2013

On The System of Knowledge: A Classification of Studies Within the Field of Geography*

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*A study performed in the mid-1980s while the author was a graduate student, but not published at that time. I am resurrecting it now (2013), unaltered, only because I think the findings still may be of interest to some readers. — C. H. S.

Introduction

Geographers have put considerable effort into fretting over the question “What is geography?” There are many reasons for this concern, among them the continuing search for philosophical approaches relevant to their studies, the need to express to workers in other fields the basic content of the discipline, the desire to identify new challenges to their spheres of expertise, and even, at times, the call to defend the integrity of the subject itself. The answer “Geography is what geographers do” is adequate to the extent that it is descriptive of the state of things at any given time, but inadequate for its lack of relevance to endeavors such as curriculum planning, resource planning, philosophical exploration, and promotion of interdisciplinary growth.

Nevertheless, it seems clear that any attempt to address deeper issues must also deal with the study of things as they are—or, at least, as they are perceived to be. The latter point is an important one, because no group can set for itself a set of tasks more complicated or obscure than its own members feel comfortable with. Thus the “what is” question cannot be answered before we have some idea both of the “absolute range” of subjects within the field and the way geographers in sum perceive these as contributing to an overall structure and orientation.

Past attempts to understand the “system of geography” have largely been based, either explicitly or implicitly, on the philosophical insights of individual workers within the field. Related analysis has sometimes created the impression that geography must be highly multi-dichotomous; James and Martin (1981, p. 406) refer to this perception as having been “harmful to the clarity of geographical thought.” At the least, however, there do seem to exist various geographic “traditions” of study. Pattison (1964) dentified four of these: spatial analysis, area studies, man-land interactions, and earth science studies. Other definitions have also been suggested, for example: geography as an interdisciplinary “service field” at the intersection of the other natural and social sciences (Fenneman, 1919), geography as human ecology (Barrow, 1923), and geography as the study of spatial systems (Ackerman, 1963). That the argument continues unabated is evident from perusal of a more recent study: *Geography’s Inner Worlds* (1992).

It is thus apparent that the cleaver may be dropped across the field in many directions. The “cleaver approach,” however, produces little insight regarding the intra-discipline forces holding geography together. With this in mind, I decided to investigate the “what is” question in a different—and in a sense more direct—fashion, tracking geographers’ own perceptions of the internal relations within their field.

I sent questionnaires to a random sample of members of the Association of American Geographers (AAG) in the hope of collecting information that could be used to construct a classificatory picture of the “system” of geography. 378 forms were sent in all; of these 120 were returned. Some of the latter had to be discarded for various reasons; 110 were eventually found to contain usable data. About 90 were filled out in entirety (“about 90,” because absolute degree of completion of the task was hard to measure). This return rate was not altogether pleasing, but was satisfactory to the extent that it provided an adequate data base for statistical analysis.

The Questionnaire

The questionnaire presented two kinds of tasks. The first and main one involved performing a set of ratings. Respondents were asked to choose from a provided list of 60 subfields those four that most closely corresponded to their own professional interests within geography, and then to rate along a scale of one through five their perception of how closely related each of the four was to each element of the entire list. A set of 240 ratings was thus recorded on each completed questionnaire. The initial list of subfields was constructed from several sources, especially the *AAG Newsletter* and yearly application form. Naturally, considerable subjectivity was involved in setting up this list, but it is felt that it provides a reasonably fair representation of recognized subfield interests within professional geography. (See Table 1.) No attempt was made to "equalize" the level of generality or nature of the studies included; indeed part of the object of the investigation was to identify the structural relationships inherent in such different levels of organization.

Respondents were given no further instructions on how to perform their ratings. Some of them complained about this, and a number apparently misunderstood the directions, but on the whole the results were quite satisfactory. A second task was also included in an effort to generate stratifiable data. Respondents were asked to note their length of experience as "professional geographers" (0–10 years, 10–20 years, or greater than 20 years), whether their undergraduate degree was in geography or some other field, and whether they usually attend (i.e., more than half the time) annual national meetings of the AAG. Regarding length of experience, 54 respondents reported "0–10," 31 reported "10–20," and 24 reported "greater than 20." 65 respondents reported that geography had been their undergraduate major; 44 responded in the negative. 56 respondents indicated that they usually attend national meetings, whereas 53 do not. An SPSS CROSSTABS analysis on these data produced only one set of results significant at the .05 level: AAG members who were not undergraduate geography majors tend to take part in national meetings less frequently than do those who were.

Despite the relatively small number of respondents, I attempted some stratified analyses on the main task data, but obtained no results that appeared significantly different from the results of the unstratified analyses. Only the latter, therefore, are described here.

Analysis Methods

Standard univariate and multivariate statistical methods were used to analyze the matrix of compiled ratings. These included correlation, regression, cluster analysis, and multidimensional scaling (MDS). The last was deemed especially important in the portrayal of field structure. MDS is now reasonably well known outside of its realm of most frequent use, psychology, but it may still be useful to provide a brief description of the method before continuing.

The basic value of MDS lies in its function of transforming a matrix of similarities data (or dissimilarities, distances, etc.) into an array of coordinate locations set within an n-dimensional Euclidean space. It is mathematically similar to other multivariate statistical techniques, but differs operationally in its employ of iterative procedures to force "best fit" solutions. Except under trivial conditions, the reduction to a few dimensions of the variation inherent in a data matrix involves some distortion; the degree of "badness of fit" of a given solution in n dimensions is most commonly measured by a statistic known as its "stress." High stress thus indicates poor correlation between the original data and its representation as an n-dimensional configuration. Stress can be reduced by increasing the number of dimensions of the solution (in an analogous fashion to the way increasing the number of factors increases variation explained in factor analysis). In general, MDS may be said to be a technique which solves the problem of determining the relative locations of a set of entities when only the distances among them are known. For further discussion of the method, see Kruskal and Wish (1978), Davison (1983), Gatrell (1983), Young (1987), and Green (1989).

As a first step in analyzing the data collected, a 60 by 60 matrix was created by allocating all ratings to their proper cells and then obtaining a mean rating for each cell. The full matrix was then collapsed to a lower half matrix. This was done despite the fact that in the initial compilation lower and upper halves were not symmetric (moreover, a rating of similarity between, for example, urban geography and physical geography performed by an urban geographer is conceptually different than the same rating performed by a physical geographer). The step was taken for two main reasons: symmetry was desirable for statistical analysis purposes, and collapsing the data in essence doubled the average number of cases associated with each cell's mean rating. Despite the fact that MDS is considered a very robust analysis method, the small number of respondents had initially been a matter of some concern, as even after collapse the average number of cases behind each cell's mean rating was only thirteen. On the other hand, 60 by 60 is a large matrix. Secondary analysis of several types indicated that the data were extremely well-behaved. Not only did the two halves of the initial matrix have nearly identical mean ratings, but each half was correlated nearly equally with the averaged lower half matrix. A follow-up regression analysis involving the same comparisons exposed no aberrant residual patterns. The correlation between the two halves of the matrix was $r = .45$; those between the two halves and the averaged lower half were $r = .78$ and $r = .80$. As a further precaution, the same tests were applied in analyses involving the 213 (out of a total of 1770) rating means associated with cells containing the most ratings (cases). Predictably, the correlations improved to $r = .74$ between halves and to $r = .92$ and $r = .93$ between each half and the averaged lower half. Again, no systematic problems surfaced from the follow-up regressions. These findings, while they in no way indicate that the two halves of the initial ratings matrix are identical in detail (indeed, additional investigation would probably lead to the conclusion they are not, and in interesting ways), do support the legitimacy of their collapse for present purposes.

Once the data had been arranged into appropriate form, the nonmetric version of KYST-2A (Kruskal et al, 1977) was applied to them. Solutions were obtained in one through five dimensions. Four dimensions provided the most instructive results (two and three dimensional solutions produced much less favorable scattergrams of actual vs. estimated values than did the four dimensional solution, stress did not markedly decrease after four dimensions, and the five dimensional solution exhibited no apparent structural refinements over the four dimensional solution). The coordinates of the four dimensional solution were then used as the input for a cluster analysis using the information statistic-based approach of Johnston and Semple (1983). The use of output from MDS studies as input for cluster analysis is usually frowned upon; hierarchical cluster analysis, especially, relies on rather different mathematical assumptions regarding the comparison of similarities than does MDS. Here, however, classification was applied mainly in an effort to make the visual results of the MDS analysis easier to appreciate (i.e., I wanted results that were directly compatible with the structural dimensions identified through the latter). The information statistic-based method was deemed appropriate because it is non-hierarchical and determines, through an exhaustive examination of all partitionings, that one which maximizes variation explained. Lastly, an analysis involving linear regression was performed in an effort to determine whether the compression of the original similarities matrix into the four dimensional MDS configuration had been accompanied by any systematic and interpretable changes in the data; i.e., whether particular subfields within geography are viewed in one way in individual comparisons between subfields but in another way after the sum of all such comparisons is taken into account.

Results

1. *The MDS Configuration: Distances Structure*

Of themselves, the standardized four dimensional coordinates comprising the MDS output configuration relay little interpretable information. Once Euclidean distances are calculated between all pairs of points in the configuration, however, useful descriptive statistics may be extracted from these. In Table 1 four such statistics (and some further information discussed later) are reported that describe the distance relationships between each point (subfield) and the set of all others. The rank of the mean distance from each point to all others is informative in indicating the perceived relative centrality of each subfield within the field as a whole. Thus, the subfield with the lowest mean distance to other subfields, "land use studies," was perceived by the respondents as a group as being closer to the "core" of geographic studies than any of the other 59. Ranking second and third, respectively, are "regional geography: physical," and "environmental impact analysis."

The Euclidean distance from each point to the origin (standardized coordinates 0,0,0,0) relays slightly different information than the mean distance because the configuration is not perfectly symmetric about the origin. It can be used as another way of interpreting the centrality of a point within the configuration, but also provides a clearer picture of the overall shape of the configuration (when the actual distances behind the rankings are studied). As it turns out, there are fewer points that are close to the origin than would be expected by chance; the interpretation seems to be that geographers as a group view their field as a discipline without central focus!

Lastly, the coefficient of variation and variance in distances between each point and all others relay some information regarding the degree of what might be termed the perceived "general service function" of each subfield. Subfields represented by a small coefficient of variation in Table 1 may be interpreted as those for which respondents could establish only a low degree of systematic affinity; in other words, these are perceived as the subfields of least relative systematic specialization. The five lowest rankings are for "geographic education," "General Systems Theory," "land use studies," "time geography," and "landscape studies." Care must be exercised in interpreting these rankings, however, as in this instance the coefficients of variation are biased to some (small) degree by the (slight) asymmetry of the configuration. For this reason, rankings of the variances are also listed in Table 1 to provide further relevant information.

Table 1. List of the sixty subfields considered in the study, ranks of each (including mean values for ties) with regard to five descriptive statistics, and the number of times each subfield was used by respondents as a basis for comparison. Lowest ranks correspond to lowest statistics for columns one through four. See text for explanation.

Subfield Name and Number Code	Rank, Mean Distance	Rank, Distance to Zero	Rank, Coeff. of Variation	Rank, Variance	Rank Change	No. of Respondents
soils (1)	43	45	43	46	6	2
diffusion studies (2)	20	22	33	29	13	4
housing (3)	48	49	57	59	-11.5	5
history of geographic studies (4)	60	60	1	20	-3	4
remote sensing (5)	41	40	24	28	-12	10
environmental law (6)	49	48	16	22	1.5	1
time geography (7)	36	32	4	4	10.5	0
regional science (8)	10.5	13	54	41	0	5
recreation geography (9)	21	20	19	13	-19	3
urban geography (10)	12	17	60	52	11.5	27
fluvial geomorphology (11)	54	54	37	57	4.5	2
settlement theory (12)	28	29	40.5	38	-17.5	4
bibliography (13)	46	42	2	6	6	1

natural hazards (14)	25	25	31	24	11.5	3
agricultural geography (15)	15	14	23	12	4.5	7
behavioral geography (16)	27	28	47	42	2	5
location theory (17)	32	36	58	53	-8.5	6
conservation/preservation (18)	31	30	29	23	-2	8
population geography (19)	29	33	59	56	-14	10
geography of crime (20)	58	58	18	49	-5.5	0
glacial studies (21)	55	55	32	54	1	3
public policy studies (22)	17	19	40.5	35	12	7
medical geography/epidemiology (23)	51	51	10	26	-7.5	3
regional geogr.: physical/ecological (24)	2	2	25	10	37	7
reg. geogr.: cultural/political/economic (25)	16	18	36	31	-9	24
spatial interaction modeling (26)	14	11	22	11	9.5	3
geographic information systems (27)	37	35	15	14	-30	7
geogr. thought/philosophy of geogr. (28)	35	31	6	8	-11.5	6
paleogeography/Quaternary studies (29)	59	59	17	50	1	4
natural resources management (30)	5	5	46	30	41.5	15
environmental impact analysis (31)	3	3	39	17	33.5	6
historical geography (32)	38	37	29	34	-20.5	25
political geography (33)	40	38	34	40	-33	14
synoptic climatology (34)	50	50	13	27	-9	3
General Systems Theory (35)	30	26	5	2	-1	2
economic geography (36)	6	9	56	44	17.5	13
cultural geography (37)	23	27	53	45	0.5	33
geographic education (38)	24	16	3	1	-23	9
computer graphics (39)	52	52	14	32	-11	6
water resources (40)	8	8	35	19	38.5	4
field techniques (41)	26	24	20	15	15	2
land use studies (42)	1	1	21	2	45.5	14
social geography (43)	34	39	55	55	9.5	7
transportation geography (44)	39	41	50.5	48	-26.5	4
biogeography (45)	47	46	29	39	-14	5
underdeveloped nations (46)	42	44	49	51	-35	7
energy studies (47)	22	21	27	18	-7	2
marketing geography (48)	44	47	42	47	-7.5	4
research methodology (49)	18	15	9	9	1.5	1
physical geography (50)	10.5	12	48	37	40	9
landscape studies (51)	13	7	8	5	-9.5	11
migration studies (52)	19	23	50.5	43	14	3
hydroclimatology/hydrology (53)	53	53	45	58	2	4
cartography (54)	45	43	11	16	-30	13
oceanography (55)	57	56	7	33	1.5	0
planning (56)	4	6	52	36	13.5	14
statistical methods (57)	33	34	26	25	-20.5	6
downslope processes (58)	56	57	44	60	-2.5	2
manufacturing geography (59)	9	10	38	21	-2	3
environmental perception (60)	7	4	12	7	-3.5	5

2. Classification Results

Through the aid of the cluster analysis it was possible to produce various classifications of the data at hand. None of these has any obvious statistical superiority over the others; the grouping into seven classes seems subjectively the most instructive, however, and this is reported in Table 2. The class labels I have designated are provided for simplification purposes only.

Table 2. Non-hierarchical cluster grouping of the sixty subfields into seven classes.

Class One ("Human Geography")

settlement theory (12), population geography (19), regional geography: cultural/political/economic (25), historical geography (32), political geography (33), cultural geography (37), social geography (43), underdeveloped nations (46), landscape studies (51), migration studies (52)

Class Two ("Pedagogic Studies")

history of geographic studies (4), time geography (7), bibliography (13), medical geography/epidemiology (23), geographic thought/philosophy of geography (28), geographic education (38)

Class Three ("Spatial Behavior")

recreational geography (9), behavioral geography (16), geography of crime (20), public policy studies (22), environmental perception (60)

Class Four ("Natural Resources")

soils geography (1), environmental law (6), natural hazards (14), agricultural geography (15), conservation/preservation (18), natural resources management (30), environmental impact analysis (31), water resources (40), land use studies (42), energy studies (47), hydroclimatology/hydrology (53), oceanography (55)

Class Five ("Spatial Analysis Studies")

diffusion studies (2), regional science (8), spatial interaction modeling (26), geographic information systems (27), General Systems Theory (35), computer graphics (39), marketing geography (48), research methodology (49), cartography (54), statistical methods (57)

Class Six ("Urban Systems Studies")

housing (3), urban geography (10), location theory (17), economic geography (36), transportation geography (44), planning (56), manufacturing geography (59)

Class Seven ("Physical Geography")

remote sensing (5), fluvial geomorphology (11), glacial studies (21), regional geography: physical/ecological (24), paleogeography/Quaternary studies (29), synoptic climatology (34), field techniques (41), biogeography (45), physical geography (50), downslope processes (58)

3. The MDS Configuration: Dimensional Structure

Despite the relatively small sample size, the results make intuitive sense and I strongly suspect that additional data would not alter them very much. Figure 1 consists of the four dimensional configuration, plotted two dimensions at a time. Subjective evaluation of these breakdowns suggest interpretations for the set of coordinate values comprising each dimension. Dimension one clearly reflects the human/physical dichotomy within the field; i.e., the lowest negative values are associated with physical geography studies, whereas the highest positive values are associated with social geography studies. Dimension two consists of a gradient between what might be termed "philosophical studies" and those that are highly technical and/or analytical in nature. Within dimension three is contrasted the interdisciplinary study of the natural environment and specific methodological techniques used to study geographical systems. Dimension four is the most difficult to interpret, but seemingly aligns those subfields that are classically associated with traditional geography against subfields that are new or deal with subjects often not associated with geography at all. However, it has also been pointed out to me that the more field-oriented specialties dominate the higher end of the dimension; the lower end, on the other hand, appears to be occupied by conceptual studies. As an aid to interpreting the internal structure of the system produced here, the class structures listed in Table 2 have been superimposed on the configurations displayed in Figure 1. We thus find, for example, that Class Six ("Urban Systems Studies") is defined in this system primarily on the basis of negative affinities with dimensions one and two.

4. Systematic Changes in the Initial Data Inherent in the Scaled Results

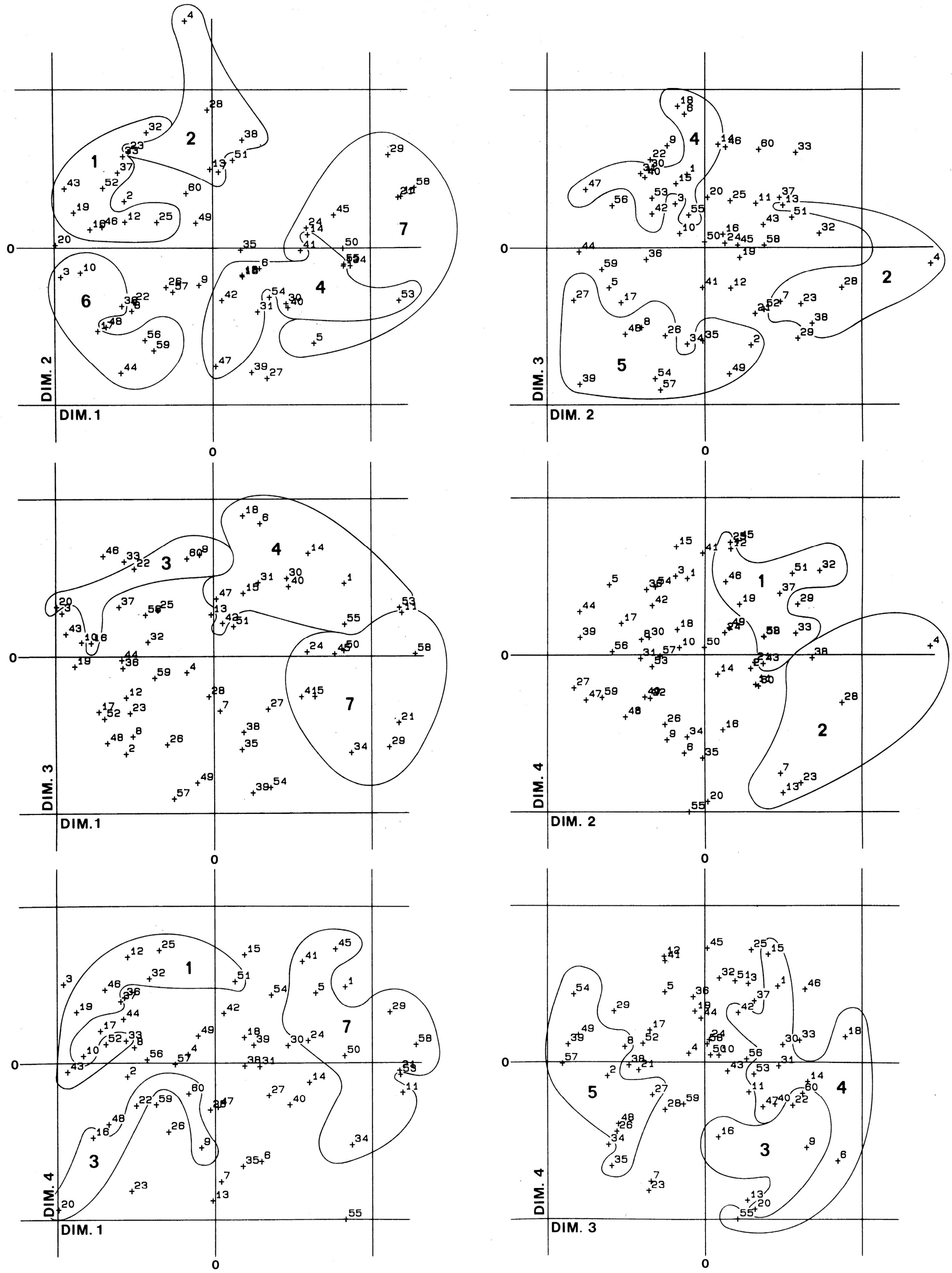
It is sometimes forgotten when studying an MDS output configuration that its derivative distances matrix relays rather different information from the initial matrix of similarities used to produce it. It is quite possible for objects (in this case, subfields) with high mean ratings in the initial matrix to end up rather remotely placed in the output configuration, and *vice versa*. The reason for this turnabout (apart from possible mis-application of the MDS procedure) is that some objects may be viewed as quite similar to a large number of other objects, but in ways that cannot be systematically represented in terms of all objects at once. A good example in the present case is "geographic education," which had the highest mean similarity rating across all comparisons, but ended up at place twenty-four in the "mean distance-to-other-points-in-the-configuration" tally. This subfield is thus apparently viewed as being individually quite relevant to all subfields listed, but in a fashion that does not serve to locate it within the main structural dimensions of the field. On the other hand, "land use studies" ranked only as a tie for position forty-five (!) in the similarities ratings, but moved to number one in the distances. This indicates that although respondents generally did not view this subfield as being highly related to their own individual studies, they had little trouble placing it within the realm of geography as a whole. Column Five of Table 1 lists the number of rank places that each subfield advanced or lost in the transformation from mean individual ratings to mean MDS configuration distances.

A question that naturally arises is whether there are any systematic changes involved in that transformation. This was investigated through a two-step procedure employing linear regression. First, the sixty mean ratings were regressed with the sixty mean configuration distances. The residuals from the operation were retrieved and then used as the dependent variable for a stepwise regression operation in which the independent variables were the coordinate values of the four dimensional MDS configuration. In the resulting regression model, dimension one proved to be a significant component at alpha = .000, with dimensions three and four adding marginally significant information (the overall model explained about twenty-seven percent of the variation in the residuals). Examination of the particular changes involved suggests that, in general, physical geography subfields have a more placeable image within the system of geography than do human geography subfields. This, despite the fact that a large majority of American geographers would probably characterize themselves as operating primarily within the latter arena.

5. Reliability, Validity and Other Considerations

The present data set, though small as regards number of respondents, is believed to be reasonably representative. The earlier-listed characteristics of the respondents, though difficult to compare in detail

Figure 1. Four-dimensional MDS representation (stress = .145) of relationships among the sixty subfields, plotted two dimensions at a time. A class structure from Table 2 is superimposed on given dimensional pairings when both Z scores for that class on those dimensions exceed plus or minus 1.50, or when the Z score on either dimension exceeds plus or minus 3.00.



with AAG membership statistics of which I am aware, do not appear to have any serious biases. The overall estimation of usual annual meeting attendance—51.4%—compares well with actual figures (especially if one takes into account unregistered attendees). There may be some concern that the more highly represented subfields have biased the results, but I do not feel this to be the case. Column Six of Table 1 lists the number of times each subfield was chosen as a basis for comparison; the range of values—0 to 33—is large, but to be expected (this range compares reasonably well with recent years' *AAG Newsletter* data on members' specialization interests). There is no correlation (r = -.003) between these values and the "changes in rank" values (Column Five of Table 1), indicating that high representation has no effect on whether a field loses or gains centrality in the system during the transformation of ratings into standardized distances. There is, however, a small but non-trivial correlation (r = .249) between Column Six values and the absolute values of Column Five, suggesting that degree of loss/gain is slightly related to representation. This is predictable, as number of ratings should optimally be related to representativeness of consensus, and thus to precision of placement within the MDS configuration. Whether this is a problem or an advantage here is debatable. As a technical exercise, the effect could largely be eliminated by prior weighting or attaching error estimates to the initial elements. I prefer, however, to leave the results as they stand, as there seems to be more value in understanding the group specification of the field as being, in fact, weighted by the more numerous perceptions of workers in the more popular subfields of study. Were the "objects" initially rated here actual objects I might argue otherwise, but in this instance the effect of ignorance of that rated is just as important to integrate as degree of familiarity is.

Considering the above, the "hollowness" of the MDS configuration noted earlier resists simple explanation (as might be expected!). Certainly, a number of the dichotomies/traditions noted earlier are plainly visible in the dimensional structure, but of themselves, these do not explain the phenomenon. The most straightforward interpretation, of course, is that there just is no subdisciplinary "core" for geography. Nevertheless, the results reported here do appear to identify "biases" of perception introduced by systematic ignorance of subdisciplinary function. Only Class Four ("Natural Resources") and Class Seven ("Physical Geography") show marked positive values as groups in Column Five of Table 1; the best interpretation of this fact is that physical geographers are in general less aware of what human geographers are doing than *vice versa*. This might suggest that, for the sake of intra-discipline balance and unity of purpose, more attention should be given in curriculum programs (and elsewhere) to introducing physical geographers to human geography concepts and study methods.

Where To Next?

The results of this pilot study left the investigator with the impression that only a few minor modifications of the questionnaire are warranted. Several subfields should probably be removed from the list and others substituted; the list should perhaps be slightly lengthened (to include, especially, interests such as "tropical geography," "arid lands geography," etc.) but the overall task reduced by decreasing the number of sets of ratings from four to three. If the number of respondents can be doubled, the specification of relationships should be improved enough to permit stratifications and additional investigations (for example, detailed "top half/bottom half" comparisons).

Structural classifications of this type might be used in a number of ways. For example, they can provide a context through which more specific studies on the sociology of geographical ideas could be developed. Gatrell's 1984 study might be noted in this regard. It would be particularly interesting to apply the kind of Q-analysis treatment he used in his study of spatial diffusion modeling citations to the various structures represented through the present MDS configuration results—for example, the relationships leading to the order expressed as dimensions two, three and four.

In a more general sense, this approach can provide clues as to more effective means by which to classify and access the knowledge making up any field of study. This process could lead in several directions, among them: (1) the development of clearer, more naturally-defined subject classifications whose implementation might help streamline efforts at bibliographic coverage; (2) parallel suggestions for refinement of software dealing with related information retrieval needs and venues; (3) the re-thinking of curriculum programs designed to teach various subjects; and even (4) the physical re-arrangement of library collections to respond to identified "cores" of interest.

A number of somewhat less ambitious applications can also be imagined. For example, studies of this kind might provide a base for subfield self-evaluation and interdisciplinary exploration efforts. It is not unthinkable to suppose that some of the results reported here do not agree with the perceptions of the workers within particular subfields; I would suggest, however, that the "blame" for such mismatches lies primarily with those workers. "Image resolution" within the system described here will only take place as new ties among subfields are forged and, importantly, reported in the appropriate avenues of publication.

Moreover, the specific system reported here could easily find a place in "research in geography" courses as an instructional device. Not only does it provide a general picture of the internal structure of the field that might be useful to a neophyte investigator at an early state in his or her education, but in addition the course instructor might also benefit from a close study of its dimensional infrastructure when in the stages of organizing his course. If the results discussed here do indeed relay some picture of the "system of geography," they should also implicitly be relevant to attempts to understand how to go about contributing to that system.

Perhaps structural classifications such as the one presented here could also provide information useful to the organization of conferences—the less overlap of sessions with similar subject content, the better!

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Appendix: Order of Subjects Scores on Each Dimensional Axis (highest placement first)

Dimension One	Dimension Two	Dimension Three	Dimension Four
downslope processes	history of geography	conservation/preservation	biogeography
fluvial geomorphology	geographic thought	environmental law	regional geography: human
hydroclimatology/hydrology	historical geography	natural hazards	agricultural geography
glacial studies	geographic education	recreation geography	settlement theory
Quaternary studies	medical/epidemiological	underdeveloped nations	field techniques
synoptic climatology	Quaternary studies	environmental perception	historical geography
oceanography	political geography	political geography	landscape studies
soils	landscape studies	public policy studies	housing
physical geography	bibliography	natural resources management	soils
biogeography	time geography	environmental impact analysis	underdeveloped nations
remote sensing	cultural geography	soils	remote sensing
natural hazards	downslope processes	water resources	cartography
regional geography: physical	migration studies	agricultural geography	economic geography
field techniques	social geography	energy studies	cultural geography
water resources	environmental perception	geography of crime	Quaternary studies
natural resources management	fluvial geomorphology	cultural geography	population geography
cartography	glacial studies	hydroclimatology/hydrology	land use studies
geographic information systems	diffusion studies	regional geography: human	transportation geography
environmental law	population geography	fluvial geomorphology	location theory
environmental impact analysis	biogeography	housing	research methodology
computer graphics	settlement theory	bibliography	regional geography: physical
geographic education	regional geography: human	planning	conservation/preservation
agricultural geography	research methodology	land use studies	political geography
conservation/preservation	underdeveloped nations	oceanography	migration studies
general systems theory	regional geography: physical	landscape studies	downslope processes
landscape studies	behavioral geography	social geography	computer graphics
land use studies	natural hazards	historical geography	natural resources management
time geography	geography of crime	urban geography	regional science
energy studies	physical geography	behavioral geography	history of geography
bibliography	general systems theory	physical geography	physical geography
geographic thought	field techniques	regional geography: physical	urban geography
recreation geography	oceanography	biogeography	planning
research methodology	synoptic climatology	downslope processes	statistical methods
environmental perception	soils	transportation geography	geographic education
history of geography	environmental law	population geography	environmental impact analysis
statistical methods	urban geography	economic geography	glacial studies
spatial interaction modeling	conservation/preservation	history of geography	social geography
regional geography: human	agricultural geography	manufacturing geography	hydroclimatology/hydrology
manufacturing geography	housing	geographic thought	diffusion studies
historical geography	recreation geography	remote sensing	natural hazards
planning	spatial interaction modeling	field techniques	fluvial geomorphology
public policy studies	statistical methods	settlement theory	environmental perception
regional science	cartography	geographic information systems	geographic information systems
medical/epidemiological	hydroclimatology/hydrology	time geography	water resources
diffusion studies	land use studies	location theory	manufacturing geography

settlement theory	public policy studies	medical/epidemiological	public policy studies
political geography	natural resources management	migration studies	energy studies
economic geography	economic geography	glacial studies	geographic thought
transportation geography	water resources	geographic education	marketing geography
cultural geography	regional science	regional science	spatial interaction modeling
marketing geography	environmental impact analysis	marketing geography	behavioral geography
migration studies	marketing geography	spatial interaction modeling	synoptic climatology
underdeveloped nations	location theory	Quaternary studies	recreation geography
location theory	planning	general systems theory	environmental law
behavioral geography	remote sensing	synoptic climatology	general systems theory
urban geography	manufacturing geography	diffusion studies	time geography
population geography	energy studies	research methodology	medical/epidemiological
social geography	computer graphics	cartography	bibliography
housing	transportation geography	computer graphics	geography of crime
geography of crime	geographic information systems	statistical methods	oceanography