curling and hockey had negative loadings; while football, basketball and golf had close to zero loadings. On dimension three: golf and baseball had positive loadings; volleyball had a negative loading; while the remaining stimuli had loadings close to zero. Table 4 contains three-dimensional stimulus coordinates for the 10 sports. A plot of the first two dimensions of this configuration is given in Figure 2.

Proximities derived from the four-dimensional MDS solution were used as input for the cluster analysis of the sports stimuli. The cubic clustering criterion suggested that there was an optimal three cluster solution. From an interpretive viewpoint, the two and four cluster solutions were also significant. The tree diagram for the hierarchical cluster solution as well as values for the cubic clustering criterion are given in Table 5. The clusters are also graphically displayed in Figure 2.

At the two cluster level golf, bowling and curling are separated
Table 4

Three Dimensional MDS Configuration

<table>
<thead>
<tr>
<th>Sport</th>
<th>Dimension 1</th>
<th>Dimension 2</th>
<th>Dimension 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>1.5948</td>
<td>-0.1151</td>
<td>0.0429</td>
</tr>
<tr>
<td>Baseball</td>
<td>0.7426</td>
<td>0.9780</td>
<td>1.1660</td>
</tr>
<tr>
<td>Curling</td>
<td>-1.0810</td>
<td>-1.5243</td>
<td>0.2353</td>
</tr>
<tr>
<td>Basketball</td>
<td>1.5221</td>
<td>0.3646</td>
<td>-0.6777</td>
</tr>
<tr>
<td>Tennis</td>
<td>-0.9176</td>
<td>1.1398</td>
<td>-0.4901</td>
</tr>
<tr>
<td>Volleyball</td>
<td>0.2619</td>
<td>0.9614</td>
<td>-1.2092</td>
</tr>
<tr>
<td>Badminton</td>
<td>-1.0275</td>
<td>1.1521</td>
<td>-0.5428</td>
</tr>
<tr>
<td>Golf</td>
<td>-1.2621</td>
<td>-0.5991</td>
<td>1.2119</td>
</tr>
<tr>
<td>Hockey</td>
<td>1.2656</td>
<td>-0.9235</td>
<td>-0.0724</td>
</tr>
<tr>
<td>Bowling</td>
<td>-1.2989</td>
<td>-1.4339</td>
<td>0.3366</td>
</tr>
<tr>
<td>SS</td>
<td>14.29531</td>
<td>10.24477</td>
<td>5.46035</td>
</tr>
</tbody>
</table>

Stress = .025
Figure 2. Plot of MDS dimensions 1 and 2 with clusters displayed (dimension 1 - horizontal axis, dimension 2 - vertical axis).
Table 5

Tree Diagram of the Hierarchical Cluster Analysis of Stimulus Proximities

<table>
<thead>
<tr>
<th>Number of Clusters</th>
<th>Cubic Clustering Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>-0.7555</td>
</tr>
<tr>
<td>3</td>
<td>-0.1977</td>
</tr>
<tr>
<td>4</td>
<td>-0.8429</td>
</tr>
<tr>
<td>5</td>
<td>-1.4467</td>
</tr>
<tr>
<td>6</td>
<td>-1.8926</td>
</tr>
<tr>
<td>7</td>
<td>-1.9107</td>
</tr>
<tr>
<td>8</td>
<td>-2.2773</td>
</tr>
<tr>
<td>9</td>
<td>1.9019</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
from the remaining sports. With three clusters, these remaining sports form two groups: tennis, badminton and volleyball versus baseball, basketball, football and hockey. Finally, in the four cluster solution, baseball is distinguished from basketball, football and hockey.

**Interpretation of the Configuration**

The foregoing analyses indicate that both quantitative and qualitative attributes play an important role in respondents' perceptions of sports. The first MDS dimension appears to represent a team sport -- individual sport dichotomy. Within this dimension all of the individual sports (golf, badminton, tennis, curling, and bowling) occupy almost equivalent positions. However, within team sports the stimuli appear to be ordered, with football being the most "team-like" and volleyball being the least. Baseball, basketball and hockey occupy roughly equivalent intermediate positions between football and volleyball. The second MDS dimension seems to embody the plane of predominant action in a sports activity and was labelled a surface-air or plane of action dimension. Curling, bowling and hockey lie on the surface end of this dimension, while badminton, tennis, volleyball and baseball lie at the air end. Golf, football and basketball are located around the middle of this dimension. This second dimension appears quantitative in nature, with the sports ordering themselves according to the degree to which their play involves surface or air action or some combination of the two.

Dimension three is not amenable to interpretation and seems to
be an artifact necessary to improve fit. Thus, the result appears to be a two-dimensional solution embedded in three dimensions.

While the MDS dimensions appear to capture attributes relevant to all the sports in the study, the clusters appear to represent characteristics of individual groups of sports. The clusters portray what appear to be three major qualitative distinctions made among the sports.

The first cluster groups sports which involve a target: golf, bowling, and curling. Here, activity is linearly unidirectional with the "ball" being moved towards a fixed location or target by a single individual. An apparent focus on technological aspects of sports seems to lead to a distinction based on whether or not the sports involved a net; badminton, tennis and volleyball thus form a second cluster on this basis. The remaining sports: football, baseball, hockey, and basketball comprise the third cluster, it would seem, on the basis of their being major team sports. Baseball's static pace of play seems to result in its forming a cluster unto itself from among the more dynamically paced major team sports. The net, major team sports and static pace clusters comprise a larger cluster which is distinct from the first and labelled interactive since each sport within it requires reciprocal action among opponents.

To summarize, the MDS solution yielded two interpretable dimensions: team-individual and surface-air. The cluster analysis identified three major groupings: target, net, and major team sports; with baseball separating from the latter to form a cluster by itself, and the non-target sports merging into an interactive cluster.
CHAPTER IV
DISCUSSION

The dimensions along which sports are perceived to vary can be readily determined from the results of this study. As expected, the MDS analysis of judgements about the similarity of the various sports yielded a simple interpretable configuration, while the cluster analysis revealed properties of the judgements which augmented the MDS analysis. A discussion of the dimensions underlying the judgements will be followed by an assessment of the role individual differences play in such judgements. The present findings will then be compared to previous efforts in this area; and finally, implications for sports planning and future studies will be noted.

It should first be noted that individuals' judgements about sports similarity are remarkably stable (intra-judge reliability = .95), at least over the half-hour it takes to work through the Sports Attitude Survey. The high item reliability (.59), given the restriction of range problem noted earlier, indicates that the items are measuring more than random responses. In short, it can be said that individual's judgements are stable and substantive.

These judgements appear to be made on the basis of a relatively small number of dimensions. The MDS analysis reveals two general dimensions which underly the entire domain of sports activities used in the present study; while the cluster analysis uncovers
properties specific to particular subsets of these sports. The dimensions uncovered were somewhat different than expected. As may be recalled it was expected that dimensions would be found from among the following possibilities: team versus individual, pace (slow versus fast sports), indoor versus outdoor, contact, seasonality and sports technology. Some of these were uncovered (e.g., team-individual and sports technology); however, other unexpected dimensions emerged.

The two dimensional MDS solution displays an interesting combination of quantitative and qualitative dimensions. The first dimension reflects a complex concept which has both qualitative and quantitative properties; while the second dimension is entirely quantitative. On the first dimension, the sports seem to be distinguished into either team sport or individual sport categories. The individual sports: bowling, curling, golf, tennis and badminton are distinguished from the rest on the basis of their being sports in which one individual is pitted against another. In terms of a concept of teamness, the individual sports are virtually identical; however the team sports order along a continuum in terms of inherent "teamness". In order from least to most teamness are: volleyball, baseball, hockey, basketball, and football. This ordering reflects the degree to which successful play depends upon the conjoint action of team members. Volleyball centers around the serve and the return with many players observing the play as it develops. Baseball's salient feature is the battle between the pitcher and the batter, again with many players merely observing the play. Hockey and basketball require more conjoint action, but still can be
dominated by individual play or players (e.g., moving the "ball" up
court/ice). Finally, football which has the most teamwork is
characterized by the necessity of conjoint action by all players,
completing blocking assignments, running, and the like.

On the second dimension, labelled plane of action, sports are
ordered along a continuum which seems to reflect the predominant
plane of action in the sport. This is the plane in which the "ball",
the defining concept of the stimulus domain, is predominantly located.
The order of the sports along this dimension is: curling, bowling,
hockey, golf, football, basketball, volleyball, baseball, badminton,
and tennis. In curling and bowling, the "ball" remains on the playing
surface. In volleyball, baseball, badminton, and tennis, the action
occurs, for the most part, in the air. In football, and to some
extent, basketball, the action is split between surface and air. In
golf and hockey, activity centers in the playing surface but the ball
does become airborne. Degree of teamwork and plane of action are
both concepts by which most sports can be described and so can be
considered as two major dimensions of the sports domain.

The two-dimensional MDS solution was embedded in a three-
dimensional configuration and this point merits some amplification. As
noted earlier, the three-dimensional solution provided the best
compromise between accurate representation of the proximities and
parsimonious representation. However, the third dimension was
uninterpretable and appeared to be an artifact necessary to fit
baseball which was judged as more similar to golf and less similar
to volleyball than is indicated by the two-dimensional configuration.
In essence, baseball seems to define its own dimension. Noting also that baseball was one of the last sports to be clustered in the cluster solution, it becomes apparent that baseball is considered to be very different from other sports.

The cluster analysis reveals characteristics specific to different groups of sports. The target and net sports clusters reflect distinctions made among sports both on the basis of how they are played and on the basis of their technological features. The major team sports cluster reflects the fact that these sports dominate the sports scene despite the differences in the way they are played. At the two cluster level, the net and major team sports group together forming what seems to be a collection of interactive sports. In interactive sports, play hinges upon the interactions between opposing teams or players and the action passes back and forth between them. Target sports, in contrast, do not require interactions among opponents and the action is one way. Four clusters occur when baseball detaches from the other team sports forming a group of its own, reflecting not only differences in style of play, but also static pace relative to the other sports dynamic pace.

Both the MDS and cluster solutions are important in understanding how individuals distinguish among the sports in the stimulus domain. Distinctions among these sports seem to be made generally along dimensions of teamness and plane of action with finer distinctions being made on the basis of technological features and style of play, interactiveness, and major or big business sport. This study employed a broadly recognizable set of sports stimuli whose defining
characteristic was the use of a ball-like object. From the results of the study, one can speculate how other sports, which fit within the constraints placed on the present stimulus domain, would be located along these dimensions. Soccer would be expected to load highly on team end of the individual-team dimension, highly on the surface end of the surface-air (plane of action) dimension and to cluster with major team sports. Racquetball and squash should load highly on the individual end of the individual-team dimension, highly on the air-end of the surface-air dimension and cluster with net sports (the wall in these sports being a pseudo-net). Running should load highly on the individual end of individual-team, highly on the surface end of surface-air (plane of action) and perhaps cluster with target sports due to its unidirectional, non-interactive nature.

The dimensions uncovered in this study may not apply to a broader sports domain, especially one that is not organized under the constraints placed upon this stimulus domain. If the domain is broader, other dimensions may emerge, increasing the complexity of the configuration, or super-ordinate dimensions may emerge, providing more parsimonious explanations. The generalizability of these dimensions to such broader domains is a question for future study.

Individual Differences

Some individual differences in the proximities were found using MANOVA and centered around how volleyball was judged. Those in Canada for more than ten years saw volleyball as less similar to
tennis than those who lived in Canada for 10 years or less. Females, 20 and older, saw volleyball as less similar to both bowling and hockey than did males, 20 and older. However, it is not clear as to why volleyball is perceived differently by these groups.

Experience with sports was not found to be a source of individual differences, contrary to expectations; however, the EXP x YLC interaction tended towards significance. Experience or the EXP x YLC interaction may have been found to be a significant factor if a measurement instrument more sensitive to variances in experience had been employed. Respondents varied little in the way of sports experience as it was measured in the present study. A five point scale measuring degree of experience with each sport, rather than a simple YES/NO format, should be more sensitive to individual differences in experience and is recommended for future studies.

Although some individual differences were identifiable via MANOVA, the principle components and the judgement clusters indicated that these differences are not strong enough to detract from the representativeness of the aggregate solution. Nevertheless, future study will focus upon how the stimulus configuration may vary among the differing groups. Of particular interest is whether or not differences in proximities reflect differences in weights assigned to dimensions by different groups or reflect the use of different dimensions. One might find, for instance, that the third dimension, which is uninterpretable in the group solution, has meaning for one or more of the groups in a sub-aggregate analysis.
Relation to Past Studies

Bergier (1978) and Levine (1977) both performed MDS and cluster analysis on a set of sports stimuli. The results of the present study are moderately similar to those of Levine, but quite unlike those of Bergier. However, Bergier used a very different sample of subjects and an almost non-overlapping stimulus set (comprised of spectator sports). Levine's sample and stimulus set were moderately similar to those in this study and also resulted in a two dimensional MDS solution. Levine, found, as did the present study, an individual vs team first dimension; however, his second dimension, degree of action, does not correspond to the present findings. Levine found some sports to cluster in a manner similar to this study. In particular, common clusters of major team sports and bowling and golf are evident. In both studies, baseball splits from the remaining team sports to become a cluster unto itself. Such parallel findings suggest that individual vs team and major team sports are pervasive organizing dimensions of people's perceptions of sport, and reinforce the finding that baseball is considered as a very different sport than the rest.

The differences between the present study and that of Levine's are attributable to both differences in stimulus domains and in differences in methods employed. The stimulus domain in the present study is more well-defined than is that of Levine's. The present research also attempted to overcome a weakness in Levine's study by using as data direct judgements of sports similarity rather than
measures derived from responses to bipolar adjective scales. As may be recalled, the disadvantage of the use of adjective scales is that respondents must confine their responses to criteria prespecified by the researcher (Green & Rao, 1972) which are unlikely to reflect all the relevant dimensions underlying the stimulus domain (Schiffman et al., 1981). By remedying these deficiencies in Levine's study, the present study obtained an MDS solution which was a substantially better fit to the data (stress in the present study was .021 compared to Levine's .196) and which contained qualitatively different dimensions.

Implications

Any implications to be drawn from this study must be tempered by the fact that this analysis is based on a small sample of possible participant sports, utilizes a relatively narrow sample of respondents (university students), and that it does not attempt to relate perceptions of sports to preferences for participation or to actual participation. However, all else being equal, one can argue that the more similar two sports are, the greater their substitutability. Given the unavailability of one sport from within the domain of this study, suggestions can be made to which of the other sports may be likely substituted. The cluster solution, represented in the two-dimensional configuration suggests that: bowling and curling; badminton and tennis; and basketball and football may be interchangeable. Golf may serve as a substitute for either curling or bowling in warm weather, and hockey could substitute for basketball or football in some winter locals. Baseball, however, seems sufficiently different from other sports so as to make it
possibly irreplaceable.

Future research should attempt to produce a more complete perceptual taxonomy based on a larger demographically representative population of respondents. The relationships among sports perceptions, sports preferences, and sports participation needs to be explored with multidimensional methods to determine if there is a causal sequence from perception to choice to action and to map how the defining concepts transform from solution to solution. Specific, empirical evidence needs to be obtained as to whether or not perceived similarity is indeed related to substitutibility. There is a tremendous lack of knowledge about people's perceptions and choice behaviours regarding sports. The present study is a first step towards more fully understanding this important subset of leisure activities.
SPRKS ATTITUDE SURVEY

(DO NOT PUT YOUR NAME ON THIS SURVEY)

Age (in years): ___  How long have you lived in Canada (in years): ___
Sex: ___

We are interested in your perceptions of various sports. Please begin by responding to the following statements about your knowledge of sports by checking yes or no beside each item.

I am familiar with:  I have seen:  I have played:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
<th>YES</th>
<th>NO</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
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INSTRUCTIONS

We are interested in how similar various sports are to one another. These sports are the same as those which appeared on the previous page. On the next few pages you will find 12 lists of sports, each with a different sport at the top of the list in capitals and underlined. We will call the sport at the top of each list the Reference Sport. Please number the sports in each list according to how similar you consider them to be to the Reference Sport. The sport in the list which you think is most similar to the Reference Sport should be given the number 1. The sport which you think is the second most similar to the Reference Sport should be given the number 2, and so on. When you have finished a list, each sport should have been given a number from 1 to 9. Consider example A:

A. CAR:

BUS (1)
AIRPLANE (3)
TRAIN (2)

Bus was ranked 1 because it was the most similar mode of travel to car. The next most similar mode of travel was train, so it was ranked 2. Finally, airplane was ranked 3 because it was the least similar mode of travel.

Now you try Example B. Below is a list of food items. Rank how similar the Reference Item is (which is in this case STEAK) to all the other items in the list.

B. STEAK:

FISH (2)
LETTUCE (3)
HAMBURGER (1)

If you have any questions please raise your hand and someone will be glad to assist you.

Now you are ready to proceed with the sport similarity rankings on the following pages.
Rank how similar each of the sports in the list is to the **Reference Sport** at the top of that list. Remember to use all the numbers between 1 and 9 in your ranking.

<table>
<thead>
<tr>
<th>1. Football:</th>
<th>2. Curling:</th>
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<tbody>
<tr>
<td>Baseball ( )</td>
<td>Volleyball ( )</td>
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<td>Curling ( )</td>
<td>Hockey ( )</td>
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<td>Basketball ( )</td>
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<td>Tennis ( )</td>
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<td>Volleyball ( )</td>
<td>Baseball ( )</td>
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<tr>
<td>Badminton ( )</td>
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<td>Golf ( )</td>
<td>Golf ( )</td>
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<tr>
<td>Hockey ( )</td>
<td>Football ( )</td>
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<tr>
<td>Bowling ( )</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Hockey:</th>
<th>4. Tennis:</th>
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</thead>
<tbody>
<tr>
<td>Badminton ( )</td>
<td>Basketball ( )</td>
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<td>Tennis ( )</td>
<td>Baseball ( )</td>
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<td>Curling ( )</td>
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</table>
Rank how similar each of the sports in the list is to the Reference Sport at the top of that list. Remember to use all the numbers between 1 and 9 in your ranking:

### 5. BASEBALL:
- Golf ( )
- Bowling ( )
- Tennis ( )
- Hockey ( )
- Football ( )
- Basketball ( )
- Badminton ( )
- Volleyball ( )
- Curling ( )

### 6. BOWLING:
- Football ( )
- Volleyball ( )
- Baseball ( )
- Badminton ( )
- Hockey ( )
- Golf ( )
- Basketball ( )
- Curling ( )
- Tennis ( )

### 7. VOLLEYBALL:
- Hockey ( )
- Badminton ( )
- Golf ( )
- Bowling ( )
- Basketball ( )
- Tennis ( )
- Curling ( )
- Football ( )

### 8. BADMINTON:
- Curling ( )
- Basketball ( )
- Hockey ( )
- Baseball ( )
- Bowling ( )
- Volleyball ( )
- Football ( )
- Tennis ( )
- Golf ( )
Rank how similar each of the sports in the list is to the Reference Sport at the top of that list. Remember to use all the numbers between 1 and 9 in your ranking.

9. BASKETBALL:
   BOWLING  ( )
   GOLF     ( )
   VOLLEYBALL ( )
   FOOTBALL ( )
   TENNIS  ( )
   CURLING ( )
   BASEBALL ( )
   BADMINTON ( )
   HOCKEY ( )

10. GOLF:
    TENNIS ( )
    FOOTBALL ( )
    BADMINTON ( )
    CURLING ( )
    BASEBALL ( )
    BOWLING ( )
    HOCKEY ( )
    BASKETBALL ( )
    VOLLEYBALL ( )

11. FOOTBALL:
    BASEBALL ( )
    CURLING ( )
    BASKETBALL ( )
    TENNIS ( )
    VOLLEYBALL ( )
    BADMINTON ( )
    GOLF ( )
    HOCKEY ( )
    BOWLING ( )

12. CURLING:
    VOLLEYBALL ( )
    HOCKEY ( )
    BOWLING ( )
    BASKETBALL ( )
    BADMINTON ( )
    BASEBALL ( )
    TENNIS ( )
    GOLF ( )
    FOOTBALL ( )

Please check to see that you have responded to all the items in this survey. Be sure to turn this survey in and obtain a course credit point for your participation. Thank you for your cooperation.
References


Carey, N.C.: SAS Institute, Inc.


Carey, N.C.: Author.


Carey, N.C.: Author.


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