

DE UTILITATE ET NECESSITATE GEOGRAPHIAE*

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'DE UTILITATE et necessitate Geographiae (concerning the usefulness of, and need for, Geography)': I borrow my title from the great seventeenth-century geographer, Bernard Varen, or Varenius, whose *Geographia Generalis*, incorporating the new theories of the universe of Copernicus, Kepler and Galileo, laid foundations on which Von Humboldt, Ritter and their successors built modern geography. Varen's book, the first English edition of which was edited at Cambridge by Newton, was widely accepted as a major contribution to European science.

Today, three centuries later, academic geography has grown vastly in factual knowledge, in concepts and in numbers of practitioners. Recently in Britain I visited departments with around 500 undergraduate and 20 post-graduate students, up to 30 full-time teachers, impressive capital facilities and major research programmes funded from both the public and private sectors. Despite the recession, I found virtually no unemployment of 1975 graduates, among whom only a third became teachers. Comparable growth may be seen elsewhere.

Despite such manifestations of vigour and utility, the essential nature, purpose and methods of contemporary geography are widely misunderstood. To other academics it seems awkwardly straddled between faculties; neither fish, fowl nor good red herring. To the man in the street the geographer seems at best regarded as a walking gazetteer of useless information — epitomised perhaps by a classic student howler, 'The Amazon is rich in undiscovered minerals' (quoted in the Institute of British Geographers, Annual Conference, 1974, p.56) — and his subject recalled as one hated at school. Few laymen seem to regard it as particularly useful, except as general education, fewer still as essential.

In claiming these attributes for geography, I shall not itemise our professional employment outlets or range of practical activities (surprising though some might find these), for such inventories seem inappropriate to an essentially serious academic occasion. In a university subject, a claim for usefulness and 'essentialness' can be no less than the high claim for the status of academic discipline, whose value to the world at large must flow from worthiness of academic pursuit. We were once advised in my department to produce — and I quote — 'practical people, not people who think', but felt unable to agree.

* An inaugural lecture delivered before the University of Rhodesia on 20 May 1976.

In this lecture I wish to present a personal and critical perspective of contemporary geography and then, briefly, to argue that this now extraordinarily rapidly-evolving discipline, and the earth's exponentially growing set of human and environmental problems are on convergent courses, a convergence likely to assign to geography an increasingly central role in research as a basis for decision-making within the next two decades. Believing this to be self-evident, I shall not refer to the vital educational role of the subject in providing a liberal education, and an understanding of our fascinating but crowded and threatened planet.

Let us look at the geographer.. The painting entitled 'The Geographer' by the seventeenth-century Flemish painter, Vermeer, is one version of him (Fig. 1). While appreciating the characteristic perception of light in this portrait, I find the interpretation of the subject unappealing. We see him indoors in a stuffy room, seeing little of the real world through the closed windows. Clearly, he is that despicable character, the armchair geographer. Note the pale face and scholarly stoop. Worse, he is a messy worker — I



Figure 1: THE GEOGRAPHER

By Johannes Vermeer (1632-75) (Staedel Institute, Frankfurt)

would not allow my students to carry out map analyses on crumpled tablecloths. Even though his dividers show that at least he measures things, I cannot take to him, for he is a layman's creation. On the other hand, a contemporary version (Fig. 2), shows the geographer as two-thirds a field man (and woman), essentially a quantifier, neatly bridging the natural and social sciences by conducting simultaneous physical and social surveys, and master of that trendy power tool, the computer. Professionally, if hardly artistically, this is a much more pleasing representation — except for the disturbing feature that he is divided, like Gaul, into three parts. Is geography, then, no longer a unified discipline? I shall return to this point.



Figure 2: THE GEOGRAPHER

(From *Area*, 1975, by permission of the Institute of British Geographers)

Turning to the geographer's object of study, by definition the earth, we note the force of the common criticism that this is a formidably large and complex object which it is arrogant to claim to study scientifically, notwithstanding much support from other earth sciences. Indeed, any claim that the earth was our academic oyster would be truly arrogant, but in fact we do not make it. Not only do we rely on the work of others for much of our information, but we ourselves focus our attention on certain *parts* of the earth and certain *aspects* of its study. We can identify what we *do* study by pruning away that which does not centrally concern us.

Firstly, we note that the earth, viewed as a planet, is on too small a scale to interest us particularly, since we cannot readily identify its various surface features. Geographers work mainly at medium scientific scales (as shown in Fig. 3), from large world regions down to, say, a few city blocks. Scale is a vital factor in geography, significantly influencing both the scope and methods of our studies and controlling levels of abstraction.

Next, we narrow our enquiries to that part of the earth where man and environment interact, generally disregarding outer space or inner earth core. For convenience, we divide this earth shell of interaction into atmosphere, lithosphere and hydrosphere, as modelled, for example, by Carol (Fig. 4). Overlapping these are the biosphere and pedosphere, plus those man-made

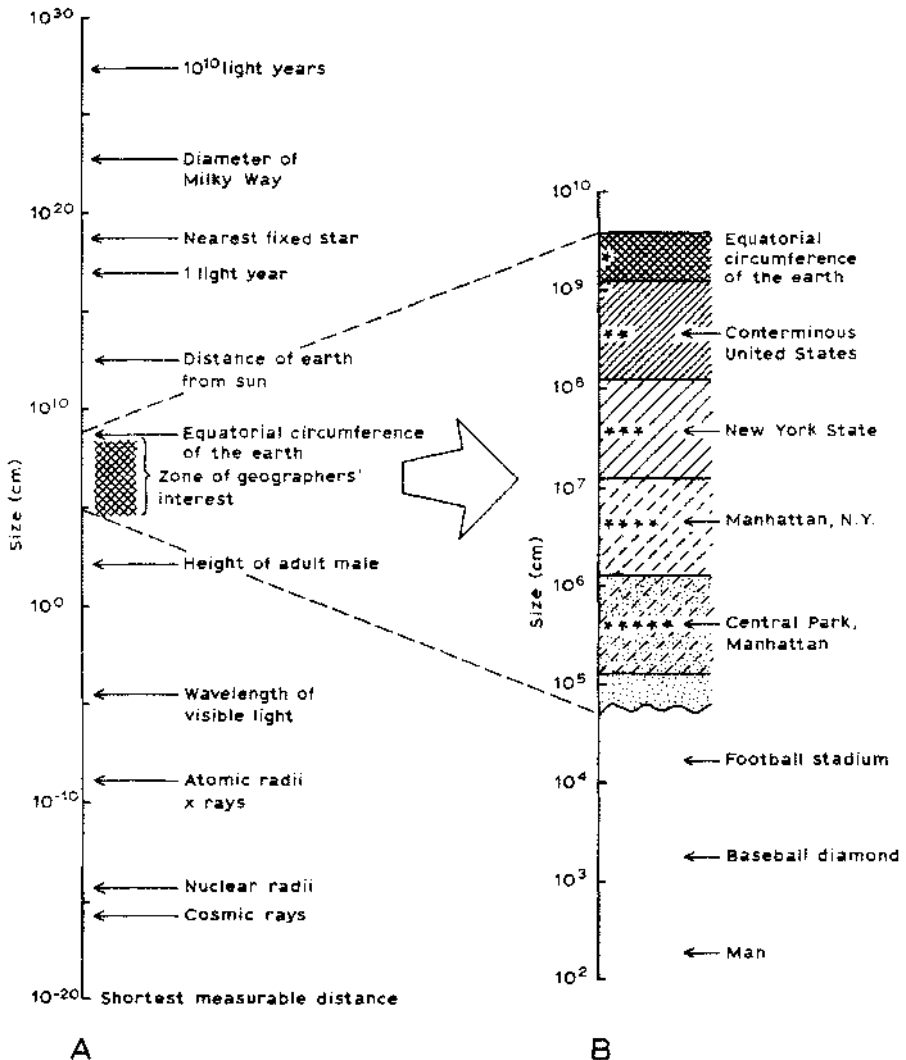


Figure 3: SCALE IN GEOGRAPHY (After Haggett, 1975)

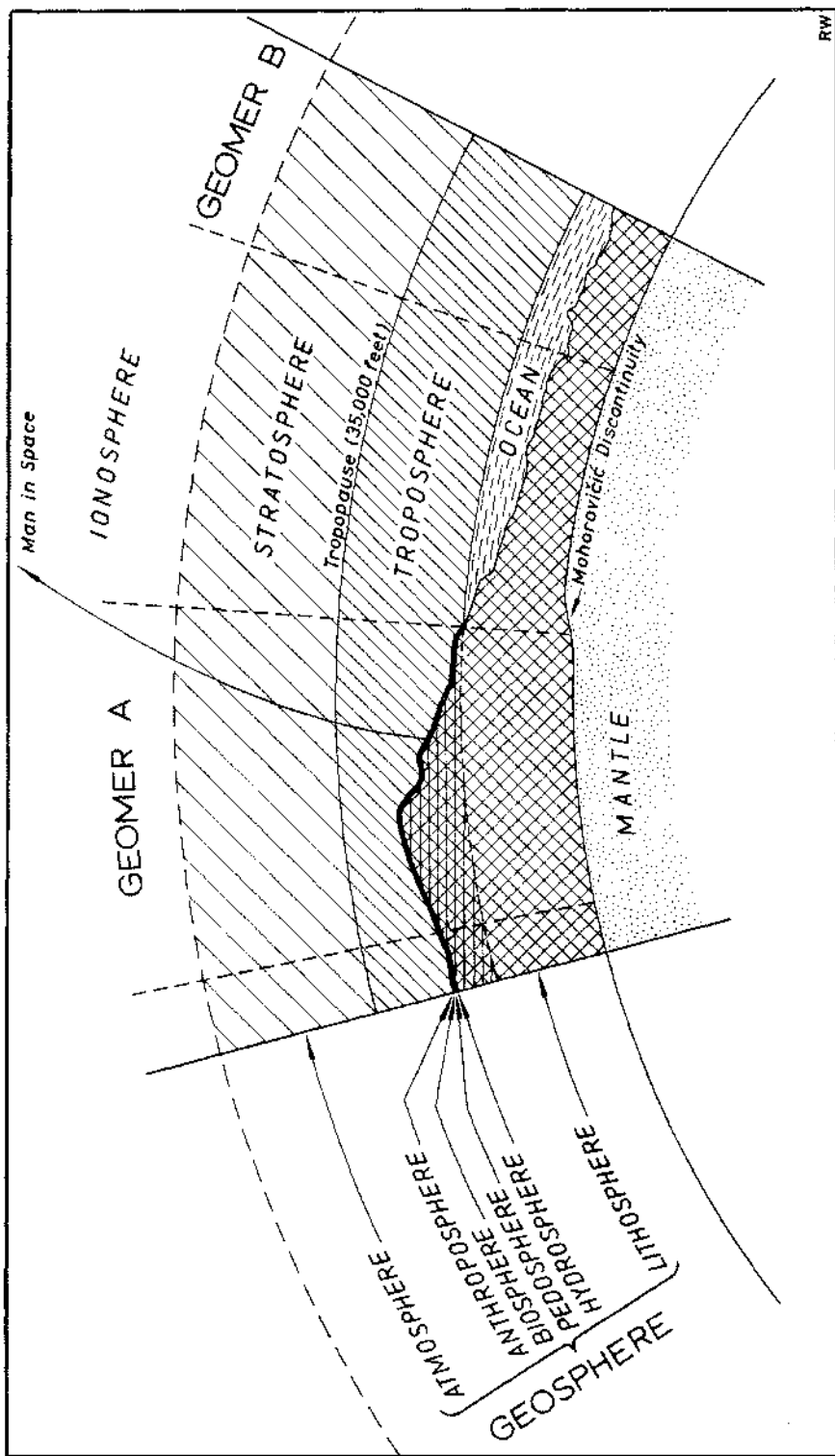


Figure 4: GEOSPHERE AND GEOMER (After Carol, 1969)

or man-dominated areas collectively forming what is here termed the anthroposphere, although there are other terms (Manshard, 1975, p. 148). These together make up what Hartshorne (1960, p.47) called the earth 'as the world of man', and Carol calls the geosphere. Substantially less than the entire planet, this is the geographer's object of study. More significant to geography than such systematic divisions as atmosphere (which derive from the systematic sciences) are areal, or loosely 'regional' crosscuts of the geosphere into *geomers*, because the essence of geographical study is man-environment interaction in its real word complex totality. Synthesis, not analysis, is the end product of our discipline, although systematic divisions are convenient in practice.

Finally, in limiting our field of study we adapt a particular spatial viewpoint of our residual 'world of man'. Our interest in the geosphere rests on the fact that it is not a uniform shell, but greatly varying from place to place: if the geosphere were uniform like the surface of a billiard ball there would be no geography to study. It also rests on the belief that the complex of dynamic spatial processes at work in the geosphere, and the patterns they form and re-form, express an underlying, holistic order, and are amenable to human reason. In this sense geography is the science of spatial processes and patterns, not of phenomena that serve as elements making up those processes or patterns.

Here, surely, lies the root cause of misunderstanding of academic geography. Whereas nearly all other sciences, natural and human, are systematic in that they focus centrally on phenomena — the botanist, plants; the geologist, rocks; and so on — geography is centrally concerned with the *spatial* attributes of all relevant phenomena, but not particularly with their other attributes. To over-simplify, we might say that systematic science may study maps to explain phenomena, geography may study phenomena to explain maps. The viewpoint of geography is thus distinctive and the trajectory of our discipline tends to cut transversely across the systematic trajectories of most other sciences. As C. A. Fisher has neatly put it, 'Against the universalist laws of the systematic sciences . . . geography [has] contraposed the variable of place' (Fisher, 1970, p.375). We are students of the variable of place.

This *fundamental* point is widely regarded as having originated in an analysis by Immanuel Kant (who for many years lectured on physical geography at Königsberg University), an analysis subsequently developed by Hettner and later by Hartshorne. Rather heroically summarised, his argument was that all knowledge is drawn either through pure reason or from experience through our senses. Knowledge from experience may then be classified either according to concepts, giving the logical classification of the systematic sciences, or according to time and place where found, the physical classification of history and geography, respectively, as chronological and chorological sciences. In the former, classification — the ordering process of science — is based on similarity of form of phenomena; in the latter, on similarities of places or times where phenomena are found. Geography is therefore exceptional (as is History) to the generally-accepted pattern of scientific ex-

planation. Although the 'exceptionalism' aspect of this argument has been criticised recently, the thesis underpins the, to me, basic concept of a transverse trajectory of investigation across the systematic sciences. My diagram of this concept (Fig. 5) indicates an operationally essential overlap between systematic sciences and the chorological — now called chorographic — science of geography. Systematic science makes significant and, in fact, increasing use of spatial perspectives, while geography draws on and contributes to phenomena-focused investigations to explain spatial processes. In fact, systematic investigations, derived from cognate sciences, provide the geographer with a lower order or peripheral methodology to his central chorographic methodology in which, in Anuchin's words (1973, p.46), 'The subject matter of geography within the geosphere of the earth appears as a synthesis of all near-surface spheres into one interacting system', or, as Chorley (1973, p.158) has put it, 'Geography concerns itself with the tangible, spatial manifestations of the continuing intercourse between man and his habitable environment'. In this intercourse Gourou (quoted in Beaujeu-Garnier, 1976, p. 91) has suggested that 'physical factors exert an influence only as a function of the civilizations which interpret them', thereby defining geography as basically anthropocentric. Von Humboldt and Ritter used the term, 'zusammenhang (a hanging together)', to describe this interacting system, while Bruhnes referred to 'connexité'. Geography is thus much misunderstood through being evaluated by the criteria of the systematic sciences, and consequently being found wanting. But one cannot legitimately criticise chalk for being tasteless cheese. Criticism of it as chalk, however, is another

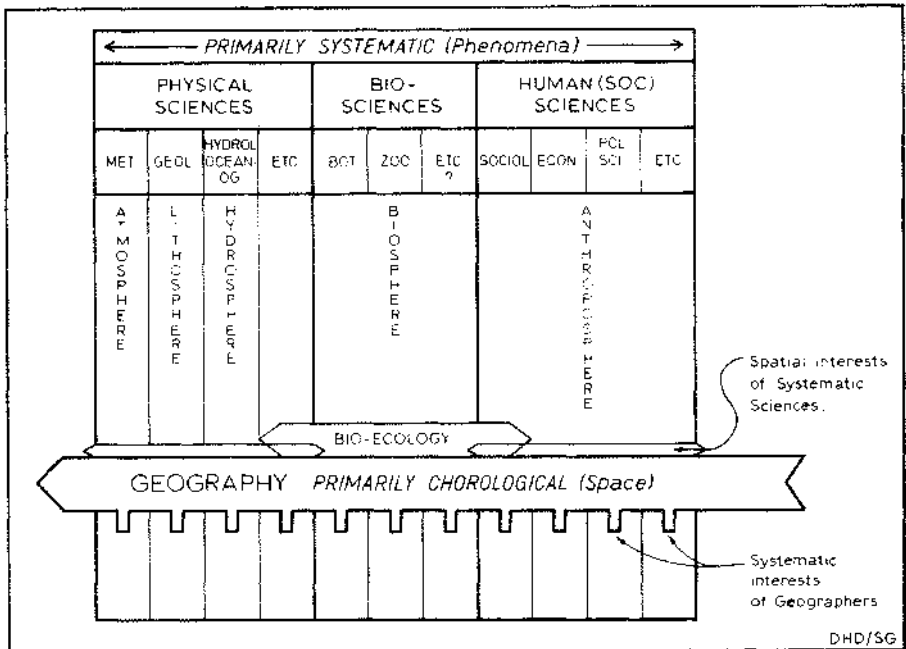


Figure 5: THE TRANSVERSE TRAJECTORY OF GEOGRAPHICAL INVESTIGATION

matter, and we must now glance at some aspects of the spatial concepts and methodology of geography as a chorographic discipline.

The geographer's methods of collecting data through field observations and survey, map analysis, library investigation and by limited experimentation, are well known and need no elaboration here. He has then tended traditionally to proceed from numerous case studies, through classification to inductive generalization and, usually through analogy, to limited theory construction and explanation. This 'Baconian' (Francis) research route, as Harvey (1969) calls it (Fig. 6), has reflected the fact that, since geographers

- 1: THE 'BACONIAN' ROUTE
- 2: AN ALTERNATIVE

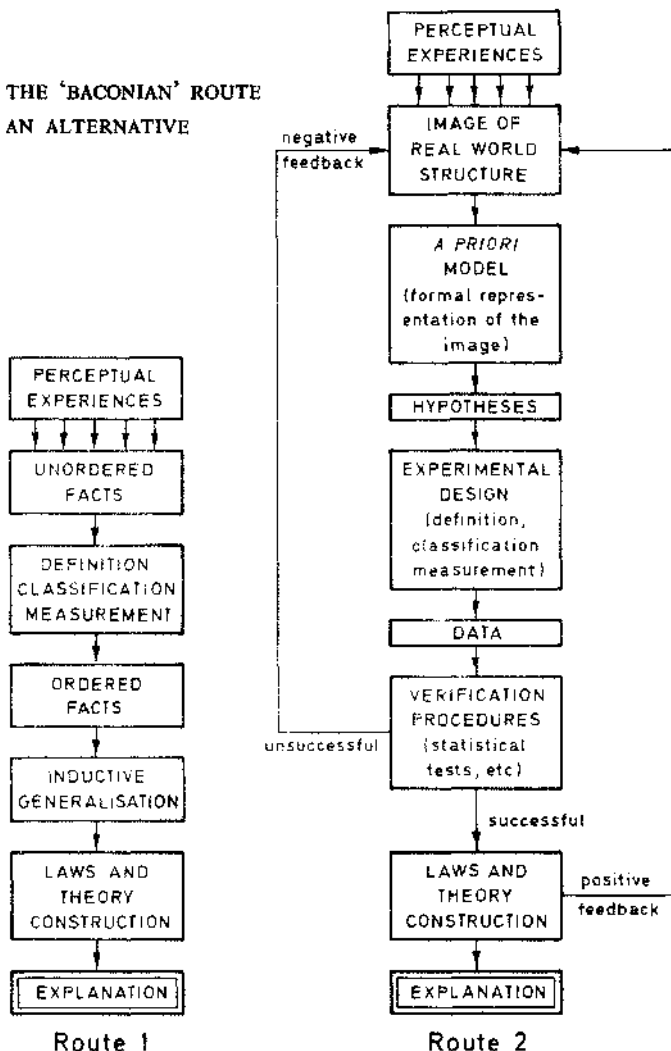


Figure 6: ROUTES TO SCIENTIFIC EXPLANATION
(After Harvey, 1969)

concentrate on the real, as opposed to some idealised, geosphere, they must recognise that this ultimately comprises unique places, so that an idiographic and thence inductive approach is appropriate as far as it will take us. Consequently, we still use this route today in dealing with an increasing conventional workload arising from the steady spread of world mapping, aerial photography, censuses and economic surveys, and from improved field mobility and increasing numbers of fieldworkers.

I must emphasize, nevertheless, that within the last two decades, geography has experienced a revolution in concept and methodology, possibly more far-reaching than any in its 2 000-year history as an identifiable subject or its more than a century as an emerging modern academic discipline. Dissatisfaction with traditional methods with limited explanatory and minimal predictive power has led to what has been described as 'the scientific dissonance that precedes scientific revolutions'. Although our revolution is still in progress, we can begin to see something of what is happening.

Firstly, there is an increasing sophisticated use of mathematical and statistical techniques for data processing, for modelling and testing of hypotheses, and for the construction of theory. This aspect of change, which initially went too far in attempting to raise the quantitative techniques from a means to an end — confusing, as it were, the shiny new power tool with the craftsman — is now essentially achieved. With some initial excesses and rather splendid absurdities beginning to fall away, it is increasingly seen to have conferred not merely greater precision and manipulative power to geographical research, but also improved capacity for logical reasoning and better communication with both natural and social scientists, opening up exciting possibilities for co-operation.

Following directly from this process of quantification, there has developed recently a strengthened concept of geography as the science rather than merely the recorder of the geosphere. In their search for deeper insights, geographers are turning increasingly to a more deductive route to explanation, which proceeds from *a priori* universal premises to statements about particular sets of events as suggested by Route II on Harvey's diagram.

A third important, and again related, trend is the shift of emphasis from investigating geographical patterns to an investigation of the spatial *processes* that create those patterns. Thus, for example, we pay more attention to physical processes that underlie landscape denudation, and also more to the flows of goods, services and information that create patterns of settlements. Increasingly, then, geography examines interactions in the geosphere between temporal process and spatial form. Berry (1973, p.10) has proposed that this new trend should be developed to become the major theme of geography, a new 'process metageography' (derived from process metaphysics), which he describes as follows:

The fundamental idea of process metaphysics is that the universe should not be regarded as made up of objects or things, but of a complex hierarchy of smaller and large *flow patterns* (i.e. processes) set within systems of even larger scales in which the 'things' are self-maintaining or self-repeating features of the flow with a certain invariance, even

though matter, energy and information are continually flowing through them. The shape of a waterfall . . . or the shape of clouds, which have a certain constancy even though masses of moist air are flowing through them and continually condensing and evaporating, would be examples. Similarly, in urban geography, the neighbourhoods of a city retain their characteristics only because the same kind of people move in and out; such self-maintaining flows preserve the social geography of the city. . . . In such a flow picture, the steady state patterns or 'objects' . . . can only be understood in a holistic relationship to their 'environment', with fields of flow extending outward indefinitely to the next such stable concentration of energy, and the next.

The emphasis in Berry's metageography is thus not on static structures but on a flow hierarchy. Of course, such systems can undergo sudden transformations to new self-maintaining arrangements which will in turn be stable for a long time — as when vortex patterns in a stream can be restructured by moving a rock in the streambed. Both the analogy with physics and the implications for decision-making in spatial or physical planning will be apparent. Hägerstrand's work in Sweden in the early 1950s on spatial diffusion theory was a classic early study of process in geography, in which he charted the spread of several agricultural innovations, including bovine tuberculosis controls and various subsidies to farmers, through the agricultural community through a process of gradual acceptance in space and time. He and his followers have since worked on operational models of this process. Their implications for the developing world are particularly interesting.

This development of a more dynamic perspective depends directly on the newer quantitative methods, particularly through modelling, so that the new concepts and methods are interactive and *in toto* represent no less than an emergent new paradigm for academic geography, largely a form of spatial systems analysis, which should enable us more meaningfully to probe underlying spatial order. In a complex world, as yet far from adequately described even in simple terms, however, we also retain our older idiographic, case-orientated studies as basic building blocks for higher studies of spatial systems. When the dust of our revolution has finally settled, I think we shall emerge again in a characteristically pragmatic posture, selecting particular tools and methods to cope with particular tasks as we become increasingly problem-orientated. As a direct consequence of this revolution, however, our new practicality will rest on firmer conceptual and methodological bases.

Our revolution has conferred another benefit. Previously, geography was in some danger of coming apart at the seams, and of its vigorous specialist divisions hiving off into the natural or social sciences on either hand. Basically, this was because weak chorographic theory at the core emphasized stronger systematic theory at the periphery, where it overlaps other fields. It is already apparent that new concepts are strengthening the core of our discipline and linking afresh so-called 'physical' and 'human' geography.

Before leaving this discussion of contemporary geography, I must briefly refer to three further trends, of perhaps wider interest. Firstly, in company

with other earth sciences, we are gaining access to large increments of geographical data at small scales through the complex of techniques rather whimsically named remote sensing. Specifically, multi-spectral satellite imagery is now deluging the earth sciences with photography from space and with digitised information. For analysis and spatial synthesis this must be captured within areal frameworks in the form of data banks, in the use of which the geographer's particular role, as a member of a multi-disciplinary team, is to assist with natural resource inventory and to take a lead in investigating direct man/land interactions as revealed in the imagery. It is perhaps fortunate for us that something of a time-lag has developed between the production and the scientific consumption of this mass of imagery, for it has enabled us to go some way in putting our academic house in order, the better to cope with it. (The time-lag, incidentally, resulted in the Christmas card industry becoming a significant consumer of space photography in the United States!)

Secondly, we are interested in insights psychologists provide into environmental perception, and we are adding mental maps to our stock-in-trade.

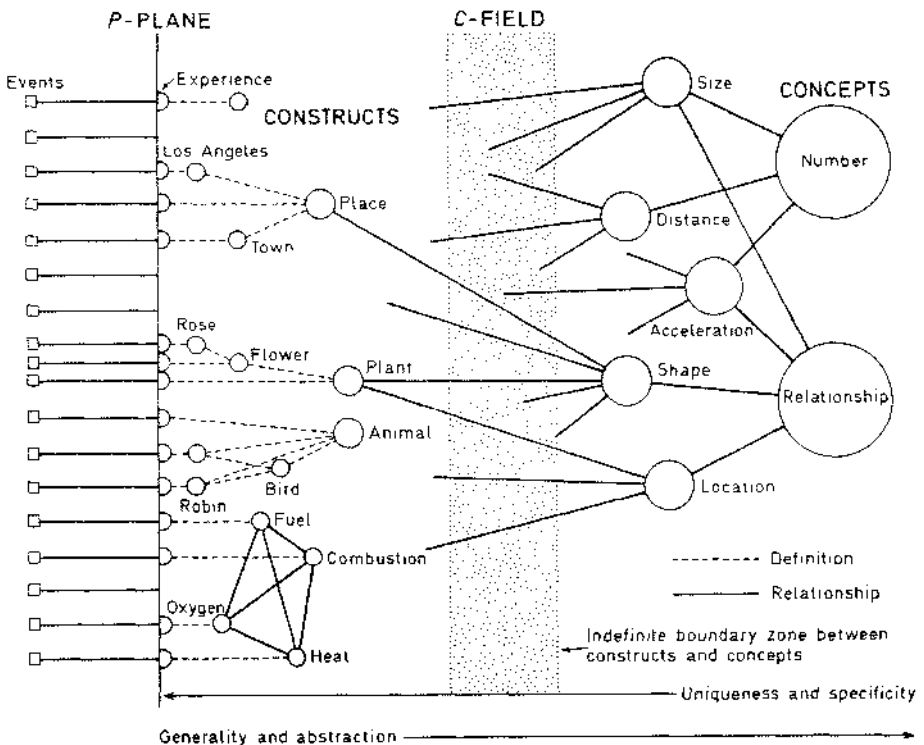


Figure 7: PERCEPTION: THE P-PLANE AND THE C-FIELD (After Margenau, 1961; and Abler, Adams and Gould, 1971)

Academic study has been described as the process of imposing order on experience. Abler, Adams and Gould's (1971, p.13) extension of Margenau's model (1961) of the intellectual process involved shows the starting point to be perception (Fig. 7). Certain events cross our sensory frontiers through our perception filters and became part of our experience, others remaining unperceived by particular individuals. Within this frontier — Margenau's P-plane — our mental constructs, our initial ideas about experience, impose a preliminary order upon them. Constructs are most specific near the P-plane (a rose), but became more generalised away from it (a flower, a plant). Thus, our mental manipulations of primary experience (or perception) bring us via increasing ordering and generalisation processes into the domain of scientific method. Geographers must accept, therefore, that there is a perception filter between individuals and the real environment, controlling both the strength with which they perceive environmental features, and the values they may attach to them. Some geographers are now formalising environmental perception into mental maps.

Gould and White (1974), in particular, have recently provided us with useful ideas on this subject. To illustrate the concept very simply, and not over-seriously, consider this home in Highlands, Salisbury, and how it might notionally be perceived by some of its occupants (Figs. 8-10). In this illustration we are concerned solely with which parts of the property are strongly perceived — the shaded areas — as opposed to the unshaded areas only faintly perceived: we are not here concerned with favourable or unfavourable perceptions. The first map describes the property in conventional terms; the maps suggest perception variations among some occupants. The last figure also combines these to indicate parts of the property strongly perceived by five, four, three persons, and so on. Among other things, this poses the question of why the owner chooses to pay for an acre but really 'sees' only half of it, whereas the person with the least stake in the property — the gardener — perceives almost all of it.

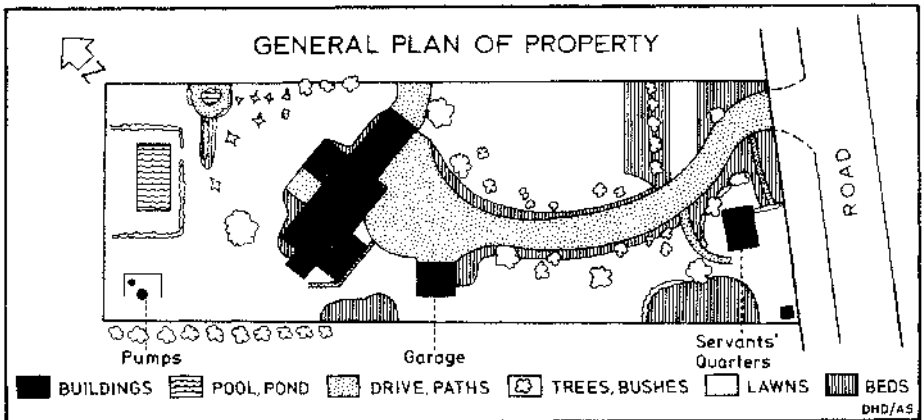


Figure 8: PERCEPTIONS OF PROPERTY (1)

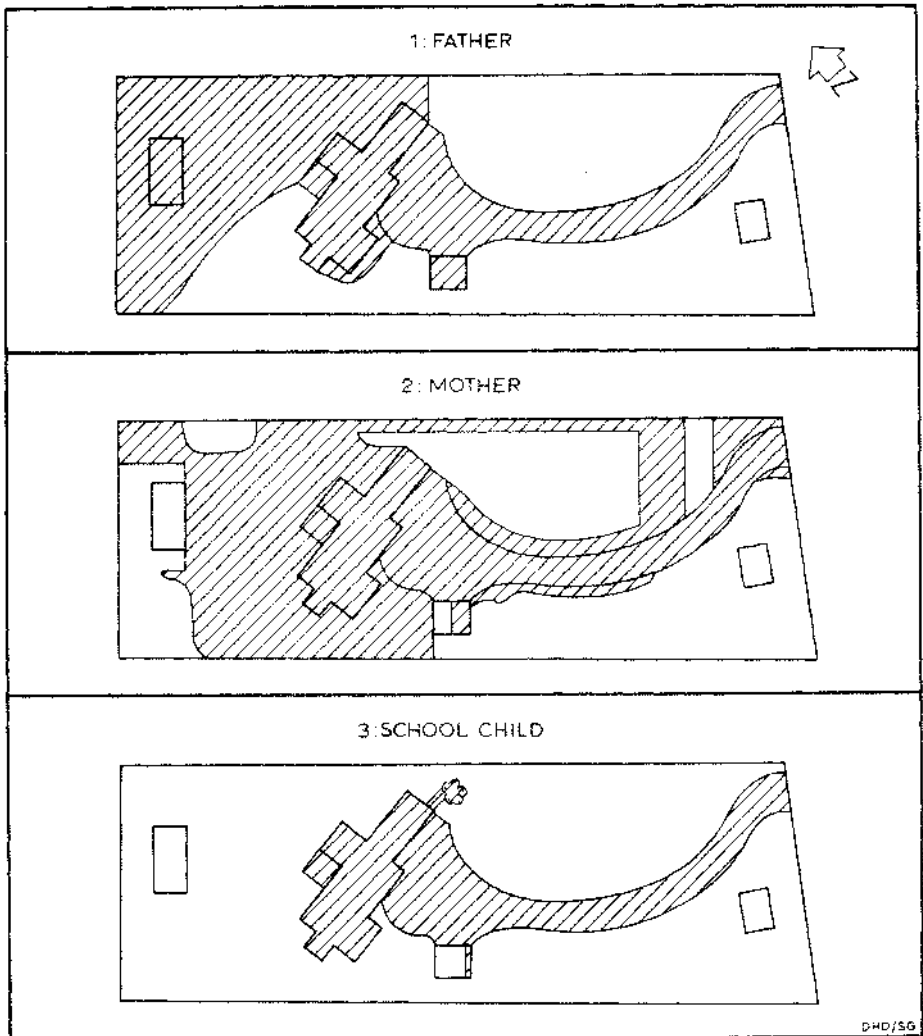


Figure 9: PERCEPTIONS OF PROPERTY (2)

In serious practice, however, mental maps are constructed on similar principles to conventional thematic maps and are calculated and measurable. For example, Gould and White describe a sample of 23 school-leaving classes from schools scattered through Britain, who had filled in a questionnaire on the desirability of various areas in Britain to work and live in, other factors being equal. On the basis of their replies, by means of constructing matrices

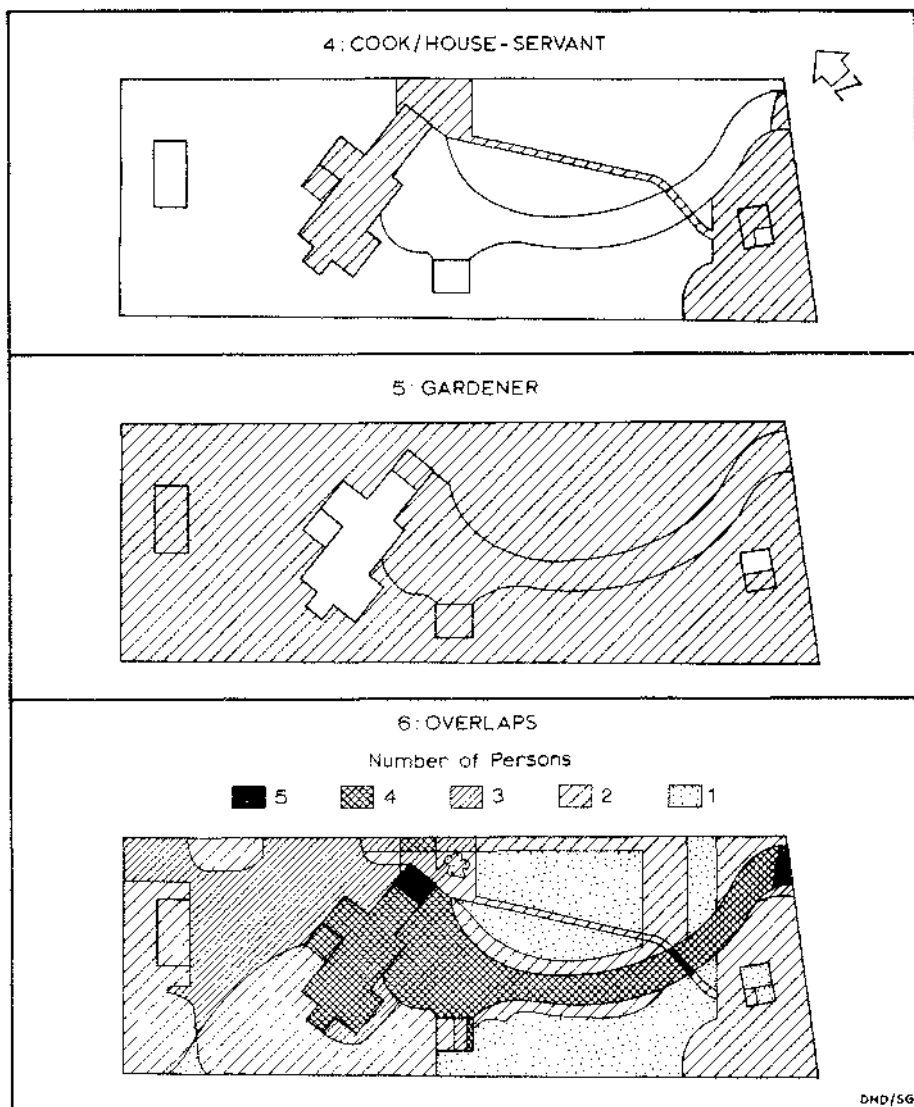


Figure 10: PERCEPTIONS OF PROPERTY (3)

and calculating correlation co-efficients, scores were assigned to various localities. These were portrayed as 'spot heights', and the equivalent of 'contour lines' (isopercepts), drawn to link places of equal perceived environmental desirability. A resultant mental map for a school in Aberystwyth, Wales, shows the Principality and southern England to be generally attractive

(the darker the shading the more attractive). Another example from Yorkshire again shows preference for southern England, but is otherwise very different. The results from all 23 schools were then averaged to produce a national perception surface, portrayed both as a conventional map and as a three-dimensional computer printout. Analysis was carried a further stage by comparing the values of localised surfaces with the national surface, which showed that localised departures from the average increase progressively northward, so that northern Scottish school-leavers' notions of desirability appear most at variance from those of Britain as a whole.

Such an exercise is more than a mere intellectual game. It has distinct practical possibilities in a world where technology increasingly makes both people and their employment opportunities more footloose, more a matter for human decision-making. Consider Gould's map of Tanzania as seen by

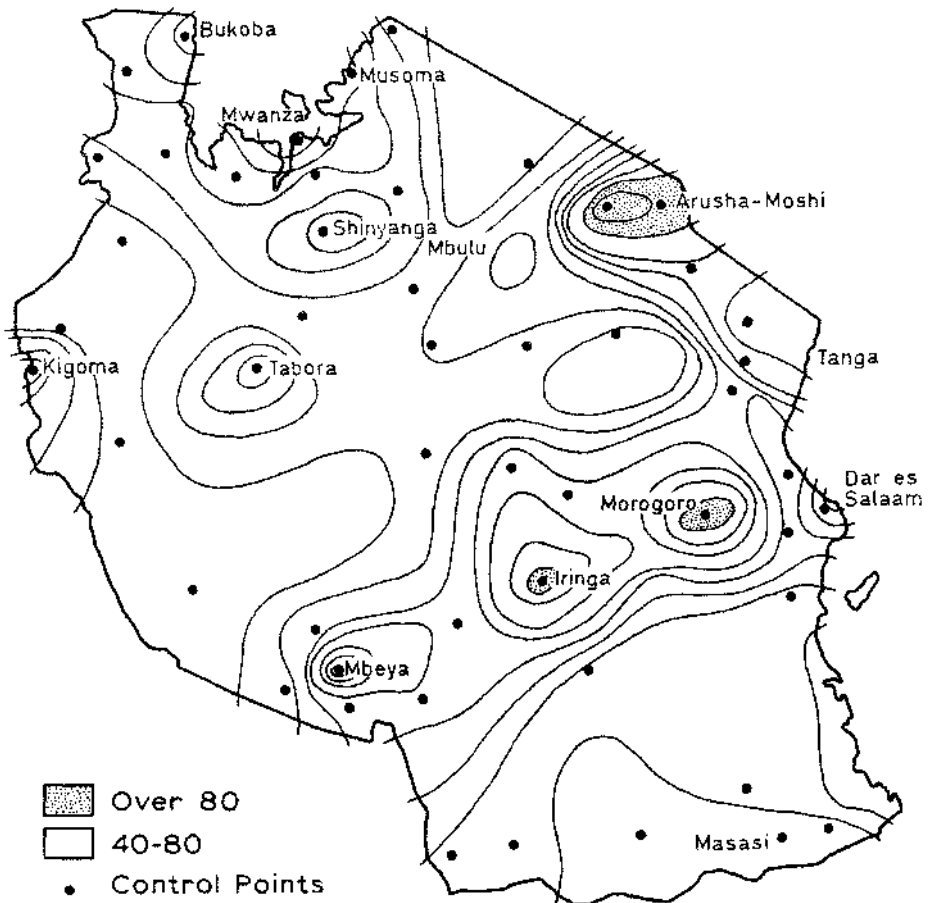


Figure 11: THE MENTAL MAP OF TANZANIAN UNIVERSITY STUDENTS
(From Gould, 1969)

new university graduates in that country (Fig. 11; Gould, 1969). Typically in a developing African country, professional people tend to prefer urban postings, but the aims of development planning call for the deployment of many in rural areas. Mental maps, plus some supplementary questions asked of the respondents, enable reasonable and quantifiable statements to be made concerning reasons for, and degree of, resistance to 'bush postings' and may even suggest appropriate levels of compensation in terms of such factors as salary and housing availability for perceived inferior localities. This surely has relevance for the deployment of scarce professional staff in such countries. Mental maps have also been used as an aid in planning the development of tourism and in environmental conservation. The influence of perception is perhaps unavoidable in planning. Either the perceptions of the 'planned' are assessed as planning guides, or the professional and administratively-orientated value judgements of the planners themselves will be imposed, albeit unconsciously. Increasingly, man-environment interaction has man as the dominant partner, changing environment according to his decisions — and his decisions, for good or ill, are informed by his perceptions. Our notions of spatial order will increasingly be man's rather than nature's in this crowding planet and consequently we must seek to understand their bases.

Finally, on concepts and methods, mental maps serve to introduce a current preoccupation we have with the problems of map transformation, which I can only touch on. Traditionally, geography investigates the geosphere in terms of Euclidian space, with distances and directions objectively measured. Given common notations and accuracy, they can be measured a hundred times by different observers and will give the same answers — a kilometre is always a kilometre. Although we have had problems in transforming space on the spherical surface of the earth to its expression on the plane of the map, in practical terms this has essentially been solved through map projections, and no longer greatly interests most geographers.

However, our perceived environment, in its physical and cultural manifestations, and the vital decisions that our dominant human species make, for good or ill, to modify that environment, are based on *relative* space. Thus in everyday life we commonly regard distance as time, cost or effort. How many people, asked how far it is from A to B, reply 'about twenty minutes'? To how many drivers is the perceived best route not the straight road directly connecting C and D, but a longer route with less traffic? Although we would not actually say that the distance from, say, Salisbury to London is x dollars, cost is likely, in fact, to be the measure that primarily determines the decision whether or not to travel, for transport technology is progressively relegating distance and also time to subsidiary status. Our decisions are also informed by our notions of social distance — some neighbourhoods are less 'nice' than others; turned into cartographic terms (necessary for charting the spatial implications of decision-making processes), this could mean that the two kilometres from Snob Hill to the wrong side of the tracks is perceived as much farther than 10 kilometres along a ridge of high-class suburbs extending in another direction. Apart from

upsetting our traditional measures of distance and direction, this also means that whereas all observers measuring absolute distance should obtain the same result, the perception of relative distance varies ultimately between individuals and theoretically can be described only in idiographic terms as aggregations of unique cases, which means that no laws can be derived from them to inform planning processes. Fortunately, at operational levels significant classes of response can be identified and probability theory harnessed to aid us.

From the geographer's standpoint, the particular problem is that the Euclidian space of our basemaps is unlikely to be isomorphic with the relative space that expresses much of the reality of man-environment interaction. This presents us with the problem of transforming maps from one mode to the other and explains the curious distortions — or apparent distortions — found on some maps, in which countries are portrayed on scales proportional with their populations (e.g. Fig 12). Similarly, a map of the United States with states drawn to scale with their total retail turnover per annum may be of more immediate practical use to a salesman than the conventional variety. From here, we are led to the problem of modelling relative space to express process through time.

While I have not attempted to touch on all new developments in geography, it will now be apparent, I hope, that our emergent new paradigm, which has entailed intense self-criticism, experimentation and a careful look at cognate disciplines in search of guidance, has already left us far stronger as a discipline than previously — seeming to most almost as far removed from the geography of the pre-1950s as that was from the 'here be dragons' variety of the Hereford World Map. Has this been sufficient to claim for us, after a century of uneven progress, the title of academic discipline?

I believe that the balance sheet is now in our favour. I can say no more on the credit side, but the debit column needs scrutiny by the hard-eyed accountants of the hard sciences. Let me assist them. Although we seem to be paying a high price for more rigour by importing some 'barbarous jargon' from other sciences (to borrow Samuel Johnson's fourth meaning of *Cant*) some of our methods still lack sufficient rigour. Yet this must somehow be attained without abandoning intuitive insights into the real world, for we must not lose the sensitivity to place of a Hardy or a Bennett for models of splendid rigour but grossly naive perceptions; and beyond a certain point we may agree with Emerson that 'a foolish consistency is the hobgoblin of little men' (quoted by Berry, 1973, p.8). We still have to harmonise rigorous deductive methods, now in the ascendant, with idiographic or case-orientated investigations. Whereas I view their side-by-side existence as different tools in the same toolbox as pragmatism appropriate to our calling, philosophers of science will shake their heads. Yet how often, in sweaty practice in laboratory sciences, is research a quest and a procedure of Galahad-like purity? In geography, it is more important, as Anuchin (1973, p.57) has said, 'to state the problem correctly and fully than in a simpler manner which is amenable to mathematical treatment'. It is also true that, in common with some social

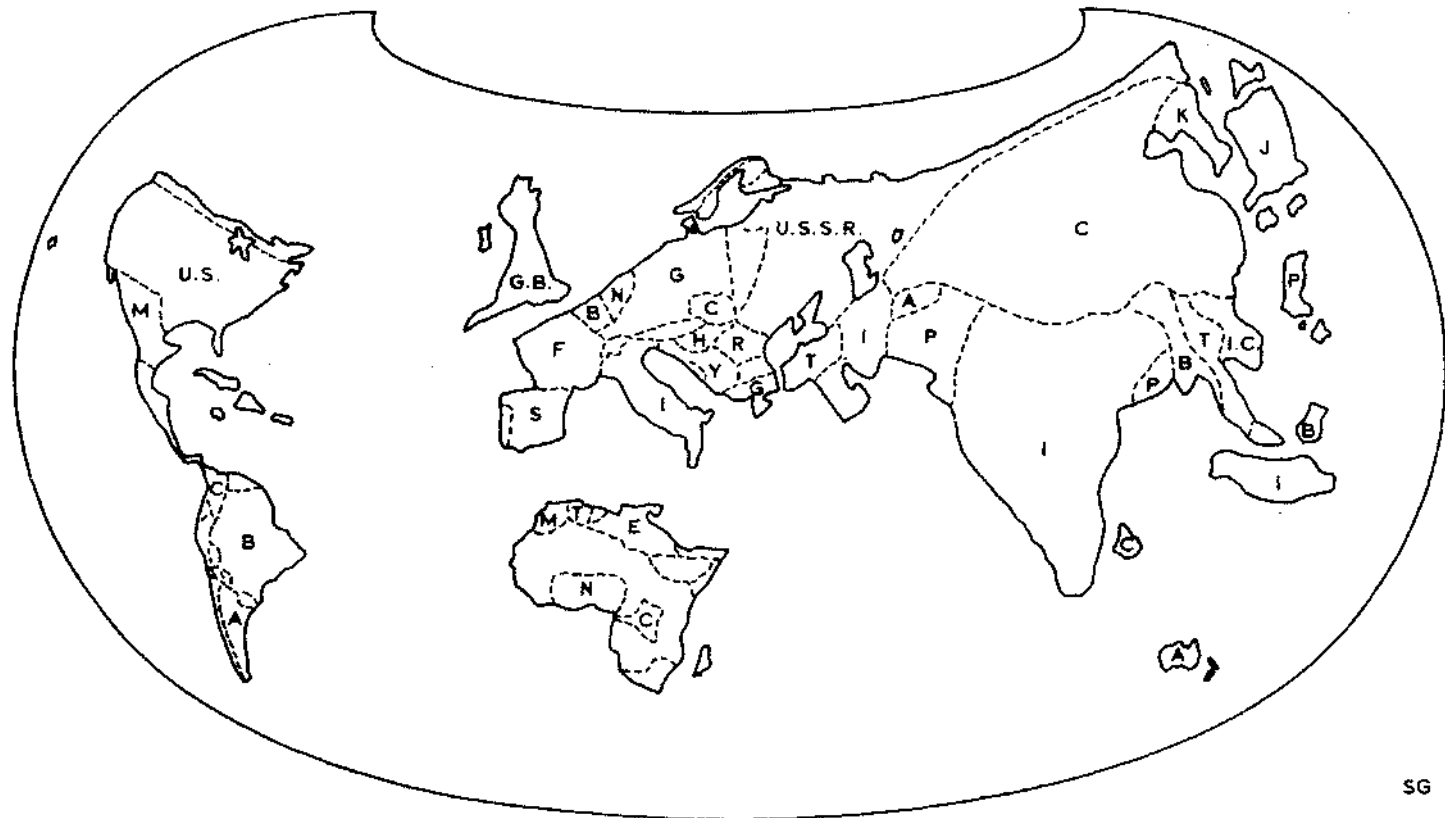


Figure 12: CONTINENTS AND SELECTED COUNTRIES ON THE SCALE OF THEIR POPULATIONS
(After Bunge, 1962)

sciences, our attempts at prediction have to date lacked success simply because man is such an exasperating variable to manipulate — and long may he so continue. Some claims made for prediction remind me of Glendower's boast in Henry IV, 'I can call spirits from the vasty deep', and Hotspur's dry reply, 'Why, so can I and so can any man, but do they come when you do call them?'.

At the chorographic heart of geography, too, we still lack a general spatial field theory to explain adequately the workings of the man-environment interface, especially as this is impelled through time at increasing pace. Yet already great strides have been made in our methods, which are finding increasing application in regional planning and elsewhere. I believe that our emergent paradigm will substantially solve some basic problems within the next decade.

Most of our debit entries relate to what I regard as the particular demon of geography — its position between, and partly cutting across, the natural and human sciences. Geography has fairly consistently claimed to be, as

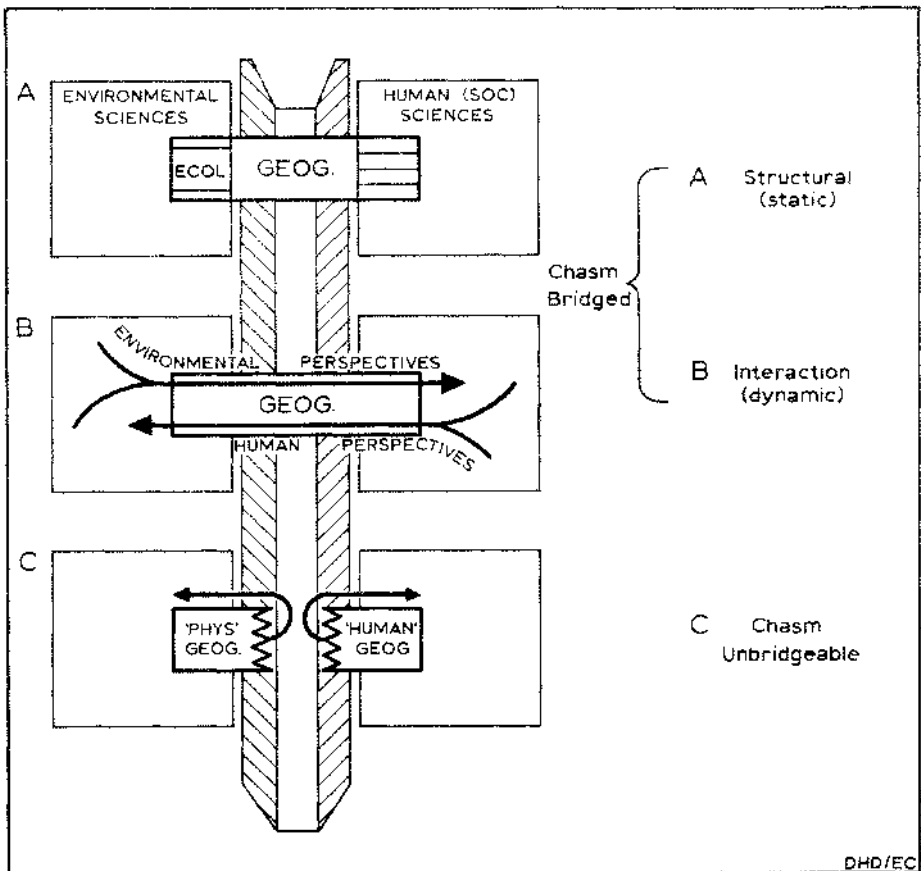


Figure 13: THE BRIDGE CONCEPT (After MacKinder et al.)

Mackinder first called it, a 'bridging discipline': something few would deny a need for. That bridge is as effective as the chorographic core of geography is credible (Fig. 13). When that core was weak, geography was dominated by the systematic sciences that overlap its periphery. Only when strong chorographically can it bridge the gap and serve as a means of linking the environmental and human insights and perspectives of other sciences. Geographers themselves disagree on that bridging role, which presupposes unity within the subject itself. Thus, Academician Gerasimov, doyen of Soviet geographers, has written, 'the former single subject of geography is being replaced by a system of science, and the encyclopaedist scholar by the collective labour of many specialist geographers, organised on a uniform plan'. But who makes the plan? And has not the camel been described as a horse designed by a committee? Gerasimov's views appear to conform to Marxist doctrine on the division of the natural from the social sciences. On the other hand, his compatriot Anuchin (writing after Stalin's death in 1953), proclaimed the essential unity of the subject and pleaded eloquently for 'A geography without adjectives' (1973, p.62). To my thinking, Anuchin's viewpoint bids fair to prevail, because of developments I have attempted to outline, and geography is now emerging again as a unified discipline able to provide the bridge.

In this, it receives substantial and increasing support. In the natural sciences ecology provides a focus for spatial perspectives and at least recognises the role of man as part of the volume of biomass and as an interferer with the biosphere. Across the chasm, through regional science, economists have contributed strongly to pure spatial theory. Systems theory, derived from engineering, provides the most promising link at a methodological level. It is also worth noting the blurring of the conceptual boundaries between the natural and human sciences. Physicists have long used statistics, while behavioural psychologists and econometricians operate rigorous scientific procedures. Even some historians, writers of 'grand history' like Toynbeen and Spengler seek to formulate laws, whereas some scientists — Simpson in Geology, and Smart in Biology — have argued that the so-called scientific method is actually that of Physics and not necessarily well suited to their needs. And even Quantum Physics has been confronted with chance variations since Heisenberg enunciated his uncertainty principle in 1927.

My diagram (Fig. 14) suggests, however, that only geography totally bridges the gap, other disciplines having supporting roles. I argue this on the grounds that no other subject places man and environment on equal levels. To the ecologists, when they nod in the direction of so-called 'human ecology', man is essentially operating within the relatively simple system of the biosphere with its negative feedback mechanisms to regulate his excesses. Such a view of man operating 'within nature's laws' seems akin to Rousseau's 'natural man', and has surely been increasingly unreal since the Industrial Revolution provided man with the physical power and the technology to bend nature to his will, seemingly regardless of the cost. It is a view of 'human ecology' castigated by Chorley (1973, pp.156-7) 'as an attempt

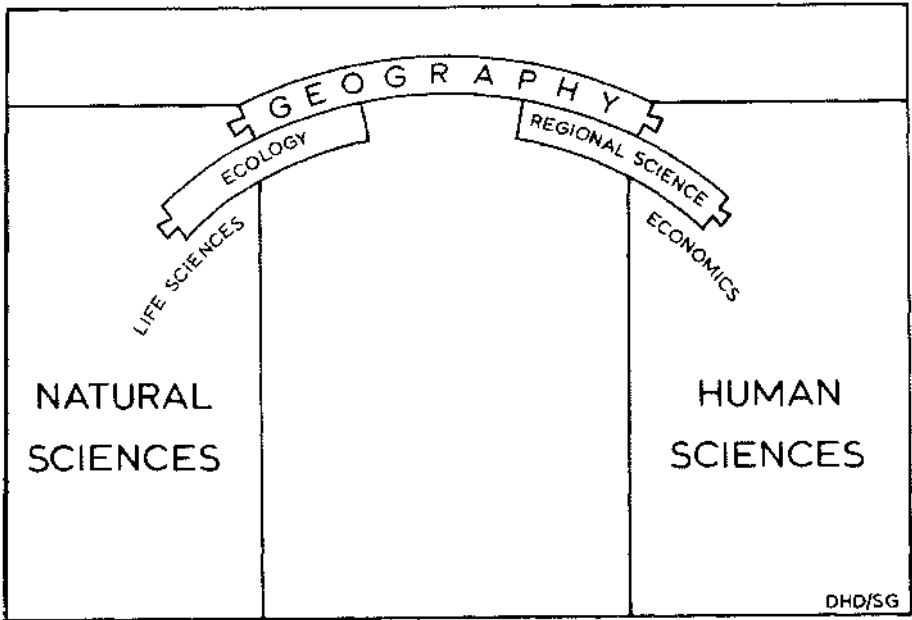


Figure 14: THE BRIDGE CONCEPT

to confront current environmental problems with the visions of Wordsworth and Emerson . . . and with a maxim for Edwardian boy scouts'. The idea that 'flows of capital investment, population, technical information, generated energy and the like, together with such constraints as interest politics and the mechanisms of group decision-making can be reduced to comparable units so as to be structured into energy systems similar to those of ecosystems is clearly an illusion'. Even the Garden of Eden, says Chorley, 'had its entrepreneur'.

Similarly, economists are, for all their methodological insights, precluded from wholly bridging the gap themselves by their abstraction of man, for their purposes, into that unnaturally rational creature, 'economic man', and particularly of his environment into uniform or statistically smoothed surfaces. Finally, despite the transferable scientific logic and methodology of the engineers through systems theory, method alone cannot link disciplines; only concepts can do so, and in the handling of mankind as a variable the systems analysts have proved naive, as shown in the Limits to Growth debate on world population and economic growth (Meadows *et al.*, 1972; Mesarovic and Pestel, 1975).

It seems to me that academic geography is left, almost by elimination, to throw a span right across the gap. As its academic placement in university faculty structures indicates, it has always had a foot on each side — what other university departments have natural and social scientists in equal numbers around the same table in their daily work? Its spatial viewpoint is equally applicable on both sides, and increasingly so. Although a bridge based on a spatial perspective provides only a slender link in itself, it can be strengthened by further ecumenical activity which seems to be developing

again in the academic world. This is heartening for, in the final analysis, as Roger Bacon wrote in the thirteenth century, 'all sciences are connected, they lend each other material aids as parts of one whole . . . none can attain its proper results separately since all are parts of one and the same wisdom,' (quoted by House, 1965). In our shrinking world it is essential that we extend that view further than Bacon could, to embrace the human sciences.

From this brief look at contemporary geography I conclude that it is not only useful but ecumenically necessary. Finally, I argue that it is also essential in the context of many critical world problems that now confront us, with 1984 just eight years away. I believe that this is so because the comprehensive re-tooling task in which geography has been engaging, together with the directional shift in its research towards the understanding of complex dynamic geo-processes and a nomothetic or law-seeking goal, supported by new masses of data and the means for processing them, are combining to bring our central research thrust onto a converging course with the juggernaut course of those world growth problems that now threaten us.

Why should geography's course bring it into the central arena of world problems? I argue this in terms of a third convergence in time. Some day it may be realistic to model our planet's plight, as systems analysts have attempted, in terms of a closed system, a uniform world in which world totals and world averages of human population, resource depletion and pollution are meaningful. On such a uniform or billiard ball earth, geography will, be fit only for the automata which by then, no doubt, the engineers or perhaps the politicians will have created to occupy it.

In the immediate future, however, such a model is highly unrealistic, an example of the current fashion for grossly oversimplify reality to make it more amenable to mathematical analysis. And in this immediate future, when problems must begin to be solved, we are still dealing with planet earth — infinitely varied, with its peoples, its resources and its environmental and cultural constraints most unequally and, in some respects, inequitably distributed upon its surface. With respect to human population it is, in fact, becoming increasingly unequally distributed, as mankind swarms into great cities and withdraws from some marginal rural land.

Thus time sequence has determined that we shall grapple with earth's problems in terms of the complex real world, in which problems express themselves spatially and in dynamically changing terms, as population explodes through medical science and its environment implodes through transportation and communications technology, with earth space itself increasingly becoming a resource — 'budget space', as Hägerstrand calls it (1973, p.79). That scenario is marginal to the interests of most other sciences, except perhaps the other chorographic sciences of ecology and oceanography: it is at the heart of geography and made to measure for its craft in its new strengthened form. So much so that the recent popular awakening to the so-called ecological crisis has placed the geographer in a position analagous to that of Molière's M. Jourdain, who found, to his surprise, that he had been speaking prose all his life.

While we shall all of us have to co-operate to tackle our urgent planetary problems, I believe that after long practice and some recent stiff corrective elocution lessons, geography speaks that particular prose better than anyone else. Consequently, I take no modest view of our role in the coming decades, believing it inevitable — provided only that we ourselves do not set our sights too low — to be a central one. While I do not adopt the lofty viewpoint attributed to a nineteenth-century Regius Professor of Greek in the University of Oxford who stated, in a public lecture, that his subject enabled him to look down with contempt on those who had not shared its benefit, I am happy to acknowledge gracefully the point of Charles Darwin's reference, in a letter to J. D. Hooker (quoted by Ackerman, 1963 p.440), to 'that great subject, that almost keystone of the laws of creation, GEOGRAPHICAL DISTRIBUTION'. Cometh the hour, cometh the discipline? We have recently had to learn some new lines, and the stage is well suited to our acting style (alarming though the scenery is). In this scenario I see geography very near the centre of the stage, and I have no hesitation in professing it, not merely useful, but necessary.

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